Work Plan for the Phase 2 Regional Site Inspections for Perfluorinated Compounds

Gabreski Air National Guard Base
West Hampton, New York

NGB/A4OR

Contract No. W9133L-14-D-0001, Task Order No. 0007

December, 2017

NGB/A4OR
Shepperd Hall
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-157

Prepared for:

NGB/A4OR
Shepperd Hall
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-5157

Prepared by:

AECOM
3101 Wilson Boulevard
Arlington, VA, 22201
USA
aecom.com

Prepared in association with:

Gabreski Air National Guard (ANG)

I certify that I am a currently a NYS registered professional engineer and that this Work Plan for Gabreski Air National Guard Base was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10).

Respectfully submitted,
AECOM

December 5, 2017

DATE

Daniel Servetas, PE

Registered Professional Engineer
STATE License No: 079068

Table of Contents

Tables

Appendices

List of Acronyms and Abbreviations

AFFF	Aqueous Film Forming Foams
ANG	Air National Guard
ANGB	Air National Guard Base
AOC	Area of Concern
APP	Accident Prevention Plan
ARFF	Aircraft rescue and firefighting
AST	Aboveground Storage Tank
BB&E	BB&E, Inc.bgs below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Contaminants of Potential Concern
CPR	Cardiopulmonary resuscitation
CSM	Conceptual Site Model
DA	Drainage Area
DoD	Department of Defense
DPT	Direct Push Technology
DQO	Data Quality Objective
EB	Equipment Blank
ECF	electrochemical fluorination
ELAP	Environmental Laboratory Approval Program
ERPIMS	Environmental Resources Program Information Management System
FD	Fire Department
FRB	Field Reagent Blank
FS	Feasibility Study
FSS	Fire Suppression System
ft	feet
FTA	Fire Training Area
FW	Fighter Wing
GIS	Geographic Information System
HA	Health Advisory
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEF	High Expansion Foam
HPDE	high density polyethylene
HRL	Health Risk Limits
HSA	Hollow-Stem Auger
IAP	International Airport Property
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
LNAPL	Light Non-Aqueous Phase Liquids
Mil-Spec	Military Specification
msl	mean sea level
MW	monitoring well
NFA	No Further Action
NFTA	Non-Fire Training Area
NGB/A4OR	National Guard Bureau, Operations Division, Restoration Branch
NRCS	Natural Resources Conservation Service
NTA	Nozzle Test Area
OBM	Off Base Migration
OWS	Oil/Water Separator
PA	Preliminary Assessment
PFAA	Perfluoroalkyl acids
PFBA	Perfluorobutanoic acid
PFBS	Perfluorobutane sulfonic acid
PFASs	Per- and Poly-fluoroalkyl Substances
PFHpA	Perfluoroheptanoic acid

PFHxS	Perfluorohexane sulfonic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PID	Photoionization Detector
POL	Petroleum, Oil, and Lubricants
PRL	Potential Release Locations
PVC	Poly-vinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
SAF/IE	Secretary of the Air Force/Installation, Environment and Energy
SB	Soil Boring
SI	Site Inspection
SOP	Standard Operating Procedure
UCMR	Unregulated Contaminant Monitoring Rule
USAF	United States Air Force
USCS	Unified Soil Classification System
US EPA	United States Environmental Protection Agency

Executive Summary

Under contract to the National Guard Bureau, Operations Division, Restoration Branch's (NGB/A4OR), AECOM will conduct a Site Inspection (SI) for Per- and Poly-fluoroalkyl substances (PFASs) at the Gabreski Air National Guard Base (ANGB), 106th Rescue Wing, Suffolk County, West Hampton, New York. The NGB/A4OR's goal for the SI is to determine presence or absence of PFASs in soil or surface water or sediment (if present) at each potential release location (PRL) and in groundwater downgradient of PRLs, and assess if PFAS constituents from the base are migrating off site. The Work Plan that follows provides the approach for obtaining the project objectives.

PFASs are compounds used in the formulation of Aqueous Film Forming Foam (AFFF), which was used by the United States Air Force (USAF) and the Air National Guard (ANG) to extinguish petroleum fires starting in approximately 1970. Releases of AFFF to the environment routinely occurred during fire training exercises. In 2016, the United States Environmental Protection Agency (US EPA) issued Drinking Water Health Advisory Levels for two specific PFASs, Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA). It is the USAFs (and ANG) policy (SAF/IE 8/11/16) to allocate funds for the investigation of potential releases of PFASs, ensure protection of human health and the environment, and address any releases of PFAS that pose an unacceptable risk. The ANG is in the process of switching out C8 based AFFF for C6 based formulations at its installations including Gabreski ANGB.

A Preliminary Assessment (PA) for PFASs was conducted at Gabreski ANGB in 2015 (BB&E, 2016). Based on findings of the PFAS PA at the Gabreski ANGB, 16 PRLs (referred to as areas of concern in the PA) have been identified where PFASs may have been released to the environment, including the locations listed in **Table ES-1**:

Table ES-1. PRLs Included in the Gabreski ANGB SI

PA AOC #	PRL Name	Recommendation	Rationale
1	IRP Site 7 – Fire Training Area	Site Inspection	Former ANG FTA from 1971 to 1986 (Used as USAF FTA from 1943 - 1971). According to Base personnel AFFF and protein foam were used, although usage amounts are unknown.
2	Fire Station – Building 300	Site Inspection	Fire Station since 1989. AFFF Stored in FD vehicles and in 5-gallon buckets, and AFFF transfer operations. Floor drains to OWS/sanitary.
4	Helicopter Pods – Building 395	Site Inspection	AFFF FSS was installed in 1998 and retrofitted to HEF in 2012. Due to contracting and certification issues, the AFFF FSS was never used and portable AFFF units were used instead. ARFF vehicles currently stored within building. No records of accidental AFFF releases. No floor drains observed. Storm drains on the apron along the southeast side of Building 395 discharge to the storm sewer system.
5	Hanger 370	Site Inspection	Equipped with AFFF FSS from approximately 1998/1999 until 2011, when the system retrofitted for use of HEF. No records of accidental AFFF releases or system testing exist.
6	Hanger 358	Site Inspection	Equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF. No records of accidental AFFF releases or system testing exist.
8	Eastern Concrete Ramp / Apron	Site Inspection	Concrete ramp/apron may have been impacted by AFFF due to the historical presence of aircraft. AFFF

PA AOC #	PRL Name	Recommendation	Rationale
			usage occurred adjacent to the ramp/apron.
9	Southern Concrete Ramp / Apron	Site Inspection	Concrete ramp/apron may have been impacted by AFFF due to the historical presence of aircraft. AFFF usage occurred adjacent to the ramp/apron.
10	IRP Site 4 – Fuel Spill Area	Site Inspection	In 1987, a fuel spill occurred within the grassy area adjacent to the south edge of the Eastern Concrete Ramp/Apron. Foam (unknown type) was applied to the spill.
11	Nozzle Testing Area	Site Inspection	FD personnel historically placed a target in the grassy area on the south edge of the concrete ramp/apron, directly across from Building 300, to use in support of vehicle nozzle testing. It is unknown whether foam or water was used.
12	Outfall SDO-001	Site Inspection	Receives discharges from the Eastern Concrete Ramp/Apron and the majority of buildings in the north and east portions of Base property. This outfall may have been impacted by AFFF due to potential historical usage of AFFF in these source areas.
13	Outfall SDO-002	Site Inspection	Receives discharges from the Southern Concrete Ramp/Apron, Building 395 (Helicopter Pods), and IRP Site 5. This outfall may have been impacted by AFFF due to potential historical usage of AFFF in these source areas.
14	IRP Site 5 – Southwest Storm Drainage Ditch	Site Inspection	Storm water drainage ditch that originates as a subsurface outfall on the southwest side of Hangar 370. This outfall may have been impacted by AFFF due to the historical usage of AFFF in the area.
15	IRP Site 8S – Old Base Septic System	Site Inspection	Site 8S consisted of one septic tank and two cesspools, which were abandoned in place in 2003. Site 8S was associated with Building 300 – Fire Station and therefore may have been impacted by AFFF.
16	IRP Site 8K- Old Base Septic System	Site Inspection	Site 8K consisted of one septic tank and three cesspools which were abandoned in place in 2003. Site 8K was associated with Building 395 – Helicopter Pods and therefore may have been impacted by AFFF.
17	IRP Site 8J- Old Base Septic System	Site Inspection	Site 8J is still currently in use as part of the stormwater drainage system. Site 8J was associated with Building 395 – Helicopter Pods and therefore may have been impacted by AFFF.
18	IRP Site 8G- Old Base Septic System	Site Inspection	Site 8G consisted of one septic tank, two cesspools, and one distribution box which were abandoned in place in 2003. Site 8G was associated with Hangar 358 and therefore may have been impacted by AFFF.

AFFF = aqueous film forming foam

ARFF = Aircraft Rescue and Firefighting
AOC = area of concern
FD = fire department

FTA = fire training area
FSS = fire suppression system
OWS = oil/water separator

For each PRL not considered an outfall, the general technical approach includes three borings with two soil samples collected at each boring and the collection of one groundwater sample from a new or existing monitoring well located in the immediate downgradient direction of groundwater flow from each PRL. For PRLs with larger footprints (such as the Concrete Ramp/Apron), additional soil and groundwater samples will be collected. Groundwater samples will be collected from six monitoring wells located in the downgradient direction of groundwater flow at the base boundary to fulfill the objective of determining if PFAS constituents from the Gabreski ANGB are migrating off-site. As detailed in the report that follows, the SI will include the collection of soil, sediment, surface water, and groundwater samples at the sixteen PRLs and six base boundary monitoring wells that will be analyzed for six PFAS constituents per USAF and ANG guidance. **Table ES-2** summarizes the proposed sampling to be conducted with this SI.

Table ES-2. Summary of SI Sampling at Gabreski ANGB

PRL Name	Estimated Number of Borings and Monitoring Wells to be Installed/Sampled	Estimated Depth of Monitoring Wells (ft bgs)	Number of Samples
IRP Site 7 – Fire Training Area	3 SB 2 MW	45	**Soil:** 6 Samples **Groundwater:** 2 Samples
Fire Station – Building 300	6 SB* 1 MW*	45	**Soil:** 12 Samples **Groundwater:** 1 Sample
Building 395 (Helicopter Pods)	3 SB 3 MW**	45	**Soil:** 6 Samples **Groundwater:** 3 Samples
Hangar 370	3 SB 1 MW	45	**Soil:** 6 Samples **Groundwater:** 1 Sample
Hangar 358	4 SB* 2 MW*	45	**Soil:** 8 Samples **Groundwater:** 2 Samples
Eastern Concrete Ramp/Apron	9 SB* 3 MW**	45	**Soil:** 18 Samples **Groundwater:** 3 Samples
Southern Concrete Ramp/Apron	4 SB* 3 MW**	45	**Soil:** 8 Samples **Groundwater:** 3 Samples
IRP Site 4 – Fuel Spill Area	7 SB* 2 MW**	45	**Soil:** 14 Samples **Groundwater:** 2 Samples
Nozzle Testing Area	3 SB 1 MW	45	**Soil:** 6 Samples **Groundwater:** 1 Sample
Outfall SDO-001	1 SW/SED	NA	**Surface Water:** 1 Sample **Sediment:** 1
Outfall SDO-002	1 SW/SED	NA	**Surface Water:** 1 Sample **Sediment:** 1
IRP Site 5 – Southwest Storm Drainage Ditch	3 SW/SED 1 MW	45	**Sediment:** 3 Samples **Surface Water:** 3 Samples
IRP Site 8S – Old Base Septic System	3 SB* 1 MW**	45	**Soil:** 6 Samples **Groundwater:** 1 Sample
IRP 8K – Old Base Septic System	3 SB 1 MW	45	**Soil:** 6 Samples **Groundwater:** 1 Sample
IRP 8J – Old Base Septic System	3 SB 3 MW*	45	**Soil:** 6 Samples **Groundwater:** 3 Samples
IRP Site 8G – Old Base Septic System	3 SB* 1 MW*	45	**Soil:** 4 Samples **Groundwater:** 1 Sample
Base Boundary Wells	6 MW**	45	**Groundwater:** 3 Samples

PRL Name	Estimated Number of Borings and Monitoring Wells to be Installed/Sampled	Estimated Depth of Monitoring Wells (ft bgs)	Number of Samples
SB = soil boring; MW = monitoring well; SW = surface water; SED = sediment; NA = not applicable * Number includes soil borings, wells, and samples that are “shared” between contiguous PRLs ** Number includes combination of new and existing monitoring wells			

1. Introduction

Under contract to National Guard Bureau, Operations Division, Restoration Branch's (NGB/A4OR), AECOM will conduct a Site Inspection (SI) at 16 potential release locations (PRLs) that have been identified by the Air National Guard (ANG) to determine presence or absence of perfluorinated compounds (PFASs) in soil, surface water, or sediment at each PRL and in groundwater downgradient of PRLs, and assess if potential PFAS constituents from the base are migrating off site. This SI Work Plan addresses the PRLs located on Gabreski Air National Guard Base (ANGB). **Figure 1-1** in **Appendix A** provides a general location map for Gabreski ANGB.

The SI, which follows the Preliminary Assessment (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 (USEPA) 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.

1.1 Scope and Objectives

This SI Work Plan defines the overall project objectives, summarizes the results from the previous PA completed in 2016 (BB&E, 2016), 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:

- For the PRLs that have been identified as requiring 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;
- Evaluate fate and transport mechanisms specifically related to PFASs to determine potential exposure pathways;
- Collect and evaluate soil, sediment, surface water and groundwater samples for PFAS constituents utilizing industry best management practices to reduce potential false positives;
- Evaluate if chemicals of concern are migrating off site, and
- Determine if the concentrations of PFAS constituents at each PRL are present in quantities or concentrations that warrant no further action (NFA) or additional investigation as part of the Remedial Investigation (RI)/Feasibility Study (FS) phase, and if so, what the appropriate data quality objectives (DQOs) should be.

Work under this task order will be completed in accordance with applicable and appropriate United States Air Force (USAF) 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:

- Air National Guard Readiness Center. 2009. Air National Guard, Environmental Restoration Program, Investigation Guidance. September.
- US EPA Guidance for Performing Site Inspections Under CERCLA; Interim Final, September 1992 (http://www.hanford.gov/dqo/project/level5/sicercla.pdf)

- US EPA Federal Facilities Remedial Site Inspection Summary Guide. July 2005 (http://www.epa.gov/fedfac/pdf/ff_si_guide.pdf)
- Secretary of the Air Force/Installation, Environment and Energy (SAF/IE). Policy on Perfluorinated Compounds. August 11, 2016.
- US EPA, 2016. Drinking Water Health Advisory for Perfluorooctanoic acid (PFOA) – May 2016. (https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final_508.pdf)
- US EPA, 2016. Drinking Water Health Advisory for Perfluorooctanesulfonic acid (PFOS) – May 2016. (https://www.epa.gov/sites/production/files/2016-05/documents/pfos_health_advisory_final_508.pdf)

PFASs are not federally regulated and are not regulated in soil and groundwater in New York. Effective April 25, 2016, the NYSDEC added PFOA and PFOS to the New York State 6 NYCRR Part 597 list of hazardous substances, thereby making it a hazardous waste pursuant to New York State Environmental Conservation Law Article 27, Title 13 (New York's State Superfund program) and 6 NYCRR Part 375 (the Superfund regulations). However, as reflected in USAF Policy (SAF/IE 8/11/16), the USAF and ANG have committed to:

- Allocate funds for the assessment, investigation, mitigation and environmental response to PFOS/PFOA releases, as needed, to ensure the protection of human health and the environment, consistent with applicable Federal or state law;
- Identify all locations on AF Installations where potential releases could have occurred and confirm whether there exists a potential unacceptable risk to human health and the environment;
- Address any PFOS/PFOA releases that pose unacceptable risk, including migration off-base, in accordance with CERCLA;
- Develop drinking water sampling guidance for PFOS/PFOA - where drinking water samples indicate unacceptable risk, as defined by exceeding US EPA's lifetime drinking water Health Advisory (HA) for PFOS and PFOA, take appropriate mitigation action for all sources on current and former ANG installations, as well as public and private water sources reasonably believed to be contaminated by ANG actions.

Six PFASs are also included on US EPA's Unregulated Contaminant Monitoring Rule-3 (UCMR) list of contaminants evaluated in large drinking water systems. Samples will be used to assess drinking water systems and evaluate occurrence frequency/concentration. The six constituents that will be sampled during PFAS investigations per USAF guidance are as follows:

- PFOS;
- PFOA;
- perfluorononanoic acid (PFNA);
- perfluorohexane sulfonic acid (PFHxS);
- perfluoroheptanoic acid (PFHpA); and
- perfluorobutanesulfonic acid (PFBS).

1.2 Work Plan Organization

This 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 Gabreski ANGB.

Section 4 describes the preliminary exposure pathways at the installation specific to the sixteen PRLs.

Section 5 summarizes the general approach to the SI.

Section 6 details the planned SI field operations that will be conducted to meet the objectives of the SI, including the latest industry best management practices to ensure defensible data quality.

Section 7 provides a list of references used in this Work Plan.

The following appendices are included in this Work Plan:

Appendix A - Figures referred to in the Work Plan.

Appendix B – Preliminary Assessment and Site Visit Report

Appendix C - Laboratory Quality Assurance Project Plan (QAPP) including key worksheets from the Uniform Federal Project QAPP guidelines. This 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 D - Field-related Standard Operating Procedures (SOPs) including a SOP specially developed for sampling/analysis of PFASs.

Appendix E - 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.

1.3 Project Organization and Responsibilities

The project organization is provided below. For this SI, Mark MacEwan is the AECOM Program Manager, Mike Myers is the AECOM Project Manager, Brant Crumbling is the ANG Program Manager, John Santacroce is the Regional Task Manager, and Captain Shaun Denton is the Gabreski ANGB Environmental Manager.

The following additional AECOM personnel will provide programmatic support on this project:

- Michael Aucoin – Chemist, National PFAS Program
- Dorin Bogdan – Regulatory Specialist, National PFAS Program
- Dora Chiang – Technical Director, National PFAS and Other Emerging Contaminants Program

For the SI field operations, James Christopher is the AECOM Field Operations Leader. He will supervise and coordinate field activities and will act as the liaison between site personnel and field subcontractors, mainly the driller (Cascade).

Additional office-based personnel will support the project including the project chemist (Mr. Naoum Tavantzis), geographic information system (GIS) data manager (Ms. Allison Carr), and health & safety manager (Mr. Alberto Munuera). Project stakeholders include Ms. Heather Bishop and Mr. John Swartout of the New York State Department of Environmental Conservation (NYSDEC).

Table 1 presents a list of the key personnel involved with the execution of the SI.

Table 1. Points of Contact

Name	Position	Phone	E-mail Address	Mailing Address
Jody Murata	ANG Program Manager	240-612-8120	Jody.a.murata.civ@mail.mil	3501 Fetchet Avenue Andrews AFB, MD 20762-5157
Shaun Denton	Gabreski ANGB Environmental Manager	631-732-7349	shaun.f.denton.mil@mail.mil	Moen Street Westhampton Beach, NY 11978
Cindy Lang	BB&E Senior Environmental Engineer	248-489-9636	clang@bbande.com	235 E. Main St., Suite 107 Northville, MI 48167
Mike Myers	Project Manager	301-820-3246	Mike.myers@aecom.com	12420 Milestone Center Drive Germantown, MD 20876
John Santacroce	Task Manager	518-951-2265	john.santacroce@aecom.com	40 British American Blvd Latham, NY 12051
Jim Christopher	AECOM Field Site Manager	845-425-4994 (o) 315-720-4584 (m)	james.christopher@aecom.com	100 Red Schoolhouse Rd, Chestnut Ridge, NY 10977

2. Background Information

2.1 Site History

The US Army developed the site in 1941 as the Westhampton Beach Army Airfield to use for gunnery training for World War II fighter pilots and instructors. At this time, Suffolk County owned the property but leased it to the U.S. Government. From 1948 to 1951, the US Army discontinued its use of a majority of the property, and a private oil company leased the airfield. In 1951, the US Air Force reactivated the airfield as the Suffolk County Air Force Base. In 1969, the Air Force deactivated and closed the base and Suffolk County began operating the airfield as Suffolk County Airport, which was renamed Francis S. Gabreski Airport in 1991.

Military operations were reintroduced in June 1970 when the 102nd Air Refueling Squadron of the 106th Air Refueling Group, New York ANG, relocated to Suffolk County. In 1972, the unit's mission changed from air refueling to fighter-interceptor, with the new mission of controlling the skies along the northeast U.S. coast. In 1975, the designation and mission changed again to "Aerospace Rescue and Recovery", later shortened to "Air Rescue" and then simply "Rescue". The current names of the 102nd Rescue Squadron and 106th Rescue Wing were assigned in 1995. However, the location of the ANG facilities has not changed since 1971. The current mission of the 106th Rescue Wing is to provide peacetime and combat search and rescue services on a world-wide basis using HC-130P Hercules aircraft and HH-60G Pave Hawk helicopters.

AFFF has been stored and used at the Gabreski ANGB for firefighting operations. One base historical fire training area (FTA) was utilized by the USAF and the ANG at the ANGB from 1943 through 1986 (BB&E, 2016).

2.2 Previous PFAS Related Investigations

Usage and storage of PFASs has been documented at Gabreski ANG as part of routine historical operations. Installation Restoration Program (IRP) Site 7, a former FTA, has previously been investigated, dating back to 1989. Long term monitoring ended in October 2012, and the NYSDEC concurred with a NFA request on April 16, 2013. The investigation and remediation of the FTA focused on petroleum and PFASs were not included in the analytical suite of constituents throughout the monitoring period.

Preliminary Assessments (PAs) focused on PFASs were conducted at 68 ANG bases in 2015 and 2016. BB&E, Inc. (BB&E), in conjunction with the ANG, conducted a base-wide PA at Gabreski ANGB to assess known and potential releases of PFASs from AFFF at FTAs and Non-Fire Training Areas (NFTAs). The PA included assessments of sites to determine if there was sufficient information that would indicate that a release of PFASs at PRLs that could impact human health and the environment. The PA included the following tasks:

- Review of information and reports in the available Administrative Record;
- review of documents related to Air Force use of AFFF;
- site visit to Gabreski ANGB;
- interviews with base environmental management personnel, the Gabreski ANGB Fire Department personnel, and aircraft hangar maintenance and operations personnel;
- photography of locations where AFFF has been used or may have been used; and
- performance of environmental data records searches to document nearby populations, water supply well information, and wetlands.

A total of 18 locations were reviewed and closeout was recommended at two of the locations (BB&E, 2016). The PRLs (referred to as areas of concern [AOC] in the PA) that were recommended for further evaluation in the SI phase are provided in **Table 2** below and the PRLs are shown on **Figure 2-1**. A copy of the PA is included in **Appendix B** for reference.

Table 2. PRLs Included in Gabreski ANGB SI

PA AOC #	Site Description	Recommendation	Rationale
1	IRP Site 7 – Fire Training Area	Site Inspection	Former ANG FTA from 1971 to 1986 (Used as USAF FTA from 1943 - 1971). According to Base personnel AFFF and protein foam were used, although usage amounts are unknown.
2	Fire Station – Building 300	Site Inspection	Fire Station since 1989. AFFF Stored in FD vehicles and in 5-gallon buckets, and AFFF transfer operations. Floor drains to OWS/sanitary.
4	Helicopter Pods – Building 395	Site Inspection	AFFF FSS was installed in 1998 and retrofitted to HEF in 2012. Due to contracting and certification issues, the AFFF FSS was never used and portable AFFF units were used instead. ARFF vehicles currently stored within building. No records of accidental AFFF releases. No floor drains observed. Storm drains on the apron along the southeast side of Building 395 discharge to the storm sewer system.
5	Hanger 370	Site Inspection	Equipped with AFFF FSS from approximately 1998/1999 until 2011, when the system retrofitted for use of HEF. No records of accidental AFFF releases or system testing exist.
6	Hanger 358	Site Inspection	Equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF. No records of accidental AFFF releases or system testing exist.
8	Eastern Concrete Ramp / Apron	Site Inspection	Concrete ramp/apron may have been impacted by AFFF due to the historical presence of aircraft. AFFF usage occurred adjacent to the ramp/apron.
9	Southern Concrete Ramp / Apron	Site Inspection	Concrete ramp/apron may have been impacted by AFFF due to the historical presence of aircraft. AFFF usage occurred adjacent to the ramp/apron.
10	IRP Site 4 – Fuel Spill Area	Site Inspection	In 1987, a fuel spill occurred within the grassy area adjacent to the south edge of the Eastern Concrete Ramp/Apron. Foam (unknown type) was applied to the spill.
11	Nozzle Testing Area	Site Inspection	FD personnel historically placed a target in the grassy area on the south edge of the concrete ramp/apron, directly across from Building 300, to use in support of vehicle nozzle testing. It is unknown whether foam or water was used.
12	Outfall SDO-001	Site Inspection	Receives discharges from the Eastern Concrete Ramp/Apron and the majority of buildings in the north and east portions of Base property. This outfall may have been impacted by AFFF due to potential historical usage of AFFF in these source areas.
13	Outfall SDO-002	Site Inspection	Receives discharges from the Southern Concrete Ramp/Apron, Building 395 (Helicopter Pods), and IRP Site 5. This outfall may have been impacted by AFFF due to potential historical usage of AFFF in these source areas.
14	IRP Site 5 – Southwest Storm Drainage Ditch	Site Inspection	Storm water drainage ditch that originates as a subsurface outfall on the southwest side of Hangar 370. This outfall may have been impacted by AFFF due to the historical usage of AFFF in the area.
15	IRP Site 8S – Old Base Septic System	Site Inspection	Site 8S consisted of one septic tank and two cesspools, which were abandoned in place in 2003. Site 8S was associated with Building 300 – Fire Station and therefore may have been

PA AOC #	Site Description	Recommendation	Rationale
			impacted by AFFF.
16	IRP Site 8K- Old Base Septic System	Site Inspection	Site 8K consisted of one septic tank and three cesspools which were abandoned in place in 2003. Site 8K was associated with Building 395 – Helicopter Pods and therefore may have been impacted by AFFF.
17	IRP Site 8J- Old Base Septic System	Site Inspection	Site 8J is still currently in use as part of the stormwater drainage system. Site 8J was associated with Building 395 – Helicopter Pods and therefore may have been impacted by AFFF.
18	IRP Site 8G- Old Base Septic System	Site Inspection	Site 8G consisted of one septic tank, two cesspools, and one distribution box which were abandoned in place in 2003. Site 8G was associated with Hangar 358 and therefore may have been impacted by AFFF.

AFFF = aqueous film forming foam
ARFF = Aircraft Rescue and Firefighting
AOC = area of concern
FD = fire department
FTA = fire training area
FSS = fire suppression system
OWS = oil/water separator

2.2.1 Background Information on PRLs Recommended for SI Activities

The following descriptions are based on the 2016 PA. The associated PRLs are depicted in **Figure 2-1**.

2.2.1.1 IRP Site 7 – Fire Training Area

Installation Restoration Program (IRP) Site 7 is a former Fire Training Area (FTA). IRP Site 7 is located approximately 130 feet northwest of the taxiway on the southeastern side of the airport on a 10-inch thick concrete hard stand. IRP Site 7 is approximately 400 feet long by 50 feet wide, and is bordered by a 10 foot wide asphalt apron.

The FTA was used for fire-fighting training exercises by the United States Air Force (USAF) from 1943 to 1971. In 1971, the ANG took over operations at the FTA and performed fire-fighting training activities at this location until 1986. The area was originally an unlined pit encompassing 1 acre, but was paved with concrete hard stand upon transfer from USAF to ANG operations in 1971. Curbing 1 foot high and 50 by 50 feet in size was constructed in 1978 to act as a berm to enclose the burn area. Waste fuels, solvents (e.g., kerosene, mineral spirits, TCE, 2-butanone, toluene, etc.), and jet fuel were reportedly poured directly on the ground and ignited for firefighting training exercises. Burn procedures were modified following construction of the berm in 1978 by floating a layer of jet fuel inside the berm on water, then either separating the fuel into a concrete UST, or burning off excess fuel. Fuel used in training exercises was stored in a steel AST located approximately 250 feet south-southeast of the former FTA. Both tanks were connected to the formed FTA by buried piping. The former FTA is located about 3,200 feet upgradient of the Suffolk County Water Authority's Meeting House Road well field.

According to Base personnel, AFFF and protein foam were used in firefighting exercises, although usage amounts are unknown. The concrete and a portion of the berm still remain. This area is now used as munitions storage. Fire training activities now take place southwest of the former FTA off of ANG property.

2.2.1.2 Building 300 – Fire Station

Building 300 was built in 1989. Approximately two pallets of 5-gallon AFFF buckets have historically been stored within Building 300 and an overhead fill system was present to transfer AFFF to vehicles. During the PA site visit, Building 300 was under renovation and therefore fire department (FD) vehicles were stored in Building 395 (Section 2.2.1.3). An average of four foam-carrying trucks have been utilized by the FD through the years. No records of accidental AFFF releases at Building 300 exist. Any AFFF releases during testing or accidental release within the fire station likely would have been routed to the floor drains which discharge to an oil/water separator (OWS) on the southeast side of the building which then discharges into the sanitary sewer system. Prior to being connected to the sanitary sewer, the Gabreski ANGB had a Base Septic System. IRP Site 8S was the old Base Septic System associated with Building 300 and is further discussed in Section 2.2.1.13.

2.2.1.3 Building 395 – Helicopter Pods

The AFFF fire suppression system (FSS) at Building 395 was installed in 1998. The AFFF FSS was never used and portable AFFF units were used instead. The FSS was retrofitted to high expansion foam (HEF) in 2012. Due to the ongoing construction at Building 300, FD vehicles are stored in Pod 3 of Building 395. During the PA site visit, four of the trucks were carrying a combined 821 gallons of AFFF and a separate trailer was carrying 2,000 gallons of AFFF. There are no records of accidental AFFF releases at Building 395. There were no floor drains observed at Building 395, and storm drams on the concrete apron along the southeast side of Building 395 discharge to the storm sewer system. Prior to being connected to the sanitary sewer, the Gabreski ANGB had a Base Septic System. IRP Sites 8K and 8J were the old Base Septic System associated with Building 395 and are further discussed in sections 2.2.1.14 and 2.2.1.15.

2.2.1.4 Hanger 370

Hangar 370, located on the southern portion of the Base, was equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF. The brand of AFFF utilized is unknown, but was a 3% concentrate. No records of accidental AFFF releases or system testing exist. AFFF for the FSS was supplied from a 300-gallon tank located in the boiler room of the hangar. Any AFFF releases during testing or accidental release within the boiler room would have been routed to the floor drain; releases within the main hangar likely entered the trench drain on the south side of the interior. Floor and trench drains thereafter led to an OWS on the east side of the hangar which then discharged into the sanitary sewer system. Prior to 2003, any releases would have discharged to the Old Base Septic System.

2.2.1.5 Hanger 358

Hangar 358, located on the southern portion of the Base, was equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF. The brand of AFFF utilized is unknown, but was a 3% concentrate. No records of accidental AFFF releases or system testing exist. AFFF for the FSS was believed to have been supplied from a 300-gallon tank located in the boiler room of the hangar. Any AFFF releases during testing or accidental release within the boiler room or main hangar would have been routed to the floor drains, and thereafter led to an OWS on the side of the hangar which then discharged into the sanitary sewer system. Prior to be connected to the sanitary sewer, the Gabreski ANGB had a Base Septic System. IRP Site 8G was the old Base Septic System associated with Building 358 and is further discussed in Section 2.2.1.16.

2.2.1.6 Eastern Concrete Ramp / Apron

Although there are no records of AFFF usage, the Eastern Concrete Ramp/Apron may have been impacted by AFFF due to the historical presence of aircraft. There were Base personnel accounts of AFFF usage adjacent to the ramp/apron (Section 2.2.1.8 and 2.2.1.9). Stormwater runoff from the eastern ramp/apron, located next to Buildings 358, 369, and 370, enters drains on the southeast side of the ramp/apron and ultimately discharges to the outfall south of the runways, Outfall SDO-001 (2.2.1.10).

2.2.1.7 Southern Concrete Ramp / Apron

Although there are no records of AFFF usage, the Southern Concrete Ramp/Apron may have been impacted by AFFF due to the historical presence of aircraft. There were Base personnel accounts of AFFF usage adjacent to the ramp/apron.

2.2.1.8 IRP Site 4- Fuel Spill Area

According to the 2011 Final Community Involvement Plan, a fuel spill occurred in 1987 within the grassy area adjacent to the south edge of the Eastern Concrete Ramp/Apron. An unknown amount of fuel spilled at the site and the FD reportedly applied foam (unknown type) to the area. The flow of fuel, water and foam was stopped before entering nearby drains. The remainder of the spill on the concrete ramp/apron surface was allowed to evaporate and absorbent matting and powdered absorbent were placed along the outfall . Remedial action is currently in place at IRP Site 4; however, analytical parameters do not include PFASs.

2.2.1.9 Nozzle Testing Area

According to Base personnel, FD personnel historically placed a target in the grassy area on the south edge of the concrete ramp/apron, directly across from Building 300, to use in support of vehicle nozzle testing. It is unknown whether foam or water was used. There was no evidence of stressed vegetation.

2.2.1.10 Outfall SDO – 001

Surface and subsurface drainage structures on the Base direct stormwater and any spills to two stormwater outfalls (SDO-001 and SDO-002), both located on airport property southeast of the Base. SDO-001 receives discharges from the Eastern Concrete Ramp/Apron, as well as the majority of buildings on the north and eastern portions of Base property. SDO-001 also receives drainage from off-Base airport property.

2.2.1.11 Outfall SDO – 002

Surface and subsurface drainage structures on the Base direct stormwater and any spills to two stormwater outfalls (SDO-001 and SDO-002), both located on airport property southeast of the Base. SDO-002 receives discharges from the Southern Concrete Ramp/Apron, as well as adjacent Building 395 (Helicopter Pods).

2.2.1.12 IRP Site 5 – Southwest Storm Drainage Ditch

IRP Site 5 is a storm water drainage ditch that originates as a subsurface outfall on the southwest side of Hangar 370. Drainage in the ditch is directed to the southwest along the ditch for about 280 ft before it goes below ground surface through a drainage culvert. The culvert resurfaces approximately 50 ft farther south and the ditch continues southwest for nearly 200 ft before drainage is again directed below ground surface through a culvert. The second culvert extends another 450 ft to the south, then resurfaces and then continues east for approximately 550 ft. At this point, flow from the ditch enters the base storm drain system. Flow eventually discharges to a dry ravine about 1500 ft southeast of IRP Site 5. The dry ravine in turn discharges to Aspatuck Creek about 1000 ft further south-southeast. The drainage receives rainwater from roof drains and runoff from paved areas in the southwestern portion of the base (PEER, 2004).

Investigations and remedial actions were conducted at IRP Site 5 from 1998 until 2009 when no further action was recommended. NYSDEC approved site closure in December 2010 (ANG, 2011). PFAS sampling was not included in the investigation activities at IRP Site 5. IRP Site 5 may have received potentially AFFF-impacted stormwater from the Southern Concrete Ramp/Apron and Building 395 – Helicopter Pods.

2.2.1.13 IRP- Site 8S Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. Appendix C-8 includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8S consisted of one septic tank and two cesspools which were abandoned in place in 2003. Site 8S was associated with Building 300 – Fire Station. PFAS sampling was not included in the investigation activities at IRP Site 8S.

2.2.1.14 IRP- Site 8K Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. The original PA Report, attached as Appendix B, includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8K consisted of one septic tank and three cesspools which were abandoned in place in 2003. Site 8K was associated with Building 395 – Helicopter Pods. PFAS sampling was not included in the investigation activities at IRP Site 8K.

2.2.1.15 IRP- Site 8J Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use for the originally intended purpose, but may be used as part of the storm water drainage system. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. The original PA Report, attached as Appendix B, includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8J is still currently in use as part of the storm water drainage system. It was not included in closure inspections, and therefore specific structure information was not collected by MACTEC. When Site 8J operated as a part of the septic sewer system, it was associated with Building 395 – Helicopter Pods. PFAS sampling was not included in the investigation activities at IRP Site 8J.

2.2.1.16 IRP- Site 8G Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. The original PA Report, attached as Appendix B, includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8G consisted of one septic tank, two cesspools, and one distribution box which were abandoned in place in 2003. Site 8G was associated with Hangar 358. PFAS sampling was not included in the investigation activities at IRP Site 8G.

2.3 Regulatory Framework

PFASs are not currently regulated at the federal level, but the US EPA has defined health advisories for PFOS and PFOA, where a sampling exceedance of the HA indicates an unacceptable risk. For the purposes of the SI Report, soil, sediment, surface water and groundwater analytical testing results will be screened against Applicable or Relevant and Appropriate Requirements and other regulatory criteria including:

- US EPA Drinking Water Health Advisory for PFOS;
- US EPA Drinking Water Health Advisory for PFOA;
- US EPA Provisional Health Advisories for PFOA and PFOS, as recommended for Hoosick Falls Water Contamination; and
- US EPA Residential – Direct Contact with Soil Regional Screening Levels.

Where multiple criteria exist, the more conservative screening value will be used. The project action levels for each Contaminant of Potential Concern (COPC) and analytical method are presented in **Appendix C**.

It should be noted that Effective April 25, 2016, the NYSDEC added PFOA and PFOS to the New York State 6 NYCRR Part 597 list of hazardous substances, thereby making it a hazardous waste pursuant to

New York State Environmental Conservation Law Article 27, Title 13 (New York's State Superfund program) and 6 NYCRR Part 375 (the Superfund regulations).

3. Site Description

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

3.1 Site Topography and Drainage

Gabreski ANG is located at the Francis S. Gabreski Suffolk County Airport in Westhampton Beach, New York on the southeast side of Long Island in the Atlantic Ocean. New York ANG currently leases the 88.5-acre property from Suffolk County.

The property is generally flat with subtle rolling terrain and stream channels that slope down from the north to the south-southeast. Surface elevations range from approximately 20 feet above mean sea level in the southern portion of the property to 70 feet in the northern portion of the Base.

While most of the precipitation percolates into the soil, surface water runoff from the majority of the property discharges into the Aspatuck Creek System. Runoff from the western portion drains into Aspatuck Creek while runoff from the eastern portion drains into Quantuck Creek. Both creeks flow into Quantuck Bay, and ultimately into the Atlantic Ocean (ANG, 2002).

3.2 Site Geology/Hydrogeology

Gabreski ANG is located on a glacial outwash plain that slopes south from the Ronkonkoma Moraine to bays and barrier islands, which form the southern boundary of Long Island. Depth to bedrock beneath the airport ranges from 1500 to 1600 feet. The bedrock is overlain by Cretaceous sediment called the Raritan formation and the Magothy formation (ANG, 2002).

The soil types at Gabreski ANG have been mapped by the Natural Resources Conservation Service (NRCS, 2013) and are as follows:

- Urban land (Ur) - More than 80 percent covered by building and pavement (originally occurring soils, which have been altered by digging, mixing, and moving are likely the Plymouth loamy sand-Pl-described below);
- Cut and fill land (Cu) - Gently sloping, complex due to grading around structures.
- Plymouth loamy sand (Pl) - 0 to 3 percent slope, excessively drained, and resulting from outwash plains and moraines.

Groundwater beneath the site is found within three different aquifers: 1) Lloyd Aquifer – the deepest aquifer, which provides a good source of drinking water in an area where salt water intrusion is common; 2) Magothy (a good source of drinking water); and 3) Upper Glacial, the unconfined, shallow surficial aquifer, which is the major source of potable water in the area. This unconfined aquifer consists of very porous and highly permeable coarse sands and gravels, and can yield large quantities of water (ANG, 2002). It is generally 120 feet thick, and flows southeast toward the headwaters of Quantuck Creek. Based on the review of the existing groundwater investigatigations conducted at the ANGB it is assumed that depth to groundwater varies from 5 feet below ground surface (bgs) in the southern portion of the site to 40 feet at higher elevations.

3.3 Critical Habitat and Threatened/Endangered Species

The following reptiles, birds, and plants are federally endangered, threatened, proposed, and/or are listed as candidate species in the vicinity of Gabreski ANGB, Suffolk County, New York (United States Fish and Wildlife Service, 2014):

- Kemp's Ridley Turtle (endangered)
- Green Turtle (threatened)

- Hawksbill Turtle (endangered)
- Leatherback Turtle (endangered)
- Loggerhead Turtle (threatened)
- Piping Plover (threatened)
- Roseate Tern (endangered)
- Sandplain Gerardia (endangered)
- Seabeach Amaranth (threatened)
- Small Whorled Pogonia (historic) (threatened)

None of these species is known to have critical habitats identified on the Base.

4. Fate and Transport and Preliminary Pathway Evaluation

The fate and transport for PFASs is highly dependent upon surface water and groundwater flow direction since PFASs are highly soluble in water. 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. Targets include both human and ecological receptors that may be exposed to any potential releases from the PRLs. Migration and exposure pathways that are considered complete may be recommended for further evaluation after completion of the SI. The proposed scope of work (see Section 5) has been developed to address data gaps identified in the preliminary pathway evaluation. A Conceptual AFFF Site Model is depicted in **Figure 4-1** (**Appendix A**) showing the potential pathways. The subsections below describe the general fate and transport mechanisms for PFASs and pathway evaluation further.

4.1 Fate and Transport

There are many different factors that can influence this fate and transport resulting in a complex Conceptual Site Model (CSM). This is especially true when PFASs are co-mingled with hydrocarbon fuels as is often the case at FTAs, spill sites, or crash sites. When hydrocarbon fuels are released, indigenous microorganisms rapidly biodegrade/oxidize the fuels resulting in anaerobic conditions (i.e. negative redox) at the source area.

Department of Defense (DoD) used seven different manufactures that produced AFFF meeting the Military Specification (Mil-Spec) MIL-F-24385. The civilian airports also used Mil-Spec AFFFs due to their superior performance. The U.S. Navy Research Laboratory in collaboration with 3M first developed AFFF in the late 1960’s. The company 3M manufactured AFFF using the electrochemical fluorination (ECF) process. Six additional manufacturers (Ansul, National Foam, Angus, Chemguard, Buckeye, and Fire Service Plus) later produced AFFF meeting the Mil-Spec using telomerization process. The composition of these AFFFs changed over time and many times without changing the product name. AFFF contains mixtures of many PFASs with some of them known as precursors. The precursors could have an abiotic and biotic transformation to dead end compounds such as PFOS and PFOA under aerobic conditions. The resulting PFASs that form due to the transformation processes are stable and do not have abiotic or biotic transformation. Some of the precursors from AFFF are cationic and zwitterionic, which have a stronger sorption to soils compared to other anionic PFASs such as PFOS and PFOA. The precursors will most likely not transform close to source zones where fuels are also present and will migrate downgradient until the fuels attenuate. Once the PFAS plume reaches an area where aerobic conditions exist, the precursors will start the process of transformation and result in increasing concentrations of Perfluoroalkyl Acids (PFAAs) including PFOS and PFOA. In the case of any PFAS detections, the available information on AFFFs will be used in the CSM in order to understand the environmental fate and potential sources of PFASs.

4.2 Preliminary Pathway Evaluation

4.2.1 Groundwater

Potential human exposure pathways that will be considered in relation to groundwater are the use of any drinking water wells and irrigation wells for public or private water supply or irrigation purposes. Documentation of designated beneficial uses for groundwater and whether such uses are actually occurring will be described in the SI Report. Any available information on background water quality for groundwater will also be considered. Groundwater in the Suffolk County Airport area is used for potable purposes though no wells are located on the Base or elsewhere on the Airport. The property lies within a Special Groundwater Protection Area of Suffolk County. The majority of the groundwater is obtained from the upper glacial aquifer. The Suffolk County Water Authority supplies the majority of potable water in the vicinity of the property, operating 15 wells in six well fields within a 4-mile radius of Francis S. Gabreski Airport (ANG, 2002). Domestic water supply wells within a 2-mile radius of the base are summarized below in **Table 3**. Additionally, a number of private wells in the vicinity of the ANGB have been identified by the NYSDEC and Suffolk County DOH.

Table 3. Public Drinking Water Supply Well Information

Well Field I.D.	Distance/Direction from Base (miles)	Aquifer Tapped	Screened Interval (ft)	Total Depth (ft)
Meeting House Road	0.61 South-Southeast	Upper Glacial	Well #20 55-75 Well #22 74-104 Well #15A 31-51	Well #20 78 Well #22 104 Well #15A 53
Quogue-Riverhead Road	1.16 North-Northeast	Magothy	Well #1 86-447	Well #1 449
Spinny Road	1.7 Due Northeast	Upper Glacial	Well #1 85-115 Well #2 118-158	Well #1 116 Well #2 163
Old Country Road	2.18 Due Southwest	Upper Glacial	Well #1 60-75 Well #2 NA Well #3 128-157	Well #1 76 Well #2 70 Well #3 161
Gus Guererra Wellfield*	0.20 Southwest	TBD	TBD	TBD

Source: PEER, 2004.
*Source: NYSDEC, Well Details TBD and presented in SI Report.

4.2.2 Surface Water and Sediment Pathway

Potential human exposures that will be considered in relation to surface water include use of surface water for drinking water, recreation and fisheries. Potential ecological receptors and exposures include sensitive environments and protected species that may be associated with the surface water. The designated beneficial uses for surface water in the area will be described. Also, the occurrence of any sensitive environments or protected species in the area of the surface waters will be noted and the results of protected species records search will be included in the SI Report.

A detailed description of site topography and drainage is located in Section 3.1 of this work plan. While surface runoff into Aspatuck Creek and Quantuck Creek is a possibility, potential impacts to surface water from operations at Gabreski ANG are considered negligible for the purpose of this PA/SI Work Plan.

The surface water from the site is not a primary source of drinking water so there is currently not an exposure pathway. Biota (crabs, clams and fish) consumed from impacted surface waters will be considered as an exposure pathway.

4.3 Soil Exposure and Air Migration Pathways

Humans may be exposed to surface and sub-surface soils during routine activities or during construction and excavation activities. Ecological receptors may also be exposed to soils if sufficient habitat is present to support or attract terrestrial flora and fauna including burrowing animals. Both current and future conditions will be considered.

Zoning and land use for both current and potential future conditions will be described. The potential for any sensitive human uses such as hospitals, schools, day care centers, playgrounds, as well as residential and military housing use will be identified and described in the SI Report. Information on size of human communities, if available (e.g., census or population and workforce data) will be included, if available. If habitat exists, a short description of habitat and ecological community and results of records search for sensitive terrestrial environments and protected species will be included in the SI Report.

A detailed site description is provided in Section 2 of this work plan. In addition, the future land-use map for Suffolk County indicates that the area around the site is zoned both residential (population in 2012 is estimated to be 1,499,273) 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).

5. SI Approach

5.1 General Approach

This section describes the SI field activities proposed for the PRLs at Gabreski ANGB as shown in **Figure 5-1 through Figure 5-10**. The objectives for the SI are to determine presence or absence of PFAS's in soil or surface water or sediment (if present) at each PRL and in groundwater downgradient of PRLs, and assess if PFAS constituents from the base are migrating off site.

A number of standardized approaches have been incorporated into the SI when considering sources, sampling strategies, and associated fate and transport (i.e., potential for off-base impact). For instance, the PRLs are categorized by release mechanism; as an example, ramps, aprons, paved FTAs, paved nozzle testing areas, and wash rack areas are all considered different kinds of PRLs, but when considering the release mechanism for each of these PRLs, they all would have involved initial releases to adjacent low-lying surface soils and in surface water runoff. Importantly, all of these types of PRLs generally involve open and accessible impervious surfaces, allowing samples to be collected immediately adjacent to or downgradient of the PRL. As such, all of these PRLs are combined in to the same "category" type.

Given this common release mechanism and accessibility, a consistent sampling strategy for these PRLs is important. In this case, the focus would be on low-lying pervious areas adjacent to paved areas, or any storm-water/surface water features in the area. Eight different general CSM categories have been developed based on the type of PRL/release mechanism. The different CSM categories, PRL types, and general sampling approach are provided in **Table 4**. Note that not all of these CSM categories or PRL types are located at Gabreski ANGB.

Table 4. General Sampling Approach by PRL CSM Category

CSM Category	PRL Type	General Sampling Approach	PRL Type Influence on CSM and Other General Comments
1	Current Buildings including Hangars with AFFF Fire Suppression Systems and Fire Stations	3 soil borings and 1 downgradient well per PRL except for large PRLs such as aprons and sludge drying beds where due to their large size, up to 6 soil borings and 3 downgradient wells are proposed.	• Near surface soil samples important because release would have been to the surface • Groundwater impacts more likely as a result of surface water runoff
2	Former Building Footprints including Hangars and Fire Stations		• Near surface soil samples important because release would have been to the surface • Groundwater impacts more likely as a result of surface water runoff
3	Open Impervious Surfaces – including Ramps, Aprons, Paved Fire Training Areas, and Paved Nozzle Testing Areas		• Near surface soil samples important because release would have been to the surface • Groundwater impacts more likely as a result of surface water runoff
4	Open Pervious Surfaces - including Grassy Fire Training Areas, Grassy Nozzle Testing Areas, Dry Detention Basins, and Dry Storm-water Drainage Basins		• Near surface soil samples important because release would have been to the surface • Groundwater impacts more likely as a result of surface water runoff

CSM Category	PRL Type	General Sampling Approach	PRL Type Influence on CSM and Other General Comments
5	Drainage Ditches	3 surface water and sediment locations along the length of the unlined drainage ditch and at its outfall	• Near surface soil samples important because release would have been to the surface • Groundwater impacts may be in areas other than downgradient groundwater
6	Storm-water Outfalls	1 surface water/sediment sample at the outfall itself	• Near surface soil samples important because release would have been to the surface • Movement of PFASs via surface water may be in
7	Former Septic System	3 soil boring/wells in association with former or abandoned-in-place structures identified	• Near surface soil samples not needed because source is subsurface • Groundwater impacts more likely as a result of subsurface leakage
OBM	Off-Base Migration	A minimum of one well will be monitored at the base boundary to evaluate off-base migration.	• Total number of wells are dependent upon the number and aerial extent of PRLs as well as the groundwater flow direction (i.e. is there more than one direction of groundwater flow).

The “PRL Type” categories that exist at Gabreski ANGB are categories 1, 3, 4, 5, 6, 7 and OBM. These CSM categories/release mechanisms have been used to determine where and how the samples should be located/collected (e.g. a surface soil sample provides limited value when the release was from a subsurface storm-water sewer). This sampling approach also ensures consistent and accurate development of an initial CSM for each PRL because data are collected at the most critical locations. This initial CSM would then inform and guide proposed sampling for the RI, if warranted.

The sampling approach at Gabreski ANGB includes the following:

- Soils - Two soil samples will be collected at each boring location, one from the surface (0-1 feet bgs) and one subsurface soil sample from the 4-5 foot bgs interval or at the elevation equivalent to the bottom elevation of a relevant appurtenance (such as a underground storm water pipe or oil water separator) not to exceed 10 feet bgs. Borings will be located in the most likely impacted area that is not paved. At the request of the ANG, borings will generally not be placed in concrete/paved areas unless the concrete/paved area is compromised (i.e. cracked) due to wear or age. Therefore, borings will be placed in the unpaved areas that collect the most volume of surface water sheet-flow from the paved areas. In some but not all PRLs, a boring used for collection of soil samples will be converted into a permanent monitoring well. Otherwise, a separate boring location will be used to advance the completion of the permanent monitoring well without soil sampling other than typical field screening using a photoionization device (PID).
- Groundwater Monitoring Wells – Existing monitoring wells will be used where possible. Review of the construction materials will be conducted to ensure that they are PFAS-free. Unless specifically stated, all monitoring wells installed as part of this SI will be permanent. Installation of permanent monitoring wells provides the ANG with the opportunity to resample the well as part of the RI phase, if applicable.
- Sediment and Surface Water - For drainage ditches, three or more (depending upon the length of the ditch) co-located sediment and surface water samples will be collected spaced apart at locations biased towards areas most likely to be impacted from PFAS containing runoff, such as discharges to the ditch from other drainage areas. At least one sediment/surface water collection point will be placed in the most downstream location prior to exiting the installation. Similarly, one sediment and surface water sample will be collected from each outfall PRL.

5.2 PRL Specific Approaches

The general approach outlined above has been used to develop the specific approach for each PRL included in this SI. **Table 5** provides a summary of the sampling approach with specific information for each PRL provided in the subsections below.

Table 5. SI Sampling Program

Location	PRL Type #	Site ID Codes	Estimated Number of Borings	Estimated Depth of Monitoring Wells (ft bgs)	Analysis Required	Figure Showing Sampling Locations
IRP Site 7 – Fire Training Area	3	IRP7	3 SB 2 MW	45	**Soil:** 6 Samples **Groundwater:** 2 Samples	Figure 5-1
Fire Station – Building 300	1	300	6 SB 1 MW[10]	45	**Soil:** 12 Samples **Groundwater:** 1 Sample	Figure 5-2
Building 395 (Helicopter Pods)	3	395	3 SB 3 MW[1]	45	**Soil:** 6 Samples **Groundwater:** 3 Samples[1]	Figure 5-3
Hangar 370	1	370	3 SB 1 MW	45	**Soil:** 6 Samples **Groundwater:** 1 Sample	Figure 5-4
Hangar 358	1	358	4 SB[2] 2 MW[3]	45	**Soil:** 8 Samples[2] **Groundwater:** 2 Samples[3]	Figure 5-5
Eastern Concrete Ramp/Apron	3	ECR	9 SB[4] 3 MW[5]	45	**Soil:** 18 Samples[4] **Groundwater:** 3 Samples[5]	Figure 5-6
Southern Concrete Ramp/Apron	3	SCR	4 SB 3 MW	45	**Soil:** 8 Samples **Groundwater:** 3 Samples	Figure 5-3
IRP Site 4 – Fuel Spill Area	4	IRP 4	7 SB[6] 2 MW[7]	45	**Soil:** 14 Samples[6] **Groundwater:** 2 Samples[7]	Figure 5-6
Nozzle Testing Area	4	NTA	3 SB 1 MW[12]	45	**Soil:** 6 Samples **Groundwater:** 1 Sample	Figure 5-6
Outfall SDO-001	6	SDO-001	1 SW/SED[8]	0	**Surface Water:** 1 Sample Sediment: 1	Figure 5-7
Outfall SDO-002	6	SDO-002	1 SW/SED[8]	0	**Surface Water:** 1 Sample Sediment: 1	Figure 5-7
IRP Site 5 – Southwest Storm Drainage Ditch	5	IRP 5	3 SW/SED 1 MW	45	**Sediment:** 3 Samples **Surface Water:** 3 Samples	Figure 5-8
IRP Site 8S – Old Base Septic System	7	IRP8S	4 SB[9] 1 MW[10]	45	**Soil:** 8 Samples[9] **Groundwater:** 1 Sample[10]	Figure 5-2
IRP 8K – Old Base Septic System	7	IRP8K	3 SB 1 MW	45	**Soil:** 6 Samples **Groundwater:** 1 Sample	Figure 5-3 Figure 5-9
IRP 8J – Old Base Septic System	7	IRP8J	3 SB 3 MW[1]	45	**Soil:** 6 Samples **Groundwater:** 3 Samples[1]	Figure 5-3
IRP Site 8G – Old Base Septic System	7	IRP8G	3 SB 1 MW	45	**Soil:** 4 Samples **Groundwater:** 1 Sample	Figure 5-5
Base Boundary Wells	OBM	BBW	6 MW[11]	45	**Groundwater:** 3 Samples[11]	Figure 5-10

SB = soil borings

MW = permanent monitoring wells

[1] Includes new proposed monitoring wells SCR-MW01, SCR-MW02, and SCR-MW03 to evaluate potential groundwater impacts from Hangar 395, IRP Site 8 (Old Base Septic System, and the southern Concrete Ramp/Apron.

[2] Includes soil boring IRP8G-SB02 evaluate potential soil impacts from Hangar 358.

[3] Includes new proposed monitoring well IRP8G-MW01 to evaluate potential groundwater impacts from Hangar 358.

[4] Includes soil borings IRP4-SB01, IRP4-SB02, IRP4-SB03, NTA-SB01, NTA-SB02, and NTA-SB03 to evaluate potential impacts from the Eastern Concrete Apron.

[5] Includes new proposed monitoring well ECR-MW01 and existing monitoring wells SW-7 and SW-5 to evaluate potential groundwater impacts from the Eastern Concrete Apron.

[6] Includes soil borings NTA-SB01, NTA-SB02, NTA-SB03, and ECR-SB02 to evaluate potential impacts from the IRP Site 4 Fuel Spill Area.

[7] Includes existing monitoring wells SW-7 and SW-5 to evaluate potential groundwater impacts from IRP Site 4 Fuel Spill Area.

[8] Stormwater and/or sediment samples will be collected from the on-Base manhole/catch basin that is closest to the base boundary supplying stormwater to this outfall.

[9] Includes soil boring 300-SB01 to evaluate potential soil impacts from IRP Site 8S (Old Base Septic System)

[10] Monitoring well IRP8S-MW01 is intended to evaluate potential groundwater impacts from both Building 300 and IRP Site 8s.

[11] Includes the existing monitoring wells SW-5, SW-10, and new proposed wells SCR-MW01, SCR-MW03, IRP5-MW01, and IRP7-MW01.

[12] Includes the existing monitoring well SW-10.

5.2.1 IRP Site 7 – Fire Training Area

Based on discussions with Gabreski ANGB personnel during a site visit on 6 December 2016 to kick-off the SI project, the former FTA was used as a storage area for unexploded ordinance. Gabreski ANGB personnel expressed a strong concern of conducting drilling operations within the paved over area that roughly coincides with the extent of the buried ordinance. For this reason, the three soil borings will be located to the south and east of the former FTA in grassy areas. As shown in **Figure 5-1**, two groundwater monitoring wells, IRP7-MW01 and MW02, is located in locations that are in the immediate downgradient direction of groundwater flow from the FTA (to the southeast).

5.2.2 Fire Station – Building 300

Based on discussions with Gabreski ANGB personnel, AFFF was historically stored in 5-gallon buckets on shipping pallets within Building 300, and an overhead fill system was used to transfer AFFF to vehicles. Based on this information, soil borings have been placed in the grassy locations that are closest to the pavement with the assumption that runoff from any potential releases of AFFF would have flowed to these areas. As shown in **Figure 5-2**, a groundwater well is shared with IRP Site 8S and is located in a location that is in the immediate downgradient direction of groundwater flow from the building (to the southeast), IRP8S-MW01.

5.2.3 Building 395 – Helicopter Pods

Based on discussions with Gabreski ANGB personnel, the AFFF fire suppression system that had been installed at Building 395 in 1998 was never used, and was retrofitted in 2012. There are no records of accidental AFFF releases from Building 395, nor were any floor drains observed in Building 395. Based on this information, soil borings are located on the concrete ramp/apron to the southeast of Building 395 adjacent to the footprint of the old base septic system. A groundwater well, which is shared with the southern concrete ramp/apron labeled SCR-MW01, is also located on the concrete ramp/apron in a location that is in the immediate downgradient location of groundwater flow from the building, which is towards the southeast (See **Figure 5-3**).

5.2.4 Hangar 370

Hangar 370 is located on the southern portion of the base, and was equipped with an AFFF fire suppression system from approximately 1998/1999 until 2011. No records of accidental AFFF releases or system testing exist. AFFF for the FSS was supplied from a 300-gallon tank located in the boiler room of the hangar. Any AFFF releases during testing or accidental releases within the boiler room would have been routed to the floor drain. Releases within the hangar likely would have entered the trench drain on the south side of the interior. The floor and trench drains led to an oil/water separator on the east side of the hangar. Based on this information, soil borings are located to the south of Hangar 370 and to the east of Hangar 370 in the vicinity of the former oil/water separator. A groundwater monitoring, 370-MW01, well is also located in a location that is in the immediate downgradient location of groundwater flow from the building, which is towards the southeast (See **Figure 5-4**).

5.2.5 Hangar 358

Hangar 358 is located on the southern portion of the base, and was equipped with an AFFF FSS from approximately 1998/1999 until 2011. No records of accidental AFFF releases or system testing exist. AFFF for the FSS was believed to have been supplied from a 300-gallon tank located in the boiler room of the hangar. Any AFFF releases during testing or accidental releases within the boiler room would have been routed to the floor drains, which were connected to an oil/water separator adjacent to the northeast corner of the building. Based on this information along with the groundwater flow direction, soil borings are located to the northeast and southeast of Hangar 358, in paved areas adjacent to the Eastern Concrete Ramp/Apron. A groundwater monitoring well, 358-MW01, is also located in a location that is in the immediate downgradient location of groundwater flow from the building, which is towards the southeast (See **Figure 5-5**).

5.2.6 Eastern Concrete Ramp/Apron

Although there are no records of AFFF usage on the Eastern Concrete Ramp/Apron, this area may have been impacted by AFFF due to the presence of aircraft. Accounts from Base personnel indicate AFFF usage adjacent to the ramp/apron. Stormwater runoff from the eastern ramp/apron enters drains on the southeast side of the ramp/apron and ultimately discharges to the outfall south of the runways. Based on this information, soil borings are located in the grassy area to the east of the ramp/apron. A groundwater monitoring well, ECR-MW01, is also located in a location that is in the immediate downgradient location of groundwater flow from the ramp/apron, which is towards the southeast (See **Figure 5-6**).

5.2.7 Southern Concrete Ramp/Apron

Although there are no records of AFFF usage on the Southern Concrete Ramp/Apron, this area may have been impacted by AFFF due to the presence of aircraft. Accounts from Base personnel indicate AFFF usage adjacent to the ramp/apron. Based on this information, soil borings are located to the northeast and to the south of the ramp/apron. A groundwater monitoring well, SCR-MW01, is also located in a location that is in the immediate downgradient location of groundwater flow from the ramp/apron, which is towards the southeast (See **Figure 5-3**).

5.2.8 IRP Site 4 – Fuel Spill Area

According to the 2011 Final Community Involvement Plan, a fuel spill occurred in 1987 on the grassy area adjacent to the southern edge of the Eastern Concrete Ramp/Apron. An unknown amount of fuel spilled at the site, and the fire department reportedly applied an unknown type of foam to the area. The flow of fuel, water, and foam was stopped before entering nearby drains. The remainder of the spill on the concrete ramp/apron surface was allowed to evaporate. Absorbent matting and powdered absorbent were placed along the outfall. Remedial action is currently in place at IRP Site 4. During the site visit conducted on 6 December 2016, the Eastern Concrete Ramp/Apron was observed to have expanded partially over the fuel spill area. Based on this information, soil borings are located within the fuel spill area and in the grassy area to the southeast of the fuel spill area. The two existing monitoring wells downgradient of this area, SW-5 and SW-7, will be sampled for PFASs as part of the investigation (See **Figure 5-6**).

5.2.9 Nozzle Testing Area

According to Base personnel, fire department historically placed a target in the grassy area on the south edge of the Eastern Concrete Ramp/Apron, across from Building 300, to use in support of vehicle nozzle testing. It is unknown whether foam or water was used during nozzle testing. Based on this information, soil borings are located adjacent to the south edge of the Eastern Concrete Ramp/Apron in the immediate vicinity of the nozzle testing area. A existing groundwater monitoring well, SW-10, is also located in a location that is in the immediate downgradient location of groundwater flow from the nozzle testing area, which is towards the southeast (See **Figure 5-6**).

5.2.10 Outfall SDO-001

Surface and subsurface drainage structures on the Base direct stormwater to two stormwater outfalls, both located on airport property, southeast of the Base. Outfall SDO-001 receives discharges from the Eastern Concrete Ramp/Apron, as well as the majority of the buildings on the northern and eastern portions of the Base property. Based on this information, a sediment sample and a surface water sample will be taken from the on-Base manhole/catch basin that is closest to the base boundary supplying stormwater to this outfall. In the event that the outfall is dry, a sample will be collected from the nearest downgradient location where water is present

5.2.11 Outfall SDO-002

Surface and subsurface drainage structures on the Base direct stormwater to two stormwater outfalls, both located on airport property southeast of the Base. Outfall SDO-002 receives discharges from the Southern Concrete Ramp/Apron, as well as adjacent Building 395 (Helicopter Pods). Based on this information, a sediment sample and a surface water sample will be taken from the on-Base manhole/catch basin that is closest to the base boundary supplying stormwater to this outfall. In the event that the outfall is dry, a sample will be collected from the nearest downgradient location where water is present.

5.2.12 IRP Site 5 – Southwest Storm Drainage Ditch

IRP Site 5 is a storm water drainage ditch that originates as a subsurface outfall on the southwest side of Hangar 370. Drainage in the ditch is directed to the southwest along the ditch for about 280 ft before it goes below the ground surface through a drainage culvert. The culvert resurfaces approximately 50 ft to the south and the ditch continues southwest for nearly 200 ft before drainage is again directed below the ground surface through a culvert. The second culvert extends another 450ft to the south, resurfaces, and then continues east for approximately 550 ft. At this point, flow from the ditch enters the base storm drain system. Flow eventually discharges to a dry ravine about 1500 ft southeast of IRP Site 5. The dry ravine discharges to Aspatuck Creek about 1000 ft further south-southeast. The drainage ditch receives rainwater from roof drains and runoff from paved areas in the southwestern portion of the Base.

Investigations and remedial actions were conducted at IRP Site 5 from 1998 until 2009 when no further action was recommended. PFAS sampling was not included in the investigation activities at IRP Site 5. IRP Site 5 may have received potentially AFFF-impacted stormwater from the Southern Concrete Ramp/Apron and Building 395 (Helicopter Pods). Based on this information, one sediment sample and one surface water sample are located along each run of the drainage ditch between the underground sections. This amounts to a total of three sediment samples and three surface water samples over the entire length of the drainage ditch. One groundwater sample will be taken from a new monitoring well, IRP5-MW01, near one of the three surface water/sediment sample locations.

5.2.13 IRP Site 8S – Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of septic system structures are still in use. Together, the individual structures make up the Old Base Septic Systems.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8.

Site 8S consisted of one septic tank and two cesspools which were abandoned in place in 2003. Site 8S was associated with Building 300. PFAS sampling was not included in the investigation activities conducted at IRP Site 8S. Based on this information, soil borings are located directly above, and to the southeast of Site 8S. A groundwater monitoring well, IRP8S-MW01, is also located in a location that is in the immediate downgradient location of groundwater flow from the former underground structure, which is towards the southeast (See **Figure 5-2**).

5.2.14 IRP Site 8K – Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of septic system structures are still in use. Together, the individual structures make up the Old Base Septic Systems.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8.

Site 8K consisted of one septic tank and three cesspools which were abandoned in place in 2003. Site 8K was associated with Building 395 (Helicopter Pods). PFAS sampling was not included in the investigation activities conducted at IRP Site 8K. Based on this information, soil borings are located directly above and to the north and west of Site 8K. A groundwater monitoring well, IRP8K-MW01, is also located in a location that is within the former leaching area of the cesspools. (See **Figure 5-3 and Figure 5-9**).

5.2.15 IRP Site 8G – Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of septic system structures are still in use. Together, the individual structures make up the Old Base Septic Systems.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8.

Site 8G consisted of one septic tank, two cesspools, and one distribution box which were abandoned in place in 2003. Site 8G was associated with Hangar 358. PFAS sampling was not included in the investigation activities conducted at IRP Site 8G. Based on this information, soil borings are located directly above, to the north, and to the southeast of Site 8G. A groundwater monitoring well, IRP8G-

MW01, is also located in a location that is in the immediate downgradient location of groundwater flow from the former underground structure, which is towards the southeast (See **Figure 5-5**).

5.2.16 IRP Site 8J – Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of septic system structures are still in use. Together, the individual structures make up the Old Base Septic Systems.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8.

Site 8J is still currently in use as part of the storm water drainage system. Site 8J was associated with Building 395 (Helicopter Pods). PFAS sampling was not included in the investigation activities conducted at IRP Site 8J. Based on this information, soil borings are located on the concrete apron to the southeast of Site 8J. A groundwater monitoring well, IRP8J-MW01, is also located in a grassy area to the south of Building 395 (See **Figure 5-3**).

6. Field Investigation Procedures

The field investigation operations consist of site preparation activities including the mobilization/demobilization of field team personnel and equipment, utility clearance, and surface/subsurface soil and groundwater sampling for PFASs utilizing direct push technology (DPT) and hollow-stem auger (HSA) drilling methods. Details concerning sampling activities and analytical methodology including specific procedures for PFAS-related investigations are presented in the SOPs (**Appendix D**). Procedures as outlined in the AECOM PFAS-specific SOP take precedence over the other SOPs. Health and safety requirements for SI field activities are provided in the APP (**Appendix E**).

6.1 Site Preparation

No vegetation clearance is planned during field investigation activities; rather the field team will work around existing site vegetation. Traffic control measures may be required to complete investigations near some PRLs. If traffic control is deemed necessary at a PRL, it will be coordinated with Gabreski ANGB operations personnel.

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 E**).

6.3 Permits and Notifications

Utility clearance will be conducted by Gabreski ANGB with input from the AECOM field team. AECOM or its drilling subcontractor will contact “Dig Safely New York”, the New York one-call utility clearance contractor. Dig information can be input into the system on-line at www.digsafelynewyork.com/or by calling 811. AECOM will also complete the utility clearance request (AF Form 103) and submit it to the Base Civil Engineer and/or Base Environmental Manager at least five business days before site activates begin. A site walk will be scheduled with the appropriate Gabreski ANGB personnel to mark out locations of subsurface activities. All field work will be coordinated with the Base Environmental Manager and/or his/her designee.

6.4 Sample Collection

6.4.1 Boring Installation and Soil Sampling

Soil samples will be collected via DPT (See SOP 3-17, **Appendix D**). A GeoProbe® DT45 or DT60 dual-tube sampling system (or equivalent) will be used to collect continuous soil cores to the target depth. DPT will be used to collect one surface soil (0-1 ft depth) and one subsurface soil sample at 4 to 5 feet bgs. Boring and or sampling depth may be adjusted in the field to sample at the depth of any PRL specific appurtenance (cesspool, drainage pipe, holding tank, etc). If refusal is encountered before the desired depth of sample location, additional attempts will be made adjacent to the original location to collect a soil sample at the desired depth. All drilling materials will be PFAS-free.

Continuous soil sampling will be completed, screened using a PID per SOP 3-20 (**Appendix D**), and manually observed for evidence of impacts (i.e. staining or odors). The soil cores will be logged for lithological descriptions by a field geologist using the Unified Soil Classification System (USCS). Observations and measurements will be recorded on field forms and in a non-treated field logbook. If permitted by the Base, 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 USCS) will be recorded. Additional observations to be recorded may include groundwater or perched water depth, organic material, or cultural debris.

Each sample will be collected into laboratory-supplied "PFAS free" high density polyethylene (HDPE) jars and labelled in pencil, and submitted to the laboratory for analysis of selected parameters. The laboratory method detection limits for these analytes are presented in the QAPP (**Appendix C**). Samples will be packaged on ice and transported via overnight commercial carrier under standard chain-of-custody procedures to the laboratory (See SOP 3-03 and 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. Field reagent blanks will accompany each cooler containing samples for PFAS analysis and will be analyzed for the project-specific list of PFASs. Due to the potential for cross-contamination, equipment blanks will be collected and analyzed. A temperature blank shall be placed in each cooler to ensure that samples are preserved between zero and four degrees Celsius during shipment.

DPT borings will be abandoned at completion of sampling activities unless they are being converted into monitoring wells. Borings in grass will be abandoned by backfilling with bentonite chips. Borings in asphalt 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. Borings into concrete are to be avoided if possible to minimize foreign object debris, which can severely damage aircraft. However, if borings are advanced into concrete, the borings will be restored similar to those in asphalt except that concrete will be placed in the borehole to provide as flush a surface as possible.

6.4.2 Monitoring Well Installation, Development, and Sampling

As described in Section 5, existing wells will be utilized to collect groundwater samples, as feasible. DPT rigs with the ability to spin augers will be used to install new, 2-inch diameter monitoring wells constructed with Schedule 40 poly-vinyl chloride (PVC), flush-threaded 10-feet sections of riser, 0.010-inch slotted well screen, and a threaded bottom cap. These permanent wells will be installed at boring locations ranging in depth about 45 feet. If refusal is encountered before the desired depth of sample location, attempts will be made adjacent to the original location. Monitoring wells will be installed in accordance with NYSDEC as specified in the DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010) and the Environmental Restoration Program, Air National Guard Investigation Guidance (ANG, 2009). The well screen will “straddle” the water table. A filter pack of 20/40 silica sand will be installed in the annulus around the well screen to a minimum of 2-feet above the well screen. A 2-foot thick bentonite seal will be placed above the filter sand and hydrated with distilled water. Bentonite grout will be placed in the well annulus from the top of the bentonite seal to ground surface. The bentonite grout will be allowed to set for a period of 24-hours prior to well completion. Monitoring wells completed as “stick-ups” will include a metal protective casing. Following installation, the permanent wells will be allowed to equilibrate with the surrounding formation until they contain a sufficient amount of water to fill the required sample containers.

New monitoring wells will be developed no sooner than 24 hours following installation by pumping and surging using a variable speed submersible pump. Development of wells will be completed per the SOP in **Appendix D** until field parameters have stabilized (See SOP 3-13, **Appendix D**).

Samples will be collected no sooner than 24 hours following development via low-flow sampling methods in accordance with NYSDEC approved procedures using bladder pumps or peristaltic pumps with disposable tubing (See SOP 3-14, **Appendix D**). Water levels will be measured to the nearest 0.01 inch and recorded. The pump tubing will be PFAS free (i.e. HDPE or other PFAS free material) and placed a minimum of two feet above the bottom of the monitoring well to prevent disturbance of sediments that may be in the bottom of the well. Groundwater samplers will be decontaminated between boring locations, as warranted (See SOP 3-06, **Appendix D**).

Each sample will be collected into laboratory-supplied bottleware and submitted to the laboratory for analysis of selected parameters. All sample containers will be PFAS free. The laboratory method detection limits for these analytes are presented as an attachment to this work plan (See **Appendix C**).

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. Field reagent blanks will accompany each cooler containing samples for PFAS analysis and will be analyzed for select PFASs. 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, 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.

6.4.3 Sediment and Surface Water

Sediment and surface water samples will be collected in accordance with the SOPs provided in **Appendix D** (See SOP 3-22 and 3-10, respectively). Samples will be collected utilizing PFAS free collection devices. Sediment will be collected from the location closest to the outfall sampling point as possible. Surface water will be collected directly from the outfall. In the event that the outfall is dry, a sample will be collected from the nearest downgradient location where water is present.

6.5 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:

- **Soil Sample Numbers: GB-xxx-yyzz-depth.**
- Installation: GB = Gabreski ANGB.
- Site Code xxx = site identification (ID) codes are located in **Table 5.**
- Media Type yy: SS = Surface Soil (0-1 ft bgs) or SB = Subsurface Soil.
- Consecutive Number zz: 01, 02, 03, etc.
- Depth: Depth below ground surface in feet. Note that the depth for surface soil samples will be “01” indicating that the sample was taken from 0-1 foot.
- Sample Type: D for duplicate.
- **Groundwater, Surface Water and Sediment Sample Number: GB-xxx-yy.**
- Installation: Gabreski ANGB = GB.
- Site Code xxx = site identification (ID) codes are located in **Table 5.**
- Media Type yy: MW = Groundwater, SD = Sediment, SW = Surface Water.
- Consecutive Number zz: 01, 02, 03, etc.
- Sample Type: D for duplicate.

The sample identification numbers for the first subsurface soil and groundwater samples at IRP Site 7 – Fire Training Area (site ID IRP7) will be GB-IRP7-SB01-10, indicating that the sample was collected from 10 ft bgs and GB-IRP7-MW01, respectively. Duplicate sample identification numbers will be followed with a “D”.

Field Reagent Blank (FRB) and equipment blank (EB) QC samples will be identified as follows:

- Field Reagent Blanks = GB-FRB-date (mmddyy), and
- Equipment Blanks = GB-EB-date (mmddyy).

6.6 Analyses and Quality Assurance/Quality Control

Samples will be analyzed for PFASs using the US EPA Method 537 (modified) as outlined in the **Appendix C**. Samples will be shipped to Eurofins Lancaster Laboratory (Eurofins), a Department of Defense (DoD) approved laboratory that is experienced in handling environmental samples, is Environmental Laboratory Approval Program (ELAP) certified for PFAS analyses, and meets DoD Installation Restoration QA Program requirements. The laboratory will provide analytical results within 30 days of sample receipt. Data validation/review will be conducted on laboratory results by AECOM chemists in accordance with procedures specified in **Appendix C**.

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 as provided in more detail in **Appendix C** of this work plan.

6.7 Health and Safety Requirements

Health and safety requirements for SI field activities are provided in the APP (**Appendix E**). Field personnel will wear Level D personal protective equipment, which will be PFAS-free. 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 (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.

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.

6.8 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 10-01, Policy on Environmental Resources Program Information Management System (ERPIMS), including the 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, and
- Sample results (analyte concentrations, dilutions, data qualifiers, method reporting/detection limits).

Samples collected during the SI will be analyzed by Eurofins Lancaster Laboratory (Eurofins) using methods identified in the QAPP (**Appendix C**). Sample collection, data analysis, and data reporting are addressed in the QAPP (**Appendix C**).

Surveying data will be compliant with NGB/A7O 11-01, Policy on Collection of Digital Spatial Data for Monitoring Wells During Environmental Investigations at Air National Guard Sites (Supplements A7CV 07-03, 15 Aug 2007, same subject).

GIS data will be compliant with the latest ANG spatial data requirements, currently NGB/A7O 14-01, Requirements for Geospatial Data Deliverables.

6.9 IDW Management

Investigation Derived Waste (IDW) generated during SI activities (e.g., soil cuttings and decontamination/purge water) will be containerized in correctly labeled 55-gallon drums. IDW will be sampled and characterized for waste profiling. 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. 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.

6.10 Documentation

The non-treated 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**).

6.11 Public Affairs

A project-specific community relations plan is not currently planned for this investigation, but may be implemented if sufficient interest from the community is realized. 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. Requests for information from the press or public will be referred to the Gabreski ANG public affairs office.

6.12 SI Report

AECOM will prepare a Draft, Draft Final, and Final PFAS SI Report for Gabreski ANGB. The PFAS 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, 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 PRLs, installation 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 Surface Water and Sediment Sampling
- 4.4 Soil Borings
- 4.5 Monitoring Well Installation / Groundwater Sampling

5.0 INVESTIGATION RESULTS

- 5.1 PRL (A-X)
  - 5.1.1 Field activities
  - 5.1.2 Investigation Results
  - 5.1.3 Updated CSM
  - 5.1.4 Conclusions and Recommendations
- 5.2 Investigation-Derived Waste Management
- 5.3 Deviations from the Work Plan

6.0 CONCLUSIONS- Summary

7.0 RECOMMENDATIONS- Summary

8.0 REFERENCES

APPENDICES (as warranted)

APPENDIX A: FIELD DOCUMENTATION

- A-1: BORING/WELL LOGS AND WELL CONSTRUCTION DIAGRAMS
- A-2: MONITORING WELL SAMPLING FORMS
- A-3: INSTRUMENT CALIBRATION
- A-4: FIELD LOGBOOK AND MISCELLANEOUS FORMS

APPENDIX B: ANALYTICAL DATA VALIDATION REPORTS AND LABORATORY DATA REPORTS

APPENDIX C: INVESTIGATION-DERIVED WASTE MANAGEMENT

6.13 Schedule

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

Table 6. Proposed Schedule - Gabreski ANGB

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

7. References

ANG, 2002. Final Environmental Baseline Survey, 106th Rescue Wing, New York Air National Guard, Francis S. Gabreski Airport, Westhampton, New York. October.

ANG, 2011. Final Community Involvement Plan for the 106th Rescue Wing. September.

ANG, 2012. Final Record of Decision for Site 8. April.

Air National Guard Readiness Center. 2009. Air National Guard, Environmental Restoration Program, Investigation Guidance. September.

BB&E, 2016. Final Preliminary Assessment Report for Perfluorinated Compounds at Gabreski Air National Guard Base, West Hampton, New York. March.

Department of Defense Instruction 4715.18, Emerging Contaminants, June 11, 2009

MACTEC Engineering and Consulting, Inc., 2003. Technical Memorandum Site 8 Septic System Remediation Completion Report, 106th Rescue Wing, New York Air National Guard, Francis S. Gabreski Airport, Westhampton Beach, Suffolk County, New York. September.

NGB/A70 10-01, Policy on Environmental Resources Program Information Management System (ERPIMS)

NGB/A7O 11-01, Policy on Collection of Digital Spatial Data for Monitoring Wells During Environmental Investigations at Air National Guard Sites (Supplements A7CV 07-03, 15 Aug 2007, same subject)

NGB/A7O 14-01, Requirements for Geospatial Data Deliverables.

NYSDEC, 2010. DER-10 Technical Guidance for Site Investigation and Remediation. http://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf. May.

PEER, 2004. Final Remedial Investigation for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12. June.

Secretary of the Air Force/Installation, Environment and Energy (SAF/IE). Policy on Perfluorinated Compounds. August 11, 2016.

United States Air Force Instruction 32-7020, The Environmental Restoration Program, November 7, 2014, modified April 18, 2016

United States Air Force Interim Guidance on Perfluorinated Compounds, September 17, 2012

United States Department of Agriculture, Natural Resources Conservation Service, 2013. Web Soil Service. http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx as accessed on 13 December 2013.

United States Department of Commerce, United States Census Bureau - Suffolk County, New York. http://quickfacts.census.gov/qfd/states/36/36103.html as accessed on 19 December 2013.

USEPA, 1992. Guidance for Performing Site Inspections Under CERCLA; Interim Final, September 1992 (http://www.hanford.gov/dqo/project/level5/sicercla.pdf)

USEPA, 2005. Federal Facilities Remedial Site Inspection Summary Guide. July 2005 (http://www.epa.gov/fedfac/pdf/ff_si_guide.pdf)

USEPA, 2012. Third Unregulated Contaminant Monitoring Rule (UCMR-3). https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule. May.

USEPA, 2016. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA) – May 2016. https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final_508.pdf as accessed on 4 January 2017

USEPA, 2016. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) – May 2016. https://www.epa.gov/sites/production/files/2016-05/documents/pfos_health_advisory_final_508.pdf as accessed on 4 January 2017

USEPA, 2016. Site-Specific Action Levels based on Hoosick Falls Water Contamination. https://www.epa.gov/ny/hoosick-falls-water-contamination as accessed on 8 May 2017.

USEPA, 2016. Regional Screening Levels – Generic Tables (May 2016). Residential – Direct Contact Soil. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016 as accessed on 8 May 2017.

USFWS (U. S. Fish and Wildlife Service) 2014. Endangered, Threatened, Proposed, and Candidate Species, New York Counties, September.

Appendix A - Figures

Appendix B – PA Report

Appendix C - Laboratory QAPP

Appendix D – Field-Related SOPs

Appendix E - Accident Prevention Plan

Appendix A - Figures

AECOM

3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 2/13/2017

Approved: xx 2/13/2017

Project No.: 60520893

Figure 1-1
Gabreski ANGB Location

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York

AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 3/6/2017

Approved: MM 3/6/2017

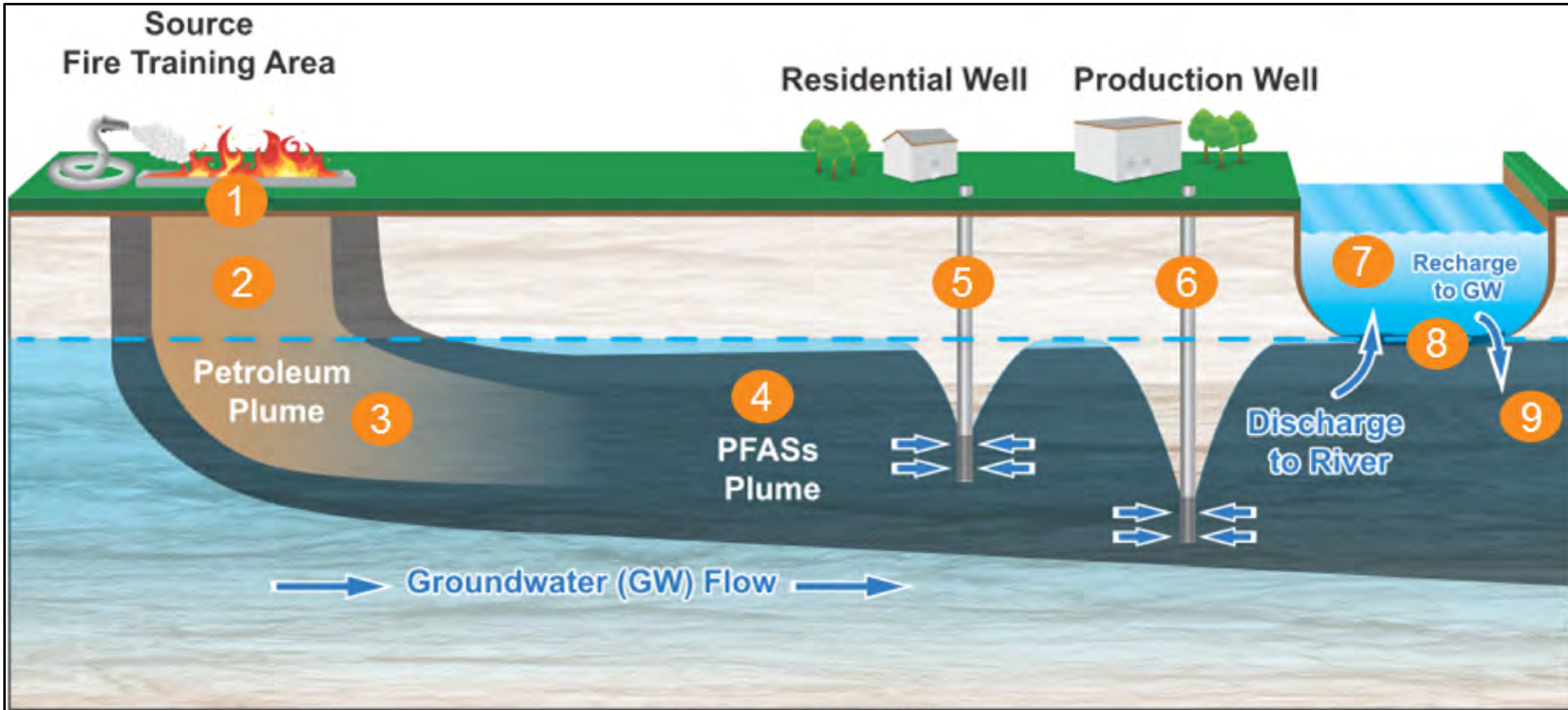
Project No.: 60520893

Figure 2-1
Gabreski ANGB Potential Release Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York

L:\GIS\GIS_Data\60520893_ANG_PFCs\MXDs\Gabreski_Workplan\Figure 2-1 Gabreski Potential Release Locations 11x17.mxd



1 Surface Soil

2 Subsurface Soil

3 Source Area GW

4 Downgradient GW Containment

5 Residential Well GW Treatment

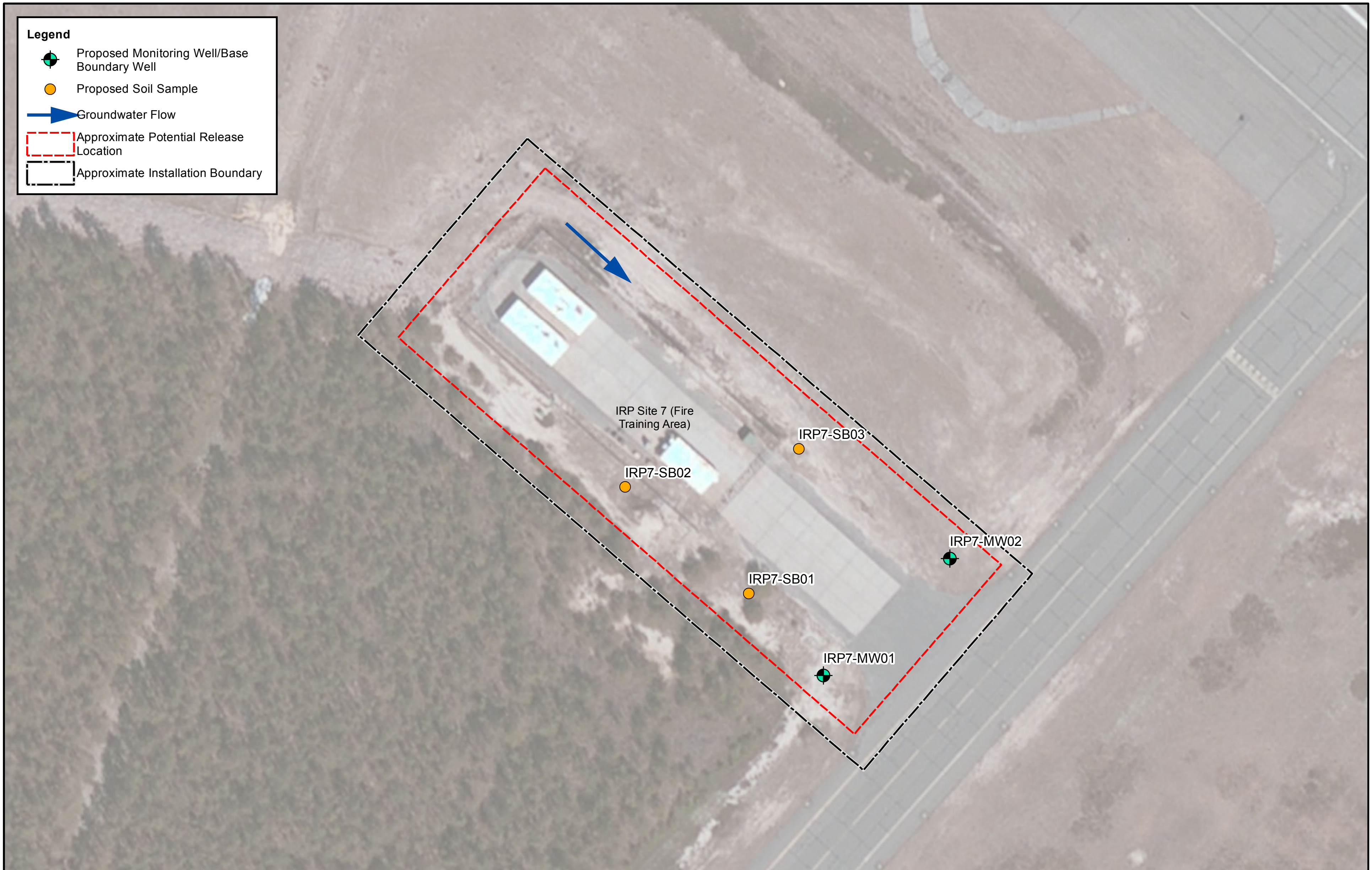
6 Production Well GW Treatment

7 Surface Water

8 Sediment

9 Offsite GW Impacted by Surface Water

AECOM 3101 Wilson Blvd., Arlington, VA 22201 T (703) 682-4900 F (703) 682-4901		Figure 4-1 **Conceptual AFFF Site Model**
Drawn: AC 2/16/2017		Gabreski ANG Perfluorinated Compounds Site Inspection Work Plan
Approved: BP 2/16/2017	*Not to Scale*	
Project No.: 60520893		Westhampton, New York



AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 10/31/2017

Approved: MM 10/31/2017

Project No.: 60520893

Figure 5-1
IRP Site 7 (Fire Training Area) Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York

AECOM

3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

Approved: MM 4/19/2017

Project No.: 60520893

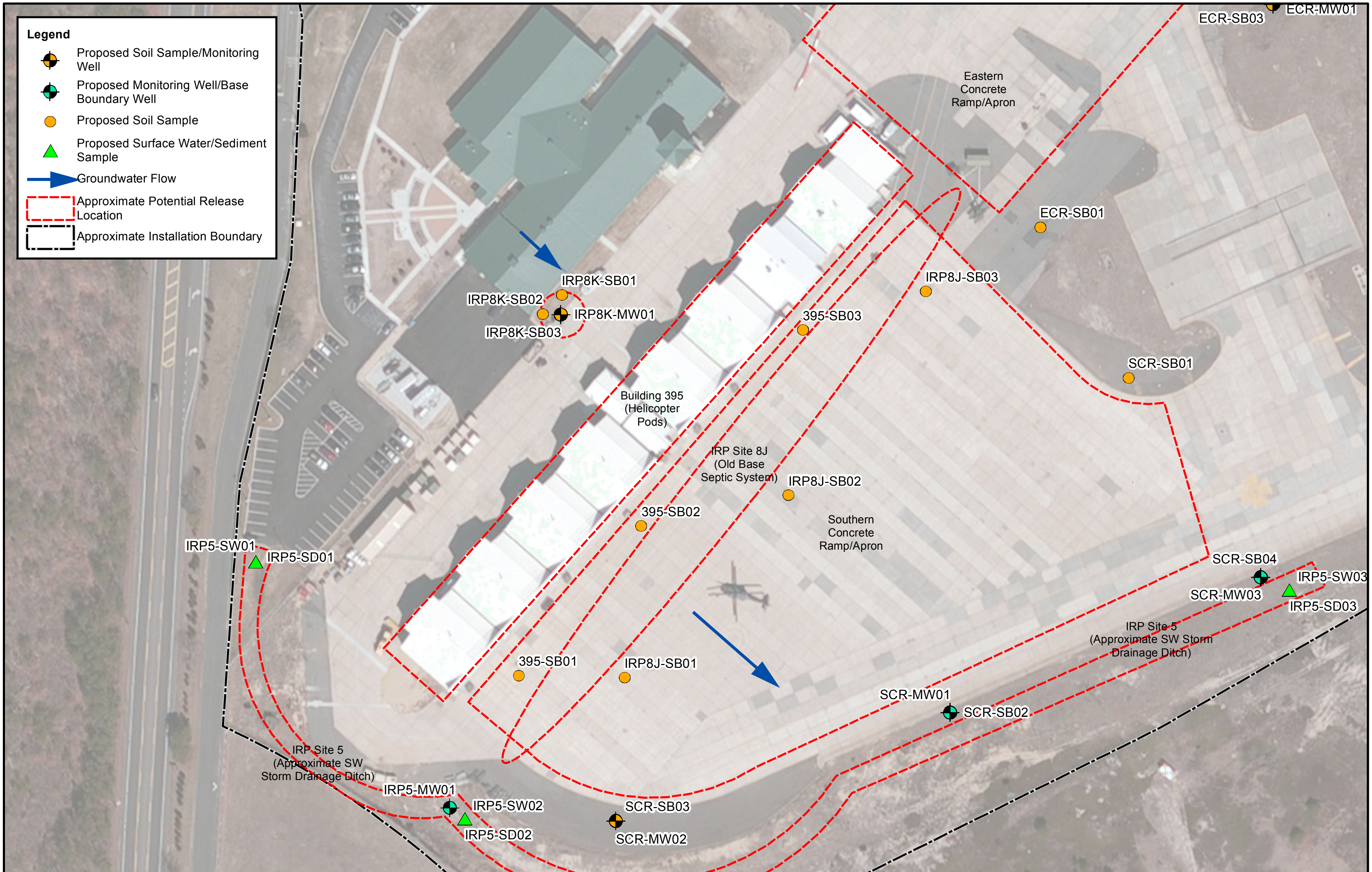
N

Feet
0 30 60

Figure 5-2
IRP Site 8S and Building 300 Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

Approved: MM 4/19/2017

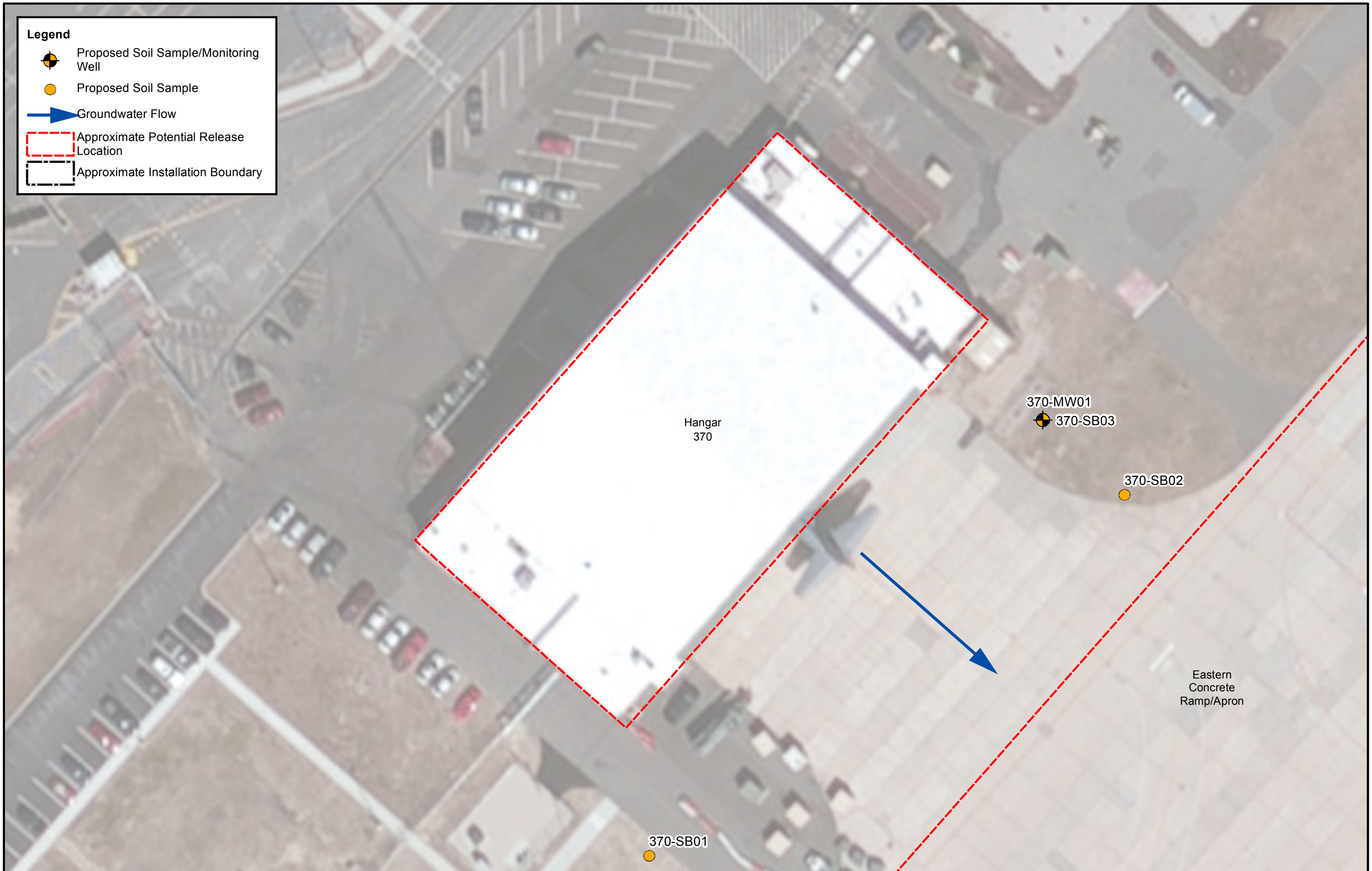
Project No.: 60520893

Figure 5-3

IRP Site 8K, IRP Site 8J, Building 395, and South Concrete Ramp/Apron Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

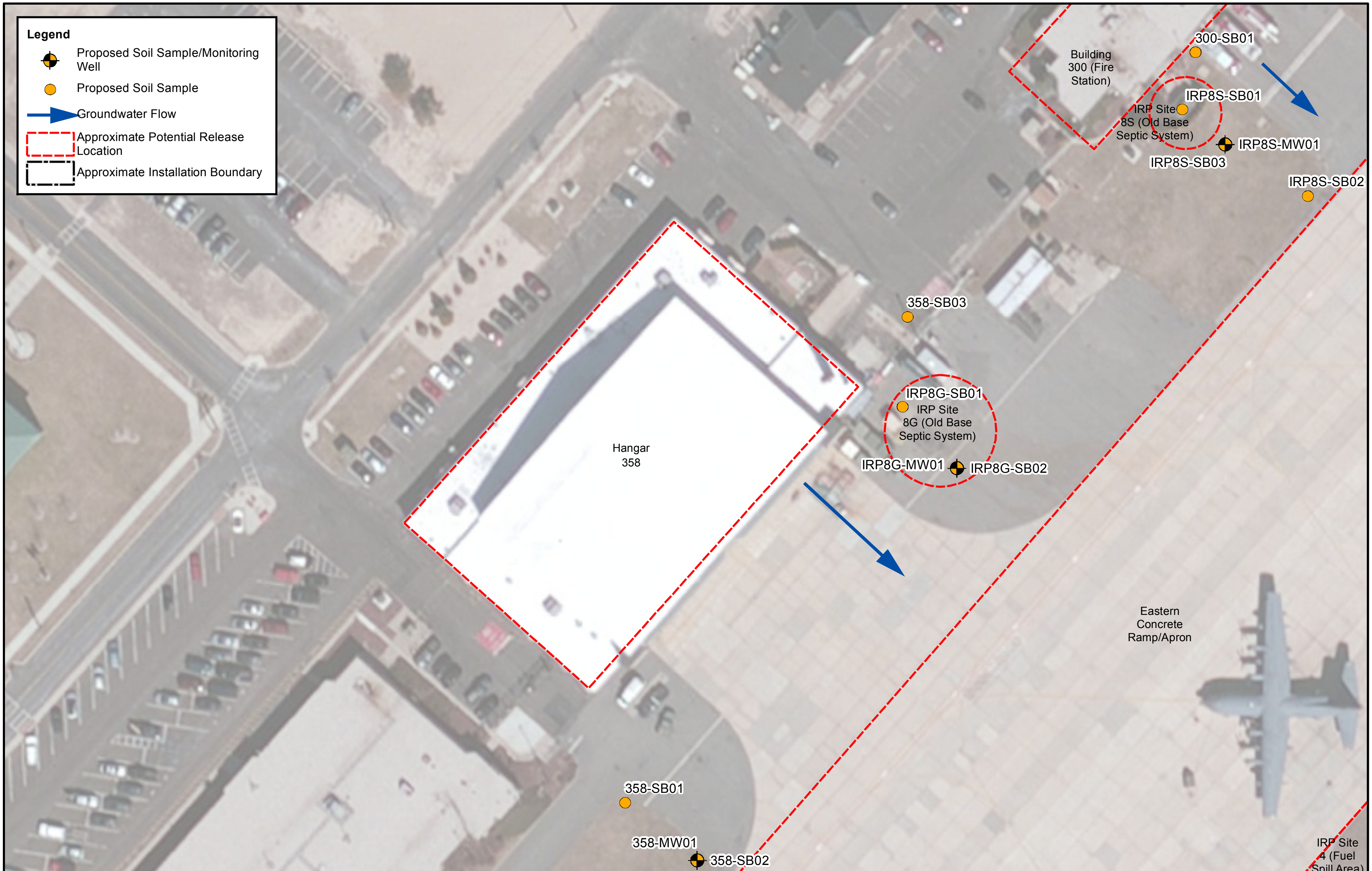
Approved: MM 4/19/2017

Project No.: 60520893

Figure 5-4
Hangar 370 Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM

3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

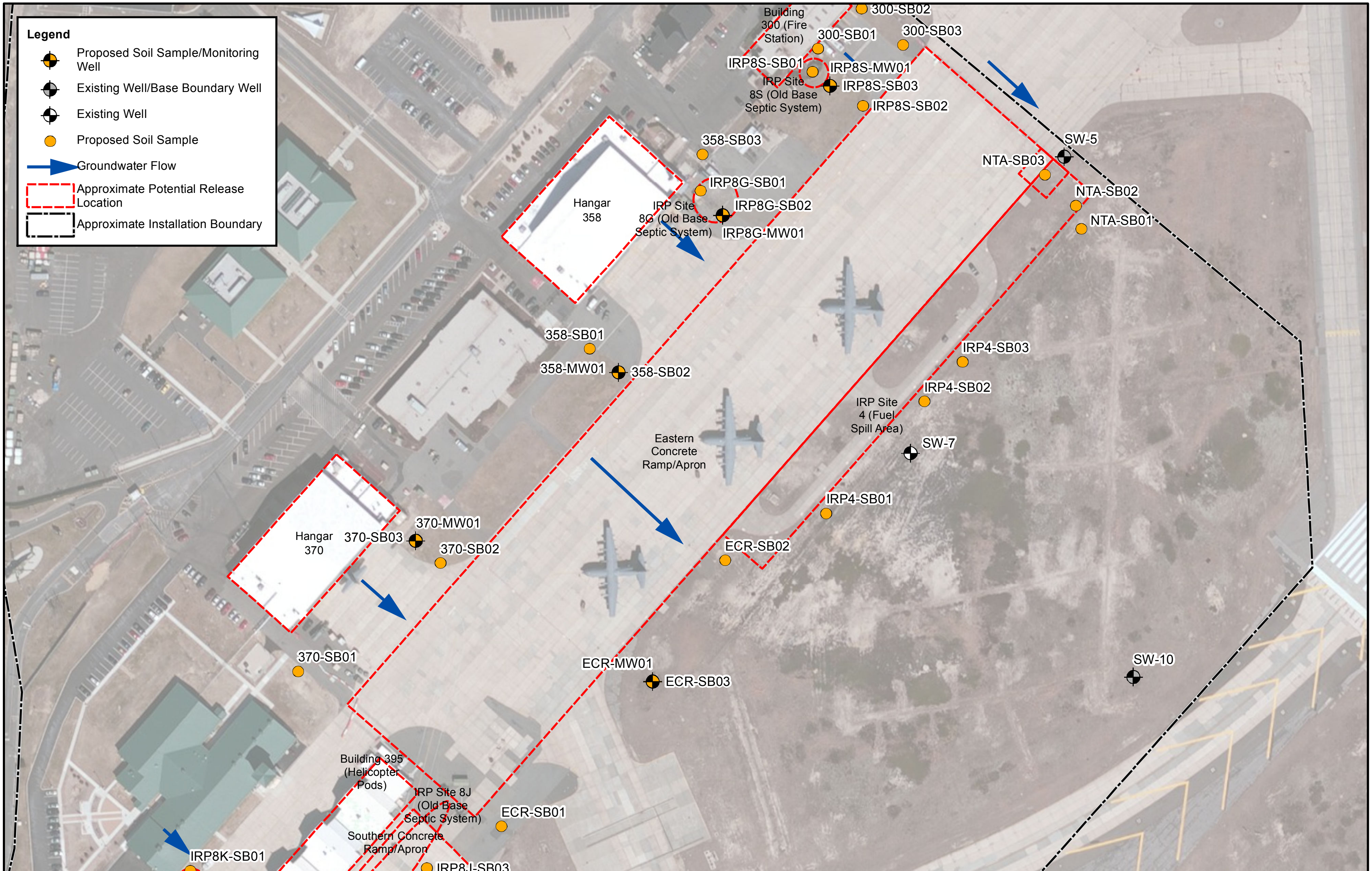
Approved: MM 4/19/2017

Project No.: 60520893

Figure 5-5
Hangar 358 and IRP Site 8G Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM

3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

Approved: MM 4/19/2017

Project No.: 60520893

Figure 5-6

Eastern Concrete Ramp/Apron, IRP Site 4, and Nozzle Testing Area (NTA) Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York

AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/18/2017

Approved: MM 4/18/2017

Project No.: 60520893

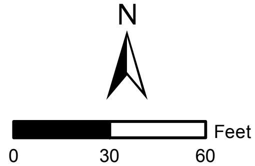
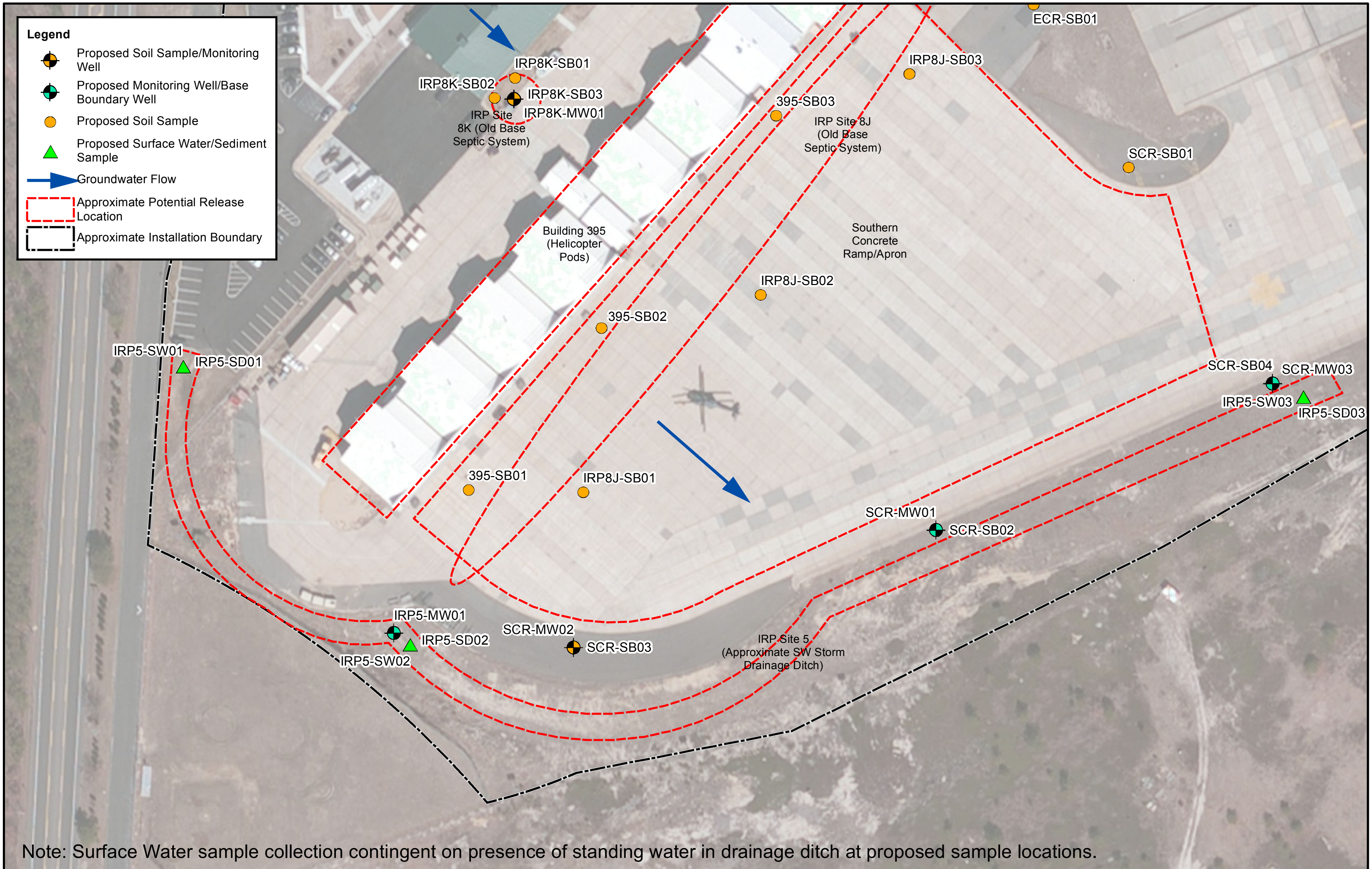


Figure 5-7
Outfall SDO-001 and Outfall SDO-002 Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM

3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

Approved: MM 4/19/2017

Project No.: 60520893

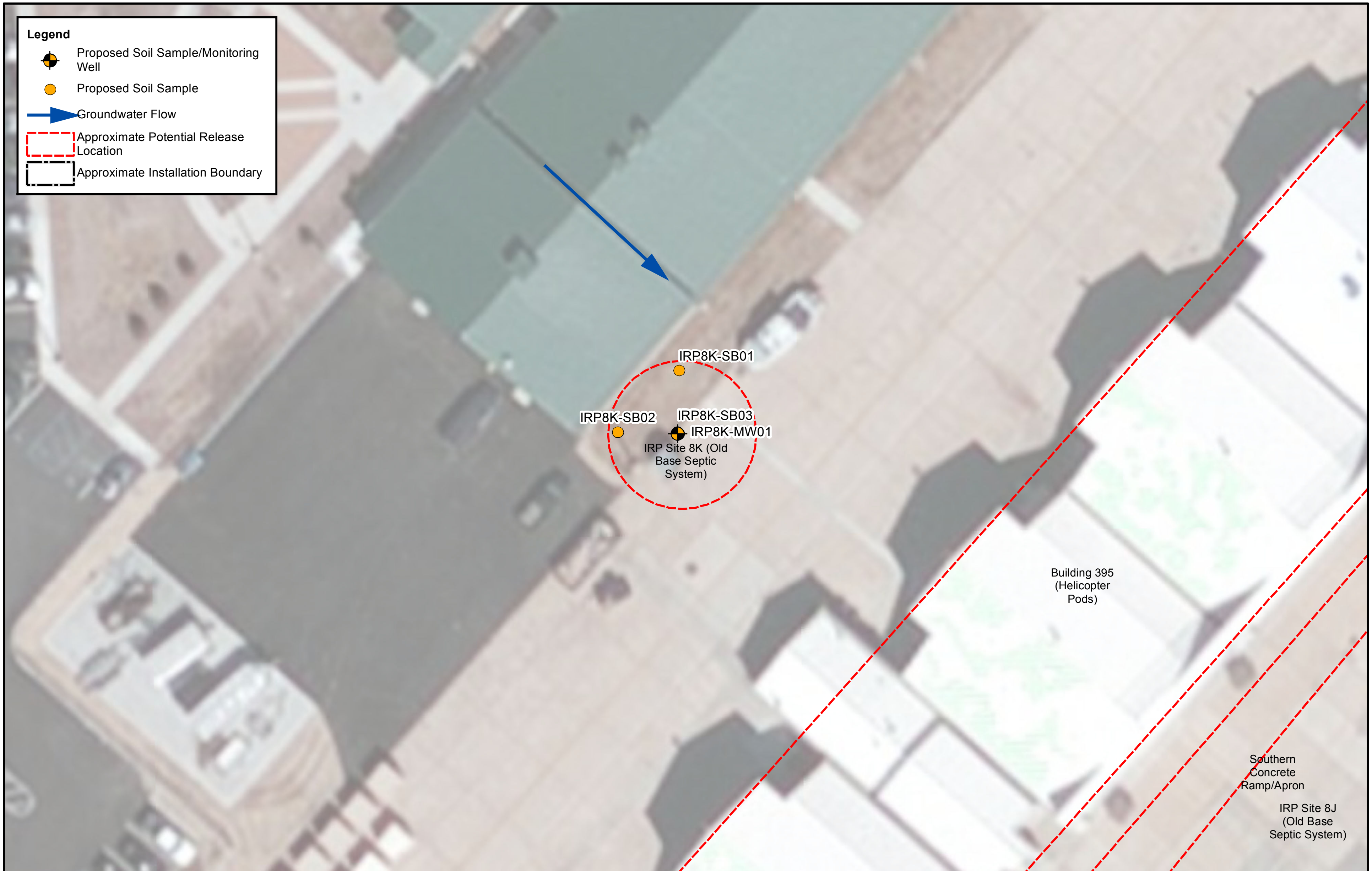
N

Feet
0 65 130

Figure 5-8
IRP Site 5 Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 4/19/2017

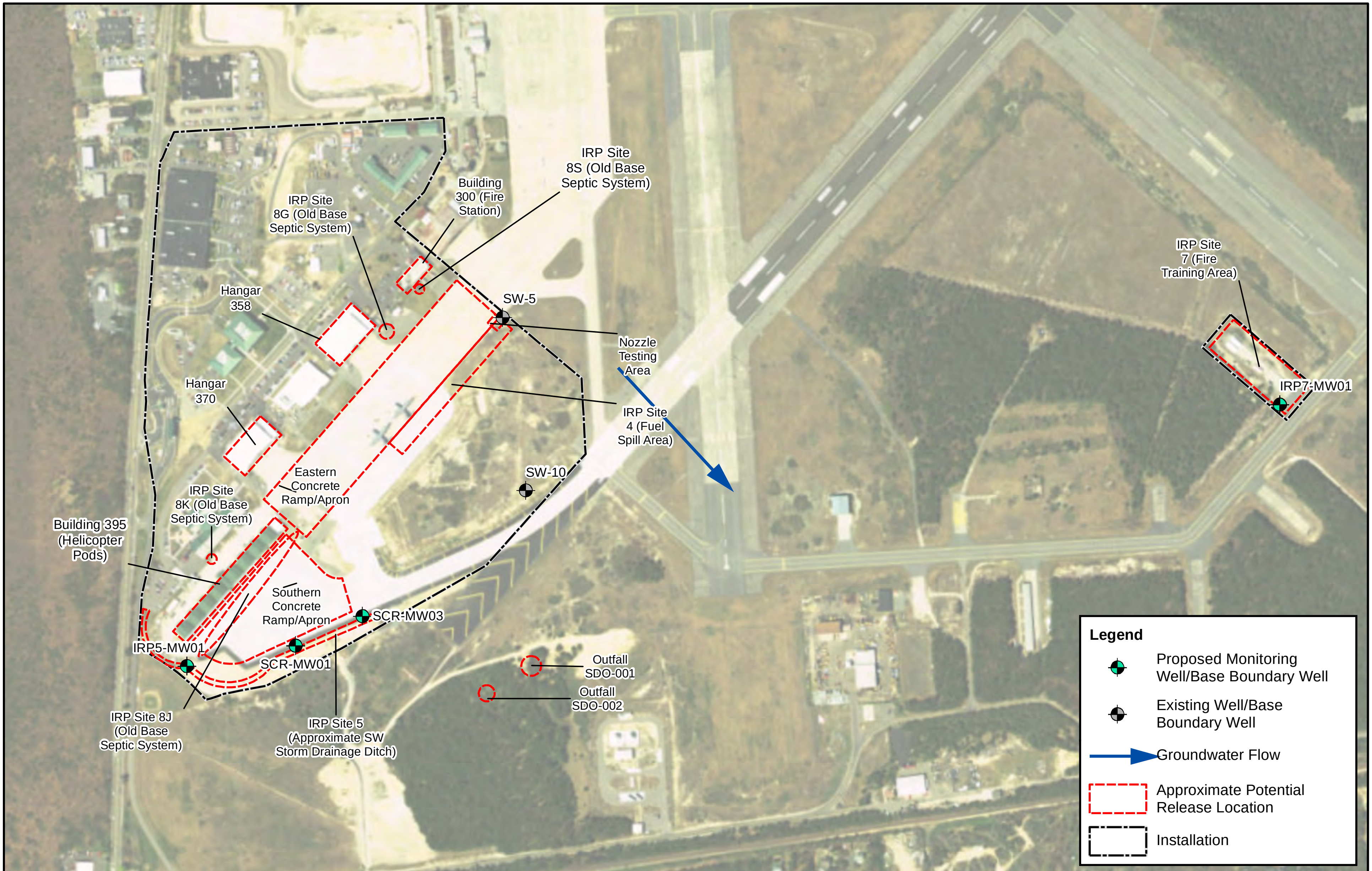
Approved: MM 4/19/2017

Project No.: 60520893

Figure 5-9
IRP Site 8K Sample Locations

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York



AECOM
3101 Wilson Blvd., Arlington, VA 22201
T (703) 682-4900 F (703) 682-4901

Drawn: AC 3/7/2017

Approved: JS 3/7/2017

Project No.: 60520893

Figure 5-10
Gabreski ANGB Base Boundary Wells

Gabreski ANG Perfluorinated Compounds
Site Inspection Work Plan

Westhampton, New York

Appendix B – PA Report

FINAL

PERFLUORINATED COMPOUNDS PRELIMINARY ASSESSMENT SITE VISIT REPORT

FRANCIS S. GABRESKI AIR NATIONAL GUARD BASE WESTHAMPTON BEACH, NEW YORK

Prepared For:

Headquarters Air National Guard
Joint Base Andrews, Maryland

March 2016

(This page intentionally left blank)

FINAL

PERFLUORINATED COMPOUNDS PRELIMINARY ASSESSMENT SITE VISIT REPORT

FRANCIS S. GABRESKI AIR NATIONAL GUARD BASE WESTHAMPTON BEACH, NEW YORK

Prepared For:

Headquarters Air National Guard
Joint Base Andrews, Maryland

Prepared By:

BB&E, Inc.
March 2016

(This page intentionally left blank)

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

AFFF	Aqueous Film Forming Foam
AMSL	above mean sea level
ANG	Air National Guard
ANGB	Air National Guard Base
AOC	Area of Concern
AST	aboveground storage tank
BB&E	BB&E, Inc.
bgs	below ground surface
EM	Environmental Manager
FD	Fire Department
FSS	fire suppression system
ft	feet
FTA	Fire Training Area
HEF	High Expansion Foam
LTM	long-term monitoring
NFA	No Further Action
NYSDEC	New York State Department of Environmental Conservation
IRP	Installation Restoration Program
OWS	oil water separator
PA	Preliminary Assessment
PFCs	Perfluorinated Compounds
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PHAL	Provisional Health Advisory Levels
RI	Remedial Investigation
SI	Site Investigation
SVOC	semi-volatile organic compound
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
VOC	volatile organic compound

(This page intentionally left blank)

1.0 INTRODUCTION

A preliminary assessment (PA) site visit was conducted by BB&E, Inc. (BB&E) on 18 November 2015 at the Francis S. Gabreski Air Guard National Guard Base (ANGB) in Columbus, Ohio. The site location is shown on Figure 1. The purpose of the trip was to identify potential sites of historic environmental releases of perfluorinated compounds (PFCs), specifically from Aqueous Film Forming Foam (AFFF) usage and storage, as shown on Figure 2. Prior to the site visit, BB&E conducted research of any documented Fire Training Areas (FTAs) in operation since 1970, or any other use or release of AFFF in accordance with the Final PFC Preliminary Assessment Work Plan (BB&E, 2015). During the site visit, BB&E conducted personnel interviews, reviewed on-site documentation and toured each potential site.

Individuals contributing to this PA effort included the following:

- Captain Shaun Denton – Gabreski ANGB Environmental Manager (EM)
- Mr. Tony Vasell – Gabreski ANGB State Environmental Technician
- Captain Kenny Caron – Station Captain for State of New York (former Gabreski ANGB Firefighter)

Sections 2.0 and 3.0 of this report outline the potential PFC sources identified on the Base property during the records review and site visit, while Section 4.0 provides conclusions and recommendations for potential follow-on actions. References are included in Section 5.0. Representative photos of the subject sites taken during the site visit are attached as Appendix A. Interview questions and records of communication are presented in Appendix B and other supporting documentation is provided in Appendix C.

1.1 Hydrogeologic Setting

According to the Final Preliminary Assessment/Site Inspection (PA/SI) report for the Regional Compliance Program (AECOM, 2015), groundwater beneath the site is found within different aquifers: 1) Lloyd Aquifer—the deepest aquifer, which provides a good source of drinking water in an area where salt water intrusion is common; 2) Magothy (a good source of drinking water); and 3) Upper Glacial the unconfined, shallow surficial aquifer, which is the major source of potable water in the area. This unconfined aquifer consists of very porous and highly permeable coarse sands and gravels, and can yield large quantities of water. It is generally 120 feet (ft) thick, and flows southeast toward the headwaters of Quantuck Creek. Depth to groundwater varies from 5 ft below ground surface (bgs) in the southern portion of the Base to 40 ft at higher elevations.

Groundwater flow direction is toward the south-southeast (PEER, 2004).

Surface water information is included in Sections 2.2.4 and 3.2.4.

2.0 FIRE TRAINING AREAS

FTA Areas of Concern (AOCs) are sites where AFFF has been released during fire training activities. The following section includes a description of any fire training AOCs, operational history, waste characteristics, and pathway evaluations. One historical FTA was used by the ANG as described below.

2.1 AOC Description, Operational History, and Waste Characteristics

The following are the FTA AOCs that were identified during this PA Investigation.

2.1.1 IRP Site 7 Fire Training Area

Installation Restoration Program (IRP) Site 7 is a former FTA. 130 feet northwest of the taxiway on the southeastern side of the airport on a 10-inch thick concrete hard stand, approximately 400 feet long by 50 ft wide, and bordered by a 10 foot wide asphalt apron. The FTA was used for fire-fighting training exercises by the United States Air Force (USAF) from 1943 until 1971. The area was originally an unlined pit encompassing 1 acre. Waste fuels, solvents (e.g., kerosene, mineral spirits, TCE, 2-butanone, toluene, etc.), and jet fuel were reportedly poured directly on the ground and ignited for firefighting training exercises.

The area was paved with concrete hard stand in 1971 after the ANG took over operations. Curbing 1 foot high and 50 by 50 ft in size was constructed in 1978 to act as a berm to enclose the burn area. Burn procedures were modified by floating a layer of jet fuel inside the berm on water, then either separating the fuel into a concrete underground storage tank (UST), or burning off excess fuel. Fuel to be used in training exercises was stored in a steel aboveground storage tank (AST) located about 250 ft south-southeast of the former FTA. Both tanks were connected to the former FTA by buried piping. The former FTA is located about 3,200 ft upgradient of the Suffolk County Water Authority's Meeting House Road well field. Use of the site for fire-fighting training exercises was discontinued by the ANG in 1986 (ANG, 2011).

IRP Site 7 was investigated in 1989 and volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were detected above respective action levels. A remedial investigation (RI) was conducted in 2001 and found VOCs, SVOCs, arsenic, and lead above action levels in groundwater samples. Long-term monitoring (LTM) was begun in 2004 and continued through October 2012, when sampling was ceased and No Further Action (NFA) was requested (SAIC, 2012). New York State Department of Environmental Conservation (NYSDEC) concurred with NFA on April 16, 2013.

According to Base personnel, AFFF and protein foam were used, although usage amounts are unknown. The concrete and a portion of the berm still remain. This area is now used as munitions storage. An undated aerial photo taken when the former FTA was in use is included as Appendix C-1.

Fire training activities now take place southwest of the former FTA - this parcel is not located on ANG property.

2.2 Pathway and Environmental Hazard Assessment

The following is a preliminary evaluation of the threats and targets associated with each potential exposure pathway. In their anionic forms, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are water soluble and can migrate readily from soil to groundwater. The United States Environmental Protection Agency (USEPA) has not established Provisional Health Advisory Levels (PHALs) for PFOS and PFOA in soil (USEPA, 2014). The primary exposure pathway for PFOS and PFOA would be the ingestion of contaminated drinking water.

2.2.1 Groundwater

Groundwater flow direction is discussed in Section 1.1. No documentation was available showing that groundwater at the Base has been tested for PFCs; therefore it is unknown whether PFCs are present in the groundwater. Based on historical practices, they may be present in the groundwater in the areas of the former FTA (IRP Site 7).

2.2.1.1 Water Wells

A review of the EDR Radius Map™ Report with Geocheck® dated November 13, 2015 shows 14 water wells within a one-mile radius of the Gabreski ANGB as listed in the Federal United

States Geological Survey (USGS) Database (Appendix C-2) (EDR, 2015). No public water supply system wells were identified within one mile of the Gabreski ANGB.

Drinking water is supplied to the Gabreski ANGB from the Suffolk County Water Authority (PEER, 2004).

According to the RI Report for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12 (PEER, 2004), the nearest public supply well field is located 0.6 miles southeast of Francis S. Gabreski Airport (Appendix C-3). As part of the RI, information on private water wells was researched at the NYSDEC Division of Water, Water Supply, at Stony Brook, New York. Well locations were found and Well Completion Reports were reviewed and copied from the files of the NYSDEC Water Supply office for all wells within the target area, during the RI. Completion Reports were found for 35 privately owned water wells dating from October 1944 through February 1990. Ten wells were installed for municipal water supply, thirteen wells were installed for domestic use, three wells were installed for commercial use by business, two wells were installed for irrigation purposes, and six wells were installed for observation (monitoring) purposes. Two wells were installed for other purposes, one being to supply firefighting water in an area where no hydrants exist, and the other being a temporary well used by a Department of Defense contractor for a rocket test (PEER, 2004). Appendix C-3 includes details on these identified wells.

2.2.2 Soil

No documentation was available showing that soils at Gabreski ANGB have been tested for PFCs; therefore it is unknown whether PFCs are present in the soil. However, based on historical practices, they may be present in the soil around the Former FTA (IRP Site 7).

2.2.3 Sediment

No documentation was available showing that sediments at Gabreski ANGB have been tested for PFCs; therefore it is unknown whether PFCs are present in sediments. Based on historical practices, PFCs could be present in sediment in locations that have received drainage from the Former FTA (IRP Site 7) AOC.

2.2.4 Surface Water

The following was obtained from the Integrated Spill and Stormwater Plan (ANG, 2012a). Most of the active administrative and industrial areas of the installation are paved or roofed and exhibit high runoff coefficients. Drainage of the built-upon area is by overland flow to either storm drain inlets connected to a network of underground pipes, or to the subsurface soils. In most areas of the Base, the surface water percolates into the porous surface soils and enters the groundwater. Many of the buildings located on the Base and at the airport discharge roof drainage or their associated paved parking areas into dry wells. Three drainage basins contain the industrial activities of the Base. These basins generally slope from northwest to southeast.

Drainage on the Base discharges through the network of in-ground conveyances and grass-lined ditches or directly into the subsurface soils. Surface and subsurface drainage structures on the Base direct stormwater and any spills to two stormwater outfalls (SDO-001 and SDO-002).

Drainage on the Base Aircraft Parking Apron (Eastern Concrete Ramp/Apron) is collected in several catch basins located along the southeastern edge of the Apron and directed through underground pipes to a main 54-inch pipe, which in turn discharges to SDO-001, located approximately 1,100 ft south of the Apron. The drainage then flows through an open drainage swale, which extends approximately 400 ft south of the outfall point, where it infiltrates into the subsurface soils north of Department of Public Works Service Road. This underground storm sewer system receives drainage from on-Base facilities located along the flight line and from off-Base airport properties located north of the Base.

Drainage from the Helicopter Parking Apron (Southern Concrete Ramp/Apron) is collected in several catch basins located along the southeast portion of the Apron, and directed through underground pipes to a main 30-inch pipe, which discharges south to SDO-002, located in a wooded area northwest of SDO-001. Building 424, which overlaps the former footprint of Building 378, has two stormwater drainage areas that discharge directly into the subsurface soils. Storm drainage basin (SDB-003) represents the on Base areas that discharge drainage directly into the subsurface soils.

Stormwater drainage at the Bulk Fuels Facility is directed to an external swale that discharges to the southwestern drainage ditch. Drainage from the bulk above ground storage tanks containment area and the loading island is directed to an interceptor tank for eventual release to the sanitary sewer system.

The Integrated Spill and Stormwater Plan (ANG, 2012a) states that the ANG is not required to monitor stormwater discharges at this time.

Based on historical practices, PFCs could be present in surface water in locations that have received drainage from the Former FTA (IRP Site 7) AOC.

Appendix C-4 shows the direction of Gabreski ANGB stormwater drainage.

(This page intentionally left blank)

3.0 NON-FIRE TRAINING AREAS

Non-FTA AOCs are sites where AFFF has been stored or released and may include crash sites, hangars, fuel spill areas, hazardous waste storage facilities, firefighting equipment testing areas, etc. In general, AFFF systems installed in hangars were designed to contain, store, and in the case of system engagement, ultimately discharge the AFFF inside the hangar.

The following section includes a description of any non-fire training AOCs identified during this PA effort including operational history, waste characteristics, and pathway evaluations, as applicable.

3.1 AOC Description, Operational History, and Waste Characteristics

The following are the Non-FTA AOCs that were identified during this PA Investigation. Appendix A contains photos of these areas. A copy of a recent sanitary and stormwater sewer system drawing, obtained during the site visit, is included in Appendix C-5. Records review focused on the potential PFC sources within the Gabreski ANGB property boundaries. According to Base personnel, the start date of AFFF use is unknown but potentially started as early as 1984. 3M, Ansul, and non-spec AFFF has been used.

3.1.1 Building 300 – Fire Station

Building 300 was built in 1989. Approximately two pallets of 5-gallon AFFF buckets have historically been stored within Building 300 and an overhead fill system was present to transfer AFFF to vehicles. During the PA site visit, Building 300 was under construction and therefore fire department (FD) vehicles were stored in Building 395 (Section 3.1.3). An average of four foam-carrying trucks have been utilized by the FD through the years. No records of accidental AFFF releases at Building 300 exist. Any AFFF releases during testing or accidental release within the fire station likely would have been routed to the floor drains which discharge to an oil/water separator (OWS) on the southeast side of the building which then discharges into the sanitary sewer system (Appendix C-6). Prior to being connected to the sanitary sewer, the Gabreski ANGB had a Base Septic System. IRP Site 8S was the old Base Septic System associated with Building 300 and is further discussed in Section 3.1.13.

3.1.2 Former Building 230 – Vehicle Maintenance

Building 230 was built in 1962 and demolished on 27 February 2012. A concrete parking area for mobility containers now covers the former footprint. Building 230 was utilized for vehicle maintenance, including the occasional maintenance of AFFF-carrying FD vehicles. There were no reports or records of accidental AFFF releases at Building 230. Information pertaining to floor drains in the former Building 230 – Vehicle Maintenance was unavailable at the time of the site visit.

3.1.3 Building 395 – Helicopter Pods

The AFFF fire suppression system (FSS) at Building 395 was installed in 1998. Due to contracting and certification issues, the AFFF FSS was never used and portable AFFF units were used instead. The fire suppression system was retrofitted to high expansion foam (HEF) in 2012. Due to construction at Building 300, FD vehicles are stored in Pod 3 of Building 395. During the PA site visit, four of the trucks were carrying a combined 821 gallons of AFFF and a trailer was carrying 2,000 gallons of AFFF. There are no records of accidental AFFF releases. There were no floor drains observed at Building 395. Storm drains on the apron along the southeast side of Building 395 discharge to the storm sewer system. Prior to be connected to the sanitary sewer, the Gabreski ANGB had a Base Septic System. IRP Sites 8K and 8J were the old Base Septic System associated with Building 395 and are further discussed in Section 3.1.14 and 3.1.15.

3.1.4 Hangar 370

Hangar 370, located on the southern portion of the Base, was equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF (construction drawings included as Appendix C-7). The brand of AFFF utilized is unknown, but was a 3% concentrate. No records of accidental AFFF releases or system testing exist. AFFF for the FSS was supplied from a 300-gallon tank located in the boiler room of the hangar. Any AFFF releases during testing or accidental release within the boiler room would have been routed to the floor drain; releases within the main hangar likely entered the trench drain on the south side of the interior. Floor and trench drains thereafter led to an OWS on the east side of the hangar which then discharged into the sanitary sewer system.

3.1.5 Hangar 358

Hangar 358, located on the southern portion of the Base, was equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF (construction drawings included as Appendix C-7). The brand of AFFF utilized is unknown, but was a 3% concentrate. No records of accidental AFFF releases or system testing exist. AFFF for the FSS was believed to have been supplied from a 300-gallon tank located in the boiler room of the hangar. Any AFFF releases during testing or accidental release within the boiler room or main hangar would have been routed to the floor drains, and thereafter led to an OWS on the side of the hangar which then discharged into the sanitary sewer system.

Prior to be connected to the sanitary sewer, the Gabreski ANGB had a Base Septic System. IRP Site 8G was the old Base Septic System associated with Building 358 and is further discussed in Section 3.1.15.

3.1.6 Building 250 - Warehouse

Historically, approximately two pallets of 5-gallon pails of AFFF have been stored at any one time in the warehouse as a backup supply for the FD. One pallet of Military Specification AFFF (3%) from Minnesota Mining and Manufacturing was observed during the site visit with pails dated circa 1988. No floor drains were observed in the building. There have been no known AFFF leaks or spills.

3.1.7 Eastern Concrete Ramp/Apron

Although there are no records of AFFF usage, the Eastern Concrete Ramp/Apron may have been impacted by AFFF due to the historical presence of aircraft. There were Base personnel accounts of AFFF usage adjacent to the ramp/apron (Section 3.1.9 and 3.1.10). Stormwater runoff from the eastern ramp/apron, located next to Buildings 358, 369, and 370, enters drains on the southeast side of the ramp/apron and ultimately discharges to the outfall south of the runways (Section 3.1.10).

3.1.8 Southern Concrete Ramp/Apron

Although there are no records of AFFF usage, the Southern Concrete Ramp/Apron may have been impacted by AFFF due to the historical presence of aircraft. There were Base personnel accounts of AFFF usage adjacent to the ramp/apron (Section 3.1.3).

3.1.9 IRP Site 4- Fuel Spill Area

According to the 2011 Final Community Involvement Plan, a fuel spill occurred in 1987 within the grassy area adjacent to the south edge of the Eastern Concrete Ramp/Apron. An unknown amount of fuel spilled at the site and the FD reportedly applied foam (unknown type) to the area. The flow of fuel, water and foam was stopped before entering nearby drains. The remainder of the spill on the concrete ramp/apron surface was allowed to evaporate and absorbent matting and powdered absorbent were placed along the outfall (IRP Site 9). Remedial action is currently in place at IRP Site 4; however, analytical parameters do not include PFCs.

3.1.10 Nozzle Testing Area

According to Base personnel, FD personnel historically placed a target in the grassy area on the south edge of the concrete ramp/apron, directly across from Building 300, to use in support of vehicle nozzle testing. It is unknown whether foam or water was used. There was no evidence of stressed vegetation.

3.1.11 Outfall SDO-001

Surface and subsurface drainage structures on the Base direct stormwater and any spills to two stormwater outfalls (SDO-001 and SDO-002), both located on airport property southeast of the Base. SDO-001 receives discharges from the Eastern Concrete Ramp/Apron, as well as the majority of buildings on the north and eastern portions of Base property. SDO-001 also receives drainage from off-Base airport property.

3.1.12 Outfall SDO-002

Surface and subsurface drainage structures on the Base direct stormwater and any spills to two stormwater outfalls (SDO-001 and SDO-002), both located on airport property southeast of the

Base. SDO-002 receives discharges from the Southern Concrete Ramp/Apron, as well as adjacent Building 395 (Helicopter Pods).

3.1.13 IRP Site 5- Southwest Storm Drainage Ditch

IRP Site 5 is a storm water drainage ditch that originates as a subsurface outfall on the southwest side of Hangar 370. Drainage in the ditch is directed to the southwest along the ditch for about 280 ft before it goes below ground surface through a drainage culvert. The culvert resurfaces approximately 50 ft farther south and the ditch continues southwest for nearly 200 ft before drainage is again directed below ground surface through a culvert. The second culvert extends another 450 ft to the south, then resurfaces and then continues east for approximately 550 ft. At this point, flow from the ditch enters the base storm drain system. Flow eventually discharges to a dry ravine about 1500 ft southeast of IRP Site 5. The dry ravine in turn discharges to Aspatuck Creek about 1000 ft further south-southeast. The drainage receives rainwater from roof drains and runoff from paved areas in the southwestern portion of the base (PEER, 2004).

Investigations and remedial actions were conducted at IRP Site 5 from 1998 until 2009 when no further action was recommended. NYSDEC approved site closure in December 2010 (ANG, 2011). PFC sampling was not included in the investigation activities at IRP Site 5. IRP Site 5 may have received potentially AFFF-impacted stormwater from the Southern Concrete Ramp/Apron and Building 395 – Helicopter Pods.

3.1.14 IRP Site 8S- Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned-in-place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. Appendix C-8 includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8S consisted of one septic tank and two cesspools which were abandoned in place in 2003. Site 8S was associated with Building 300 – Fire Station. PFC sampling was not included in the investigation activities at IRP Site 8S.

3.1.15 IRP Site 8K- Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. Appendix C-8 includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8K consisted of one septic tank and three cesspools which were abandoned in place in 2003. Site 8K was associated with Building 395 – Helicopter Pods. PFC sampling was not included in the investigation activities at IRP Site 8K.

3.1.16 IRP Site 8J- Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. Appendix C-8 includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8J is still currently in use as part of the storm water drainage system. Site 8J was associated with Building 395 – Helicopter Pods. PFC sampling was not included in the investigation activities at IRP Site 8J.

3.1.17 IRP Site 8G- Old Base Septic System

IRP Site 8 is a composite of underground structures including cesspools, septic tanks, distribution boxes, oil/mud traps, and dry wells at numerous locations throughout the base. Most of the structures have been removed, while others have been abandoned in place. None of the septic system structures are still in use. Together, the individual structures (former and abandoned in place) make up the Old Base Septic Systems. Site 8 includes 21 subsites, designated as Subsites 8A through 8U, based on the individual structures and subsystems that were identified. Appendix C-8 includes a figure identifying the various IRP Site 8 subsites.

Environmental studies were performed at Site 8 from 1991 to 2005. The initial studies indicated that Site 8 had the potential to cause environmental impacts and warranted further assessment and/or action. Based on the initial investigations, remedial action was taken to mitigate any potential impacts to soil or groundwater at Site 8. Subsequently, an additional investigation was conducted to determine the extent of any soil or groundwater contamination remaining at the site. Only localized occurrences of low-level contaminants were found at the site (ANG, 2012b). Site 8 was recommended for no further action in 2012 and received regulatory concurrence on 2 April 2013.

According to the Technical Memorandum for Site 8 Septic System Remediation Completion Report (MACTEC, 2003), Site 8G consisted of one septic tank, two cesspools, and one distribution box which were abandoned in place in 2003. Site 8G was associated with Hangar 358. PFC sampling was not included in the investigation activities at IRP Site 8G.

3.2 Pathway and Environmental Hazard Assessment

The following is a preliminary evaluation of the threats and targets associated with each potential exposure pathway. In their anionic forms, PFOS and PFOA are water soluble and can migrate readily from soil to groundwater. The USEPA has not established PHALs for PFOS and PFOA in soil (USEPA, 2014). The primary exposure pathway for PFOS and PFOA would be the ingestion of contaminated drinking water.

3.2.1 Groundwater

Groundwater flow direction is discussed in Section 1.1. No documentation was available showing that groundwater at the Base has been tested for PFCs; therefore it is unknown whether PFCs are present in the groundwater. Based on historical practices, they may be present in the groundwater in the areas in areas such as: Building 300- Fire Station, Building 395 – Helicopter Pods, Hangar 370, Hangar 358, Eastern and Southern Concrete Ramp/Apron, IRP Site 4- Fuel Spill Area, Nozzle Testing Area, Outfall SDO-001, Outfall SDO-002, IRP Site 5-Southwest

Storm Drainage Ditch, IRP Site 8S-Old Base Septic System, IRP Site 8K-Old Base Septic System, IRP Site 8J-Old Base Septic System, and IRP Site 8G-Old Base Septic System.

3.2.1.1 Water Wells

A review of the EDR Radius Map™ Report with Geocheck® dated November 13, 2015 shows 14 water wells within a one-mile radius of the Gabreski ANGB as listed in the Federal United States Geological Survey (USGS) Database (Appendix C-2) (EDR, 2015). No public water supply system wells were identified within one mile of the Gabreski ANGB.

Drinking water is supplied to the Gabreski ANGB from the Suffolk County Water Authority (PEER, 2004).

According to the RI Report for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12 (PEER, 2004), the nearest public supply well field is located 0.6 miles southeast of Francis S. Gabreski Airport (Appendix C-3). As part of the RI, information on private water wells was researched at the NYSDEC Division of Water, Water Supply at Stony Brook, New York. Well locations were found and Well Completion Reports were reviewed and copied from the files of the NYSDEC Water Supply office for all wells within the target area, during the RI. Completion Reports were found for 35 privately owned water wells dating from October 1944 through February 1990. Ten wells were installed for municipal water supply, thirteen wells were installed for domestic use, three wells were installed for commercial use by business, two wells were installed for irrigation purposes, and six wells were installed for observation (monitoring) purposes. Two wells were installed for other purposes, one being to supply firefighting water in an area where no hydrants exist, and the other being a temporary well used by a Department of Defense contractor for a rocket test (PEER, 2004). Appendix C-3 includes details on these identified wells.

3.2.2 Soil

No documentation was available showing that soils at Gabreski ANGB have been tested for PFCs; therefore it is unknown whether PFCs are present in the soil. Based on historical practices, they may be present in the soil in areas such as: Building 300- Fire Station, Building 395 – Helicopter Pods, Hangar 370, Hangar 358, Eastern and Southern Concrete Ramp/Apron, IRP Site 4- Fuel Spill Area, Nozzle Testing Area, Outfall SDO-001, Outfall SDO-002, IRP Site 5-

Southwest Storm Drainage Ditch, IRP Site 8S-Old Base Septic System, IRP Site 8K-Old Base Septic System, IRP Site 8J-Old Base Septic System, and IRP Site 8G-Old Base Septic System.

3.2.3 Sediment

No documentation was available showing that sediments at Gabreski ANGB have been tested for PFCs; therefore it is unknown whether PFCs are present in sediments. Based on historical practices, PFCs could be present in sediment in locations that have received drainage from AOCs such as Outfalls SDO-001 and -002.

3.2.4 Surface Water

The following was obtained from the Integrated Spill and Stormwater Plan (ANG, 2012a). Most of the active administrative and industrial areas of the installation are paved or roofed and exhibit high runoff coefficients. Drainage of the built-upon area is by overland flow to either storm drain inlets connected to a network of underground pipes, or to the subsurface soils. In most areas of the Base, the surface water percolates into the porous surface soils and enters the groundwater. Many of the buildings located on the Base and at the airport discharge roof drainage or their associated paved parking areas into dry wells. Three drainage basins contain the industrial activities of the Base. These basins generally slope from northwest to southeast.

Drainage on the Base discharges through the network of in-ground conveyances and grass-lined ditches or directly into the subsurface soils. Surface and subsurface drainage structures on the Base direct stormwater and any spills to two stormwater outfalls (SDO-001 and SDO-002).

Drainage on the Base Aircraft Parking Apron (Eastern Concrete Ramp/Apron) is collected in several catch basins located along the southeastern edge of the Apron and directed through underground pipes to a main 54-inch pipe, which in turn discharges to SDO-001, located approximately 1,100 feet south of the Apron. The drainage then flows through an open drainage swale, which extends approximately 400 feet south of the outfall point, where it infiltrates into the subsurface soils north of Department of Public Works Service Road. This underground storm sewer system receives drainage from on Base facilities located along the flight line and from off Base airport properties located north of the Base.

Drainage from the Helicopter Parking Apron (Southern Concrete Ramp/Apron) is collected in several catch basins located along the southeast portion of the Apron, and directed through underground pipes to a main 30-inch pipe, which discharges south to SDO-002, located in a wooded area northwest of SDO-001. Building 424, which overlaps the former footprint of Building 378, has two stormwater drainage areas that discharge directly into the subsurface soils. Storm drainage basin (SDB-003) represents the on Base areas that discharge drainage directly into the subsurface soils.

Stormwater drainage at the Bulk Fuels Facility is directed to an external swale that discharges to the southwestern drainage ditch. Drainage from the bulk above ground storage tanks containment area and the loading island is directed to an interceptor tank for eventual release to the sanitary sewer system.

The Integrated Spill and Stormwater Plan (ANG, 2012a) states that the ANG is not required to monitor stormwater discharges at this time.

Based on historical practices, PFCs could be present in surface water in locations that have received drainage from the AOCs with known AFFF usage such as Outfalls SDO-001 and -002.

Appendix C-4 shows the direction of Gabreski ANGB stormwater drainage.

(This page intentionally left blank)

4.0 FINDINGS AND CONCLUSIONS

18 potential AOCs have been identified at the Gabreski ANGB during this PA. Of these 18 AOCs, 16 are recommended for further investigation.

Further investigation is recommended at the Gabreski ANGB to characterize potential soil, groundwater, surface water, and sediment PFC contamination. In addition, verification of the structural integrity of the existing oil/water separators and connected sanitary sewer is also advised.

Table 1 summarizes the recommendation and rationale for each potential AOC identified at the Base.

Table 1: Preliminary Assessment Report Summary and Recommendations

No.	Potential AFFF PFC AOC	GPS Coordinates		Rationale	Recommendation
		Latitude	Longitude		
1	IRP Site 7 - Fire Training Area	40.837370°	-72.628441°	Former FTA from 1971 to 1986. According to Base personnel AFFF and protein foam were used, although usage amounts are unknown.	Proceed to SI. Focus on soil and groundwater.
2	Building 300 – Fire Station	40.838623°	-72.641827°	Fire Station since 1989. AFFF stored inside fire vehicles and in 5-gallon buckets. Floor drains inside building are connected to OWS then sanitary sewer system.	Proceed to SI. Focus on soil and groundwater.
3	Former Building 230 – Vehicle Maintenance	40.839808°	-72.643183°	Vehicle Maintenance building from 1962 to 2012. Currently a concrete parking area for mobility containers. Building 230 was utilized for occasional maintenance of AFFF-carrying FD vehicles. There were no reports or records of accidental AFFF releases.	No Further Action
4	Building 395 – Helicopter Pods	40.834942°	-72.644856°	AFFF FSS was installed in 1998 and retrofitted to HEF in 2012. Due to contracting and certification issues, the AFFF FSS was never used and portable AFFF units were used instead. ARFF vehicles currently stored within building. No records of accidental AFFF releases. No floor drains observed. Storm drains on the apron along the southeast side of Building 395 discharge to the storm sewer system.	Proceed to SI. Focus on soil and groundwater.
5	Hangar 370	40.836545°	-72.644505°	Equipped with AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF. No records of accidental AFFF releases or system testing exist.	Proceed to SI. Focus on soil and groundwater.

Table 1: Preliminary Assessment Report Summary and Recommendations

No.	Potential AFFF PFC AOC	GPS Coordinates		Rationale	Recommendation
		Latitude	Longitude		
6	Hangar 358	40.837889°	-72.642882°	Equipped with an AFFF FSS from approximately 1998/1999 until 2011, when the system was retrofitted for use of HEF. No records of accidental AFFF releases or system testing exist.	Proceed to SI. Focus on soil and groundwater.
7	Building 250 - Warehouse	40.839524°	-72.645442°	Historically, approximately two pallets of 5-gallon buckets of AFFF have been stored at any one time in the warehouse as a backup supply for the FD. No floor drains were observed in the building. There have been no known AFFF leaks or spills.	NFA.
8	Eastern Concrete Ramp/Apron	40.836669°	-72.642633°	Concrete ramp/apron may have been impacted by AFFF due to the historical presence of aircraft. AFFF usage occurred adjacent to the ramp/apron.	Proceed to SI. Focus on soil and groundwater on the downgradient edge of ramp/apron.
9	Southern Concrete Ramp/Apron	40.834665°	-72.644151°	Concrete ramp/apron may have been impacted by AFFF due to the historical presence of aircraft. AFFF usage occurred adjacent to the ramp/apron.	Proceed to SI. Focus on soil and groundwater on the downgradient edge of ramp/apron.
10	IRP Site 4 - Fuel Spill Area	40.836421°	-72.641520°	In 1987, a fuel spill occurred within the grassy area adjacent to the south edge of the Eastern Concrete Ramp/Apron. Foam (unknown type) was applied to the spill.	Proceed to SI. Focus on soil and groundwater.
11	Nozzle Testing Area	40.837924°	-72.640509°	FD personnel historically placed a target in the grassy area on the south edge of the concrete ramp/apron, directly across from Building 300, to use in support of vehicle nozzle testing. It is unknown whether foam or water was used.	Proceed to SI. Focus on soil and groundwater.

Table 1: Preliminary Assessment Report Summary and Recommendations

No.	Potential AFFF PFC AOC	GPS Coordinates		Rationale	Recommendation
		Latitude	Longitude		
12	Outfall SDO-001	40.833633°	-72.639772°	Receives discharges from the Eastern Concrete Ramp/Apron and the majority of buildings in the north and east portions of Base property. This outfall may have been impacted by AFFF due to potential historical usage of AFFF in these source areas.	Proceed to SI. Focus on soil, groundwater, sediment, and surface water.
13	Outfall SDO-002	40.833208°	-72.641090°	Receives discharges from the Southern Concrete Ramp/Apron, Building 395 (Helicopter Pods), and IRP Site 5. This outfall may have been impacted by AFFF due to potential historical usage of AFFF in these source areas.	Proceed to SI. Focus on soil, groundwater, sediment, and surface water.
14	IRP Site 5-Southwest Storm Drainage Ditch	40.833837°	-72.645584°	Storm water drainage ditch that originates as a subsurface outfall on the southwest side of Hangar 370. This outfall may have been impacted by AFFF due to the historical usage of AFFF in the area.	Proceed to SI. Focus on soil, groundwater, sediment, and surface water.
15	IRP Site 8S – Old Base Septic System	40.838415°	-72.641788°	Site 8S consisted of one septic tank and two cesspools which were abandoned in place in 2003. Site 8S was associated with Building 300 – Fire Station and therefore may have been impacted by AFFF.	Proceed to SI. Focus on soil and groundwater.
16	IRP Site 8K – Old Base Septic System	40.835154°	-72.645246°	Site 8K consisted of one septic tank and three cesspools which were abandoned in place in 2003. Site 8K was associated with Building 395 – Helicopter Pods and therefore may have been impacted by AFFF.	Proceed to SI. Focus on soil and groundwater.

Table 1: Preliminary Assessment Report Summary and Recommendations

No.	Potential AFFF PFC AOC	GPS Coordinates		Rationale	Recommendation
		Latitude	Longitude		
17	IRP Site 8J – Old Base Septic System	40.834778°	-72.644665°	Site 8J is still currently in use as part of the storm water drainage system. Site 8J was associated with Building 395 – Helicopter Pods and therefore may have been impacted by AFFF.	Proceed to SI. Focus on soil and groundwater.
18	IRP Site 8G – Old Base Septic System	40.837941°	-72.642191°	Site 8G consisted of one septic tank, two cesspools, and one distribution box which were abandoned in place in 2003. Site 8G was associated with Hangar 358 and therefore may have been impacted by AFFF.	Proceed to SI. Focus on soil and groundwater.

AFFF – Aqueous Film Forming Foam
AOC – Area of Concern
ARFF – aircraft rescue and firefighting foam
FD – Fire Department
FSS – fire suppression system
FTA – Fire Training Area
GPS – Global Positioning Satellite
HEF – high expansion foam
IRP – Installation Restoration Program
PFC – Perfluorinated Compound
SI – Site Investigation

(This page intentionally left blank)

5.0 REFERENCES

AECOM, 2015. Regional Compliance Restoration Program Preliminary Assessment/Site Inspection. July.

ANG, 2011. Final Community Involvement Plan for the 106th Rescue Wing. September.

ANG, 2012a. 106th RQW Integrated Spill and Stormwater Plan. May 31, 2012.

ANG, 2012b. Final Record of Decision for Site 8. April.

BB&E, 2015. Final Perfluorinated Compound (PFC) Preliminary Assessment Work Plan, Prepared for Headquarters Air National Guard Andrews AFB, Maryland. July.

EDR, 2015. EDR Radius Map™ Report with Geocheck®. November 13, 2015.

Leidos, 2015. Request of No Further Action at IRP Site 9. July 20.

MACTEC, 2003. Technical Memorandum Site 8 Septic System Remediation Completion Report. September.

PEER, 2004. Final Remedial Investigation for Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and 12. June.

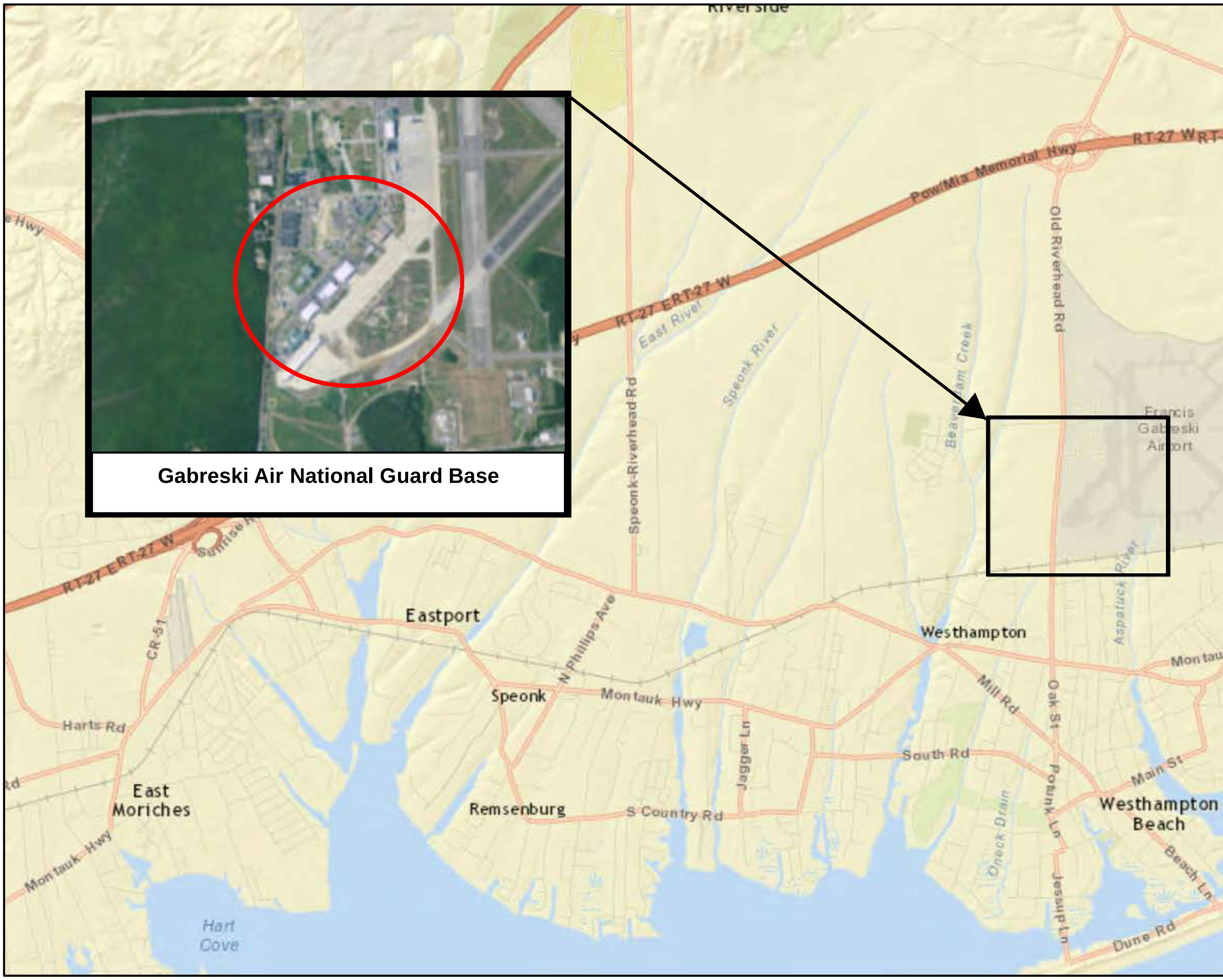
SAIC, 2012. Request for No Further Action at IRP Site 7. December 31, 2012.

URS, 2011. Final Community Involvement Plan. September.

USEPA, 2014. Peer Review of Health Effects Documents for PFOA and PFOS. February.

(This page intentionally left blank)

FIGURES



NORTH

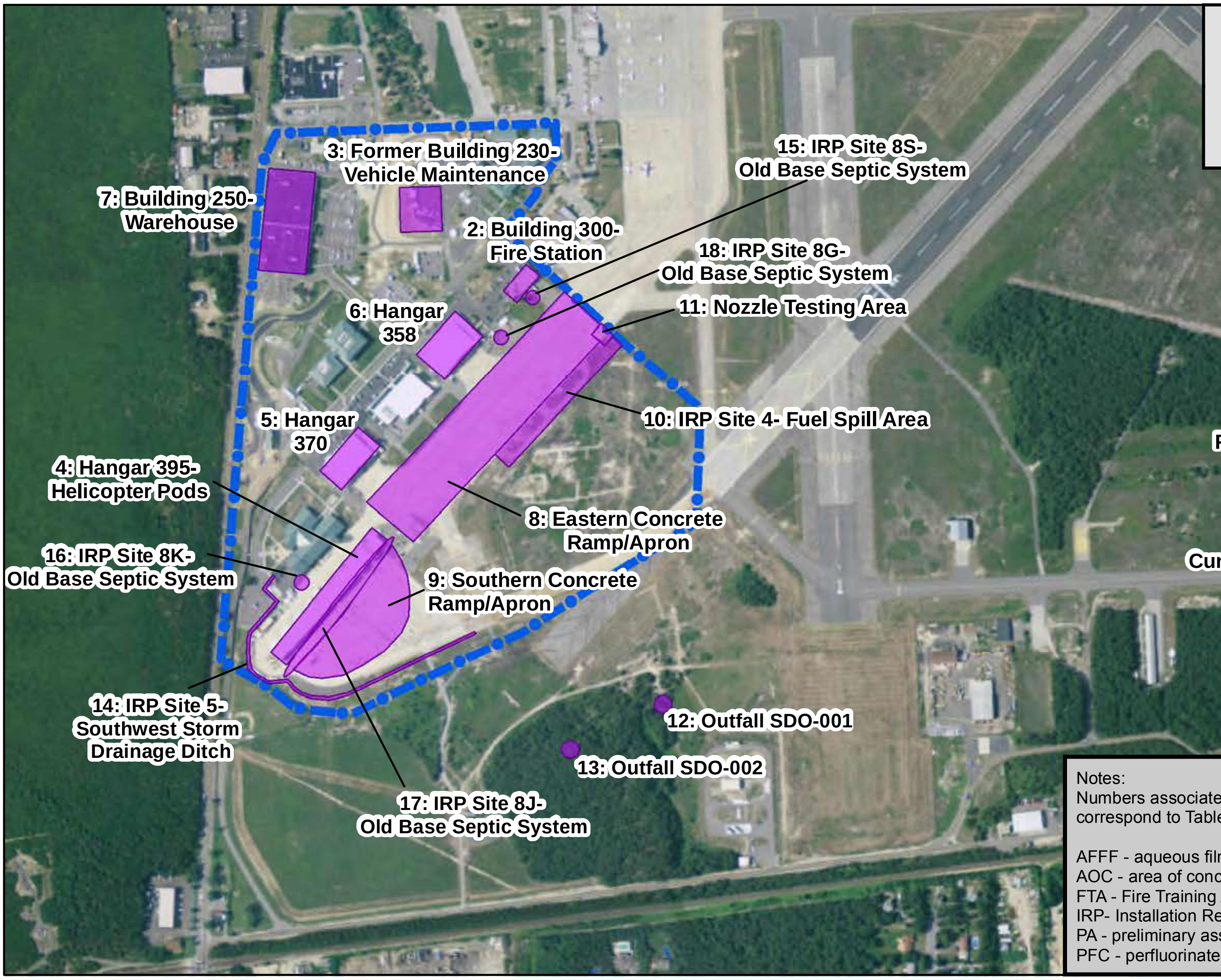
0 1 2
Miles

Figure 1
Site Location Map

Gabreski Air National Guard Base
Westhampton Beach, New York

Document Path: H:\IT\GIS\ANG\AFFF PFC\Gabreski\Site Location Map Gabreski.mxd

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, a
KMA 11/5/2015



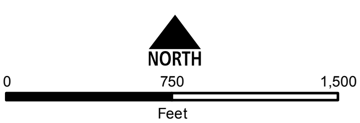


Figure 2
Site Features and Potential AOCs

Gabreski Air National Guard Base
Westhampton Beach, New York

Document Path: H:\IT\GIS\ANG\AFFF PFC\Gabreski\Site Features Map Gabreski.mxd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
KMG 1/26/2016

APPENDIX A

PHOTO DOCUMENTATION

Appendix A
Francis S. Gabreski Air National Guard Base, PFC PA Site Visit, Westhampton Beach, NY – November 18, 2015

Photo 1: Trench drains were present in Building 300 (Fire Station), which was undergoing construction during the PA site visit. Fire Department vehicles were stored in this area. AFFF pallets were historically stored on the far (northeasterly) wall.

Photo 2: Looking northeast toward the Fire Department nozzle testing area which is located directly across the apron from Building 300.

Photo 3: Drains were present on the apron.

Photo 4: Looking east toward a fuel spill area where AFFF was used, located on the southeast side of the apron.

Photo 5: Floor drains were present in Hangar 358.

Photo 6: Trench drains were present in Hangar 370.

Photo 7: Fire Department vehicles are currently stored in Pod 3 of Hangar 395.

Photo 8: Looking northwest toward IRP Site 7 – Fire Training Area.

Photo 9: A portion of the berm (left side of photo) remains at IRP Site 7 – Fire Training Area.

Photo 10: Looking southeast towards the Current FTA, which is located outside of the ANG property boundary.

Photo 11: Military Specification AFFF (3%) from Minn. Mining and Manufacturing was present in Building 250 – Warehouse.

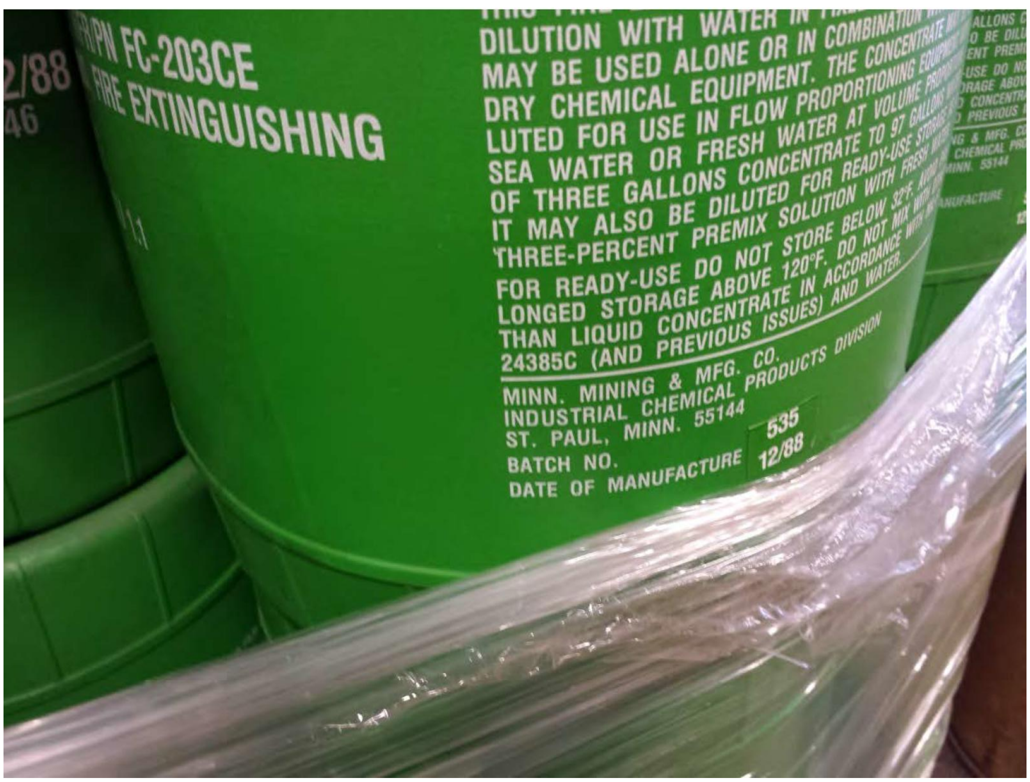


Photo 12: AFFF pails in Building 250 – Warehouse were dated circa 1988.

APPENDIX B

RECORDS OF COMMUNICATION

1/7/15

Interviewed: Tony Vasell
On Base Since: 1984
Currently: NY State Environmental Technician
Formerly: Industrial Hygienist

Interview Questions regarding AFFF use
(At Present and back to 1970)

1. When did AFFF first start being used on this installation?
At least since 1984 for fire fighting

2. What are the years of active use for each Fire Training Area (FTA), Aircraft Hangar, Fire Department, other places AFFF may have been used (collectively Potential Areas of Concern (PAOC)?
This date may be in IRP Document.
FTA is now the Munitions Area (on ANG property).
Parcel used for FTA (to the SW of former FTA) is not on ANG property.

3. What type of AFFF is used or has been used on this installation (i.e. 3%, 6%, High Expansion Foam)?
~~XX~~ Had 6% at some point.
3% in hangars?

4. What manufacturer's AFFF products are used or were used on this installation (i.e. 3M, Ansul, Chemguard, etc.)?
3M & Ansul

5. Did you ever dispose of old bulk AFFF, if so, when and where?
No. Currently looking to dispose of foam from trucks & bulk storage in warehouse & hangar 395

6. Is the AFFF stored as a mixed solution (3% or 6%) or do you formulate the AFFF on the installation?
NA

7. If AFFF is formulated on base, where is the solution mixed, contained, transferred, etc.?
NA

8. Are your automated fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam?
Thinking AFFF (3%) was in Hangars A (310) and B (358) before HEF conversion, and 395 (in pods).
Fire Station (300) has a 1,000 gal OWS.

OWSs associated with hangars. There was no evidence of OWS leaking during the "yank a tank" program in 1995.
The county samples every ≈5 weeks now at hangars.
The county samples prior to every discharge (discharges go to WWTP south of the Base).

9. If retrofitted, when was that done?

Interview turned over to Capt Caron, who Tony said would have more information

10. Do you have an inventory of the amount of AFFF stored on the installation, now and in the past, or present in automated fire suppression systems? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate?

11. Provide a list of vehicles that carried AFFF, now and in the past, and where are/were they located? Any vehicles have a history of leaking AFFF?

12. How much AFFF (gallons) is/was carried/stored in the specified vehicles?

13. Do you ever dispose of unused AFFF? If so, how and where?

14. Has unused AFFF ever been disposed of in the past? If so, how and where?

15. Do you/did you test the vehicles spray patterns to make sure equipment is working properly?

16. How often are/were these spray tests performed and can you provide the locations of these tests, now and in the past?

17. Can you describe the procedure on how vehicles and systems are/were supplied with AFFF?

18. Can you provide the procedures on how these vehicles are/were cleaned/decontaminated and where vehicle cleaning is performed currently as well as performed in the past?

19. Is/was there a specified area on the installation where vehicles are filled with AFFF and does this area have secondary containment in case of spills?

20. When a release of AFFF occurs during a fire training exercise, now and in the past, how is the AFFF cleaned and disposed of?

21. How many FTAs are/were on this installation and where are they?

22. How many FTAs are active and inactive?

23. What types of fuels/flammables were used at the FTAs?

JP4 and possibly solvents.

Solvents found in area samples, but may be from the aircraft refurbishing building nearby.

24. For inactive FTAs, when was the last time that fire training using AFFF was conducted at them? Find out ahead of time in Admin Record for former FTAs.

25. What are/were the non-FTA locations where PFCs or AFFF release systems are installed (i.e. Hangars, Wastewater Treatment Plants, Fire Stations, etc.)? Where are/were these locations (Building numbers)?

26. Do you have a list (Building names and numbers, current and demolished) where the fire suppression systems either currently contain or have contained AFFF?

27. Do you have records of fuel spill logs and emergency response logs? Knowledge of aircraft mishaps/crashes?

28. Do you have recollection or records of AFFF being used as a precaution in response to fuel releases to prevent fires?

29. Do you have recollection or records of historical emergency response sites (i.e. crash sites and fires) where AFFF was used?

30. Do you have recollection or record of emergency runway landings where foam might have been used as a precaution?

31. If not written records or incomplete written records, do you have anecdotal/verbal information and locations of spills or other emergency response incidents where AFF was used?

See back page

32. What is the typical procedure for removing dispensed AFFF from an area where it has been used?

33. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste water treatment plants, and AFFF ponds)?

34. Do you have or did you have a chrome plating shop on base? If no, skip to Question #38.

35. What were/are the years of operation of that chrome plating shop?

36. Do you know whether the shop has/had a foam blanket mist suppression system or used a fume hood for emissions control?

37. If foam blanket mist suppression was used, where was the foam stored, mixed, applied, etc.?

38. Is there anyone else or other base organization personnel that you would recommend we interview? Name, organization, position, phone number, e-mail.

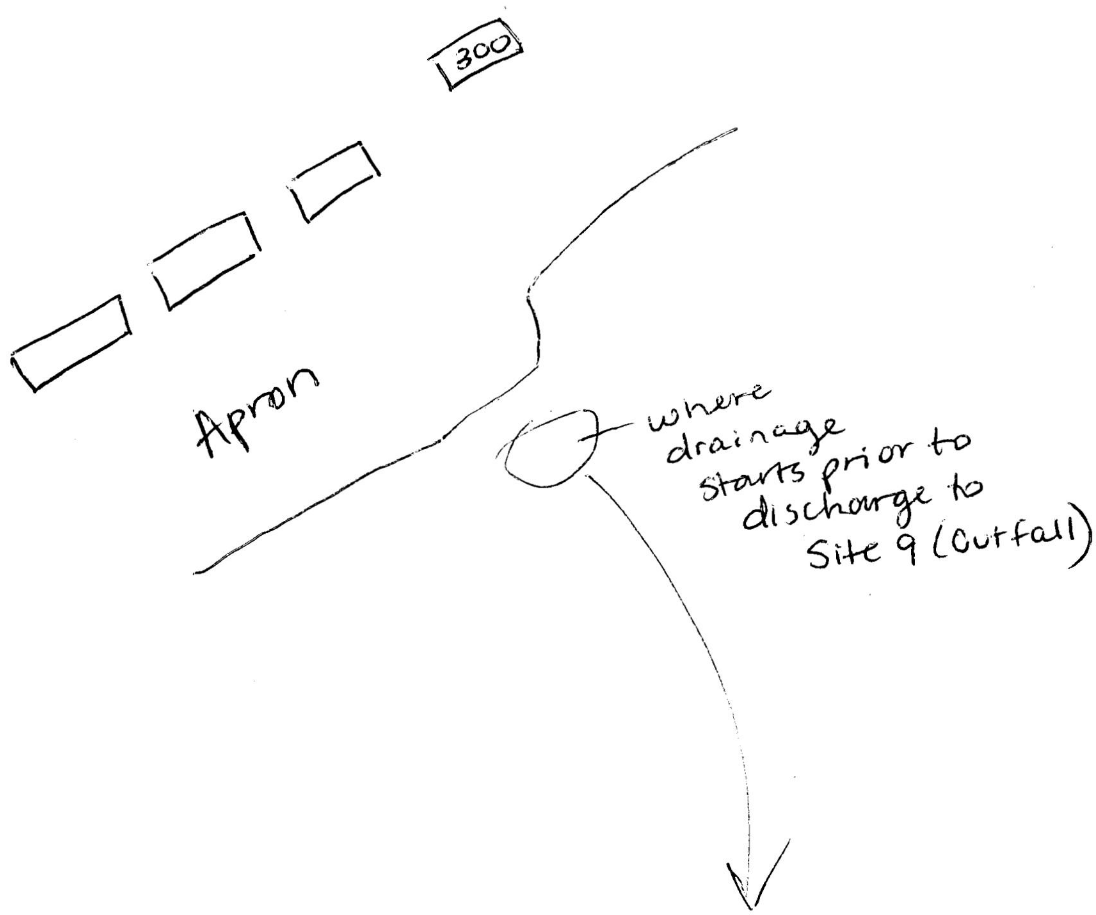
39. Was it common practice to wash away fuel spills with AFFF?

See back page →

40. Identify drainage patterns around flightline/ramp area. Point source discharge is likely AFFF Area of Concern (AOC).

Groundwater from Base flows south to the Aspatuck River.
Drainage from the apron and adjacent buildings discharges to Site 9 (outfall).

Nearby ~~sensitive~~ sensitive environments: the Quogue Wildlife Refuge to the SE of the former FTA.
The former FTA is approximately 2500 ft NW of the open water @ the Quogue.



11/17/15 Interviewed: Capt Kenny Caron
On Base since 1988
Currently: Station Capt for State of NY
Formerly: Fire fighter

Interview Questions regarding AFFF use
(At Present and back to 1970)

1. When did AFFF first start being used on this installation?
   Not sure when started

2. What are the years of active use for each Fire Training Area (FTA), Aircraft Hangar, Fire Department, other places AFFF may have been used (collectively Potential Areas of Concern (PAOC)?
   FTA: not known — 1987 → AFFF & protein foam used @ FTA
   Target behind Fire House - early '90s

3. What type of AFFF is used or has been used on this installation (i.e. 3%, 6%, High Expansion Foam)?
   In FD trucks, 6% was used, then switched to 3% in '90s

4. What manufacturer's AFFF products are used or were used on this installation (i.e. 3M, Ansul, Chemguard, etc.)?
   3M & Ansul

5. Did you ever dispose of old bulk AFFF, if so, when and where?
   No

6. Is the AFFF stored as a mixed solution (3% or 6%) or do you formulate the AFFF on the installation?
   —

7. If AFFF is formulated on base, where is the solution mixed, contained, transferred, etc.?
   —

8. Are your automated fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam?
   Currently HEF

9. If retrofitted, when was that done?

~~At~~ Not known

10. Do you have an inventory of the amount of AFFF stored on the installation, now and in the past, or present in automated fire suppression systems? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate?

No

11. Provide a list of vehicles that carried AFFF, now and in the past, and where are/were they located? Any vehicles have a history of leaking AFFF?

On average, about 4 trucks with foam through the years.

12. How much AFFF (gallons) is/was carried/stored in the specified vehicles?

Currently, 4 trucks carry the following: 210 gal, 500 gal, 55 gal, & 56 gal

And a trailer carries 2,000 gal.

13. Do you ever dispose of unused AFFF? If so, how and where?

No

14. Has unused AFFF ever been disposed of in the past? If so, how and where?

No

15. Do you/did you test the vehicles spray patterns to make sure equipment is working properly?

Yes - may have been water or foam

16. How often are/were these spray tests performed and can you provide the locations of these tests, now and in the past?

Not known

target opposite of fire house.

Also could've been performed anywhere in grass area south of apron.

17. Can you describe the procedure on how vehicles and systems are/were supplied with AFFF?

The majority of time, was hand poured with cans.
There is an overhead fill system in fire house (Bldg 300).
Currently, have a foam trailer in Bldg 395 (Bldg 300 under construction)

18. Can you provide the procedures on how these vehicles are/were cleaned/decontaminated and where vehicle cleaning is performed currently as well as performed in the past?

Cleaned at Fire Station, which has drains.
An OWS was installed in 1996.

19. Is/was there a specified area on the installation where vehicles are filled with AFFF and does this area have secondary containment in case of spills?

Fire House

20. When a release of AFFF occurs during a fire training exercise, now and in the past, how is the AFFF cleaned and disposed of?

NA

21. How many FTAs are/were on this installation and where are they?

1

22. How many FTAs are active and inactive?

1 active off-Base

23. What types of fuels/flammables were used at the FTAs?

JP4

24. For inactive FTAs, when was the last time that fire training using AFFF was conducted at them? Find out ahead of time in Admin Record for former FTAs.

≈ 1987

25. What are/were the non-FTA locations where PFCs or AFFF release systems are installed (i.e. Hangars, Wastewater Treatment Plants, Fire Stations, etc.)? Where are/were these locations (Building numbers)?

Hangar A, B, 395 (now = HEF)

26. Do you have a list (Building names and numbers, current and demolished) where the fire suppression systems either currently contain or have contained AFFF?

27. Do you have records of fuel spill logs and emergency response logs? Knowledge of aircraft mishaps/crashes? No

↳ Airshow crash in '94 south of WWTP
Plane fire in '89 on runway → see back page for sketch

Foam may have been used

28. Do you have recollection or records of AFFF being used as a precaution in response to fuel releases to prevent fires?

No

29. Do you have recollection or records of historical emergency response sites (i.e. crash sites and fires) where AFFF was used?

See # 27

30. Do you have recollection or record of emergency runway landings where foam might have been used as a precaution?

No

31. If not written records or incomplete written records, do you have anecdotal/verbal information and locations of spills or other emergency response incidents where AFF was used?

No

32. What is the typical procedure for removing dispensed AFFF from an area where it has been used? NA

33. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste water treatment plants, and AFFF ponds)?

NA

34. Do you have or did you have a chrome plating shop on base? If no, skip to Question #38.

No ANG chrome shop (not sure about AF)

35. What were/are the years of operation of that chrome plating shop?

—

36. Do you know whether the shop has/had a foam blanket mist suppression system or used a fume hood for emissions control?

—

37. If foam blanket mist suppression was used, where was the foam stored, mixed, applied, etc.?

—

38. Is there anyone else or other base organization personnel that you would recommend we interview? Name, organization, position, phone number, e-mail.

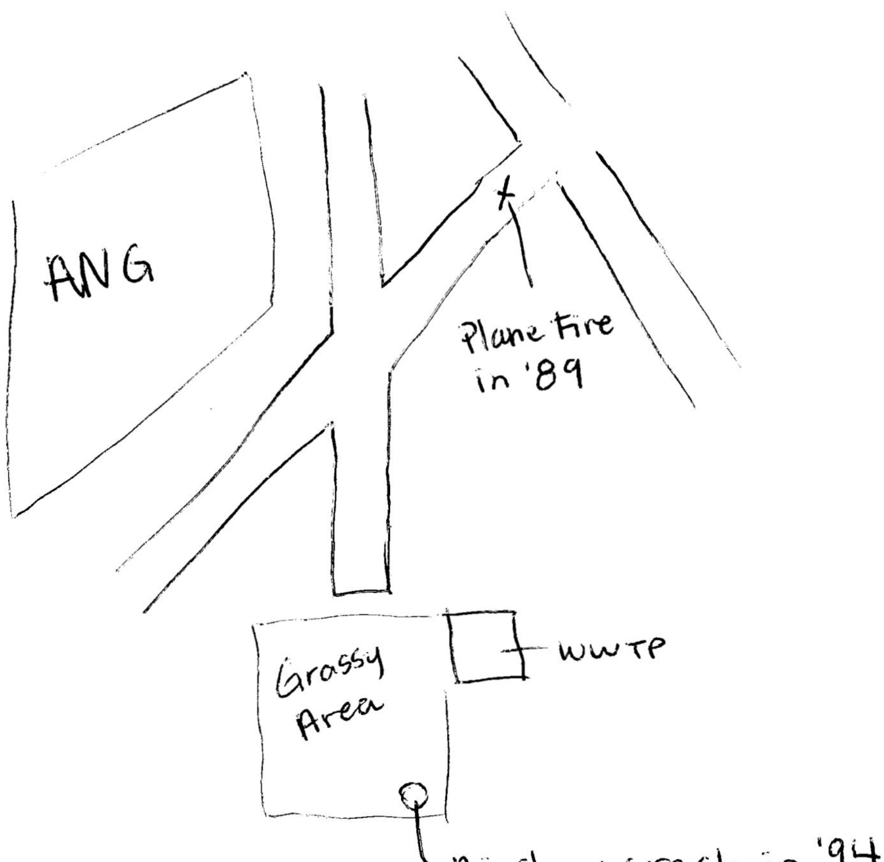
NA

39. Was it common practice to wash away fuel spills with AFFF?

NA

40. Identify drainage patterns around flightline/ramp area. Point source discharge is likely AFFF Area of Concern (AOC).

Aircraft Mishaps Sketch



APPENDIX C

SUPPORTING DOCUMENTATION

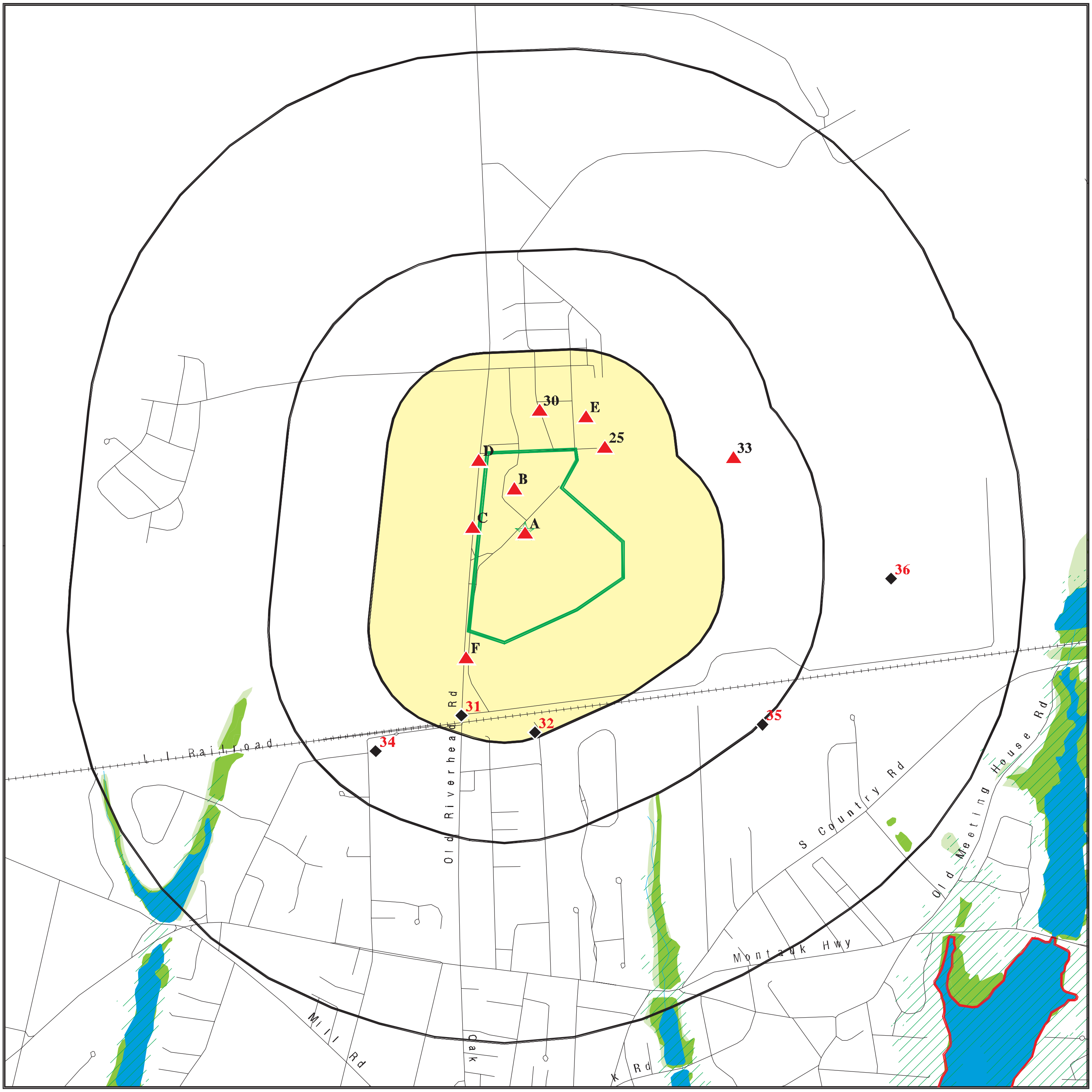
APPENDIX C-1

IRP SITE 7 FIRE TRAINING AREA AERIAL PHOTOGRAPH (DATE UNKNOWN)

APPENDIX C-2

EDR ONE-MILE RADIUS WATER WELLS MAP

OVERVIEW MAP - 4466400.2S

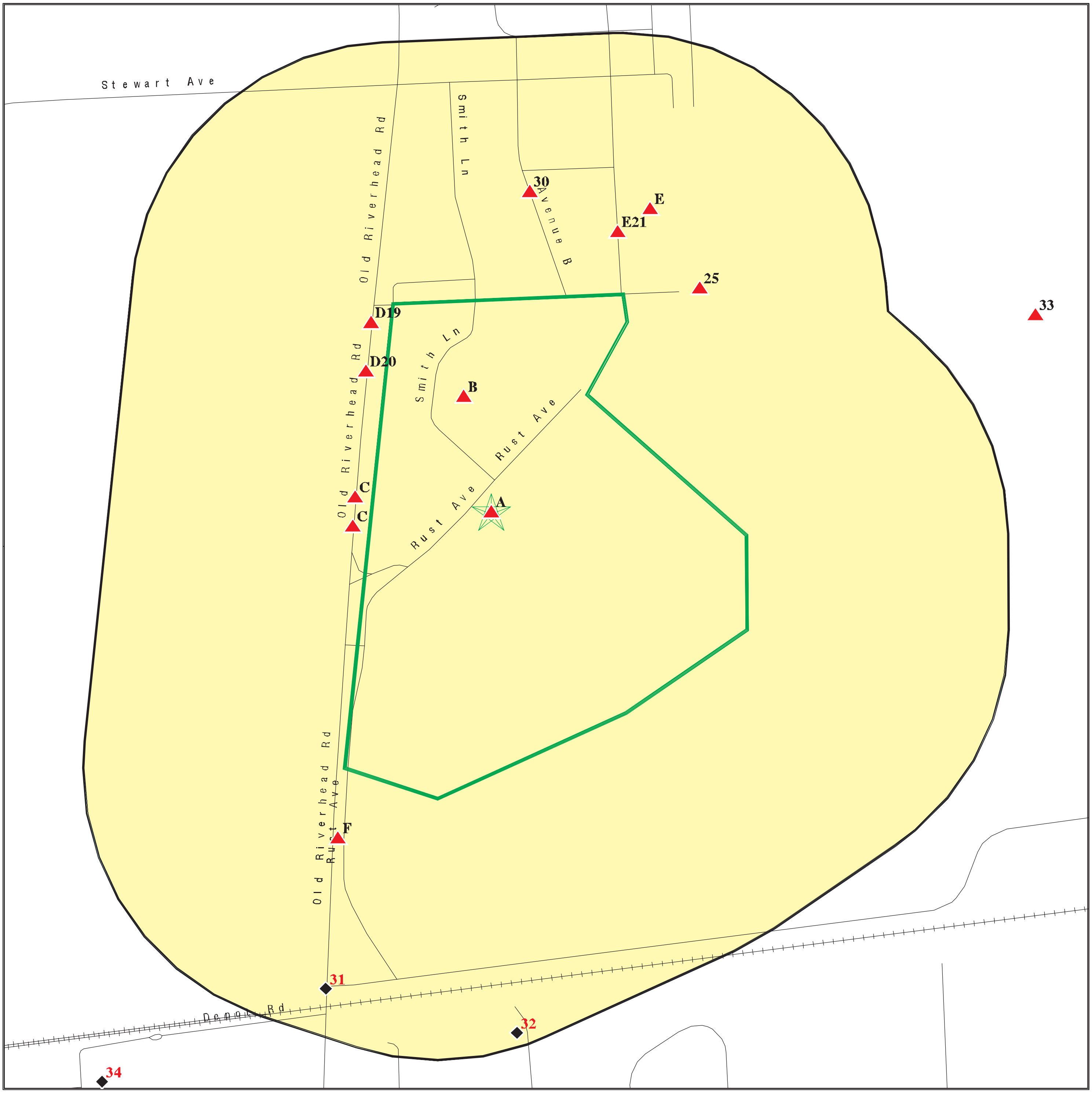


- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Gabreski ANGB	CLIENT:	B.B. & E
ADDRESS:	150 Old Riverhead Road Westhampton Beach NY 11978	CONTACT:	Naila Hosein
		INQUIRY #:	4466400.2s
LAT/LONG:	40.8375 / 72.6438	DATE:	November 13, 2015 2:03 pm

DETAIL MAP - 4466400.2S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

Sensitive Receptors

National Priority List Sites

Dept. Defense Sites

Indian Reservations BIA

100-year flood zone

500-year flood zone

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Gabreski ANGB	CLIENT:	B.B. & E
ADDRESS:	150 Old Riverhead Road	CONTACT:	Naila Hosein
	Westhampton Beach NY 11978	INQUIRY #:	4466400.2s
LAT/LONG:	40.8375 / 72.6438	DATE:	November 13, 2015 2:05 pm

PHYSICAL SETTING SOURCE MAP - 4466400.2s

County Boundary
Major Roads
Contour Lines
Airports
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

0 1/4 1/2 1 Miles

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Closest Hydrogeological Data
Oil, gas or related wells

SITE NAME: Gabreski ANGB ADDRESS: 150 Old Riverhead Road Westhampton Beach NY 11978 LAT/LONG: 40.8375 / 72.6438	CLIENT: B.B. & E CONTACT: Naila Hosein INQUIRY #: 4466400.2s DATE: November 13, 2015 2:06 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.250

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	USGS40000834163	1/4 - 1/2 Mile ESE
2	USGS40000834046	1/4 - 1/2 Mile SSE
3	USGS40000834367	1/2 - 1 Mile NW
A4	USGS40000834067	1/2 - 1 Mile SE
5	USGS40000833994	1/2 - 1 Mile SSW
A6	USGS40000834045	1/2 - 1 Mile SE
B7	USGS40000834083	1/2 - 1 Mile ESE
B8	USGS40000834084	1/2 - 1 Mile ESE
9	USGS40000834038	1/2 - 1 Mile SE
B10	USGS40000834044	1/2 - 1 Mile SE
11	USGS40000833976	1/2 - 1 Mile SE
12	USGS40000834099	1/2 - 1 Mile ESE
13	USGS40000834115	1/2 - 1 Mile WSW
14	USGS40000834328	1/2 - 1 Mile WNW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **ESE** **1/4 - 1/2 Mile** **Lower**	**FED USGS**	**USGS40000834163**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-405008072382201		
Monloc name:	S 3468. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.835655
Longitude:	-72.638984	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	45.0
Vert measure units:	feet	Vertacc measure val:	0.1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	53
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
2 **SSE** **1/4 - 1/2 Mile** **Lower**	**FED USGS**	**USGS40000834046**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404953072382201		
Monloc name:	S 52492. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8314884
Longitude:	-72.6389841	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 9

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1975-12-15		11.71	1975-09-22		11.72
1975-06-09		12.46	1975-02-28		11.95
1974-11-25		10.57	1974-10-11		10.85
1974-09-09		11.15	1974-08-15		11.31
1974-07-11		11.72			

3
NW
1/2 - 1 Mile
Higher

FED USGS **USGS40000834367**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-405037072390301		
Monloc name:	S 3543. 1		
Monloc type:	Well		
Monloc desc:	LAT/LONG UPDATES FROM SIM 3066		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8438611
Longitude:	-72.65025	Sourcemap scale:	24000
Horiz Acc measure:	.1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from Digital Map		
Horiz coord refsys:	NAD83	Vert measure val:	64.1
Vert measure units:	feet	Vertacc measure val:	0.1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	1907	Welldepth:	58
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 694

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2005-02-24		18.25	2005-01-20		17.96
2004-12-15		18.00	2004-11-23		18.23
2004-10-21		18.66	2004-09-22		19.00
2004-08-20		19.59	2004-07-19		20.04
2004-06-14		20.37	2004-05-20		20.36
2004-04-22		19.47	2004-03-15		19.56
2004-02-20		19.81	2004-01-29		19.74
2003-12-16		19.71	2003-11-18		20.15
2003-10-21		20.65	2003-09-15		21.35
2003-08-18		21.83	2003-07-15		21.67
2003-06-16		20.29	2003-05-15		19.55

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2003-04-16		18.43	2003-03-20		17.80
2003-02-27		17.50	2003-01-17		16.46
2002-12-23		16.08	2002-11-15		15.86
2002-10-17		16.01	2002-09-19		16.17
2002-08-21		16.36	2002-07-15		16.55
2002-06-17		16.29	2002-05-20		16.02
2002-04-24		16.12	2002-03-18		16.46
2002-02-22		16.79	2002-01-18		17.28
2001-12-20		17.71	2001-11-26		18.08
2001-10-19		18.69	2001-09-19		19.04
2001-08-23		19.33	2001-07-16		19.40
2001-06-28		19.26	2001-05-31		19.18
2001-04-19		17.27	2001-03-20		16.35
2001-02-21		16.17	2001-01-24		16.26
2000-12-20		16.53	2000-11-24		16.81
2000-10-26		17.14	2000-09-29		17.42
2000-08-29		17.71	2000-07-20		17.86
2000-06-22		17.77	2000-05-24		17.41
2000-04-27		17.09	2000-03-20		16.97
2000-02-23		17.15	1999-12-22		17.58
1999-11-17		17.77	1999-10-28		17.89
1999-09-29		18.07	1999-08-19		18.44
1999-07-21		18.68	1999-05-21		19.14
1999-03-31		18.69	1998-03-16		17.81
1997-03-12		19.72	1996-09-25		18.22
1996-06-25		18.67	1996-03-18		17.35
1996-01-18		16.19	1995-12-06		15.73
1995-09-19		15.76	1995-07-21		16.10
1995-05-17		16.34	1995-03-22		16.36
1995-01-18		16.55	1994-12-14		16.82
1994-10-25		17.44	1994-09-26		17.83
1994-08-25		18.20	1994-07-20		18.67
1994-06-17		18.96	1994-05-24		19.12
1994-04-21		17.74	1994-03-31		18.06
1994-03-01		17.21	1994-02-01		17.03
1993-12-22		17.02	1993-11-23		17.18
1993-09-24		17.95	1993-08-30		18.27
1993-07-21		18.81	1993-06-21		19.11
1993-05-17		19.23	1993-04-30		18.90
1993-03-22		17.79	1993-03-02		17.68
1993-01-29		17.40	1992-12-30		17.02
1992-11-18		17.11	1992-10-20		17.35
1992-09-22		17.54	1992-08-31		17.65
1992-07-14		17.60	1992-06-29		17.31
1992-05-11		16.82	1992-04-13		16.92
1992-03-16		17.00	1992-02-19		17.09
1992-01-27		17.23	1991-12-20		17.56
1991-11-13		17.97	1991-10-21		18.21
1991-09-16		18.53	1991-08-22		18.68
1991-07-19		18.86	1991-06-21		19.15
1991-05-23		18.99	1991-04-25		18.75
1991-03-20		18.83	1991-02-25		18.70
1991-01-29		18.67	1990-12-26		18.92
1990-11-16		19.57	1990-10-16		19.97
1990-09-17		21.41	1990-08-21		20.72

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1990-07-16		21.01	1990-06-14		20.97
1990-05-14		20.76	1990-04-19		20.80
1990-03-28		20.84	1990-02-28		20.93
1990-01-29		21.13	1989-12-26		21.39
1989-11-27		21.34	1989-10-23		21.58
1989-09-25		21.89	1989-08-23		20.90
1989-07-26		20.09	1989-06-28		19.28
1989-05-23		17.26	1989-04-26		16.47
1989-03-20		16.11	1989-02-28		16.20
1989-01-24		16.25	1988-12-29		16.15
1988-11-22		16.02	1988-10-25		16.25
1988-09-27		16.49	1988-08-22		16.83
1988-07-22		17.11	1988-06-20		17.36
1988-05-23		17.49	1988-04-25		17.17
1988-03-24		16.64	1988-02-25		16.12
1988-01-25		16.11	1987-11-25		16.71
1987-10-28		17.05	1987-09-16		17.51
1987-08-12		17.83	1987-07-16		17.99
1987-05-14		17.71	1987-04-30		17.42
1987-04-02		17.02	1987-02-24		16.39
1987-02-03		15.93	1986-12-23		14.99
1986-11-25		14.94	1986-10-28		15.07
1986-10-06		15.05	1986-08-20		15.46
1986-07-24		15.64	1986-06-25		15.84
1986-05-20		15.84	1986-04-22		15.69
1986-03-26		15.47	1986-02-25		15.53
1986-01-16		15.82	1985-12-17		16.05
1985-11-18		16.28	1985-10-22		16.48
1985-09-25		16.70	1985-08-21		17.02
1985-07-25		17.06	1985-06-20		17.30
1985-05-20		17.63	1985-04-22		17.98
1985-03-20		18.49	1985-02-21		18.94
1985-01-30		19.33	1984-12-19		20.16
1984-11-26		20.62	1984-10-23		21.29
1984-09-24		21.85	1984-08-27		22.22
1984-07-23		22.53	1984-06-20		22.11
1984-05-23		21.72	1984-04-23		20.90
1984-03-22		19.70	1984-03-02		19.56
1984-01-29		19.04	1983-12-19		18.72
1983-11-21		18.62	1983-10-21		18.99
1983-09-19		19.48	1983-09-14		19.54
1983-08-22		19.80	1983-07-26		19.98
1983-06-29		20.14	1983-06-20		20.19
1983-05-23		19.73	1983-05-23		19.73
1983-05-10		18.99	1983-04-21		17.69
1983-03-21		16.64	1983-02-24		16.49
1983-01-24		16.79	1982-12-20		17.29
1982-12-08		17.42	1982-11-24		17.67
1982-10-20		18.22	1982-10-06		18.42
1982-09-20		18.66	1982-09-08		18.81
1982-08-19		19.02	1982-07-21		19.21
1982-06-23		18.36	1982-05-18		16.07
1982-04-22		15.95	1982-03-22		15.71
1982-02-24		15.34	1982-01-25		15.05
1981-12-21		15.14	1981-11-20		15.34

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1981-10-27		15.49	1981-09-21		15.69
1981-08-24		15.81	1981-07-20		15.93
1981-06-22		16.84	1981-05-21		15.86
1981-04-21		16.00	1981-03-23		16.24
1981-02-25		16.47	1981-01-26		16.84
1980-12-23		17.34	1980-11-24		17.75
1980-10-28		18.14	1980-09-23		18.62
1980-08-26		18.96	1980-07-24		19.26
1980-06-23		19.48	1980-05-22		18.78
1980-04-30		18.79	1980-03-25		18.51
1980-02-26		18.82	1980-02-04		19.06
1979-12-19		19.65	1979-11-23		20.03
1979-10-26		20.47	1979-09-25		20.95
1979-08-28		21.39	1979-07-26		21.79
1979-06-29		21.86	1979-05-29		22.07
1979-05-03		22.32	1979-03-27		22.34
1979-02-27		21.94	1979-01-31		19.97
1978-12-18		19.19	1978-11-29		19.36
1978-10-26		19.89	1978-10-04		20.22
1978-08-29		20.67	1978-07-25		20.95
1978-06-29		20.99	1978-05-25		21.23
1978-04-25		21.49	1978-03-22		21.77
1978-02-22		21.70	1978-01-25		19.54
1977-12-22		18.65	1977-11-29		18.37
1977-10-25		18.06	1977-09-21		17.87
1977-08-24		18.10	1977-07-26		18.24
1977-06-24		18.44	1977-05-26		18.47
1977-04-27		18.04	1977-03-03		17.66
1977-01-27		17.92	1976-12-28		18.06
1976-11-23		18.24	1976-11-02		18.34
1976-09-29		18.47	1976-08-25		18.55
1976-07-29		18.65	1976-06-25		18.95
1976-05-20		19.20	1976-04-29		19.26
1976-04-02		19.35	1976-02-26		19.00
1976-01-29		18.46	1975-11-26		18.47
1975-11-03		18.70	1975-10-22		18.67
1975-08-28		19.50	1975-08-04		19.75
1975-07-02		19.22	1975-05-29		18.87
1975-04-24		18.41	1975-03-24		18.04
1975-02-25		17.56	1975-01-31		17.15
1975-01-06		18.22	1974-12-27		17.20
1974-11-27		17.45	1974-10-31		17.74
1974-09-30		18.08	1974-07-04		18.90
1974-03-29		18.35	1973-12-26		18.90
1973-10-04		20.23	1973-07-02		21.24
1973-03-30		20.12	1972-12-29		18.69
1972-10-02		19.00	1972-07-07		18.67
1972-03-27		17.54	1971-12-20		16.64
1971-09-23		17.45	1971-09-01		17.66
1971-08-09		17.75	1971-07-27		17.88
1971-06-25		16.99	1971-06-08		18.11
1971-05-28		18.14	1971-04-27		18.02
1971-03-15		16.74	1971-02-23		16.95
1971-01-28		16.89	1971-01-06		16.64
1970-11-24		17.00	1970-10-22		17.29

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel
1970-10-08		17.44
1970-07-23		18.28
1970-05-11		18.66
1970-03-11		17.25
1970-01-15		16.60
1969-11-24		16.48
1969-09-30		16.99
1969-07-29		17.45
1969-05-29		17.48
1969-03-27		17.18
1969-01-24		16.90
1968-11-26		16.95
1968-09-26		17.60
1968-07-30		18.22
1968-05-21		18.78
1968-03-29		17.97
1968-01-29		17.76
1967-11-28		17.99
1967-10-03		18.42
1967-07-25		18.04
1967-05-28		16.69
1967-03-31		15.45
1967-01-26		15.03
1966-11-28		15.37
1966-09-28		16.58
1966-07-27		15.90
1966-06-07		15.36
1966-03-25		15.50
1966-01-03		15.86
1965-11-30		16.49
1965-09-28		17.09
1965-07-26		17.43
1965-05-25		17.43
1965-03-29		17.22
1965-01-28		16.64
1964-11-23		17.21
1964-09-30		17.99
1964-07-29		18.64
1964-05-27		18.62
1964-03-26		17.42
1964-01-30		17.46
1963-12-03		17.88
1963-09-27		18.70
1963-07-31		19.09
1963-05-28		19.18
1963-03-27		19.29
1963-01-30		19.10
1962-12-04		18.81
1962-10-02		19.27
1962-07-26		19.78
1962-05-31		20.31
1962-04-03		19.90
1962-02-06		19.42
1961-11-28		19.39
1961-10-04		19.49

Date	Feet below Surface	Feet to Sealevel
1970-08-28		17.92
1970-06-15		18.63
1970-04-09		17.34
1970-02-25		17.22
1969-12-22		16.34
1969-11-03		16.69
1969-08-27		17.27
1969-06-27		17.59
1969-04-30		17.42
1969-02-28		17.18
1968-12-27		16.77
1968-10-24		17.22
1968-08-30		17.49
1968-07-01		18.48
1968-04-24		18.67
1968-02-27		17.78
1967-12-27		17.75
1967-10-30		18.17
1967-08-30		17.99
1967-06-27		17.37
1967-04-25		16.10
1967-02-28		15.55
1966-12-27		15.12
1966-10-27		15.57
1966-08-31		15.90
1966-06-30		15.56
1966-04-26		15.35
1966-02-28		15.70
1965-12-28		16.20
1965-11-01		16.78
1965-08-30		17.34
1965-06-28		17.42
1965-04-21		17.45
1965-03-02		16.85
1964-12-28		16.85
1964-10-27		17.57
1964-08-31		18.30
1964-07-01		18.80
1964-04-28		17.67
1964-02-25		17.12
1963-12-27		17.60
1963-11-04		18.24
1963-09-04		18.91
1963-07-02		19.10
1963-04-29		19.31
1963-02-26		19.06
1962-12-27		19.07
1962-10-29		19.06
1962-08-31		19.42
1962-07-03		20.02
1962-04-30		20.30
1962-03-05		19.68
1962-01-03		19.10
1961-11-06		19.45
1961-09-06		19.55

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel
1961-07-26		19.79
1961-05-31		19.36
1961-04-04		18.66
1961-02-01		17.90
1960-12-07		18.05
1960-10-04		18.40
1960-08-01		18.81
1960-06-08		19.20
1960-04-06		18.90
1960-02-01		18.81
1959-11-23		19.65
1959-09-28		20.43
1959-08-04		20.75
1959-05-29		20.91
1959-03-31		19.65
1959-01-29		19.94
1958-12-01		20.20
1958-09-26		20.50
1958-07-29		21.24
1958-05-26		21.00
1958-03-25		19.08
1958-01-27		17.09
1957-11-25		16.84
1957-09-25		17.50
1957-07-30		17.86
1957-05-28		18.46
1957-03-27		17.64
1957-01-30		17.81
1956-11-28		18.54
1956-10-03		19.18
1956-07-30		19.75
1956-05-28		20.04
1956-03-28		18.87
1956-01-25		19.26
1955-11-25		18.44
1955-10-06		18.19
1955-07-26		18.82
1955-05-25		19.21
1955-03-25		19.33
1955-01-25		19.32
1954-11-18		19.43
1954-09-30		18.92
1954-07-27		18.63
1954-05-27		18.68
1954-03-26		18.59
1954-01-27		19.06
1953-11-20		18.87
1953-10-07		19.55
1953-08-25		20.24
1953-06-24		20.87
1953-04-30		19.96
1953-02-27		17.80
1952-12-22		18.00
1952-11-06		18.52
1952-08-27		19.04

Date	Feet below Surface	Feet to Sealevel
1961-07-06		19.68
1961-05-01		19.09
1961-02-28		18.06
1961-01-06		17.94
1960-11-08		18.02
1960-09-02		18.54
1960-07-06		18.97
1960-05-04		19.09
1960-02-29		18.65
1959-12-30		19.16
1959-10-28		20.07
1959-09-01		20.66
1959-07-01		20.69
1959-05-01		20.71
1959-02-25		19.77
1959-01-07		20.14
1958-10-28		20.11
1958-08-25		20.86
1958-06-24		21.46
1958-04-28		20.36
1958-02-26		18.45
1957-12-17		16.67
1957-10-28		17.16
1957-08-28		17.80
1957-07-02		18.39
1957-04-24		17.88
1957-02-27		17.68
1956-12-20		18.22
1956-10-31		18.87
1956-08-29		19.55
1956-06-21		20.05
1956-04-26		19.46
1956-02-29		18.76
1955-12-28		18.96
1955-11-02		18.20
1955-08-25		18.62
1955-06-21		19.08
1955-04-25		19.17
1955-02-23		19.47
1954-12-27		19.15
1954-10-26		19.40
1954-08-24		18.44
1954-06-29		18.82
1954-04-28		18.45
1954-02-25		18.85
1953-12-21		18.72
1953-11-09		19.03
1953-09-10		19.99
1953-08-05		20.45
1953-05-28		20.78
1953-03-31		18.53
1953-02-04		17.65
1952-12-02		18.20
1952-09-25		18.86
1952-07-23		19.01

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel
1952-06-25		18.79
1952-04-23		18.06
1952-03-27		17.61
1952-01-25		16.34
1951-11-28		16.09
1951-09-26		16.40
1951-07-26		16.74
1951-05-31		16.83
1951-03-28		15.50
1951-01-23		15.35
1950-11-28		15.73
1950-09-28		16.20
1950-07-25		16.43
1950-05-25		16.10
1950-03-27		16.22
1950-01-30		16.57
1949-11-30		17.45
1949-09-28		18.34
1949-07-25		19.19
1949-05-23		19.65
1949-03-28		19.06
1949-01-31		18.04
1948-11-30		18.14
1948-09-30		18.87
1948-08-05		19.34
1948-05-28		18.64
1948-03-31		17.85
1948-01-27		16.68
1947-11-24		16.50
1947-10-02		16.68
1947-07-31		17.10
1947-06-05		17.01
1947-04-03		16.22
1947-01-23		16.75
1943-03-31		17.09
1943-01-29		16.33
1942-11-30		15.90
1942-09-28		16.39
1942-09-11		16.52
1942-08-28		16.63
1942-08-14		16.73
1942-07-31		16.82
1942-07-17		16.91
1942-07-06		17.01
1942-06-19		17.06
1942-06-05		17.04
1942-05-22		16.97
1942-05-08		16.82
1942-04-24		16.55
1942-04-14		16.31
1909-11-18		16.52
1909-08-25		17.47
1909-06-01		17.42
1909-03-24		16.51
1909-01-12		17.05

Date	Feet below Surface	Feet to Sealevel
1952-05-27		18.45
1952-03-28		17.62
1952-02-29		17.07
1951-12-21		16.08
1951-11-02		16.12
1951-08-29		16.58
1951-06-29		16.86
1951-04-25		16.04
1951-02-27		15.18
1950-12-26		15.52
1950-10-30		15.97
1950-08-30		16.41
1950-06-27		16.24
1950-04-27		16.11
1950-02-24		16.36
1949-12-28		17.07
1949-10-26		17.94
1949-08-23		18.84
1949-06-29		19.40
1949-04-25		19.44
1949-02-21		18.30
1948-12-23		17.84
1948-10-27		18.55
1948-08-25		19.22
1948-07-06		19.20
1948-04-30		18.30
1948-02-25		17.33
1947-12-22		16.54
1947-10-28		16.48
1947-09-03		16.88
1947-07-09		17.18
1947-05-06		16.61
1947-03-06		16.38
1943-04-30		17.31
1943-02-25		16.77
1942-12-31		15.84
1942-11-02		16.11
1942-09-18		16.47
1942-09-04		16.58
1942-08-21		16.68
1942-08-07		16.78
1942-07-24		16.87
1942-07-10		16.96
1942-06-26		17.03
1942-06-12		17.06
1942-05-29		17.01
1942-05-15		16.90
1942-04-30		16.68
1942-04-17		16.39
1909-12-16		16.03
1909-10-06		17.02
1909-07-13		17.84
1909-04-24		16.66
1909-03-02		16.53
1908-11-17		17.87

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1908-10-12		18.36	1908-08-20		19.02
1908-07-08		19.35	1908-06-10		19.49
1908-05-08		19.44	1908-04-04		19.04
1908-03-05		18.55	1908-02-08		18.01
1908-01-06		17.55	1907-11-15		18.12
1907-08-15		18.95	1907-03-18		18.37

A4
SE
1/2 - 1 Mile
Lower

FED USGS **USGS40000834067**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404955072381001		
Monloc name:	S 3544. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8320439
Longitude:	-72.6356506	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	39
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 132

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1954-12-27		13.14	1954-10-25		13.47
1954-06-29		12.76	1954-03-26		12.62
1953-12-21		13.36	1953-11-20		12.16
1953-11-09		12.30	1953-10-06		12.47
1953-08-25		13.18	1953-08-05		13.42
1953-05-28		14.65	1953-04-30		14.67
1953-03-31		13.54	1952-12-29		11.66
1952-12-02		11.78	1952-11-06		12.05
1952-09-25		12.60	1952-08-27		13.05
1952-07-23		13.00	1952-06-25		13.27
1952-05-27		13.15	1952-04-23		12.87
1952-03-27		12.64	1952-02-29		12.33
1952-01-25		11.64	1951-12-21		11.09
1951-11-28		11.01	1951-11-02		10.59
1951-10-01		10.77	1951-08-29		11.13

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1951-07-26		11.46	1951-06-29		11.69
1951-05-31		11.92	1951-04-25		11.87
1951-03-28		11.13	1951-02-27		10.57
1951-01-23		10.15	1950-12-26		10.20
1950-11-28		10.30	1950-10-31		10.46
1950-09-28		10.72	1950-08-30		11.01
1950-07-25		11.33	1950-06-27		11.36
1950-05-25		11.16	1950-04-27		11.12
1950-03-27		11.06	1950-02-28		10.95
1950-01-31		10.65	1949-12-28		10.83
1949-12-01		11.01	1949-10-26		11.29
1949-10-04		11.55	1949-08-23		12.09
1949-07-25		12.56	1949-06-29		12.95
1949-05-23		13.42	1949-04-25		13.58
1949-03-28		13.60	1949-02-21		13.00
1949-01-31		12.72	1948-12-23		11.52
1948-11-30		11.69	1948-10-27		11.94
1948-09-30		12.27	1948-08-25		12.85
1948-08-05		13.10	1948-07-06		13.45
1948-05-28		13.12	1948-04-30		13.02
1948-03-31		12.77	1948-02-25		12.70
1948-02-06		11.99	1947-12-22		11.28
1947-11-24		11.36	1947-10-28		10.76
1947-10-02		11.02	1947-09-03		11.29
1947-07-31		11.58	1947-07-09		11.78
1947-06-05		11.94	1947-05-06		11.80
1947-04-03		11.10	1947-03-06		10.99
1947-01-25		11.02	1943-04-30		11.94
1943-03-31		11.90	1943-02-25		11.67
1943-01-29		11.35	1942-11-30		10.27
1942-11-02		10.40	1942-09-28		10.64
1942-09-18		10.72	1942-09-11		10.77
1942-09-04		10.83	1942-08-28		10.89
1942-08-21		10.95	1942-08-14		10.95
1942-08-07		11.05	1942-07-31		11.12
1942-07-24		11.19	1942-07-17		11.26
1942-07-10		11.33	1942-07-03		11.41
1942-06-26		11.45	1942-06-19		11.52
1942-06-12		11.58	1942-06-05		11.63
1942-05-29		11.66	1942-05-22		11.71
1909-12-16		10.28	1909-11-18		10.47
1909-10-06		10.83	1909-08-24		11.45
1909-07-13		12.00	1909-06-01		12.35
1909-04-24		11.47	1909-03-24		11.36
1909-03-02		10.95	1909-01-12		10.69
1908-11-17		11.10	1908-10-12		11.48
1908-08-19		12.15	1908-07-08		12.69
1908-06-10		12.96	1908-05-02		13.16
1908-04-04		13.17	1908-03-05		12.88
1908-02-08		12.53	1908-01-06		11.77
1907-08-15		12.42	1907-03-18		12.22

Map ID Direction Distance Elevation		Database	EDR ID Number
5 **SSW** **1/2 - 1 Mile** **Lower**		**FED USGS**	**USGS40000833994**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404946072385601		
Monloc name:	S 3506. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8295439
Longitude:	-72.6484289	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	40.0
Vert measure units:	feet	Vertacc measure val:	0.1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	102
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

A6 **SE** **1/2 - 1 Mile** **Lower**		**FED USGS**	**USGS40000834045**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404953072380701		
Monloc name:	S 52548. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8314884
Longitude:	-72.6348172	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 7

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1975-09-22		10.83	1975-06-10		11.41
1975-04-28		11.69	1975-02-28		11.11
1974-11-21		9.79	1974-10-11		9.97
1974-09-18		10.08			

B7
ESE
1/2 - 1 Mile
Lower

FED USGS **USGS40000834083**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404956072380101		
Monloc name:	S 52128. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8323217
Longitude:	-72.6331505	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	37
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 33

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1983-03-04		10.36	1982-12-21		9.90
1982-09-16		12.69	1981-03-02		9.66
1980-12-06		10.03	1980-09-06		10.83
1980-06-21		11.98	1980-03-13		10.96
1979-12-17		11.49	1979-09-21		12.00
1979-06-22		13.38	1979-03-13		14.37
1979-01-04		11.40	1978-03-15		13.56
1977-12-15		11.55	1977-09-21		10.65
1977-06-21		11.16	1977-03-23		10.73
1976-12-28		10.67	1976-09-27		10.90
1976-06-23		11.25	1976-03-25		12.05
1975-12-15		11.33	1975-09-22		11.15

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1975-06-10		11.70	1975-02-28		11.38
1974-12-19		10.28	1974-11-25		10.07
1974-10-11		10.31	1974-09-09		10.52
1974-08-15		10.74	1974-07-09		11.20
1974-06-19		11.44			

B8
ESE
1/2 - 1 Mile
Lower

FED USGS **USGS40000834084**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404956072380102		
Monloc name:	S 52552. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8323217
Longitude:	-72.6331505	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

9
SE
1/2 - 1 Mile
Lower

FED USGS **USGS40000834038**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404952072380401		
Monloc name:	S 52549. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8312106
Longitude:	-72.6339839	Sourcemap scale:	24000

Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 4

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1975-02-28		10.58	1974-11-21		9.30
1974-10-11		9.47	1974-09-09		9.65

B10
SE
1/2 - 1 Mile
Lower

FED USGS **USGS40000834044**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404953072375901		
Monloc name:	S 52550. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8314884
Longitude:	-72.6325949	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 7

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1975-09-22		10.41	1975-06-10		11.01
1975-04-28		11.33	1975-02-28		10.74
1974-11-21		9.34	1974-10-11		9.57
1974-09-18		9.70			

Map ID Direction Distance Elevation	Database	EDR ID Number
11 **SE** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS40000833976**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404944072380901		
Monloc name:	S 52551. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8289884
Longitude:	-72.6353728	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	27.8
Vert measure units:	feet	Vertacc measure val:	0.1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	19740828	Welldepth:	29
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 71

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2003-03-20		10.29	2002-03-18		8.35
2001-03-23		9.53	2000-03-20		9.18
1999-03-31		10.17	1998-03-16		10.55
1997-03-12		10.35	1996-03-18		9.82
1995-03-22		8.83	1994-03-31		10.61
1994-03-09		9.78	1993-03-22		9.93
1992-03-16		8.92	1991-03-20		9.82
1990-03-28		10.43	1990-03-22		10.47
1989-01-13		8.95	1988-05-04		9.62
1987-03-03		9.64	1986-12-29		8.59
1986-09-25		7.68	1986-06-03		8.28
1986-03-12		8.35	1985-09-17		9.21
1985-07-03		8.73	1985-07-03		8.73
1985-03-27		8.94	1985-01-01		9.34
1984-09-25		10.24	1984-06-21		11.55
1984-04-02		11.34	1983-09-14		9.38
1983-06-29		10.63	1983-05-10		11.53
1983-03-04		8.94	1982-12-21		8.43
1982-12-08		8.52	1982-10-06		8.93
1982-09-16		12.23	1982-09-08		9.31
1982-06-14		10.60	1982-03-01		8.80
1981-12-09		7.79	1981-09-18		8.03
1981-06-12		8.40	1981-03-02		8.36
1980-12-06		8.53	1980-09-06		8.09

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1980-06-21		9.09	1980-03-13		9.78
1979-12-14		9.71	1979-09-19		9.10
1979-06-22		11.09	1979-03-26		11.75
1979-01-03		9.65	1978-10-05		9.60
1978-03-15		11.42	1977-12-15		10.04
1977-09-21		8.11	1977-06-21		9.43
1977-03-23		9.11	1976-06-23		9.41
1976-03-25		10.13	1975-12-15		9.50
1975-09-22		9.31	1975-06-10		9.86
1975-04-28		10.14	1975-02-28		9.71
1974-11-21		8.44	1974-10-11		8.58
1974-09-09		8.76			

12
ESE
1/2 - 1 Mile
Lower

FED USGS **USGS40000834099**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-404959072375001		
Monloc name:	S 9582. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8331551
Longitude:	-72.6300948	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	40.0
Vert measure units:	feet	Vertacc measure val:	0.1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	59
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

13
WSW
1/2 - 1 Mile
Lower

FED USGS **USGS40000834115**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-405001072393001		
Monloc name:	S 36154. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8337105
Longitude:	-72.6578738	Sourcemap scale:	24000

Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	74
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 41

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1981-03-31		7.59	1981-03-18		7.65
1980-07-02		9.03	1980-03-25		8.91
1980-01-10		9.32	1979-10-03		9.90
1979-07-23		10.64	1979-02-01		8.82
1979-01-12		9.21	1978-10-03		9.74
1978-06-23		10.45	1978-03-28		11.02
1978-01-05		8.52	1977-10-12		8.03
1977-06-30		8.69	1977-04-07		8.70
1977-01-12		9.38	1976-09-27		9.05
1976-06-30		9.41	1976-03-16		9.59
1976-01-09		9.07	1975-10-09		8.77
1975-06-30		9.16	1975-04-08		8.70
1974-12-30		8.35	1974-09-19		8.75
1974-06-11		9.87	1974-03-20		9.59
1973-12-21		10.05	1973-09-27		10.69
1973-06-19		9.93	1973-03-29		10.27
1972-12-27		9.60	1972-10-02		9.30
1972-07-07		8.82	1972-03-21		7.70
1971-12-17		8.60	1971-09-22		7.64
1971-03-19		8.16	1970-10-26		8.27
1970-03-11		8.35			

14
WNW
1/2 - 1 Mile
Lower

FED USGS **USGS40000834328**

Org. Identifier:	USGS-NY		
Formal name:	USGS New York Water Science Center		
Monloc Identifier:	USGS-405032072392901		
Monloc name:	S 89541. 1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	02030202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	40.8425993
Longitude:	-72.6578737	Sourcemap scale:	24000

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Northern Atlantic Coastal Plain aquifer system		
Formation type:	Glacial Aquifer, Upper		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	108
Welldepth units:	ft	Wellholedepth:	110
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

APPENDIX C-3

WATER WELL INFORMATION FROM 2004 REMEDIAL INVESTIGATION

The upward movement of water from the Magothy Aquifer would cause the upper glacial water to flow horizontally toward surface water discharge points. Migration of contaminants downward into lower aquifers is very unlikely (Dames & Moore 1986).

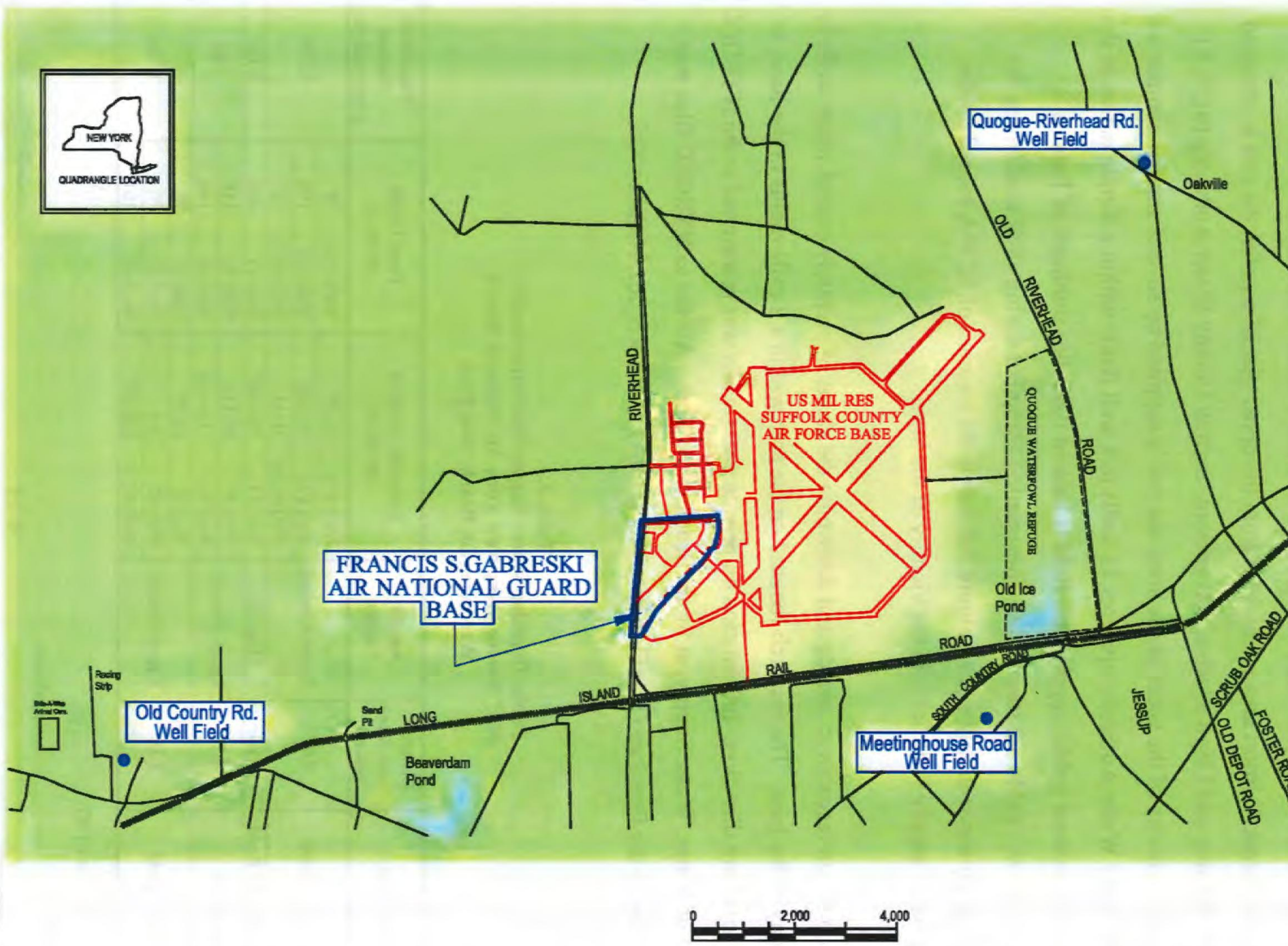
Groundwater is the only water supply source for Suffolk County. Most of the water in the Francis S. Gabreski Airport area is obtained from the upper glacial aquifer; the rest is obtained from the Magothy and Lloyd aquifers. At present, Suffolk County Water Authority (SCWA) supplies the majority of the water in the area; the rest is supplied by several smaller companies. Suffolk County Water Authority operates 18 wells in 4 well fields within a 4-mile radius of the site, and their nearest public supply well field is located 0.6 miles southeast of Francis S. Gabreski Airport. Table 3.2 summarizes information compiled during 1987 concerning the public drinking water supply wells. Figure 3.6 shows the location of SCWA owned public drinking water supply well fields in the vicinity of the base.

PEER conducted research to catalog and determine the status of privately owned water wells in the vicinity of the base. The research focused on the area within a 2-mile radius of the base, in the downgradient direction. Information on private water wells was researched at the NYSDEC Division of Water, Water Supply, at Stony Brook, New York. Access to NYSDEC files was obtained under the Freedom Of Information Act (FOIA), FOIA Request Number 735.

Table 3.2
Public Drinking Water Supply Well Information
106th Rescue Wing New York Air National Guard
Westhampton Beach, New York

Well Field I.D.	Distance from Site (miles)	Aquifer Tapped	Screened Interval (ft BGS)		Total Depth (ft BGS)		Population Served (Approximate)
Meeting House Road	0.61	Upper Glacial	Well #20	55-75	Well #20	78	6,538
			Well #22	74-104	Well #22	104	
			Well #15A	31-51	Well #15A	53	
Quogue-Riverhead Road	1.16	Magothy	Well #1	386-447	Well #1	449	1,189
Spinny Road	1.7	Upper Glacial	Well #1	85-115	Well #1	118	189
			Well #2	118-158	Well #2	163	
Old Country Road	2.18	Upper Glacial	Well #1	60-75	Well #1	76	1,783
			Well #2	NA	Well #2	70	
			Well #3	128-157	Well #3	161	

Source: Dames & Moore 1987.

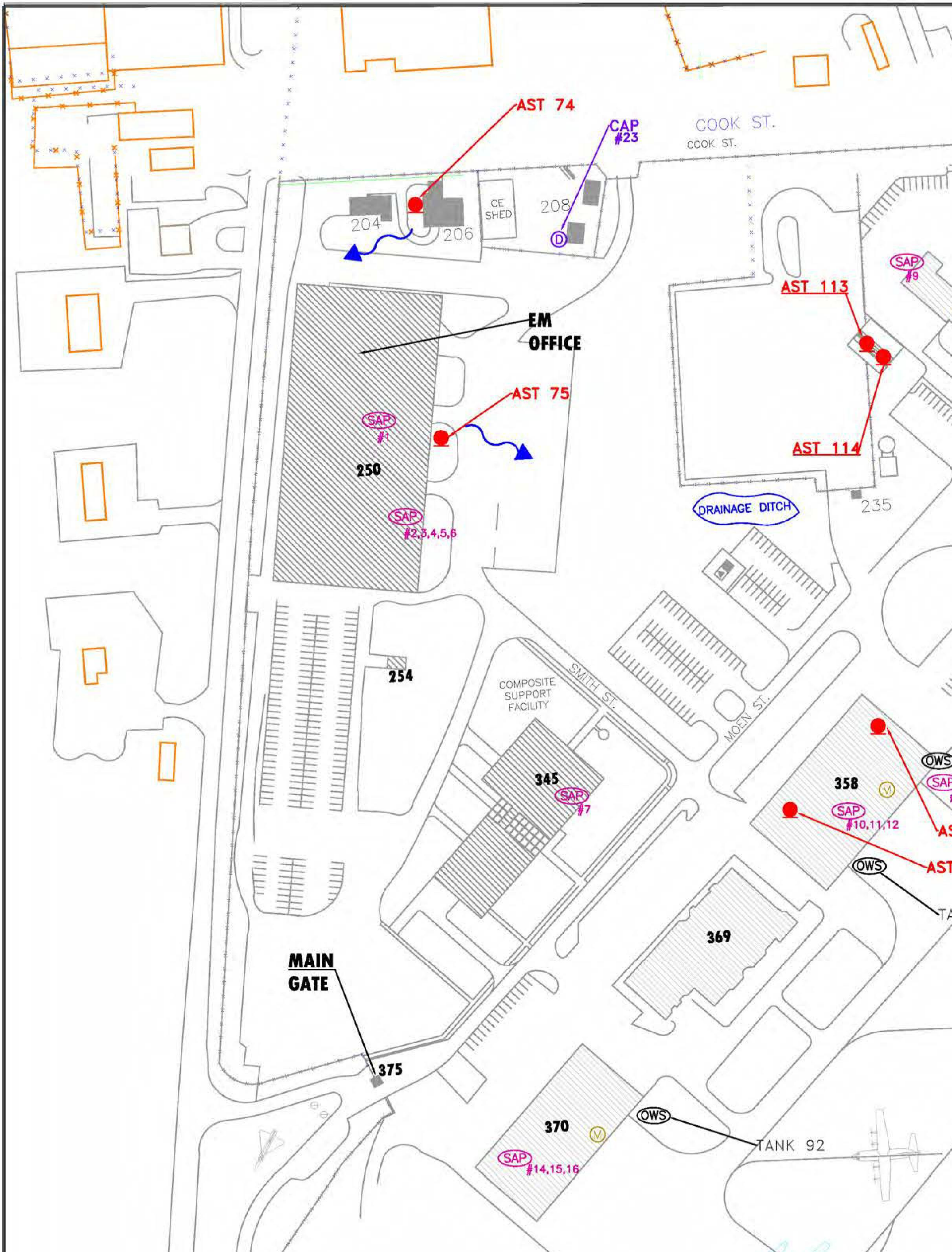


SOURCE: USGS 7.5 minute series quadrangle maps

PEER	PUBLIC DRINKING WATER SUPPLY WELL FIELD LOCATIONS 106th RESCUE WING, NEW YORK ANG FRANCIS S. GABRESKI AIRPORT WESTHAMPTON BEACH, NEW YORK
PROJ./1566-053	
GAB 1566-053/Final RI/FIG 3.6	

APPENDIX C-4

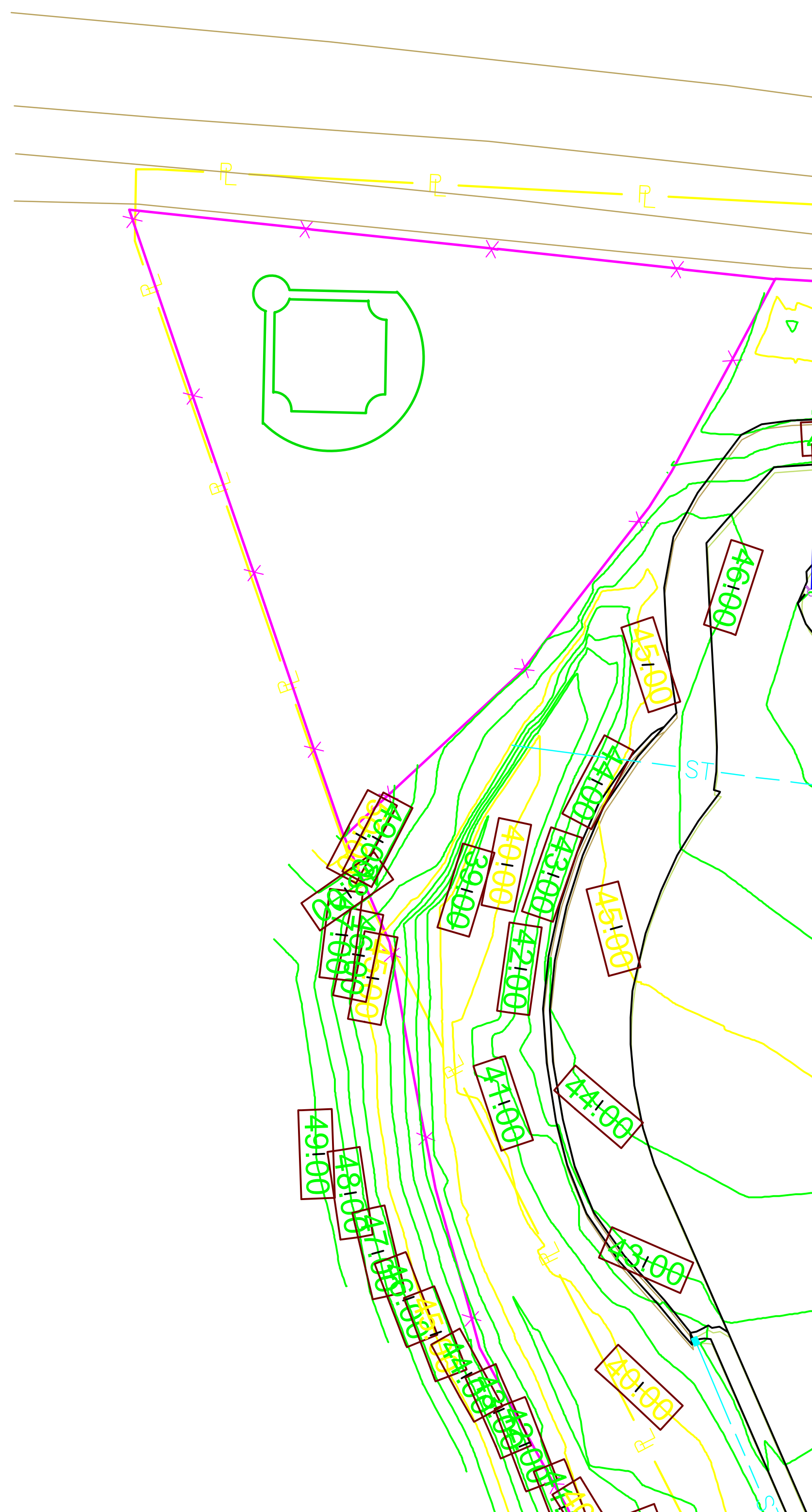
STORMWATER MAP



AST 74
CAP #23
COOK ST.
COOK ST.
204
206
CE SHED
208
D
SAP #9
AST 113
EM OFFICE
AST 75
SAP #1
250
AST 114
235
DRAINAGE DITCH
SAP #2,3,4,5,6
254
COMPOSITE SUPPORT FACILITY
SMITH ST.
MOEN ST.
345
SAP #7
358
M
SAP #10,11,12
OWS
369
MAIN GATE
375
370
M
OWS
TANK 92
SAP #14,15,16

APPENDIX C-5

SANITARY AND STORMWATER SEWER SYSTEMS



PL
PL
PL
46.00
45.00
44.00
43.00
42.00
41.00
40.00
39.00
45.00
44.00
43.00
40.00
49.00
48.00
47.00
ST

APPENDIX C-6

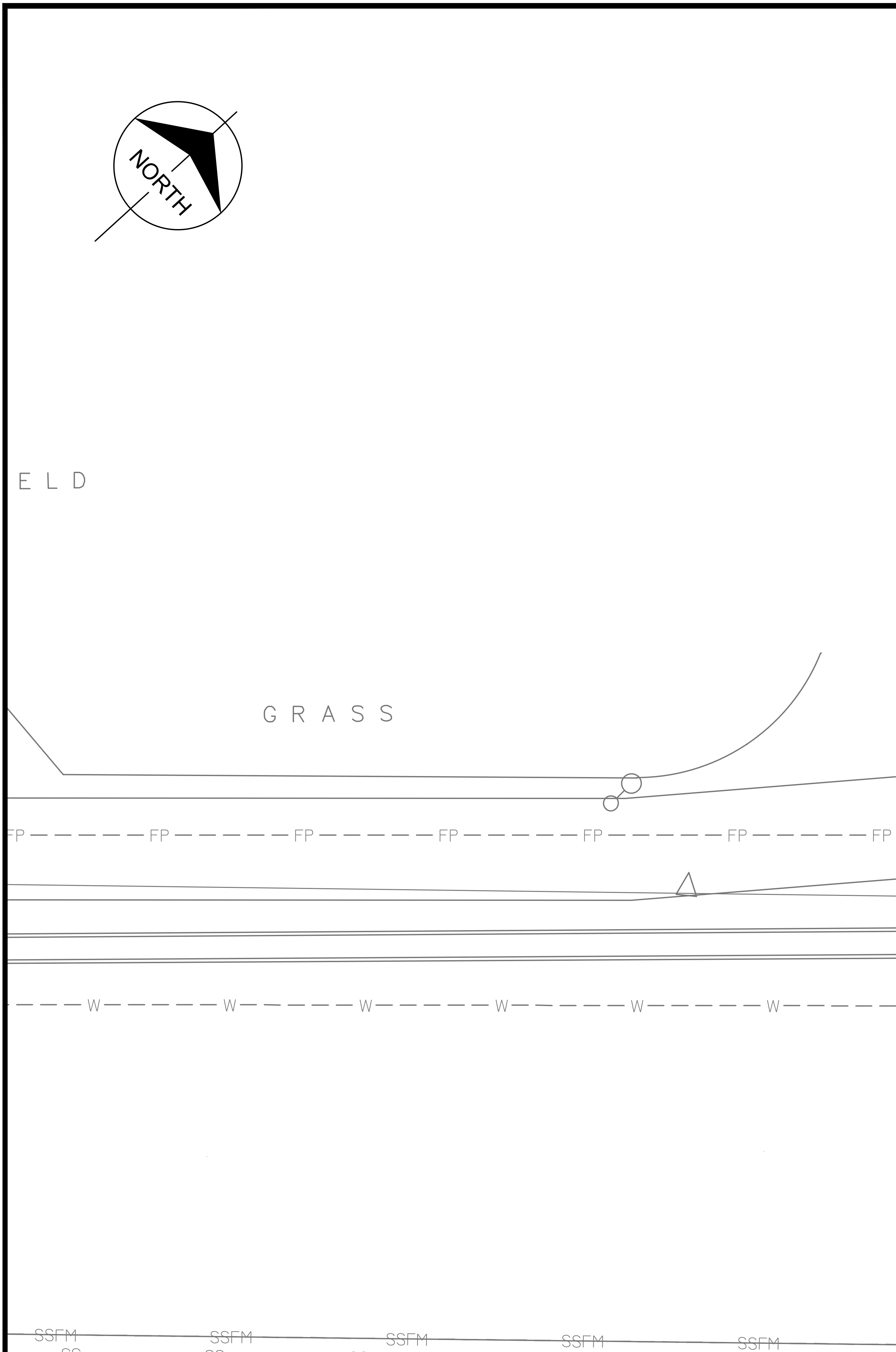
BUILDING 300 (FIRE STATION) FLOOR PLAN – 2012

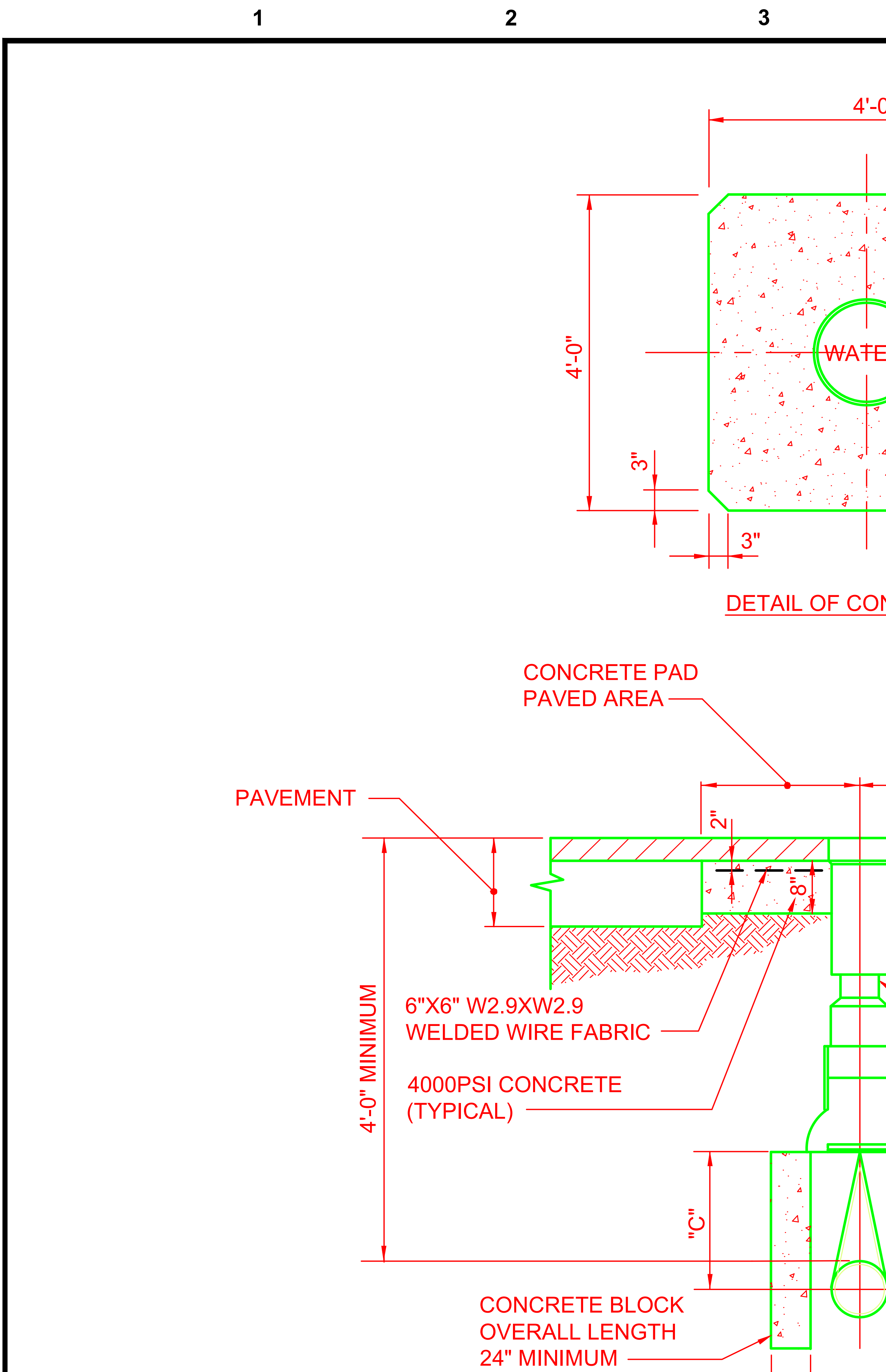
APPENDIX C-7

DECOMMISSIONING OF BUILDING 358 AND 370 AFFF FIRE SUPPRESSIONS SYSTEMS

AIR NATIONAL GUARD

1 2 3





1
2
3
4'-0
4'-0"
3"
3"
WATE
DETAIL OF CON
CONCRETE PAD
PAVED AREA
PAVEMENT
2"
8"
4'-0" MINIMUM
6"X6" W2.9XW2.9
WELDED WIRE FABRIC
4000PSI CONCRETE
(TYPICAL)
"C"
CONCRETE BLOCK
OVERALL LENGTH
24" MINIMUM

1 2 3

FIRE PROTECTION DESIGN CRITERIA:

1. APPLICABLE CODES AND STANDARDS:
   A. NFPA 10 - PORTABLE FIRE EXTINGUISHERS
   B. NFPA 11A - MEDIUM AND HIGH EXPANSION FOAM SYSTEMS
   C. NFPA 13 - NATIONAL FIRE PROTECTION ASSOCIATION STANDAR
      INSTALLATION OF SPRINKLER SYSTEMS
   D. NFPA 409 - STANDARDS ON AIRCRAFT HANGARS

2. FACILITY FIRE PROTECTION SYSTEM SHALL BE SERVED FROM THE
   LOCATED IN THE FIRE PUMP ROOM. FIRE PROTECTION CONTRAC
   HYDRAULICALLY DESIGN THE PREACTION FIRE PROTECTION SYS
   CALCULATED STATIC AND RESIDUAL PRESSURE AVAILABLE.

3. MAXIMUM VELOCITY IN ANY ABOVE GROUND FIRE PROTECTION PIP
   FPS, AND 10 FPS UNDERGROUND.

4. PIPING SYSTEM COMPONENTS AND DESIGN SHALL BE PROVIDED F
   MINIMUM WORKING PRESSURE.

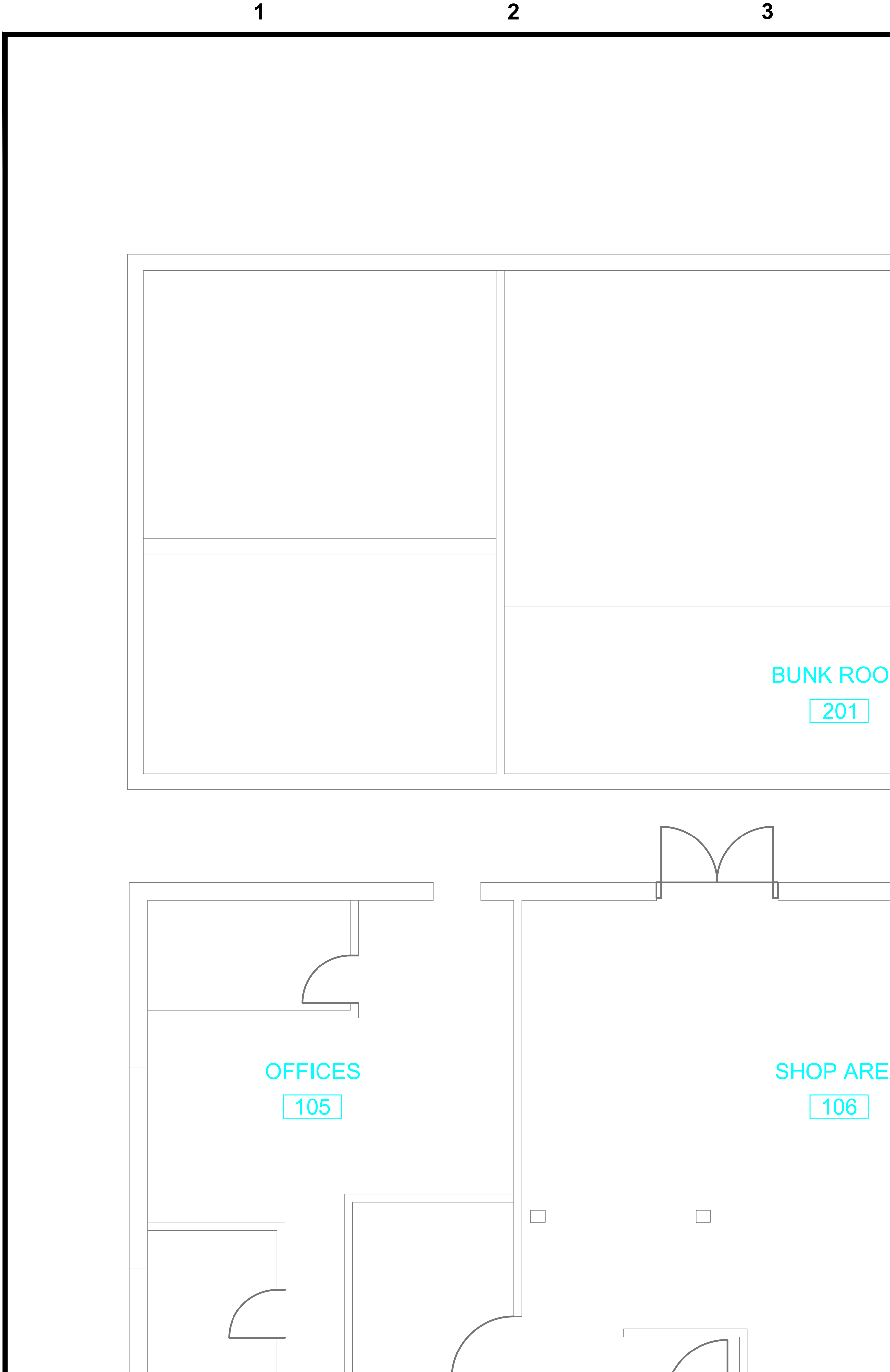
5. WATER/FOAM SUPPLY CALCULATIONS:
   OVERHEAD WET SPRINKLER SYSTEM:
   5000 SQ.FT X 0.20 GPM/SQ. FT = 1000 GPM

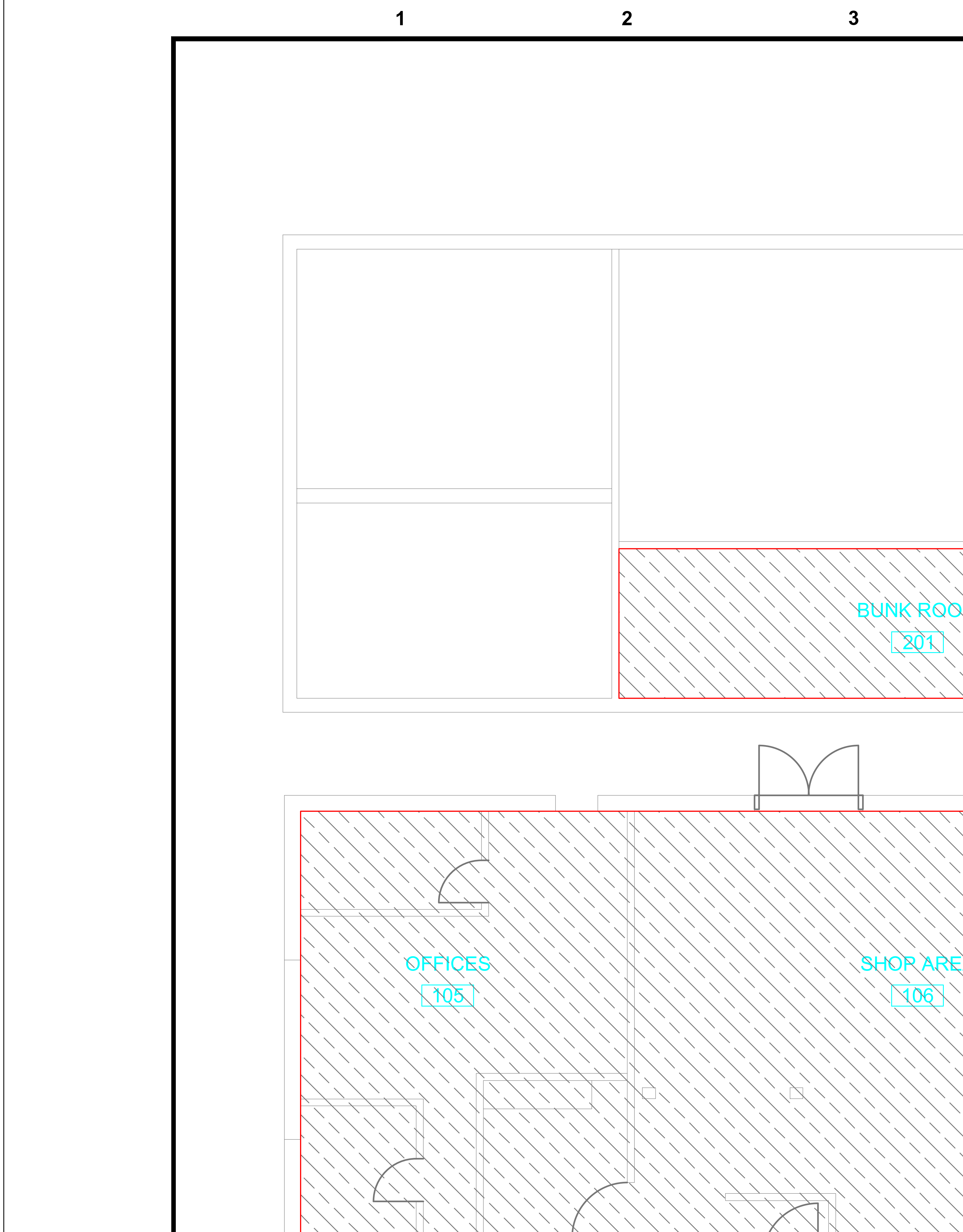
   LOW-LEVEL HIGH EXPANSION FOAM:
   FOAM GENERATORS SHALL DELIVER A FOAM SOLUTION TO A DEPTH O
   4 MINUTES, COVERING THE ENTIRE AREA OF THE AIRCRAFT HANGAR.
   DISCHARGE FOR FOAM GENERATORS:

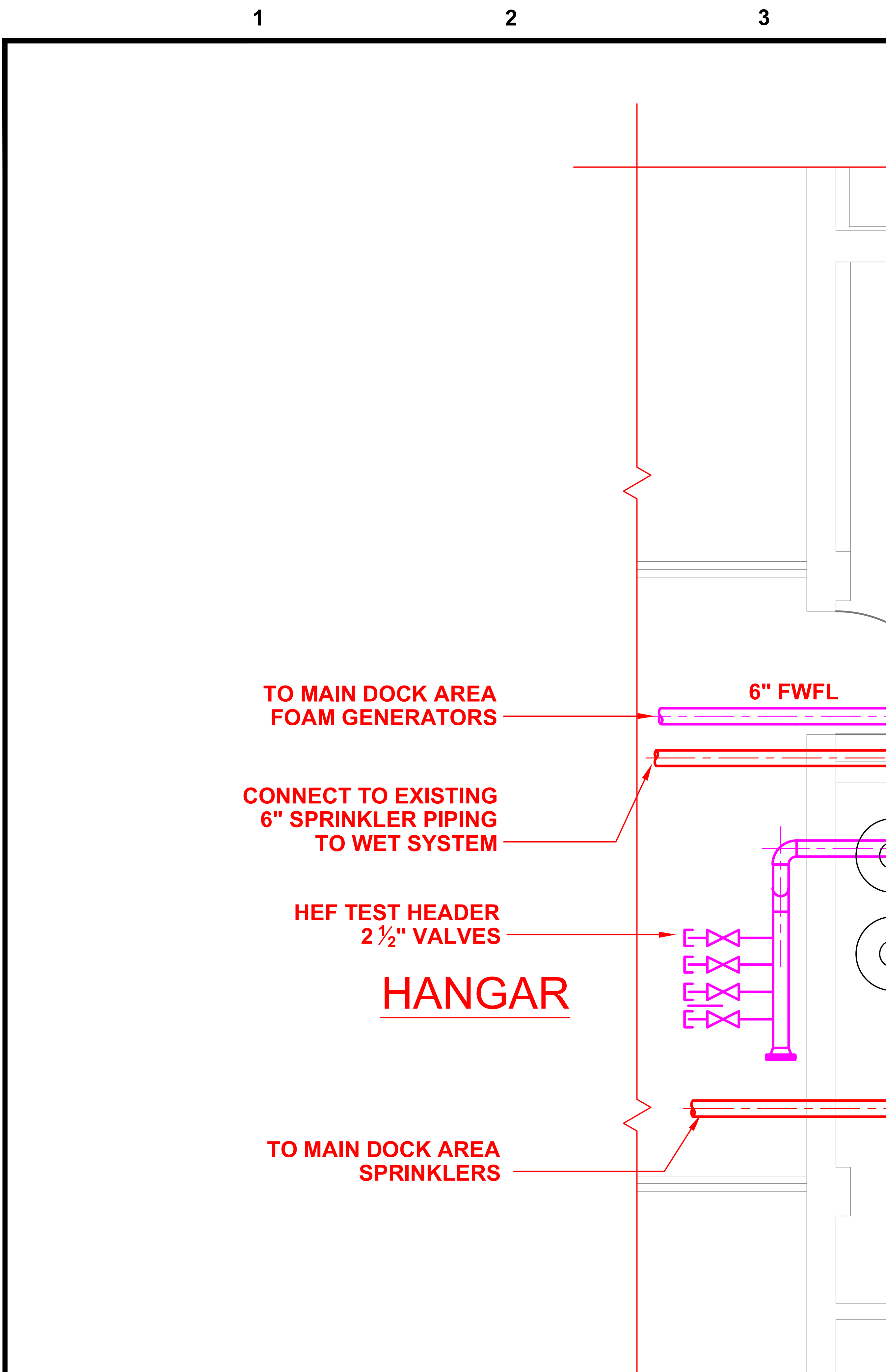
   R = (V/T + Rs)*Cn*Cl
   R = RATE OF DISCHARGE (CFM)
   V = AREA * AREA FACTOR * DEPTH
   T = TIME (4 MIN)
   Rs = S * Q (10*1200 = 12,000 CFM)
   S = FOAM BREAKDOWN FROM SPRINKLERS (10 CFM/GPM)
   Q = SPRINKLER FLOW RATE (1000 GPM)
   Cn = SHRINKAGE COMPENSATION (1.15)
   Cl = COMP FOR FOAM LOSS (2.5)
   R = (70400 CF/4 MIN + 12,000 CFM)*1.15*2.5 = 85100 CFM

PROVIDE (6) FOAM GENERATORS AT 14,200 CFM EACH (85100 CFM TOTAL).
EACH GENERATOR REQUIRES 135 GPM WATER AT 74 PSIG.

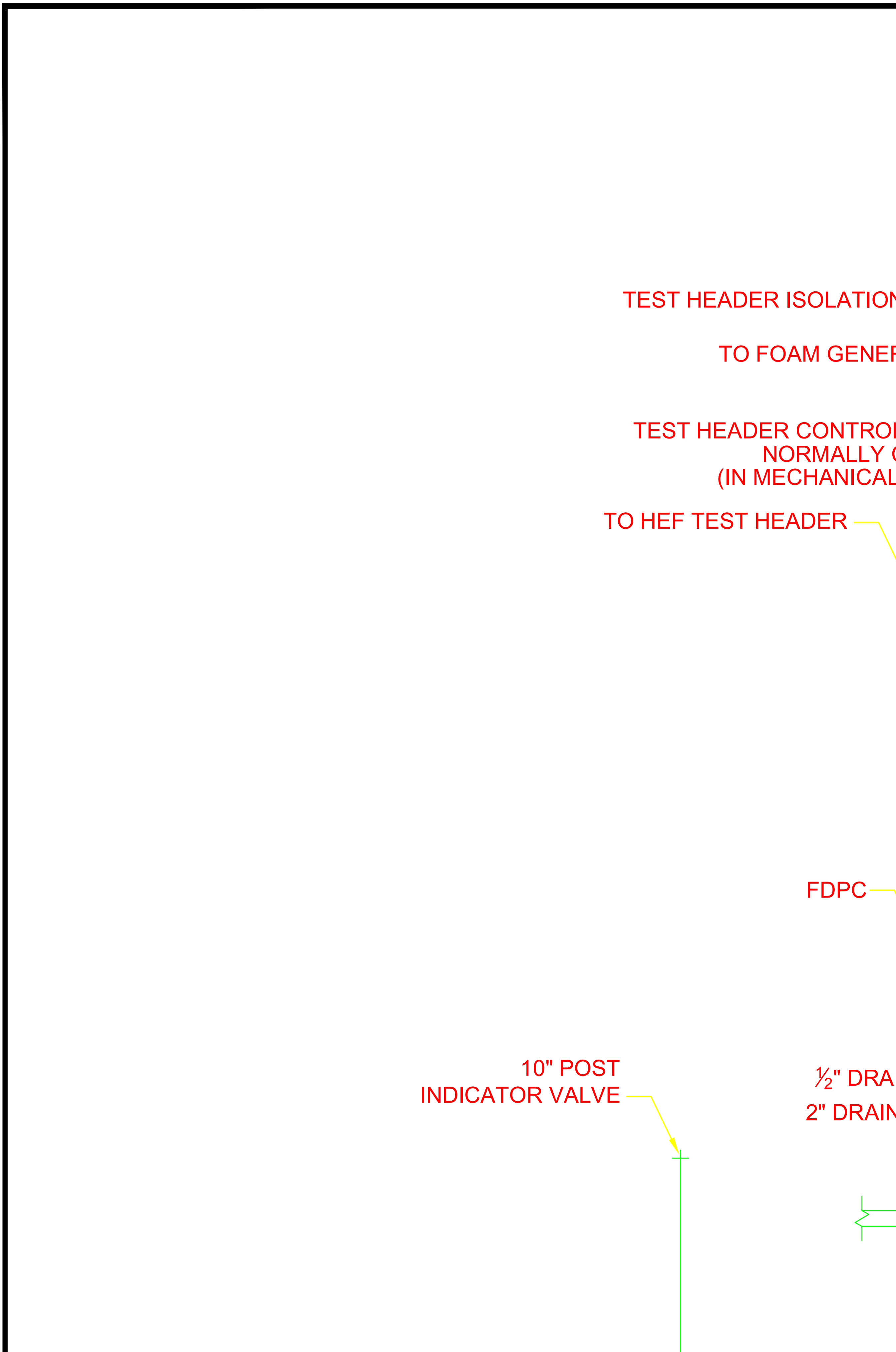
WATER REQ'S: 6 GENERATORS * 135 GPM EACH = 810 GPM


1
2
3
BUNK ROO
201
OFFICES
105
SHOP ARE
106

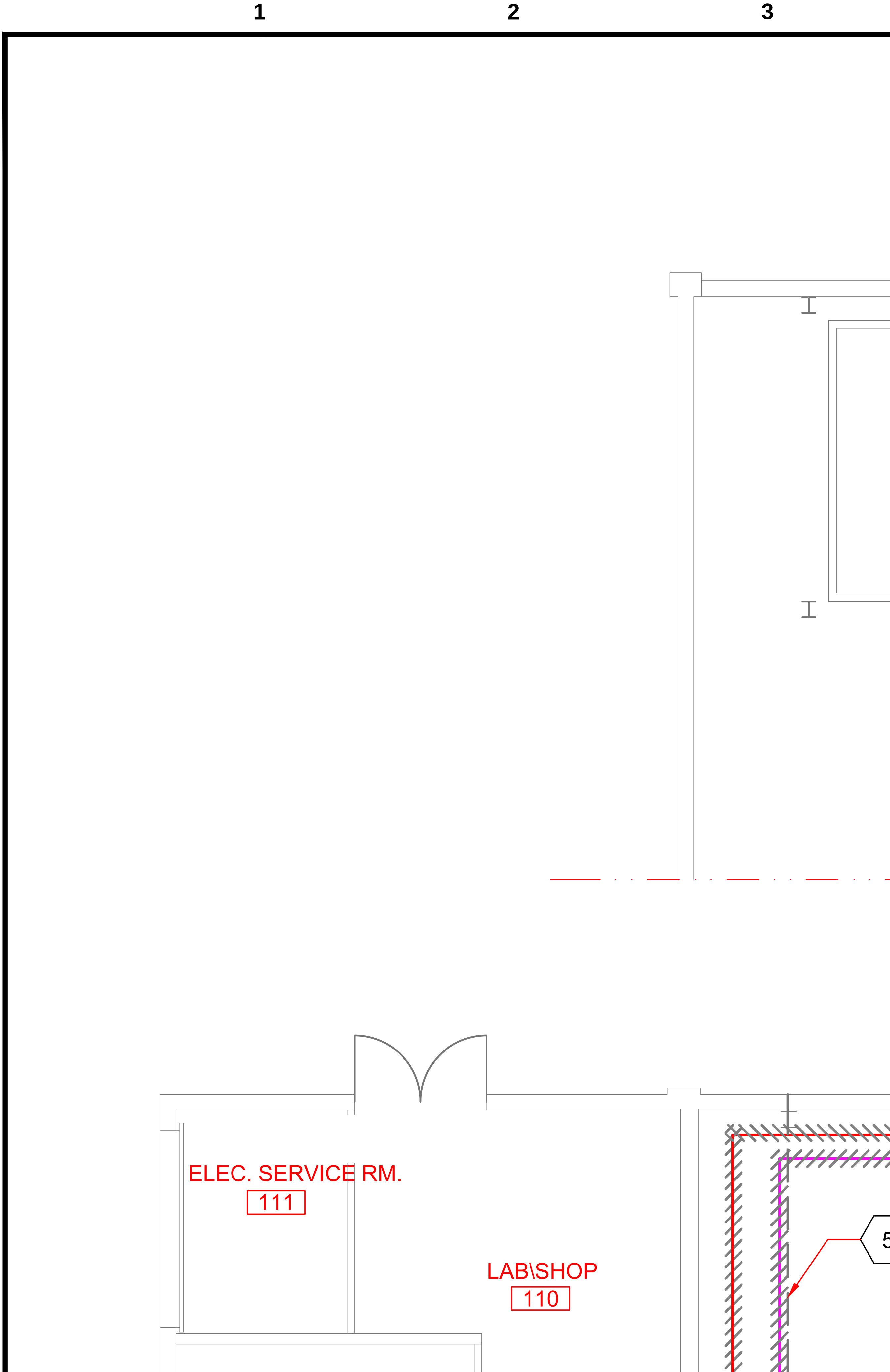

1
2
3
BUNK ROO
201
OFFICES
105
SHOP ARE
106

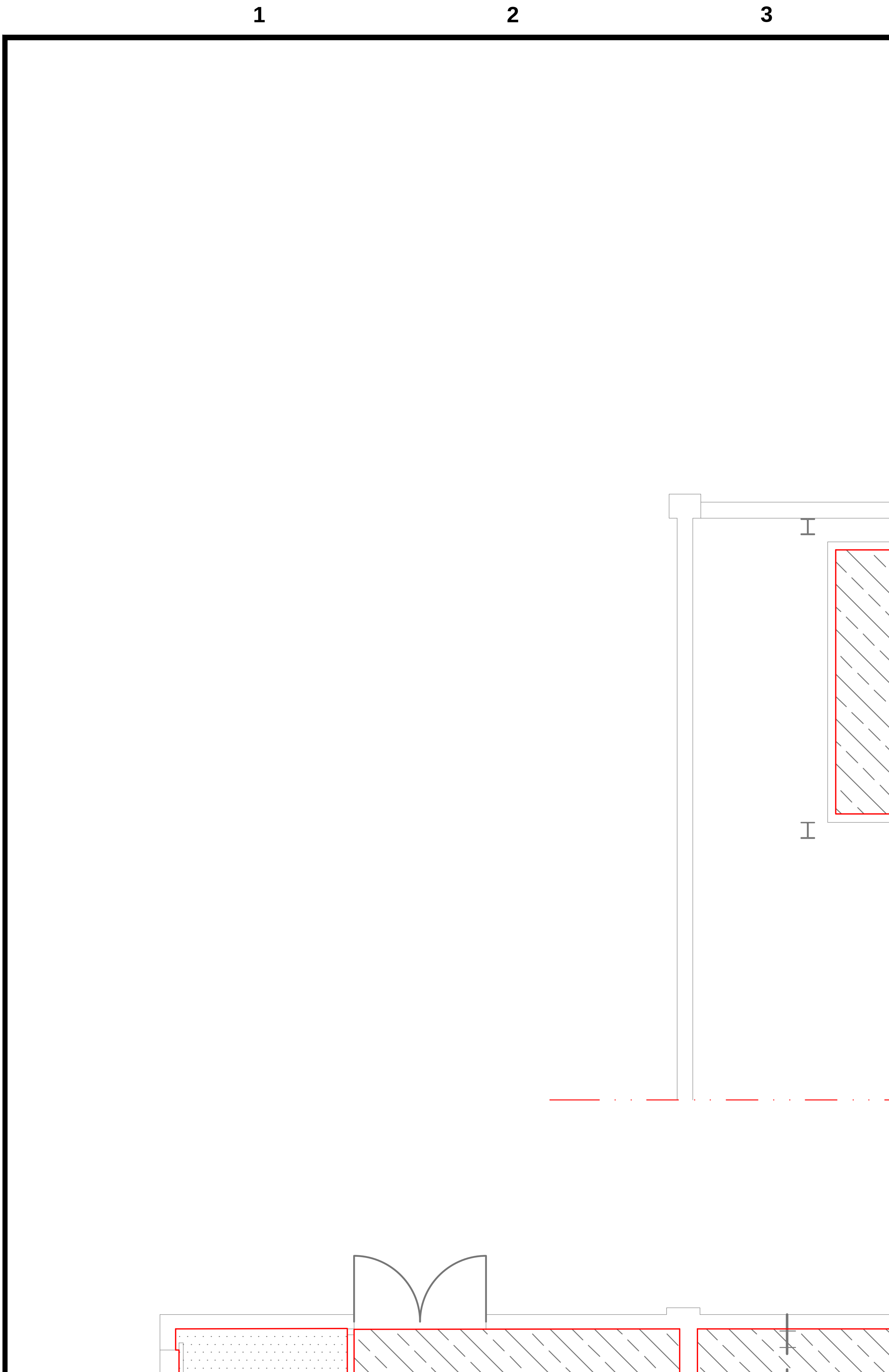

1
2
3
TO MAIN DOCK AREA
FOAM GENERATORS
6" FWFL
CONNECT TO EXISTING
6" SPRINKLER PIPING
TO WET SYSTEM
HEF TEST HEADER
2 ½" VALVES
HANGAR
TO MAIN DOCK AREA
SPRINKLERS

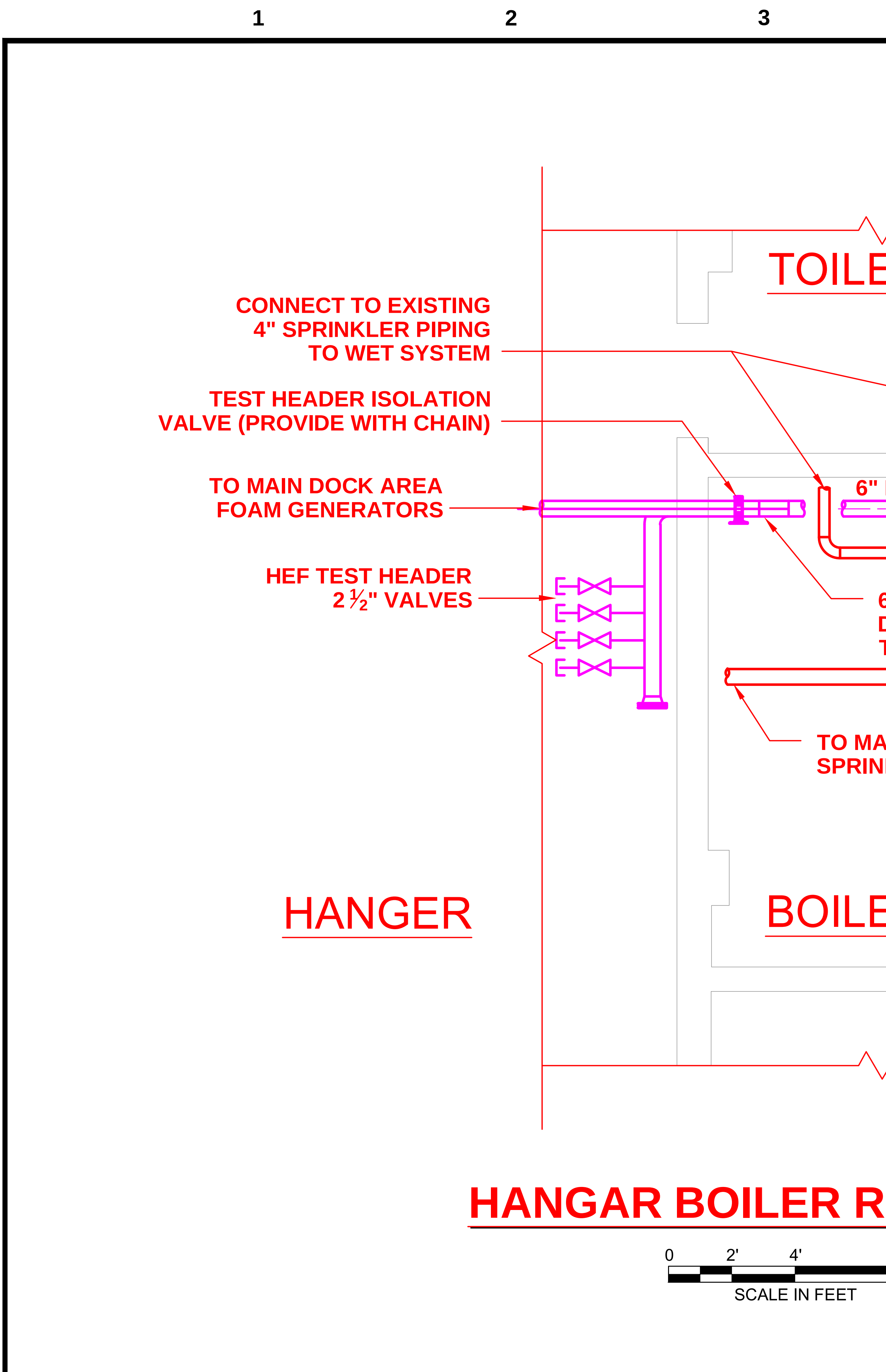
1 2 3



TEST HEADER
TO FOAM
TEST HEADER
NORMALLY
(IN
TO HEF TEST HEADER
FDPC
10" POST
INDICATOR VALVE
2" DRAIN


1
2
3
ELEC. SERVICE RM.
111
LAB\SHOP
110


1
2
3


1
2
3
TOILE
CONNECT TO EXISTING
4" SPRINKLER PIPING
TO WET SYSTEM
TEST HEADER ISOLATION
VALVE (PROVIDE WITH CHAIN)
TO MAIN DOCK AREA
FOAM GENERATORS
6"
HEF TEST HEADER
2½" VALVES
TO MA
SPRIN
HANGER
BOILE
HANGAR BOILER R
0
2'
4'
SCALE IN FEET

APPENDIX C-8

IRP SITE 8 FIGURE

FINAL
RECORD OF DECISION
SITE 8

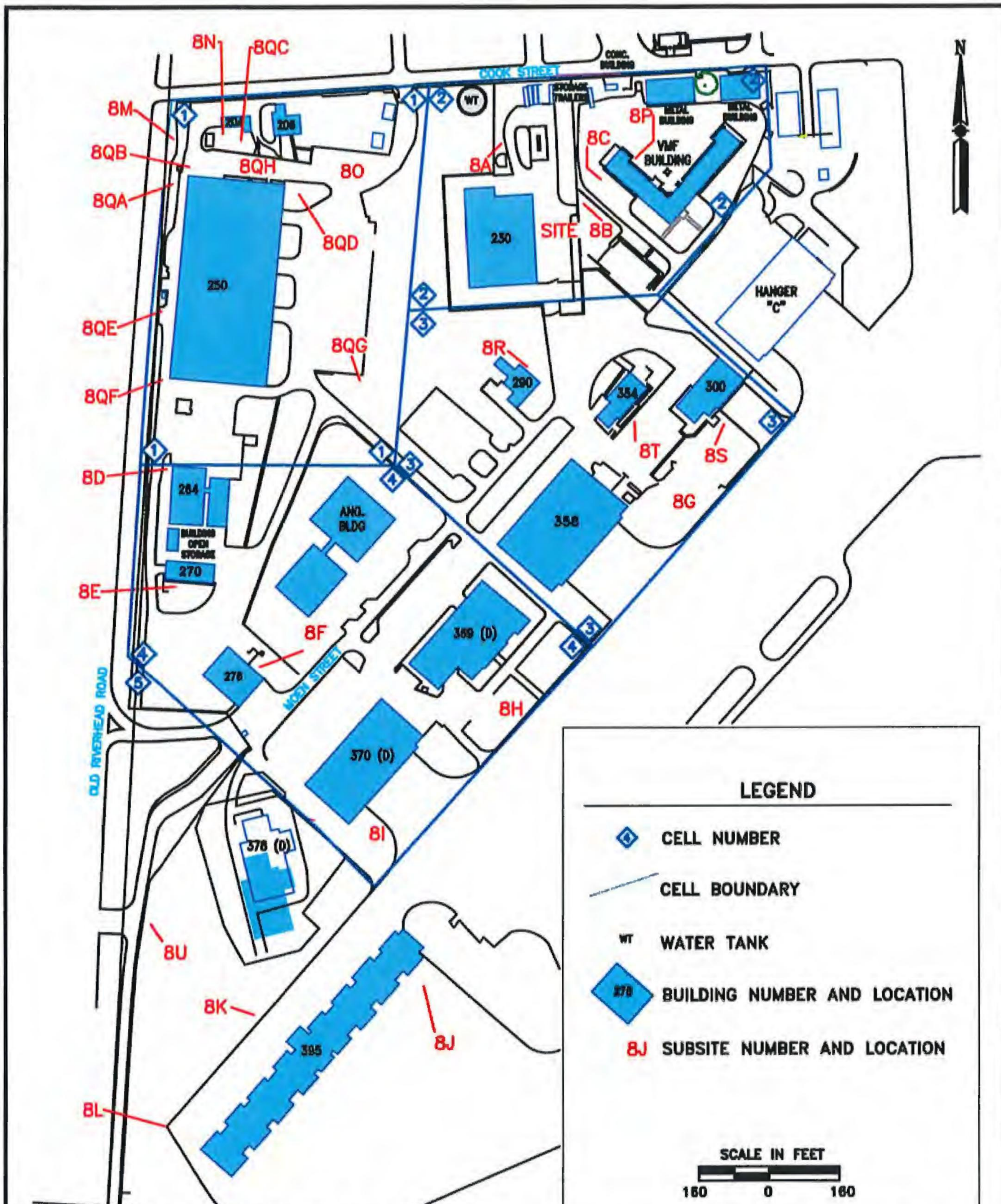
106TH RESCUE WING
FRANCIS S. GABRESKI AIRPORT
WESTHAMPTON BEACH, NEW YORK

APRIL 2012

Prepared for

NGB/A7OR
3501 Fetchet Avenue
Andrews AFB, MD 20762

under National Guard Bureau
Contract DAHA-92-01-D-0004
Delivery Order No. 034



SOURCE: MACTEC Engineering and Consulting, Inc., September 2003

PROJ./3005-034
ROD/FIG 2.3

SITE 8 – CELL AND SUBSITE LOCATION MAP
106th RESCUE WING
WESTHAMPTON BEACH, NEW YORK

FIGURE 2.3

Appendix C - Laboratory QAPP

Table 1. Project-Specific Laboratory QAP Crosswalk

Please note that this is not a full QAPP, the following worksheets were completed to be a laboratory-specific Quality Assurance Plan. The table below is a Crosswalk of the worksheets completed for this Appendix. Please refer to the Work Plan for information not covered in the QAPP.

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section		Included in Laboratory QAPP
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off	N/A- See Work Plan
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List	
		2.2.4	Project Organization and Schedule	
4, 7 & 8	Analytical Personnel Qualifications and Sign-Off Sheet	2.2.1	Title, Version, and Approval/Sign-Off	Chemistry Portions completed
		2.2.7	Special Training Requirements and Certification	
6	Analytical Communication Pathways	2.2.4	Project Organization and Schedule	Completed
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data	N/A- See Work Plan
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data	
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria	
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria	Completed
13	Secondary Data Uses and Limitations	Ch. 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA	N/A- See Work Plan
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule	
15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria	Completed
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks	N/A- See Work Plan
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure , Experimental Design, and Sampling Tasks	
		2.3.2	Sampling Procedures and Requirements	
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements	Completed
20	Field QC	2.3.5	Quality Control Requirements	N/A- See Work Plan
21	Field SOPs	2.3.2	Sampling Procedures and Requirements	
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables	

Table 1. Project-Specific Laboratory QAP Crosswalk

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section		Included in Laboratory QAPP
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description	Completed
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables	Completed
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables	
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation	
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements	
29	Analytical Documents and Records	2.2.8	Documentation and Records Requirements	
31, 32 & 33	Analytical Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)	
		2.5.5	Reports to Management	
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods	
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods	
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods	
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability	N/A- See Work Plan
		2.5.3	Potential Limitations on Data Interpretation	
		2.5.4	Reconciliation with Project Requirements	

QAPP Worksheet #4, 7 & 8: Analytical Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

ORGANIZATION: AECOM

Name	Project Title/Role	Education/Experience	Signature/Date
Mike Myers	Project Manager	Education: B.S. Environmental Science and Policy Experience: 12 years	Mike Myers 02/21/2017
Mike Kuzia-Carmel	Field Manager	Education: B.S. Environmental Geology Experience: 4 years	02/22/2017
Devon Chicoine	Project Chemist/Data Manager	Education: B.S., Chemistry; M.S. Environmental Studies Experience: 15 years	Devon Chicoine 02/21/2017
Naoum Tavantzis	Project Chemist	Education: BA, Environmental Science, Masters of Business Administration Experience: 8+ Years	02/21/2017
Dorin Bogdan	Regulatory Specialist, Project QA/QC Officer	Education: B.S. Civil Engineering. Ph.D Environmental and Water Resources Engineering Experience: 9 years	Dorin Bogdan 02/21/2017

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

QAPP Worksheet #4, 7 & 8: Analytical Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

ORGANIZATION: Eurofins

Name	Project Title/Role	Education/Experience	Signature/Date
Kathy Klinefelter	Project Manager	Education: M.S. Physiology/with Experience: ELLE since 1993	Katherine A. Klinefelter 02/21/2017
Jen Lewis	Account Manager	Education: B.S. Chemistry/ with Experience: ELLE since 1985	Jennifer E Lewis 02/21/2017
Dorothy Love	Quality Assurance Director	Education: B.S. Environmental Experience: Health/ with ELLE since 1989	Dorothy M Love 02/21/2017

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

QAPP Worksheet #6: Analytical Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Regulatory agency interface	AECOM	Mike Myers	Mike.Myers@aecom.com 301-820-3246	Communicate technical approaches and decisions directly to regulatory agency on an as-needed basis, documented via phone records and emails.
Field progress reports	AECOM	Mike Kuzia-Carmel	michael.kuzia-carmel@aecom.com 518-951-2253	All materials and information about the project will be forwarded from the AECOM PM to ANG.
Stop work due to safety issues	AECOM	Mike Kuzia-Carmel	michael.kuzia-carmel@aecom.com 518-951-2253	Work may be stopped by all staff at any time for any safety concern. Notify PM of any work stoppages same day.
Analytical laboratory modifications and performance problems	AECOM	Naoum Tavantzis	Naoum.Tavantzis@aecom.com 301-267-8761	Notify AECOM PM and QA Officer in a timely manner of performance problems encountered by the contracted analytical laboratory. PM will secure approval for modifications to the QAPP as necessary from ANG. All approved modifications will be included in Nonconformance Reports.
Field corrective actions	AECOM	Dorin Bogdan	Dorin.Bogdan@aecom.com 616-574-8383	Daily, communicate field programs reports to the AECOM PM via email with attached scanned field notes.
Sample receipt variances	Eurofins	Kathy Klinefelter	katherineklinefelter@eurofinsus.com; 717-556-7256	Initial response within 2 hours of contact; issue resolution based on complexity of problem
Laboratory quality control variances	Eurofins	Kathy Klinefelter	katherineklinefelter@eurofinsus.com; 717-556-7256	Initial response within 2 hours of contact; issue resolution based on complexity of problem
Analytical corrective actions	Eurofins	Kathy Klinefelter	katherineklinefelter@eurofinsus.com; 717-556-7256	Initial response within 2 hours of contact; issue resolution based on complexity of problem
Data verification issues, e.g., incomplete records	Eurofins	Kathy Klinefelter	katherineklinefelter@eurofinsus.com; 717-556-7256	Initial response within 2 hours of contact; issue resolution based on complexity of problem

QAPP Worksheet #6: Analytical Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Data validation issues, e.g., non-compliance with procedures	Eurofins	Naoum Tavantzis & Devon Chicoine	Naoum.Tavantzis@aecom.com 410-637-1629 Devon.Chicoine@aecom.com 703-682-9069	Verify/validate all analytical chemistry sample results from analytical laboratories with criteria developed in this QAPP and deliver to the PM and Project QA Manager
Data review corrective actions	Eurofins	Naoum Tavantzis & Devon Chicoine	Naoum.Tavantzis@aecom.com 410-637-1629 Devon.Chicoine@aecom.com 703-682-9069	Notify Laboratory PMs to identify resolution/correction actions.

QAPP Worksheet #12: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Water
Analytical Group Perfluorinated Compounds
Concentration Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQI)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Precision/ Accuracy/Bias	Analyte recovery limits 70-130%, RPD<30%	Laboratory Control Sample	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	±20% of the target ratio, which is the ion ratio in the midpoint of the calibration standard.	Ion ratio confirmation for PFOA using 2nd SRM transition	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	70-130% recovery	Surrogate	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	At least 5 points. After calibration, each point, except the lowest, should be back calculated and be within 70-125%. The lowest point should be within 70-130%	Initial calibration standards	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Lab Contamination	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample	Method Blank	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	Analyte recovery limits 70-130%. RPD<30	MS/MSD	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Sensitivity	Detection limits ≤ to PALs	Detection Limits	A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Completeness	Presentation of samples and analyses requested on COC in lab reports and EDD	Reported Sample Data	S & A
Water sampling	EPA 537 Rev. 1.1 modified/37-12	Comparability	Based on accuracy and media comparison	Use of standardized SOPs in field and laboratory	S & A

QAPP Worksheet #12: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil
Analytical Group Perfluorinated Compounds
Concentration Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQI)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Precision/ Accuracy/Bias	Analyte recovery limits 70-130%, RPD<30%	Laboratory Control Sample	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	±20% of the target ratio, which is the ion ratio in the midpoint of the calibration standard.	Ion ratio confirmation for PFOA using 2^{nd} SRM transition	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	70-130% recovery	Surrogate	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	At least 5 points. After calibration, each point, except the lowest, should be back calculated and be within 70-125%. The lowest point should be within 70-130%	Initial calibration standards	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Lab Contamination	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample	Method Blank	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Accuracy/Bias	Analyte recovery limits 70-130%, RPD<30	MS/MSD	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Sensitivity	Detection limits ≤ to PALs	Detection Limits	A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Completeness	Presentation of samples and analyses requested on COC in lab reports and EDD	Reported Sample Data	S & A
Soil/Sediment sampling	EPA 537 Rev. 1.1 modified/37-12	Comparability	Based on accuracy and media comparison	Use of standardized SOPs in field and laboratory	S & A

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Groundwater
Analyte Group: Perfluorinated Compounds EPA Method 537 Rev. 1.1 modified

Analyte	CAS Number	PAL (ng/L)	PAL Reference	PQL (ng/L)	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
							DL (ng/L)	LOD (ng/L)	LOQ (ng/L)
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	70	EPA 2016(1)	7.0	70	130	2.0	6.0	6.0
Perfluorooctanoic acid (PFOA)	335-67-1	70	EPA 2016(1)	7.0	70	130	0.60	2.0	2.0
Perfluorononanoic acid (PFNA)	375-95-1	NA	NA	NA*	70	130	0.60	2.0	2.0
Perfluorohexanesulfonate (PFHxS)	355-46-4	NA	NA	NA*	70	130	1.0	3.0	3.0
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	NA	NA*	70	130	0.50	2.0	2.0
Perfluorobutanesulfonate (PFBS)	375-73-5	80,000	EPA 2016(2)	8,000	70	130	0.80	3.0	3.0

PQLs are ideally 1/10 regulatory standard listed

(1) EPA, 2016. Fact Sheet PFOA & PFOS Drinking Water Health Advisories. EPA 800-F-16-003. November 2016.
Provides guidance provides a health advisory level of 70 ppt for PFOS and PFOA. If both PFOS and PFOA are found to be present, the concentrations of both PFCs combined will be compared to the value of 70 ppt.

(2) Based on USEPA Drinking Water Health Advisory for PFOS and PFOA and similar adjustment to PFBS tapwater RSL of 20% contribution to exposure.

* NA = Not Available; PALs are not available for select compounds.

CAS Number = Chemical Abstracts Service Registry Number

PAL = Preliminary Action Levels

PQL = Practical Quantitation Limit

DL = Detection Limit

LOD = Limit of Detection

LOQ = Limit of Quantification

ng/L = nanograms / Liter

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface Water
Analyte Group: Perfluorinated Compounds EPA Method 537 Rev. 1.1 modified

Analyte	CAS Number	PAL (ng/L)	PAL Reference	PQL (ng/L)	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
							DL (ng/L)	LOD (ng/L)	LOQ (ng/L)
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	70	EPA 2016(1)	7.0	70	130	2.0	6.0	6.0
Perfluorooctanoic acid (PFOA)	335-67-1	70	EPA 2016(1)	7.0	70	130	0.60	2.0	2.0
Perfluorononanoic acid (PFNA)	375-95-1	NA	NA	NA*	70	130	0.60	2.0	2.0
Perfluorohexanesulfonate (PFHxS)	355-46-4	NA	NA	NA*	70	130	1.0	3.0	3.0
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	NA	NA*	70	130	0.50	2.0	2.0
Perfluorobutanesulfonate (PFBS)	375-73-5	NA	NA*	NA	70	130	0.80	3.0	3.0

PQLs are ideally 1/10 regulatory standard listed

(1) EPA, 2016. Fact Sheet PFOA & PFOS Drinking Water Health Advisories. EPA 800-F-16-003. November 2016. Provides guidance provides a health advisory level of 70 ppt for PFOS and PFOA. If both PFOS and PFOA are found to be present, the concentrations of both PFCs combined will be compared to the value of 70 ppt.

* NA = Not Available; PALs are not available for select compounds.

CAS Number = Chemical Abstracts Service Registry Number

PAL = Preliminary Action Levels

PQL = Practical Quantitation Limit

DL = Detection Limit

LOD = Limit of Detection

LOQ = Limit of Quantification

ng/L = nanograms / Liter

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

atrix: Soil

Analyte Group: Perfluorinated Compounds EPA Method 537 Rev. 1.1 modified

Analyte	CAS Number	PAL (ng/g)	PAL Reference	PQL (ng/g)	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
							DL (ng/g)	LOD (ng/g)	LOQ (ng/g)
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1,000	Hoosick Falls(1)	100	70	130	0.30	0.90	0.90
Perfluorooctanoic acid (PFOA)	335-67-1	1,000		100	70	130	0.20	0.60	0.60
Perfluorononanoic acid (PFNA)	375-95-1	NA	NA	NA*	70	130	0.10	0.40	0.40
Perfluorohexanesulfonate (PFHxS)	355-46-4	NA	NA	NA*	70	130	0.20	0.60	0.60
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	NA	NA*	70	130	0.20	0.60	0.60
Perfluorobutanesulfonate (PFBS)	375-73-5	1.26×10^6	EPA RSL(2)	1.26×10^5	70	130	0.20	0.60	0.60

PQLs are ideally 1/10 regulatory standard listed

(1) Hoosick Falls, New York Drinking Water and Groundwater Contamination Frequently Asked Questions (January 2016)

(2) Values calculated from current version of USEPA's Online RSL calculator , February 2017. Residential – Direct Contact with Soil RSLs. Direct contact includes incidental ingestion of soil, dermal contact and outdoor inhalation of particulates

* NA = Not Available; PALs are not available for select compounds.

CAS Number = Chemical Abstracts Service Registry Number

PAL = Preliminary Action Levels

PQL = Practical Quantitation Limit

DL = Detection Limit

LOD = Limit of Detection

LOQ = Limit of Quantification

ng/L = nanograms / Liter

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Sediment
Analyte Group: Perfluorinated Compounds EPA Method 537 Rev. 1.1 modified

Analyte	CAS Number	PAL (ng/g)	PAL Reference	PQL (ng/g)	Laboratory Control Spike Lower Control Limit (%)	Laboratory Control Spike Upper Control Limit (%)	Achievable Laboratory Limits		
							DL (ng/g)	LOD (ng/g)	LOQ (ng/g)
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1,000	Hoosick Falls[(1)]	100	70	130	0.30	0.90	0.90
Perfluorooctanoic acid (PFOA)	335-67-1	1,000		100	70	130	0.20	0.60	0.60
Perfluorononanoic acid (PFNA)	375-95-1	NA	NA*	NA	70	130	0.10	0.40	0.40
Perfluorohexanesulfonate (PFHxS)	355-46-4	NA	NA*	NA	70	130	0.20	0.60	0.60
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	NA*	NA	70	130	0.20	0.60	0.60
Perfluorobutanesulfonate (PFBS)	375-73-5	NA	NA*	NA	70	130	0.20	0.60	0.60

PQLs are ideally 1/10 regulatory standard listed
(1) Hoosick Falls, New York Drinking Water and Groundwater Contamination Frequently Asked Questions (January 2016)

* NA = Not Available; PALs are not available for select compounds.

CAS Number = Chemical Abstracts Service Registry Number

PAL = Preliminary Action Levels

PQL = Practical Quantitation Limit

DL = Detection Limit

LOD = Limit of Detection

LOQ = Limit of Quantification

ng/L = nanograms / Liter

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory Eurofins Lancaster Laboratories Environmental, LLC 2425 New Holland Pike Lancaster, PA 17601
attention Sample administration (Kathy Klinefelter: KatherineKlinefelter@eurofinsus.com: 717-556-7256:
List any required accreditations/certifications: DoD/ELAP
Back-up Laboratory: N/A
Sample Delivery Method: FedEx

Analyte/ Analyte Group	Matrix	Method/ SOP	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Perfluorinated Compounds	Groundwater & Surface Water	Method 537 Rev. 1.1 modified	11/30/2018	250 mL HDPE	None, 2-6C (trizma optional)	14 days	28 days	28 days
Perfluorinated Compounds	Soil & Sediment	Method 537 Rev. 1.1 modified	11/30/2018	250 mL HDPE	None, 2-6ºC	28 days	28 days	28 days

QAPP Worksheet #23: Analytical SOP's
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

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)
37-10	SOP-SP-001… Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS) Rev 1 1/28/2010	N/A	Maintenance	LC/MS/MS	ELLE	N
37-11	MC-SP-002… Thermo Scientific Trace Ultra Gas Chromatograph Quantum XLS Tandem Mass Spectrometer (GC/MS/MS) Preventative and Corrective Maintenance Rev 1 9/26/2011	N/A	Maintenance	LC/MS/MS	ELLE	N
37-12	10954 Perfluorinated Alkyl Substances (PFASs) in Aqueous Samples by Method 537.1 modified Using LC/MS/MS Rev. 1 10/7/2016	N/A	PFAS	LC/MS/MS	ELLE	N
37-15	14027 Perfluorinated Alkyl Substances (PFASs) in Solids by Method 537.1 modified Using LC/MS/MS Rev. 1 10/7/2016	N/A	PFAS	LC/MS/MS	ELLE	N

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/position responsible for Corrective Action	SOP Reference
LC/MS/MS PFC Compounds in Water EPA Method 537.1 modified and LC/MS/MS PFC Compounds in Solids EPA Method 537.1 modified	Initial Calibration: Minimum of five calibration standards spanning at least a 20-fold concentration range. Continuing Calibration: Analyze every 10 samples and at the end of the analysis sequence. Concentrations alternate between low, mid, and high levels of the calibration curve.	Spans at least a 20-fold concentration range	After continuing calibration fails. Continuing calibration checks occur every 10 samples and at the end of the analysis sequence.	Initial Calibration: Back calculated concentration of each calibration point, except CAL 1 standard, with ±70-130% of true. CAL 1 standard back calculated concentration ±50-150% of true value. Continuing Calibration: Target compounds ≤25% drift. For compounds with an isotopically labeled internal standard ≤40% drift	Recalibrate, perform instrument maintenance. If calibration does not meet method criteria, recalibrate.	ELLE analyst	37-12

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.2.3)
(EPA 2106-G-05 Section 2.3.6)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
LC/MS/MS	Backflush of column, injection port and pre-columns, cleaning of ion spray cone, adjustment of collision energies, others as needed	Calibration Check	Visual	As Needed	Initial calibration or calibration verification passes method specifications	Perform additional maintenance prior to instrument calibration or calibration verification	ELLE Analysts	37-10

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal
(UFP-QAPP Manual Section 3.3)
(EPA 2106-G-05 Section 2.3.3)

Sampling Organization: AECOM

Laboratory: Eurofins Lancaster Laboratories

Method of sample delivery (shipper/carrier): FEDEX

Number of days from reporting until sample disposal: 60 Days

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	AECOM	SOP 3-03 *Field Sample Numbering SAP Section 3.13*
Chain-of-custody form completion	AECOM	SOP 3-03 *Sample Chain-of-Custody*
Packaging	AECOM	SOP 3-04 *Sample Packaging and Shipping*
Shipping coordination	AECOM	
Sample receipt, inspection, & log-in	ELLE	SOPSA103: Environmental Sample Receipt and Unpacking; rev 13; 9/24/2014
Sample custody and storage	ELLE	SOPSS006: Automated Storage Retrieval and Discarding of Samples; rev 9; 4/22/2011
Sample disposal	ELLE	SOPSS006: Automated Storage Retrieval and Discarding of Samples; rev 9; 4/22/2011

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4,5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix: Soil & Aqueous
Analytical Group: Perfluorinated Compounds
Analytical Method: EPA Method 537 rev.1.1 Modified
SOP Reference: 37-10
Certification Status: DOD/ELAP certification

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Initial Calibration (ICAL) for all analytes and surrogates	Minimum of 5 calibration standards to establish linearity at method set-up and after major maintenance.	Each calibration point for each analyte must calculate to be within 75-125%, except the lowest cal point which must calculate to within 70-130%.	Correct problem, then repeat ICAL.	Flagging is not appropriate.	No samples may be run until ICAL has passed. Calibration can be linear (5 standards) or quadratic (6 standards); weighting is allowed.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	Target compounds ≤25% drift. For compounds with an isotopically labeled internal standard ≤40% drift	Reanalyze the ICV. If ICV fails again do system maintenance and recalibrate.	Flagging is not appropriate.	No samples may be run until calibration has been verified.
Continuing Calibration Verification (CCV)	Analysis of mid-level standard after every 10 field samples. All samples must be bracketed by the analysis of a standard demonstrating that the system was capable of accurately detecting and quantifying perfluorinated compounds.	Target compounds ≤25% drift. For compounds with an isotopically labeled internal standard ≤40% drift	Recalibrate, and reanalyze all affected samples since the last acceptable CCV; Or Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and re-calibrate; then reanalyze all affected samples since the last acceptable CCV.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Flagging is only appropriate in cases where the samples cannot be reanalyzed.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4,5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix: Soil & Aqueous
Analytical Group: Perfluorinated Compounds
Analytical Method: EPA Method 537 rev.1.1 Modified
SOP Reference: 37-10
Certification Status: DOD/ELAP certification

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal Standard (IS)	Addition of isotopically labeled analytes to every sample, batch QC sample, standard, instrument blank, and method blank.	Determine that the absolute areas of the quantitation ions of the IS(s) are within 50- 150% from the average areas measured during initial calibration.	If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. For failed QC samples, correct problem, and rerun all associated failed field samples.	Apply Q-flag and discuss in the case narrative.	Failing internal standard should be thoroughly documented in the case narrative.
Tune Check	Prior to ICAL and after any mass calibration or maintenance is performed.	Tuning standard must contain analytes of interest or appropriate substitute. Mass assignments of tuning standard within 0.5 amu of true value.	Retune instrument. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone.	Flagging is not appropriate.	Problem must be corrected. Sample analysis shall not proceed without acceptable tuning.
Method Blank (MB)	One per preparatory batch.	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, reprep and reanalyze MB and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Estimate detections in the method blank will be reported.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4,5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix: Soil & Aqueous
Analytical Group: Perfluorinated Compounds
Analytical Method: EPA Method 537 rev.1.1 Modified
SOP Reference: 37-10
Certification Status: DOD/ELAP certification

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory Control Sample (LCS)	One per preparatory batch.	See WS#15 for control limits	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-extracted	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch.	See WS#15 for control limits	Flag outliers	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch per matrix.	See WS#15 for control limits MS or MD: RPD of all analytes ≤ 30% (between MS and MSD or sample and MD)	Flag outliers	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	The data shall be evaluated to determine the source of error. Analyze MS/MSD for low concentration samples and Sample/MD for high concentration samples.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4,5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix: Soil & Aqueous
Analytical Group: Perfluorinated Compounds
Analytical Method: EPA Method 537 rev.1.1 Modified
SOP Reference: 37-10
Certification Status: DOD/ELAP certification

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Surrogate Spike	All field and QC samples.	70-130%	Reanalyze if outside limits, if confirmed, report data with comment. If not confirmed re-extract	Apply Q-flag and discuss in the case narrative.	Alternative surrogates are recommended when there is obvious chromatographic interference.

QAPP Worksheet #29: Analytical Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

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

Project Assessments			
Record	**Generation**	**Verification**	**Storage location/archival**
Field audit checklists	QC Manager	Project Manager	Project File
Data verification checklists	Project Chemist	Senior Project Chemist	Project File
Data validation report	Project Chemist	Senior Project Chemist	Project File
Data usability assessment report	Project Chemist	Senior Project Chemist	Project File

Laboratory Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Narrative	Eurofins	Project Chemist	Project File
COC	Eurofins	Project Chemist	Project File
Summary of Results	Eurofins	Project Chemist	Project File
QC Results	Eurofins	Project Chemist	Project File
Chromatograms	Eurofins	Project Chemist	Project File

Laboratory Data Deliverables	
Record	**PFCs**
Narrative	X
COC	X
Summary Results	X
QC Results	X
Chromatograms	X

QAPP Worksheet #31, 32 & 33: Analytical Assessments and Corrective Action
(UFP-QAPP Manual Section 4.1.1 and 4.1.2)
(EPA 2106-G-05 Section 2.4 and 2.5.5)

Laboratory Assessments: Eurofins

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

QAPP Worksheet #34: Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

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

QAPP Worksheet #35: Data Verification Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

This worksheet documents procedures that will be used to verify project data. It applies to both field and laboratory records. Data verification is a completeness check to confirm that all required activities were conducted, all specified records are present, and the contents of the records are complete. As illustrated in the following example, verification often is performed at more than one step by more than one person.

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Chain of custody forms and shipping forms	Chain of Custody, Shipping Documents	Chain of custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain of custody should be initialed by the reviewer, a copy of the chain of custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Appropriate field investigation Task Leaders for the individual medias
Review of field logbooks	Field Logbooks	Review for completeness and accuracy	Appropriate field investigation Task Leaders
Field data validation TSAs	None	N/A	N/A
Fixed laboratory analytical data review	Laboratory Data Package	Data controls are compared to this QAPP and DoD QSM v 5.0	PM or QA Manager
Fixed laboratory TSAs	Laboratory Data Package	ELAP audit and internal quality audits	QA Manager
Fixed laboratory data verification/validation	Data Validation Reports	100% data verification/validation for aqueous, soil.	AECOM Project Chemist
Fixed laboratory data validation TSAs	Data Validation Reports	Calculate and assess laboratory DQIs.	QA Manager, or designee

QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Data Validator: AECOM

Analytical Group/Method	**Organic Data**
Data deliverable requirements	ERPIMS, .csv
Analytical specifications	WS #28 & Laboratory SOP
Measurement performance criteria	WS #12, WS#15, and WS#28
Percent of data packages to be validated	100%
Percent of raw data reviewed	100%
Percent of results to be recalculated	0%
Validation procedure	*National Functional Guidelines for Organic Superfund Data Review* (EPA, 2016)
Validation code	Per Guidelines
Electronic validation program/version	The EDDs will be compared to the pdf version of the laboratory data report by AECOM. The review will be performed on 10 percent of the electronic data results. If a discrepancy is identified, the laboratory will be required to correct the error.

Eurofins Quality Assurance Manual & SOPs

****** Laboratory SOPs are proprietary business information to be shared for review among ANG, AECOM, and federal facility regulators only ******

Appendix D – Field-Related SOPs

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 **Site Supervisor, 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 **Site Supervisor** is responsible for ensuring that all **field personnel** follow these procedures and that the logbook is completed properly and daily. The **Site Supervisor** is also responsible for submitting copies to the **Project Manager**, who is responsible for filing them and submitting a copy (if required by the 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 CTO 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.

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

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 **Laboratory Coordinator** within 24 hours of sample receipt.

4.5 The **Site Supervisor** is responsible for ensuring that all **field personnel** follow these procedures. The **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 **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., 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 CTO 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 **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.*

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

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>

Attachment 2
Generic Chain-of-Custody / Analytical Request Form

M901376

CHAIN OF COUSTODY 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 8 / 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	

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

4

Cooler No:	413		
QC Level:	PACDIV Level D	TAT:	Normal - per contract

5 container # (water): TPH 8015B 1; CLP VOAs 2; CLP SVOAs 2; CLP Pesticides 1; CLP Metals 2; EPA 8080 (PCBs only) 1; Extra Volume MS/MSD 2

Preservatives: TPH 8015B HCL; CLP VOAs HCL; CLP Metals HNO3

Sample Data 6 | Matrix/QC 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
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										9
					13			TOTALS:	6	9	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

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):

Original (white), Lab Copy (yellow), Field Copy (pink)

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:

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 **Site Supervisor** 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** <u>must</u> 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

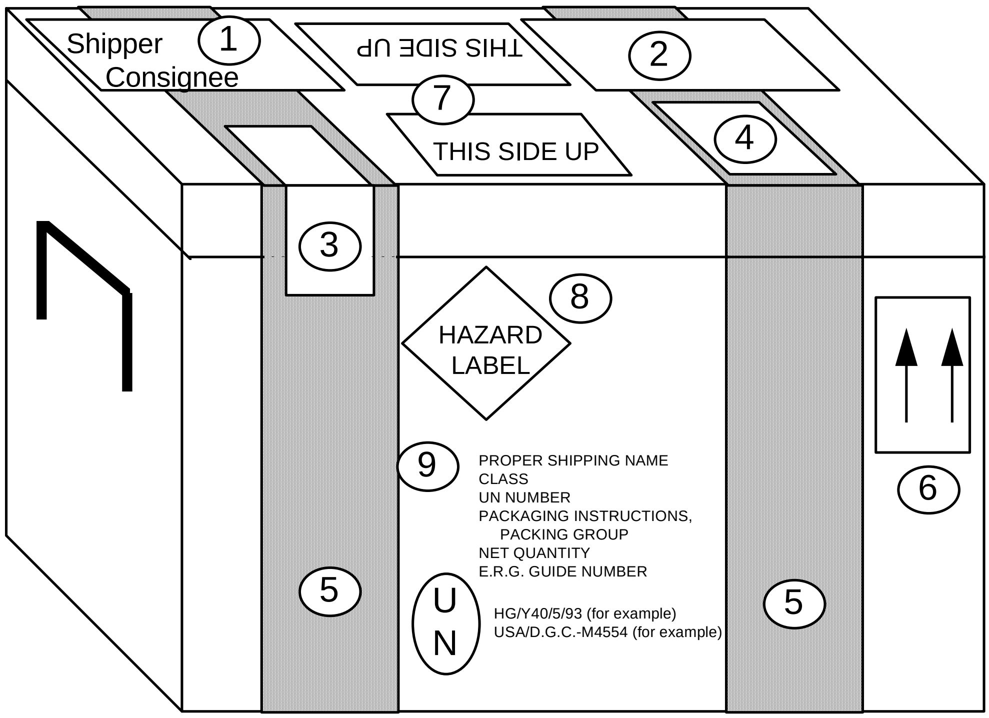
8.8 Attachment 8 – Soil Import Permit

8.9 Attachment 9 – Soil Samples Restricted Entry Labels

8.10 Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*.

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

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**

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.*

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.

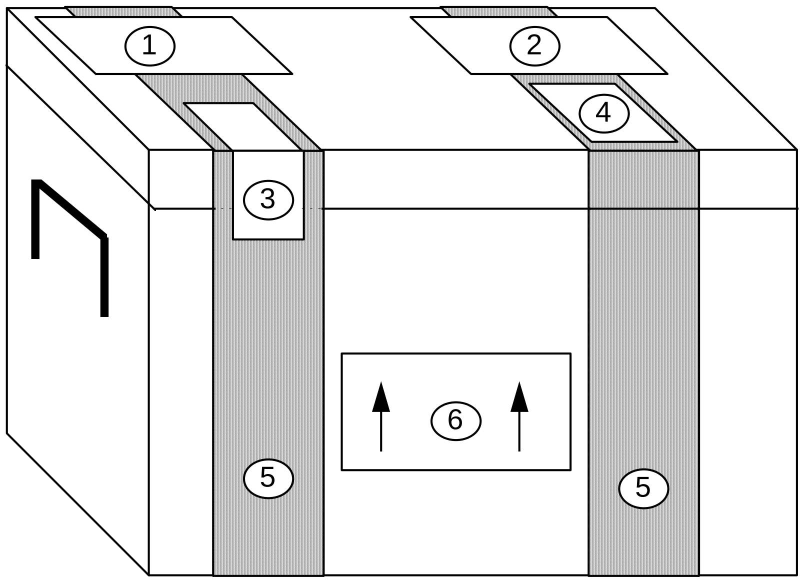
3. Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4ºC until compositing 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

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	coolers	Soil samples for laboratory 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)

Name/Title	Signature	Date
Joe Smith, Ogden	Joe Smith	1/1/94

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 laboratory 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)

Investigation-Derived Waste Management

Procedure 3-05

1.0 Purpose and Scope

This standard operating procedure (SOP) describes activities and responsibilities of the United States Army Corp of Engineers (USACE), New England District, with regard to 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 under the ER Program. 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 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.

This procedure was developed to serve as management-approved professional guidance for the management of IDW generated. It focuses on the requirements for minimizing, segregating, handling, labeling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are also noted in this procedure.

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 (APP). In the absence of a APP, work will be conducted according to the WP and/or direction from the **Site Safety and Health Officer (SSHO)**.

All **Field Personnel** responsible for IDW management must adhere to the APP and must wear the PPE specified in the site-specific APP. 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 **Site Supervisor** 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 Labeling

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

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.

Department of Energy, United States (DOE). 1994. *The Off-Site Rule*. EH-231-020/0194. Office of Environmental Guidance. March.

1999. *Management of Remediation Waste under the Resource Conservation and Recovery Act (RCRA)*. Office of Environmental Policy and Assistance. 20 December.

Environmental Protection Agency, United States (EPA). 1991. *Management of Investigative-Derived Wastes During Site Inspections*. Office of Emergency and Remedial Response. EPA/540/G-91/009. May.

1992a. *Guidance for Performing Site Inspections under CERCLA*. EPA/540/R-92/021. Office of Emergency and Remedial Response. September.

1992b. *Guide to Management of Investigative-Derived Wastes*. Quick reference fact sheet. OSWER Dir. 9345.3-03FS. Office of Solid Waste and Emergency Response. January.

1997a. *Sending Wastes Off Site? OSC and RPM Responsibilities under the Off-Site Rule*. EPA/540-F-97-006, Office of Solid Waste and Emergency Response. September.

1997b. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.* 3rd ed., Final Update IIIA. Office of Solid Waste. Updates available: www.epa.gov/epaoswer/hazwaste/test/new-meth.htm.

1998. *Management of Remediation Waste under RCRA*. EPA/530-F-98-026. Office of Solid Waste and Emergency Response. October.

(No Date). *Compliance with the Off-Site Rule During Removal Actions.* Office of Regional Counsel (Region 3). Hendershot, Michael.

Author	**Reviewer**	**Revisions (Technical or Editorial)**
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

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 and Health Officer (SSHO)** 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 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 (APP) and Site Safety and Health Plan (SSHP) and must wear the personal protective equipment (PPE) specified in the site-specific APP/SSHP. 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 **SSHO** 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 HSP 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 **Site Supervisor (SS)** 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 CTO WP.

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.

8.2 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

8.3 Procedure 3-05, *IDW Management*.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

Surface Water and Liquid Sampling

Procedure 3-10

1.0 Purpose and Scope

1.1 The purpose of this document is to define the standard operating procedure (SOP) for surface water and liquid sampling (for example, liquid characterization sampling). This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to surface water samples from shallow and deep water using a variety of samplers. Specific information regarding coring locations can be found in the associated Sampling and Analysis Plan (SAP).

1.2 This procedure is the Program-approved professional guidance for work performed by AECOM under contract to the United States Army Corp of Engineers (USACE).

1.3 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. If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to surface water sampling then those procedures may be added as an appendix to the project specific SAP.

1.4 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Program Quality Manager. Deviations to this SOP will be documented in the field records.

2.0 Safety

2.1 Depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling the first surface water sampling location. All **field sampling personnel** responsible for sampling activities must review the project-specific Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) paying particular attention to the control measures planned for the sampling tasks. Conduct preliminary area monitoring to determine the potential hazard to field sampling personnel. If significant contamination is observed, minimize contact with potential contaminants in both the vapor and liquid phase through the use of respirators and disposable clothing.

2.2 In addition, observe standard health and safety practices according to the project-specific APP/ SSHP. Suggested minimum protection during well sampling activities includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves, rubberized steel-toed boots, and an American National Standards Institute-standard hard hat. Half-face respirators and cartridges and Tyvek® suits may be necessary depending on the contaminant concentrations, and shall always be available on site.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the **Site Safety and Health Officer (SSHO)** or designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the APP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSHO.

2.4 The health and safety considerations for the work associated with surface water sampling include:

- Proper selection of personal protective equipment for work around water bodies (e.g., personal flotation devices [PFDs]), as specified in the project-specific APP.
- Appropriate health and safety protocols for working in a boat (if applicable), as specified in the project-specific APP.
- Proper lifting techniques when retrieving surface water samplers, large muscles of the legs should be used, not the back.
- Stay clear of all moving equipment and avoid wearing loose fitting clothing.
- To avoid slip/trip/fall hazards as a result of working on wet surfaces, wear work boots/work boot covers with textured soles.
- 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 insulated clothing

3.0 Terms and Definitions

None.

4.0 Interferences

None.

5.0 Training and Qualifications

5.1 Qualifications and Training

5.1.1 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 surface water sampling activities comply with this procedure. The Project Manager or designee shall review all surface water sampling forms on a minimum monthly basis. The Project Manager is responsible for ensuring that all field sampling personnel involved in surface water 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 **Site Supervisor (SS)** 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. Minimum qualifications for field sampling personnel require that one individual on the field team shall have a minimum of 6 months of experience with surface water sampling.

5.2.5 The **field sampler and/or task manager** is responsible for directly supervising the surface water sampling procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data collected during sampling. If deviations from the procedure are required because of anomalous field conditions, they must first be approved by the Program Quality Manager and then documented in the field logbook and associated report or equivalent document.

6.0 Equipment and Supplies

The following equipment list contains materials that may be needed in carrying out the procedures outlined in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Work Plan
- Maps/Plot plan
- Tape measure
- Survey stakes, flags, or buoys
- Camera and film
- Stainless steel, plastic, or other appropriate composition (e.g., Teflon) bucket
- Laboratory supplied sampling containers
- Ziploc plastic bags for samples, and sample jars
- Logbook
- Labels
- Chain of Custody (COC) forms
- Site description forms
- Cooler(s)
- Ice
- Equipment/Apparatus
- Decontamination supplies/equipment
- Spade or shovel
- Spatula
- Scoop
- Trowel
- Task specific surface water sampling equipment

7.0 Calibration or Standardization

None.

8.0 Procedure

8.1 Selection of Sampling Techniques

Proper selection of sampling points and collection methodology are essential to meeting the objectives of a surface water sampling program. Sampling points should be selected for collection of surface water samples on the basis of characteristics of the body of surface water body to be monitored, the location of the body of surface water, and its hydrologic boundaries with respect to the site. Other considerations include the contaminants of concern, logistical considerations, such as access to the surface water body, the direction of flow, and determination of a background location.

Methods of collecting surface water samples vary from hand sampling procedures at a single point to sophisticated, multipoint sampling techniques. The number and type of samples to be collected depends on the characteristics of the body of water, the amount of suspended sediment that a moving body carries, the size of the discharge area at the site, and other factors. Multipoint sampling techniques apply to larger bodies of water; the samples are composited to provide a more representative sample.

Whenever possible, the sampling device, either disposable or constructed of a nonreactive material, should hold at least 500 milliliters to minimize the number of times the liquid must be disturbed, thus reducing agitation of any sediment layers. A 1-liter polypropylene or stainless steel beaker with a pour spout and handle works well. Any sampling device might contribute contaminants to a sample. The correct sampling device will not compromise the integrity of the sample and will give the desired analytical results.

8.1.1 Shallow Water Body Surface Water Sample Collection

A dip or grab sample is appropriate for a small body of water, or for collecting near-surface samples in a larger surface water body. The sampling method involves filling a sample container by submerging it either just below the surface, or by lowering the container to a desired depth by using a weighted holder. For shallow bodies of surface water, hold the sample container carefully just beneath the water surface to avoid disturbing the streambed and stirring the sediment. Position the container's mouth so that it faces upstream, while the sampling personnel are standing downstream. Any preservative added to the sample should be added after sample collection to avoid loss of preservative. Alternatively, a transfer device may be dipped into the water, and then the contents transferred to the appropriate container containing the preservative. For near-surface sample collection in a large surface water body, a pond sampler may be used if an extended reach is required to collect a representative sample. A pond sampler consists of a single use sample container attached to a telescoping, heavy-duty, aluminium pole via an adjustable clamp attached to the end. The collection technique for shallow surface water samples can be used for near-surface samples in a large surface water body.

8.1.2 Deep Surface Water Sample Collection

For deeper surface water bodies, either sample containers or transfer devices may be used to collect a sample. A weighted holder that allows either a sample transfer device or a sample container to be lowered, opened for filling, closed, and returned to the surface is suggested for sampling deeper surface water bodies. This is because concentrations of constituents near the surface of a deeper body of surface water might differ from the total concentration distributed throughout the water column cross section and thus a surface sample would not be representative of the water body. An open container that is lowered and raised to the surface at a uniform rate so that the bottle is just filled on reaching the surface is appropriate for deeper stagnant water bodies, however this method does not collect a truly representative sample in deeper flowing surface water bodies.

Kemmerer Samplers. Collect samples near the shore unless sampling from a boat is feasible and permitted. If a boat is used, the body of water should be cross-sectioned and samples should be collected at various depths across the water in accordance with the project specific SAP. The Kemmerer Sampler consists of a glass, plastic, or Teflon bottle, a weighted sinker, a bottle stopper, and a line that is used to open the bottle and to lower and raise the sampler during sampling. The general procedure for using the sampler is as follows (or refer to manufacturer’s instructions):

1. Obtain the sampler and check the knot at the bottom of the sampler for tightness and size. The knot should be sufficiently large so that it will not pull through the central tube of the sampler.
2. Assemble the weighted bottle sampler for making the cast by pulling the trip head into the trip plate. This can be done by holding the top and bottom stoppers and giving a short, hard pull to the bottom stopper.
3. Measure and mark the desired depth on the sampling line. Tie the free end of the line to the railing of the vessel to prevent accidental dropping of the sampler.

4. Gently lower the sampler to the desired depth so as not to remove the stopper prematurely.
5. Pull out the stopper with a sharp jerk of the sampler line or by lowering a messenger down the line to trip the stoppers.
6. Allow the bottle to fill completely, as evidenced by the cessation of air bubbles.
7. Raise the sampler and cap the bottle. Untie the line from the railing and carry the sampler to your sampling station.
8. Transfer water into appropriate sample containers. Preserve the sample, if necessary, following guidelines in the project-specific SAP. In most cases, place preservatives in sample containers before sample collection to avoid overexposure of samples and overfilling of bottles during collection.
9. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.
10. Fill out the sample label and record all relevant information in the sample collection form, the field logbook, and/or the field laptop/tablet. In addition, the chain of custody form should be filled out as soon as possible. These procedures should be done in accordance with SOP 3-03 Recordkeeping, Sample Labeling, and Chain of Custody.
11. Immediately place the properly labeled sample bottle(s) in a cooler with ice.
12. Wipe the sample clean and decontaminate if necessary for the collection of additional samples. Decontaminate according to the procedures in SOP 3-06 Equipment Decontamination.
13. Always store the sampler in the open position (stoppers not in the tube).

Teflon Bailers. Teflon bailers can also been used to collect samples in deep bodies of water. When the use of Teflon bailers is deemed appropriate for sampling water from a specific depth, the bailers shall be equipped with a check valve that closes during sample retrieval.

1. Attach a line that is premeasured to the appropriate sampling depth to the dedicated Teflon bailer and lower to the desired depth.
2. Ensure that the check valve is engaged tugging on the line with a sharp jerk.
3. Raise the bailer and transfer the water to sample containers. Preserve the sample, if necessary, following guidelines in the project-specific SAP. In most cases, place preservatives in sample containers before sample collection to avoid overexposure of samples and overfilling of bottles during collection.
4. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.
5. Fill out the sample label and record all relevant information in the sample collection form, the field logbook, and/or the field laptop/tablet. In addition, the chain of custody form should be filled out as soon as possible. These procedures should be done in accordance with SOP 3-03 Recordkeeping, Sample Labeling, and Chain of Custody.
6. Immediately place the properly labeled sample bottle(s) in a cooler with ice.
7. A new dedicated bailer and new line should be used for each sampling location.

Peristaltic Pump. Another method of extending the reach of sampling efforts is to use a small peristaltic pump. In this method, the sample is drawn through heavy-wall Teflon tubing and pumped directly into the sample container. This system allows the operator to reach into the liquid body, sample from depth, or sweep the width of narrow streams.

If medical-grade silicon tubing is used in the peristaltic pump, the system is suitable for sampling almost any analyte, including most organics. Some volatile stripping may occur; due to the relatively high flow rate of the pump. Therefore, avoid pumping methods for sampling volatile organics. Battery-operated peristaltic pumps are available and can be easily carried by hand or with a shoulder sling, as needed. It is necessary in most situations to change both the Teflon suction line and the silicon pump tubing between sampling locations to avoid cross contamination. This action requires maintaining a sufficiently large stock of material to avoid having to clean the tubing in the field.

Peristaltic pumps work especially well for sampling large bodies of water when a near-surface sample will not sufficiently characterize the body as a whole. When sampling a liquid stream that exhibits a considerable flow rate, it may be necessary to weight the bottom of the suction line.

Use the following procedures for collecting samples using peristaltic pumps:

1. Install clean, silicone tubing in the pump head, per the manufacturer's instructions. Pharmaceutical-grade silicone tubing (e.g., PharMed tubing) may be required for some projects depending on the analyses required. Refer to the project specific SAP for specific tubing requirements. Allow sufficient tubing on the discharge side to facilitate convenient dispensation of liquid into sample bottles but only enough on the suction end for attachment to the intake line. This practice will minimize sample contact with the silicone pump tubing. (Some types of thinner Teflon tubing may be used.).
2. Select the length of suction intake tubing necessary to reach the required sample depth and attach it to the tubing on the intake side of the pump. If necessary, a small weight composed of inert material (e.g., stainless steel) which will not react with chemicals of concern may be used to weight the intake tubing. Heavy-wall Teflon of a diameter equal to the required pump tubing will suit most applications. (A heavier wall will allow for a slightly greater lateral reach.)
3. A purge volume that is at a minimum equal to the tubing volume should be passed through the system prior to sample collection. Collect this purge volume in a bucket. Once the sample has been collected, the purged water volume can be returned to the water body.
4. Fill necessary sample bottles by allowing pump discharge to flow gently down the side of bottle with smooth laminar flow and minimal entry turbulence. Cap each bottle as it is filled.
5. Preserve the sample, if necessary, following guidelines in the project-specific SAP. In most cases, place preservatives in sample containers before sample collection to avoid overexposure of samples and overfilling of bottles during collection.
6. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.
7. Fill out the sample label and record all relevant information in the sample collection form, the field logbook, and/or the field laptop/tablet. In addition, the chain of custody form should be filled out as soon as possible. These procedures should be done in accordance with SOP 3-03 Recordkeeping, Sample Labeling, and Chain of Custody.
8. Immediately place the properly labeled sample bottle in a cooler with ice.
9. Allow the system to drain thoroughly, and then disassemble.

8.2 Transfer Devices

Samples from various locations and depths can be composited if project quality objectives indicate that it is appropriate; otherwise, collect separate samples. Identify approximate sampling points on a sketch of the water body. Use the following procedures for collecting samples using transfer devices:

1. Submerge a stainless steel dipper or other suitable device, causing minimal disturbance to the surface of the water and the sediment at the floor of the surface water body. Note the approximate depth and location of the sample source (e.g., 1 foot up from bottom or just below the surface).
2. Allow the device to fill slowly and continuously.
3. Retrieve the dipper or device from the surface water with minimal disturbance.
4. Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper or device edge.
5. Empty the dipper or device slowly, allowing the sample stream to flow gently down the side of the bottle with smooth laminar flow and minimal entry turbulence.
6. Continue delivery of the sample until the bottle is filled.
7. If necessary, preserve the sample according to guidelines in the project-specific SAP. In most cases, place preservatives in sample containers before sample collection to avoid overexposure of samples and overfilling of bottles during collection.

8. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.
9. Fill out the sample label and record all relevant information in the sample collection form, the field logbook, and/or the field laptop/tablet. In addition, the chain of custody form should be filled out as soon as possible. These procedures should be done in accordance with SOP 3-03 Recordkeeping, Sample Labeling, and Chain of Custody.
10. Dismantle the sampler and decontaminate according to the procedures in SOP 3-06 Equipment Decontamination.

Multipoint sampling techniques that represent both dissolved and suspended constituents and both vertical and horizontal distributions are applicable to larger bodies of water. Subsequent to sample collection, multipoint sampling techniques may require a compositing and sub-sampling process to homogenize all the individual samples into the number of subsamples required to perform the analyses of interest. Homogenizing samples is discouraged for samples collected for volatile organic analysis, because aeration causes a loss of volatile compounds. If collection of composite samples is required, then include the procedure for compositing in the project-specific work plan.

The sampling devices selected must not compromise sample integrity. Collect samples with either disposable devices, or devices constructed of a nonreactive material, such as glass, stainless steel, or Teflon. The device must have adequate capacity to minimize the number of times the liquid must be disturbed, reducing agitation of any sediment layers. Further, the device must be able to transfer the water sample into the sample container without loss of volatile compounds. A single- or double-check valve or stainless steel bailer made of Teflon equipped with a bottom discharging device may be utilized.

All equipment used for sample collection must be decontaminated before and after use in accordance with Procedure 3-06 – Equipment Decontamination.

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, holding times, container types, as well as various QC samples such as trip blanks, field blanks, equipment blanks, and field duplicates.

10.0 Data and Records Management

10.1 Field notes will be kept during sampling activities in accordance with SOP 3-03 – Recordkeeping, Sample Labeling, and Chain of Custody. During the completion of sampling activities, fill out the sample logbook and transmit forms to the CTO Manager for storage in project files.

10.2 Deviations to the procedures detailed in the SOP should be recorded in the field logbook.

11.0 Attachments or References

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.

Environmental Protection Agency, United States (EPA). 1987. *A Compendium of Superfund Field Operations Methods*. EPA/540/P-87/001, EPA, Office of Emergency and Remedial Response, Washington, D.C.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Robert Shoemaker Senior Scientist	Naomi Ouellette, Project Manager	Rev 0 – Initial Issue

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 Project 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 Work Plan (WP) and Sampling and Analysis Plan (SAP), which takes precedence over these procedures.

1.5 This procedure is the professional guidance for work performed by AECOM under contract to the United States Army Corp of Engineers (USACE).

1.6 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-specific Accident Precention Plan (APP) and Site Safety and Health Plan (SSHP). In the absence of a APP/SSHP, work will be conducted according to the project-specific WP, SAP, and/or direction from the Site Safety and Health Officer (SSHO).

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 **Project Manager** is responsible for ensuring that well development activities comply with this procedure. The **Project 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 **Site Supervisor** 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

Well ID:

Client: ____________

Project No: ____________ Date: ________ Developer: ____________________

Site Location: ____

Well/Piezometer Data

Well ☐ Piezometer ☐ Diameter __________ Material ____________

Measuring Point Description ____________ Geology at Screen Interval (if known) ____________

Depth to Top of Screen (ft.) ____________

Depth to Bottom of Screen (ft.) ____________ Time of Water Level Measurement ________

Total Well Depth (ft.) ____________ Calculate Purge Volume (gal.) ________

Depth to Static Water Level (ft.) ____________ 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 This procedure is the Program-approved professional guidance for work performed by AECOM under contract to the United States Army Corp of Engineers (USACE).

1.3 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 Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP), 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 APP/SSHP. 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 APP/SSHP 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 **Site Supervisor (SS)** 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 APP/SSHP)
- Approved plans such as: project-specific APP/SSHP and 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 Us e

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.

Environmental Protection Agency, United States (EPA). 1982. *Handbook for Sampling and Sample Preservation of Water and Wastewater.* EPA-600/4-82-029. Cincinnati: EPA Office of Research and Development, Environmental Monitoring and Support Laboratory.

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.

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:

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.

(continued on back)

d. Acceptance criteria pass/fail

	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

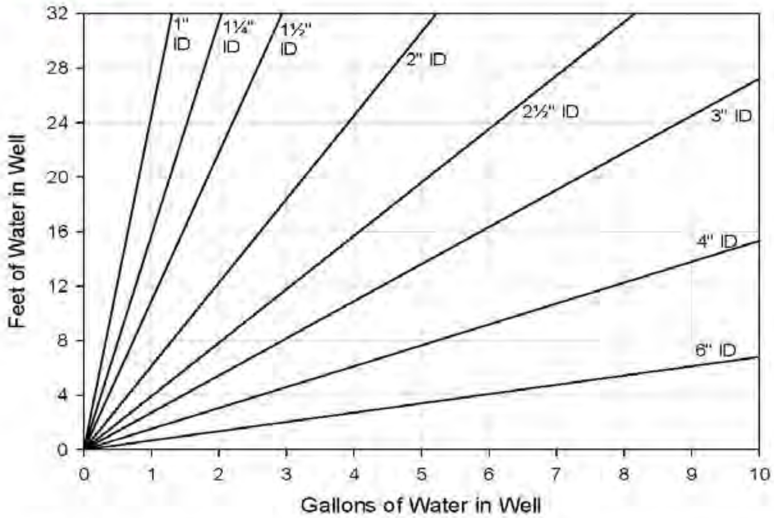
Comments ______

Signature ______ Date ______

Page 1 of 2

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 ________________

Page 2 of 2

Direct Push Sampling Techniques

Procedure 3-17

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) provides guidance on the use of direct push techniques for the United States Army Corp of Engineers (USACE).

1.2 This procedure is the Program-approved professional guidance for work performed by AECOM for USACE.

1.3 This procedure shall serve as management-approved professional guidance for the 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.

1.4 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 Accident Prevention Plan (APP) and Site-Safety and Health Plan (SSHP). 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 APP/SSHPs offer guidelines on air surveillance and on selection of PPE. In addition, the site-specific APP/SSHP 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 APP/SSHP, 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 APP/SSHP, 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 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 Site Supervisor 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 APP/SSHP); 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 Attachment 1 – Boring Log

10.2 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.

10.3 SOP 3-05, *IDW Management.*

10.4 SOP 3-06, *Equipment Decontamination.*

10.5 SOP 3-21, *Surface and Subsurface Soil Sampling.*

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

Attachment 1
Boring Log

Boring ID:

Page 1 of ____

Project Name:	Drilling Company:	Type of Surface Material:
Project Number:	Drilling Method:	Patching Material:
Date Started Drilling:	Rig Type:	Drilling Water Level:
Date Finished Drilling:	Core Size:	Boring Total Depth (bgs):
Physical Location:		Logged By:

(Note: bgs = below ground surface)

Depth Range	Re covery ft/ft	PID (ppm)	Moisture Content	GA Class.	USCS	GA Class: Garfield Avenue Sites classification & Modified Unified Soil Clasiffication System	
						Ground Surface Cover and Thickness:	Sample name & #:
0-1							
1-2							
2-3							
3-4							
4-5							
5-6							
6-7							
7-8							
8-9							
9-10							
10-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							

Stratigraphic Unit Intervals:		Comments:
1.)	5.)	
2.)	6.)	
5.)	6.)	

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 Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP). In the absence of a APP, work will be conducted according to the Work Plan (WP) and/or direction from the **Site Safety and Health Officer (SSHO)**.

2.2 Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project APP/SSHP 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 Project Manager is responsible for ensuring that the operation and calibration activities comply with this procedure. The Project 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 Site Supervisor 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 Sampling and Analysis Plan (SAP), which takes 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-specific Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP). In the absence of a APP/SSHP, work will be conducted according to the Work Plan (WP) and/or direction from the **Site Safety and Health Officer (SSHO)**.

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 SAP. The following details equipment typically needed for soil sampling, based on the various methods. See the SAP for specific detail of equipment and supply needs.

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 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 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 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 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 HASP.
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 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 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 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 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 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 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 SAP.

2. Cut open the acetate liner. If required in the 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 SAP should be collected (see Section 7.6.1) prior to logging the sample.

3. If required in the SAP, collect a soil sample (as defined in the 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 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 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 SAP. Collect a sample and perform screening analyses as required by the 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 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 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 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 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 3-19, Headspace Screening for Total VOCs

SOP 3-20, Operation and Calibration of a Photoionization Detector

Author	Reviewer	Revisions (Technical or Editorial)
Robert Shoemaker Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

Sediment Sampling

Procedure 3-22

1.0 Purpose and Scope

1.1 Sediment contamination is a widespread environmental problem that can pose a threat to a variety of aquatic ecosystems. Sediment functions as a reservoir for common contaminants such as pesticides, herbicides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals such as lead, mercury, and arsenic. Contaminated sediments represent a hazard to aquatic life through direct toxicity, as well as to aquatic life, wildlife, and human health through bioaccumulation. Accurate assessment of environmental hazards posed by sediment contamination depends in large part on the accuracy and representativeness of sediment collection and analyses (U.S. EPA, 2001).

1.2 Selection and proper use of sediment sampling equipment is essential to the collection of accurate, representative sediment data that will meet the project Data Quality Objectives (DQOs). Most sediment collection devices are designed to isolate and consistently retrieve a specified volume and surface area of sediment, from a required depth below the sediment surface, with minimal disruption of the integrity of the sample and no contamination of the sample. Maintaining the integrity of the collected sediment, for the purposes of the measurements intended, is a primary concern in most studies because disruption of the sediment's structure could change its physiochemical and biological characteristics, thereby influencing the bioavailability of contaminants and the potential toxicity of the sediment (U.S. EPA, 2001).

When selecting the type of sediment sampling equipment to be used for an event, the project DQOs as well as the sediment characteristics should be considered. Related to the project DQOs is the desired depth of sediment sampling. For monitoring and assessment studies where historical contamination is not the focus, the upper 10 to 15 centimeters (cm) is typically the horizon of interest, as this is the horizon that generally contains the most recently deposited sediments and most epifaunal and infaunal organisms (U.S. EPA, 2001). The 0-6 inches interval for sediments with less than two feet of water is also used for human health risk assessment purposes. Sampling of these horizons can usually be done with grab samplers. However, if sediment contamination is being related to organism exposures (e.g. benthic macroinvertebrates and/or fish), or if characterization of deeper sediments is important for comparison of recent surficial versus historical contamination, then more precise sampling of sediment depths might be needed, and a hand corer may be more suitable (U.S. EPA, 2001).

1.3 This standard operating procedure (SOP) describes the procedure for the collection of sediment samples using the Petite Ponar® Grab Sampler, Ekman Bottom Grab Sampler, and Wildco® Hand Corer (or similar sampling devices). The applicability of each of the sediment samplers is described below.

The Petite Ponar® Grab Sampler is used to collect sediment samples in:

- Firm, hard bottoms such as sand, gravel, consolidated marl, and clay
- Mixtures of sand, stones, and coarse debris
- Soft or mucky sediments

The Ekman Bottom Grab Sampler is used to collect sediment samples in:

- Soft, finely divided littoral bottoms free from vegetation and intermixtures of sand, stones, and other coarse debris
- Bottoms composed of finely divided mulch, mud, muck, or submerged fine peaty materials

The Wildco® Hand Corer is used:

- To collect sediment samples for geological characterizations and dating
- To collect sediment samples for programs where it is important to maintain an oxygen-free environment for the sample during collection
- To collect sediment samples from a deeper depth than a grab sampler, and to characterize the depth of contamination at a site
- To investigate the historical input of contaminants to aquatic systems
- To collect sediment samples in semi-consolidated and soft sediment

Pictures and exploded diagrams of the Petite Ponar Grab Sampler, Ekman Bottom Grab Sampler, and Wildco® Hand Corer are presented in Figures 1, 2, and 3, respectively.

1.4 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

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 Depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling the first location. 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 sampling tasks. Conduct preliminary area monitoring of sample locations 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 solid or liquid matrix through the use of respirators and disposable clothing.

2.2 Observe standard health and safety practices according to the project-specific HASP. Suggested minimum protection during sediment sampling activities includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves, and waders (if applicable). Refer to the project-specific HASP for the required PPE.

2.3 Handle all sediments removed from potentially contaminated locations in accordance with the IDW handling procedures in SOP 3-05, IDW Management.

2.4 Depending upon the type of contaminant expected or determined in previous sampling efforts, employ the following safe work practices:

- If sampling from a boat, all sampling personnel should wear personal flotation devices (PFDs) when in the boat, and should follow all health and safety protocols for working in a boat presented in the project-specific HASP.

- Lifting the samplers into the boat, dumping its contents, and washing those contents may require leaning over the side of the boat. Care should be taken to keep the boat in proper balance at all times during sampling.

- Severe injury to fingers or hands can be caused by movement of the lever arms of the Petite Ponar® Grab Sampler. Do not handle or move the Petite Ponar® Grab Sampler unless the safety pin is fully inserted in the locking holes.

- Severe injury to fingers or hands can be caused by the closing of the sharpened scoops of the Ekman Bottom Grab Sampler. Handle the Ekman Bottom Grab Sampler very carefully when the springs are set and the cable loops are hooked (armed) on the Twin-Pin™ pins on the release mechanism. Do not “arm” the Ekman Bottom Grab Sampler until the sampler is ready to be used. The Ekman Bottom Grab Sampler spring-loaded jaws are potentially dangerous; extreme care must be exercised when setting the jaws. To prevent injury (and to extend the life of the springs), unhook both springs from their scoop buttons after each sampling session.

3.0 Terms and Definitions

None.

4.0 Training and Qualifications

4.1 The **Contract Task Order (CTO) Manager** is responsible for ensuring that sediment sampling activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all field sampling personnel involved in sediment sampling 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 sampling personnel follow these procedures.

4.4 **Field sampling personnel** are responsible for the implementation of this procedure.

4.5 The field sampler and/or task manager is responsible for directly supervising the sediment sampling procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data collected during sampling.

5.0 Equipment and Supplies

5.1 For sediment sampling using all types of equipment, the following supplies are required:

- Stainless steel bowls
- Stainless steel hand trowels, spoons, spatulas, and scoops
- Munsell Color Chart
- Particle size chart

5.2 Petite Ponar® Grab Sampler

- 3/16” braided polyester line
- Auxiliary weights

5.3 Ekman Bottom Grab Sampler

- 11 oz split messenger
- 3/16” braided polyester line
- Extension Handle
- Auxiliary weights

5.4 Wildco® Hand Corer

- 3/16” braided polyester line
- Extension handle
- Stainless steel core catchers (for normal sediments)
- Eggshell™ core catchers (for wet sediments)
- Stainless steel nose piece
- Cellulose acetate butyrate (CAB) liners
- Core liner end caps
- Core liner cutter
- Geologists table

- Auxiliary weights

6.0 Procedure

6.1 Depending on the characteristics of the site being investigated, sediment samples may be collected from a boat, or by sampling personnel in waders. In all instances, sediment sampling should begin from the most downstream location and proceed to the most upstream location. If sediment samples are collocated with surface water samples, the surface water sample should be collected prior to the sediment sample in order to avoid increased turbidity from displaced sediment. Regardless of the type of sediment sampling equipment used, documentation of field observations and collection activities should be recorded on the sediment sampling sheet or electronic data collection device. The following observations should be recorded on the sediment sampling form (see Attachment 1) for all sediment sampling activities:

- Sample location
- Weather conditions and other relevant site conditions
- Depth of water to the nearest 0.1 foot. A surveyor rod may be used. If the surveyor rod is used, minimize water turbulence and do not disturb any sediment.
- Physical characteristics of the water body such as estimated current speed (stagnant, slow, medium, or fast) and direction, odor, color, presence of any dead vegetation, surface sheens, etc.
- Sediment color according to the Munsell Color Chart
- Sediment grain size according to a particle size chart

Specific procedures for the collection of sediment samples using the Petite Ponar® Grab Sampler, Ekman Bottom Grab Sampler, and Wildco® Hand Corer are presented below.

6.2 Petite Ponar® Grab Sampler

6.2.1 Inspect the sampler to ensure all parts are in good working condition.

6.2.2 Decontaminate the sampler according to the procedures in SOP 3-06, Equipment Decontamination.

6.2.3 Attach the 3/16” braided polyester line to the sampler by looping the line through the clevis at the top center of the lever arms and tying securely. Tie the other end of the line to the boat (if applicable), or make sure to hold on to the other end of the line. Strong, tight knots (e.g. bowline, two half hitches) are essential for operator safety and to prevent losing the sampler. If necessary, attach the auxiliary weights to the sampler according the manufacturer’s directions.

6.2.4 Insert the Pinch-Pin™ into its hole in the lever arms, making sure to firmly push the Pinch-Pin™ into the hole. As long as the line is taught, the Pinch-Pin™ will stay in its place. When the line becomes the least bit slack (e.g. when the sampler hits the bottom), the Pinch-Pin™ spring will force the Pinch-Pin™ out of its hole, allowing the scoops to close.

6.2.5 Just before lowering the grab into the water, and with the line taught, remove the safety pin so the closing mechanism will release when the sampler is on the bottom. Make sure to keep the line taught, as any loss of tension in the line will cause the Pinch-Pin™ to pop out, closing the sampler.

6.2.6 Lower the sampler into the water in a slow and controlled fashion, especially during the final 1-2’, such that the bow wave is minimized, thus minimizing the dispersal of fine material on the sediment surface. At no time should the sampler be allowed to “free fall” down through the water column.

6.2.7 Once the sampler has reached the bottom, release the tension on the line, and allow the sampler to sink into the sediment momentarily. The release of tension on the line will cause the Pinch-Pin™ to pop out.

6.2.8 Collect the sample by pulling on the line, which will cause the lever arms to drive the scoops into the sediment in a closing motion. Keep pulling on the line in a controlled fashion until the scoops drive through the sediment and close.

6.2.9 Once the sampler scoops have closed, continue pulling on the line in a controlled fashion in order to retrieve the sampler back to the surface. When the sampler reaches the surface, lift it clear and bring it above a decontaminated stainless steel bowl. Inspect the sampler to ensure that an acceptable sample has been collected (See Figure 4). If the sample is not acceptable, discard the sample in an area that is not proximal or upstream to the area or subsequent areas that are being sampled.

6.2.10 Prior to sampling and sample homogenization, the overlying water in the sampler should be siphoned off, and not decanted (U.S. EPA 2001).

6.2.11 If acid volatile sulfide/simultaneously extracted metals (AVS/SEM) samples are to be collected, open the top screens of the sampler and collect the AVS/SEM sample directly from the sediment contained in the sampler according to the procedures specified in the project-specific SAP.

6.2.12 If volatile organic compound (VOC) samples are to be collected, open the top screens of the sampler and collect the VOC samples by inserting a syringe, Terra Core sampler, or other VOC sampling device directly into the undisturbed sediment contained within the sampler, making sure to follow all VOC sampling procedures specified in the project-specific SAP. Once the VOC samples have been collected, collect an additional aliquot for the VOC percent solids sample directly from the undisturbed sediment contained within the sampler.

6.2.13 Once the AVS/SEM and VOC samples have been collected (or if AVS/SEM and VOC samples are not required), open the sampler by pulling the two scoops open, taking care to keep hands and fingers away from the sharpened edges of the scoops, and allow the sediment to exit the sampler into the decontaminated stainless steel bowl.

6.2.14 If additional aliquots are necessary to provide adequate sample volume, repeat steps 6.2.3 through 6.2.12 until an adequate sample volume has been collected, taking care to deploy the sampler to an area that is proximal and upstream, but not on top of, the previous sample location.

6.2.15 Once an adequate sample volume has been collected, homogenize the sample in the stainless steel bowl, record the sediment sample information on the Sediment Sample Collection Form (see Attachment 1), and collect the sediment samples according to the procedures specified in the project-specific SAP (typically in order of decreasing volatility).

6.3 Ekman Bottom Grab Sampler with the 11 oz Split Messenger

6.3.1 Inspect the sampler to ensure all parts are in good working condition.

6.3.2 Decontaminate the sampler according to the procedures in SOP 3-06, Equipment Decontamination.

6.3.3 Attach the 3/16” braided polyester line to the sampler by passing the line through the trip mechanism and knotting it securely below the underlying plate. Thread the 11 oz split messenger on the line, and tie the other end of the line to the boat (if applicable), or make sure to hold on to the other end of the line. Strong, tight knots (e.g. bowline, two half hitches) are essential to prevent losing the sampler. If necessary, attach the auxiliary weights to the sampler according the manufacturer’s directions.

6.3.4 Set the spring on the side of the sampler by hooking the end of the spring onto one scoop button and stretching the spring to reach the second scoop button. Repeat this procedure with the spring on the other side of the sampler.

6.3.5 Arm the scoops by hooking one cable loop to one Twin-Pin™ pin in the trip assembly on the top of the sampler. The white ball on the cable can be used as a hand grip to assist getting the cable loop hooked onto the Twin-Pin™ pin. Repeat for the opposite cable loop. The sampler is now armed and dangerous. Do not allow anything to come in contact with the trip assembly at the top of the sampler, as this may cause a sudden and unexpected closure of the sampler.

6.3.6 Lower the sampler into the water in a slow and controlled fashion, especially during the final 1-2', such that the bow wave is minimized, thus minimizing the dispersal of fine material on the sediment surface. At no time should the sampler be allowed to "free fall" down through the water column.

6.3.7 Once the sampler has reached the bottom, allow the sampler to settle momentarily. Once the sampler has settled, hold the line with just enough tension to keep it straight, and send the 11 oz split messenger down the line. Once the 11 oz split messenger impacts Twin-Pin™ strike pad in the trip assembly on the top of the sampler, the two cable loops will be released from the Twin-Pin™ pins, and the spring-loaded scoops of the sampler will automatically close.

6.3.8 Retrieve the sampler by pulling up the line in with a moderate, steady speed. When the sampler reaches the surface, lift it clear and bring it above a decontaminated stainless steel bowl. Inspect the sampler to ensure that an acceptable sample has been collected (See Figure 4). If the sample is not acceptable, discard the sample in an area that is not proximal or upstream to the area or subsequent areas that are being sampled.

6.3.9 Prior to sampling and sample homogenization, the overlying water in the sampler should be siphoned off, and not decanted (U.S. EPA 2001).

6.3.10 If AVS/SEM samples are to be collected, open the top lids of the sampler and collect the AVS/SEM sample directly from the sediment contained in the sampler according to the procedures specified in the project-specific SAP.

6.3.11 If VOC samples are to be collected, open the top lids of the sampler and collect the VOC samples by inserting a syringe, Terra Core sampler, or other VOC sampling device directly into the undisturbed sediment contained within the sampler, making sure to follow all VOC sampling procedures specified in the project-specific SAP. Once the VOC samples have been collected, collect an additional aliquot for the VOC percent solids sample directly from the undisturbed sediment contained within the sampler.

6.3.12 Once the AVS/SEM and VOC samples have been collected (or if AVS/SEM and VOC samples are not required), open the sampler by pulling on the white balls on both cables, opening the spring-loaded scoops and allowing the sediment to exit the sampler into the decontaminated stainless steel bowl. While the spring-loaded scoops are being held open, do not place hands or fingers inside or underneath the sampler.

6.3.13 If additional aliquots are necessary to provide adequate sample volume, repeat steps 6.3.4 through 6.3.11 until an adequate sample volume has been collected, taking care to deploy the sampler to an area that is proximal and upstream, but not on top of, the previous sample location.

6.3.14 Once an adequate sample volume has been collected, homogenize the sample in the stainless steel bowl, record the sediment sample information on the Sediment Sample Collection Form (see Attachment 1), and collect the sediment samples according to the procedures specified in the project-specific SAP (typically in order of decreasing volatility).

6.4 Ekman Bottom Grab Sampler with the Extension Handle

6.4.1 Inspect the sampler to ensure all parts are in good working condition.

6.4.2 Decontaminate the sampler according to the procedures in SOP 3-06, Equipment Decontamination.

6.4.3 Attach the extension handle to the top of the sampler with machine bolts.

6.4.4 Arm the sampler according to the procedures described in steps 6.3.3 and 6.3.4 above.

6.4.5 Using the extension handle, lower the sampler to a point 4-6" above the sediment surface, and drop the sampler to the sediment, keeping the sampler vertical at all times.

6.4.6 Trigger the trip assembly by depressing the button on the upper end of the extension handle. This will cause the two cable loops to be released from the Twin-Pin™ pins, and the spring-loaded scoops of the sampler will automatically close.

6.4.7 While keeping the sampler vertical, bring the sampler over to a decontaminated stainless steel bowl. Inspect the sampler to ensure that an acceptable sample has been collected (See Figure 4). If the sample is not acceptable, discard the sample in an area that is not proximal or upstream to the area or subsequent areas that are being sampled.

6.4.8 Collect samples according to the procedures described in steps 6.3.8 through 6.3.13 above.

6.5 Wildco® Hand Corer with the Push Handles

6.5.1 Inspect the sampler to ensure all parts are in good working condition:

- Assemble and disassemble the core tube from the head and nose piece to make sure the threads are not binding. If the threads are binding, consult the manufacturer's directions.
- Make sure that the CAB plastic liner can slide easily in and out of the core tube.
- Make sure the bottom edge of the core tube and nose piece are sharp and free from nicks or dents. If necessary, file smooth using a round file.
- Check the flutter valve for ease of movement.
- Check the flutter valve seat to make sure it is clear of any obstruction, disfigurement, grease, and/or oil that could prevent a tight closure.

6.5.2 Decontaminate the sampler according to the procedures in SOP 3-06, Equipment Decontamination.

6.5.3 Screw the corer head onto the core tube, and screw the two handles onto the corer head.

6.5.4 Insert a CAB plastic liner into the core tube, insert a core catcher onto the end of the CAB plastic liner (stainless steel for normal sediments, Eggshell™ for wet sediments), and screw the stainless steel nose piece onto the core tube. If using the hand corer from a boat, bridge, high dock, etc., be sure that the appropriate extension handle (5', 10' or 15') is attached to the corer head.

6.5.5 Get in position over the sampling location. If wading in shallow water, be sure to approach the sample location from the downstream side. Line up the sampler, aiming it vertically for the point where the sample is being taken, and push the hand corer in a smooth continuous motion through the water and into the sediment. Increase the thrust as necessary to obtain the penetration desired. Do not hammer or pound the corer into the sediment.

6.5.6 Retrieve the sample by pulling straight up on the handles, keeping the corer as vertical as possible. If the corer has not been completely submerged, close the flutter valve by hand and press it shut while the sample is being retrieved. The flutter valve must be kept very wet if it is to seal properly and prevent sample washout. If the substrate is gripping the corer too tightly, gently rock the top of the corer back and forth horizontally to increase the size of the hole created by the corer and reduce the pull-out suction.

6.5.7 Unscrew the nose piece from the corer and cap the bottom end of the CAB core liner. Release the flutter valve to free the CAB core liner, and slide the CAB core liner from the core tube. Cap the top of the CAB core liner and inspect the CAB core liner for recovery. If the recovery is adequate, proceed to step 6.5.8. If the recovery is not adequate, resample the location by repeating steps 6.5.3 through 6.5.7.

6.5.8 Bring the CAB core liner with the sediment sample over to the geologist table, keeping the core vertical. Place the CAB core liner on the geologist table and cut open with a core liner cutter. If AVS/SEM samples are to be collected, collect the AVS/SEM sample directly from the sediment contained in the core liner according to the procedures specified in the project-specific SAP. If VOC samples are to be collected, collect the VOC samples by inserting a syringe, Terra Core sampler, or other VOC sampling device directly into the sediment core. Consult the project-specific SAP for project-specific VOC sediment sampling procedures. Once the VOC samples have been collected, collect an additional aliquot for the VOC percent solids sample directly from the sediment core.

6.5.9 Once the AVS/SEM and VOC samples have been collected (or if AVS/SEM and VOC samples are not required), use a decontaminated stainless steel spoon to transfer the remaining sediment core into a decontaminated stainless steel bowl.

6.5.10 If additional aliquots are necessary to provide adequate sample volume, repeat steps 6.5.3 through 6.5.8 until an adequate sample volume has been collected, taking care to deploy the corer to an area that is proximal, but not on top of, the previous sample location.

6.5.11 Once an adequate sample volume has been collected, homogenize the sample in the stainless steel bowl, record the sediment sample information on the Sediment Sample Collection Form (see Attachment 1), and collect the sediment samples according to the procedures specified in the project-specific SAP (typically in order of decreasing volatility).

6.6 Wildco® Hand Corer with the Clevis and Line

6.6.1 Inspect the corer as described in step 6.5.1 above.

6.6.2 Decontaminate the sampler according to the procedures in SOP 3-06, Equipment Decontamination.

6.6.3 Screw the corer head onto the core tube. Attach the 3/16" braided polyester line to the corer by passing the line through the clevis in the corer head and knotting it securely. Strong, tight knots are essential to prevent losing the corer. If necessary, attach the auxiliary weights to the sampler according the manufacturer's directions.

6.6.4 Insert a CAB plastic liner into the core tube, insert a core catcher onto the end of the CAB plastic liner (stainless steel for normal sediments, Eggshell™ for soupy sediments), and screw the stainless steel nose piece onto the core tube.

6.6.5 Position the corer over the drop point and steady momentarily, making sure to keep the corer vertical at all times. Make sure to arrange the 3/16" braided polyester line to run freely. Since the corer's penetration is by simple gravity, it is important that there be no restraint on the corer during descent by stricture on the line. Keep a firm hold on the free end of the line, or tie it to the boat (if applicable) or some other permanent fixture.

6.6.6 Drop the corer into the water, and allow the corer to free fall until it hits the sediment surface. The corer should not be dropped to depths greater than 20' to 30'. Dropping the corer to depths greater than 20' to 30' may result in the corer striking the sediment surface at an angle less than 90°, resulting in an unsatisfactory sample.

6.6.7 Once the corer has entered the sediment and is no longer falling, draw the line taut, and then pull on the line to pull the corer from the sediment. Once the corer has been pulled free from the sediment, bring the corer back to the surface by pulling up the line, using a smooth, hand-over-hand fashion. This movement automatically causes the flutter valve to close, preventing sample washout in all but the soupiest of sediments.

6.6.8 Once the corer has been returned to the surface, lift the corer clear of the water, being careful to keep the corer as vertical as possible at all times.

6.6.9 Collect the sediment sample according to the procedures outlined in steps 6.5.6 through 6.5.11 above.

7.0 Quality Control and Assurance

7.1 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.

7.2 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.

8.0 Records, Data Analysis, Calculations

8.1 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.

8.2 Sample collection records (Attachment 1) will provide descriptive information for the sediment samples collected at each location.

8.3 The field logbook is kept as a general log of activities and should not be used in place of the sample collection record.

8.4 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

8.5 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

9.0 Attachments or References

Attachment 1 – Sediment Sample Collection Record

Figure 1 – Petite Ponar® Grab Sampler and Exploded Diagram

Figure 2 – Ekman Bottom Grab Sampler (Large, Tall, and Standard Sizes) and Exploded Diagram

Figure 3 – Wildco® Hand Corer (with Case and Accessories) and Exploded Diagram

Figure 4 – Illustrations of Acceptable and Unacceptable Grab Samples

NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

U.S. Environmental Protection Agency (U.S. EPA). 2001. *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.* October.

Wildlife Supply Company. 2003. 2424- Hand Corer Instructions.

Wildlife Supply Company. 2004. Ekman Bottom Grabs Instructions and Maintenance.

Wildlife Supply Company. 2004. 1728-G30/ 1728-G40 Petite Ponar® Grab.

SOP 3-05, *IDW Management*.

SOP 3-06, *Equipment Decontamination*.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Robert Shoemaker Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

Attachment 1

Sediment Sample Collection Record

SEDIMENT SAMPLE COLLECTION FORM

Project Name:

Date(s):

Project #:		Date:
Sample Location ID:		Time:
Sample #:		Weather:
Samplers:		

Sample Information:

Sample Depth:		Sampling Device:
Water Depth:		
Distance from River Bank:		
River Flow Rate:		
Field Decon:	Yes No Dedicated	Sample Type: Grab Composite

Munsell Color:

Sample Description:

Other physical characteristics of water body at sample location:
(Water color, turbidity, odor, presence of sheens, dead\stressed vegetation)

Sample Comments/Description:

Figure 1
Petite Ponar® Grab Sampler and Exploded Diagram

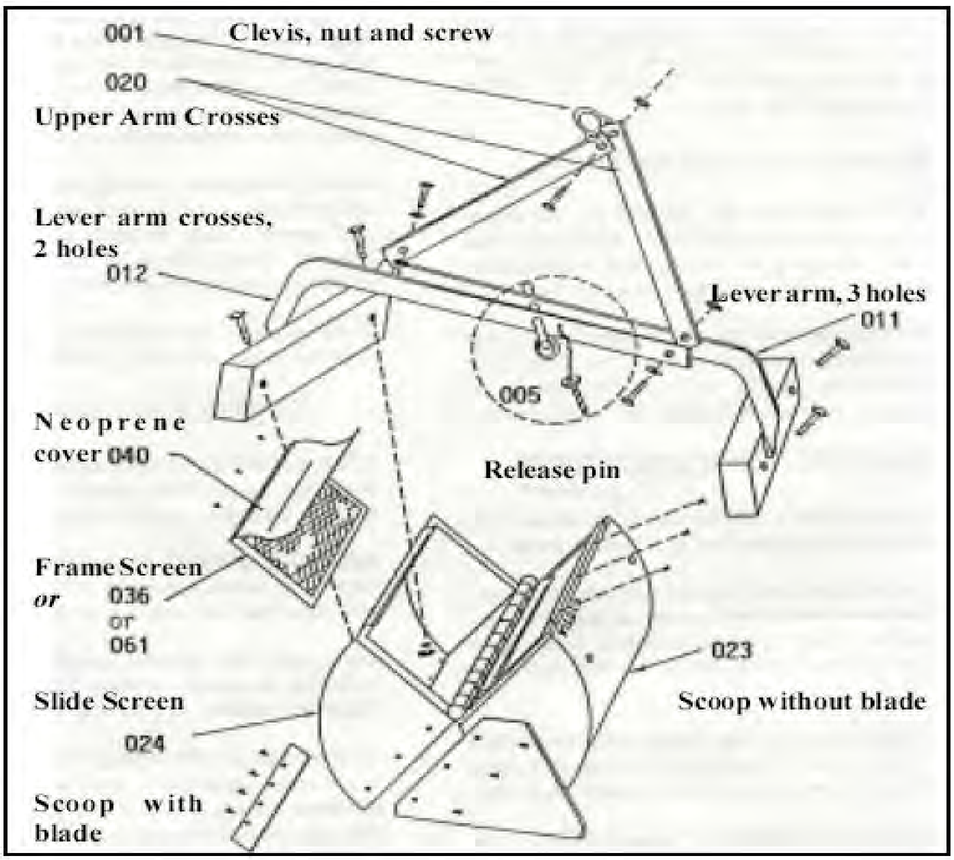
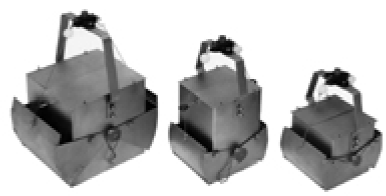


Figure 2

Ekman Bottom Grab Sampler (Large, Tall, and Standard Sizes) and Exploded Diagram



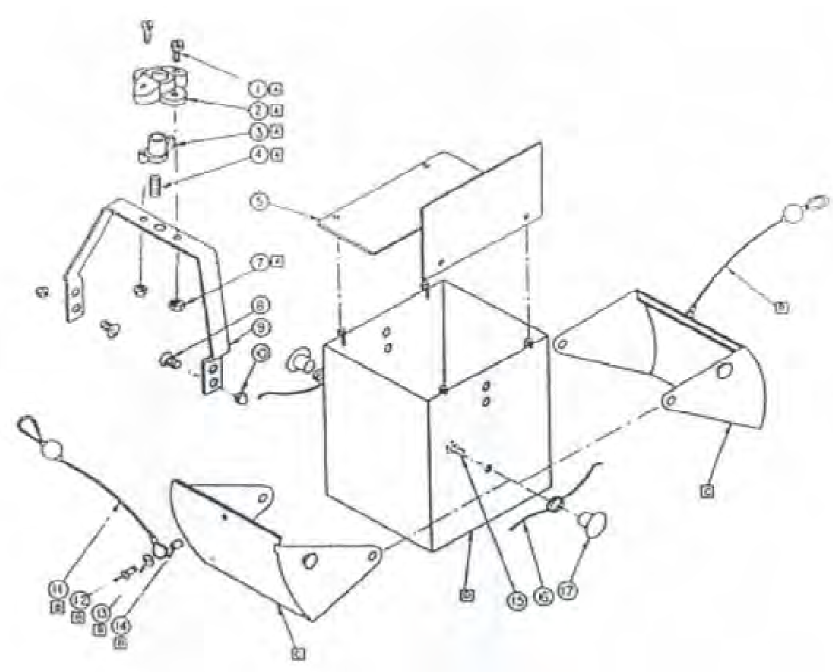
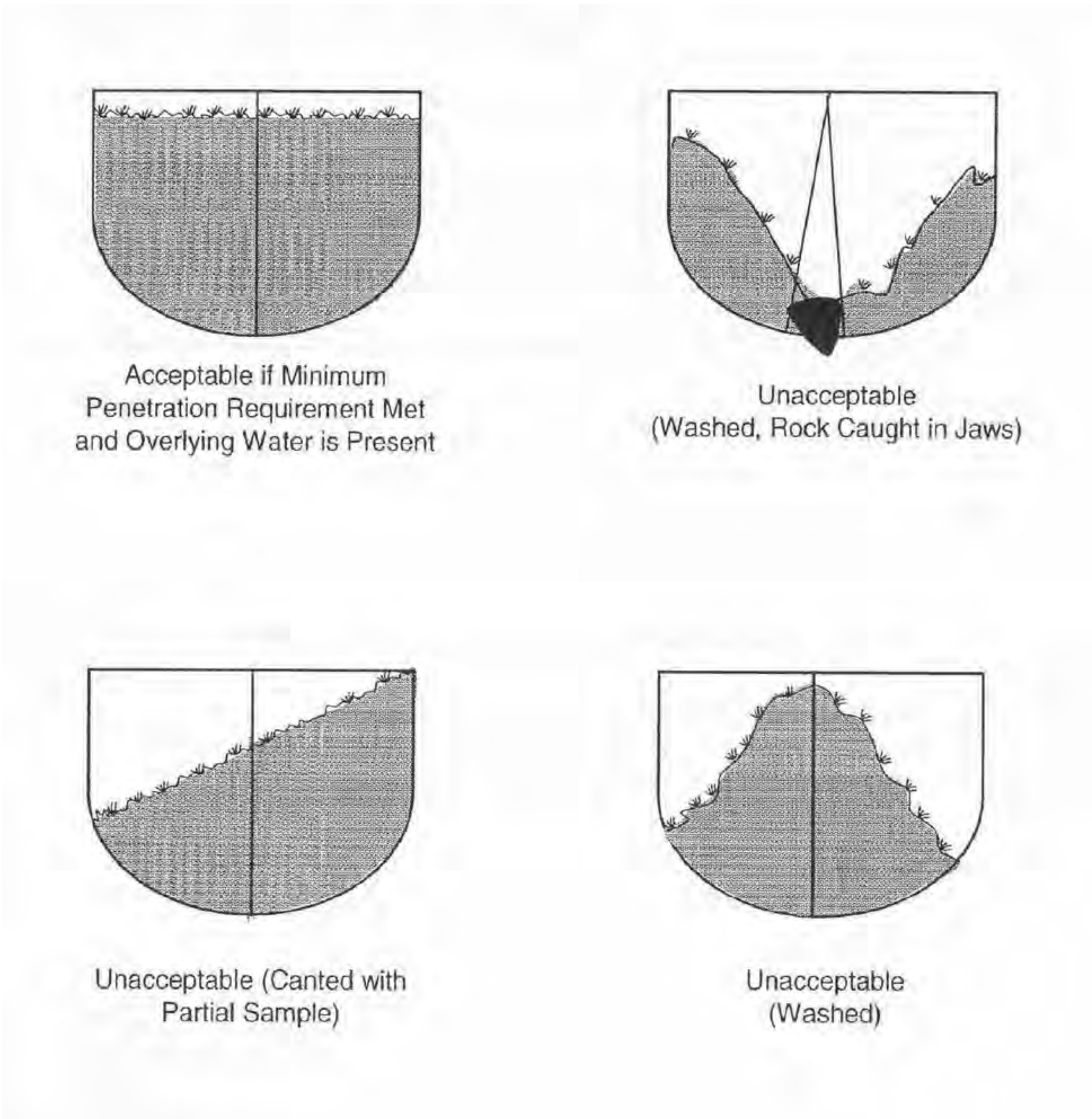


Figure 3
Wildco® Hand Corer (with Case and Accessories) and Exploded Diagram

Figure 4
Illustrations of Acceptable and Unacceptable Grab Samples



Standard Operation Procedures PFAS Sampling

Prepared by: AECOM Global PFAS Practice

February 2017

Table of Contents

1 Introduction, Purpose, and Objectives

Poly- and perfluoroalkyl substances (PFAS) are a class of hundreds of compounds that contain chains of various lengths of fluorine-carbon bonds. Fluorine-carbon bonds are one of the strongest bonds in nature; therefore, these compounds have distinct properties of strength, durability, heat-resistance and stability. PFAS are used in the manufacturing of intermediary products and hundreds of articles of commerce used in electronics, aerospace/defense, building/construction, alternative energy, automotive, semiconductors, military, healthcare, outdoor apparel/equipment and chemical/pharmaceutical manufacturing, and most notably in aqueous film forming foams (AFFF) used for fire training and firefighting (https://fluorocouncil.com/PDFs/Infographic-FluoroTechnology-Makes-Important-Products-for-Vital-Industries-Possible.pdf)

Included in these hundreds of articles of commerce that may contain residual PFAS are many items typically found in the sampling environment. These can be divided into two basic categories: 1) the sampling equipment and 2) the items within the sampling environment not related to the sampling equipment. The sampling equipment includes items such as bailers, pumps, tubing, sample jars and lids, gloves, sharpies, decontamination liquids and equipment, metal scoops, aluminum foil, coated field notebooks, etc. Items within the sampling environment not related to the sampling equipment include, but are not limited to, stain- and water-resistant fabrics found in outerwear and boots and in treated vehicle upholstery, personal care items, sunscreens and insect repellants, food wrappers/containers, residual fabric softeners on washed clothing, etc. What complicates evaluation of the PFAS contamination potential of items in this second category is the fact that manufacturers of these items have modified the suite of PFAS used and the amounts used in the manufacturing. In many cases, whether a specific item will be a source of PFAS contamination or not is hard to determine; as a precautionary measure, practical elimination of all of these items from the sampling environment is recommended.

Eliminating all items in the sampling environment that may be a potential source of PFAS contamination is particularly important as the various screening criteria and laboratory reporting limits for PFAS compounds are decreasing. For example, the United States Environmental protection Agency (USEPA) May, 2016, Lifetime Health Advisory for two commonly found PFAS compounds, perfluorooctanoic acid (PFOA) and perfluorosulfonic acid (PFOS), separately or combined, is 70 parts per trillion (ppt), New Jersey has a proposed drinking water MCL of 14 ppt for PFOA, and the June 2016 Australian and New Zealand Environment Conservation Council (ANZZECC) draft freshwater (ecological) guideline for PFOS is 0.23 ppt, which is below current laboratory reporting limits.

The purpose of this document is to train all qualified personnel and subcontractors who collect or otherwise handle PFAS environmental media samples or other types of samples for which PFAS analysis is required such as AFFF concentrate, protective clothing and/or concrete infrastructure (secondary containment structures, air strips, pipes, etc.) in AECOM's best practices. In addition, this document is a guidance resource that can be used along with the standard operating procedures (SOPs) for sampling media that are required to be followed for the client's project, or AECOM SOPs, if client SOP requirements do not exist. This document will supplement the AECOM-required training necessary prior to performing PFAS sampling of environmental media.

The objective of this document is to provide, in a single document, guidance on avoiding PFAS contamination during sampling of environmental media and includes the following topics:

- Safety (Section 2)
- Training and Qualifications (Section 3)
- General PFAS Sampling Guidance (Section 4)

2 Safety

As with any field mobilization, it is the responsibility of the field technical lead, Site Safety Officer (SSO), and all field personnel to be aware of the physical, chemical, and biological hazards associated with the particular site. The mitigation of potential hazards should be documented in site-specific Health and Safety Plans (HASPs) and Task Hazard Assessments (THAs) and incorporated into daily tailgate safety meetings to reinforce the message. The ubiquitous nature of PFAS presents several constraints to specific types of personal protective equipment (PPE) that are commonly used to mitigate health and safety concerns.

Field sampling occurring during extreme weather (e.g., rainfall, snowfall or extreme heat) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination (see below Section 4.4 on Field Clothing and PPE), but will also ensure the safety of the field personnel. Sampling programs that include PFAS should take these factors into consideration during the planning phase and be aware of field conditions prior to mobilization.

While using proper sampling SOP guidance and PPE, human exposure to PFAS during sampling should be minimized. It is important to note that USEPA Lifetime Health Advisory (May, 2016) listed PFOA and PFOS as hazardous substances and PFAS and established the advisory of 70 ppt for PFOA and PFOS, separately or combined.

3 Training and Qualifications

The AECOM Global PFAS Practice has prepared this written guidance document and a series of PFAS sampling training modules to guide AECOM practitioners on how to properly sample different environmental media at PFAS impacted sites:

- The prepared guidance document and training modules are for internal use only.
- The trained staff will be certified and will be responsible for ensuring that subcontractors at AECOM job sites meet AECOM sampling requirements.
- AECOM PFAS team intends to maintain a consistent practice when sampling for PFAS to avoid unnecessary cross contamination.
- Given that PFAS sampling techniques, understanding of PFAS cross contamination, PFAS analytical methods and regulatory requirements continue to evolve, this AECOM PFAS SOP will be a living document and will be revised and updated on a regular and “as needed” basis.
- Training modules may be updated and field staff may need to be re-certified in the future.

- The AECOM PFAS SOP will include the latest practice of science and engineering related to PFAS sampling, and it may be more stringent than external PFAS sampling guidance.
- AECOM PFAS project managers (PMs) are responsible for communicating with AECOM clients and implementing the PFAS sampling practice according to the client's instruction.

4 General PFAS Sampling Guidance

4.1 Consideration of Sampling Objectives

The overarching objectives of the project will influence the fundamentals of any sampling and analysis program. It is critical that the rationale and approach to a sampling program considers the end use of the data. For instance, sampling a first flush of stagnate pipe water may be appropriate if the data collected is to be used for inclusion in a human health risk assessment as this sample will represent the worst-case scenario (i.e. not the average). It is recommended good practice to consider the project objectives when using this guidance to develop a project-specific sampling and analysis plan.

4.2 Materials to Avoid in the PFAS Sampling Environment

As stated in Section 1.0, there are many potential sources of PFAS cross contamination that may be found in the typical sampling environment, both in the sampling equipment and the items within the sampling environment not related to the sampling equipment. The list of these items will change based on the specific media that you are sampling.

In general, however, there are known items and material of construction that should be avoided as they have been shown to be or have the potential to be sources of PFAS cross contamination. The first list below include those materials of construction that should not be within the sampling environment and terms or phrases that AECOM personnel can check for that may indicate that a particular item may be a potential PFAS contamination source. The second list below includes materials of construction that have been proven to not be sources of potential PFAS contamination for which AECOM personnel can check for when selecting an item that will be within the sampling environment.

4.2.1 Materials That Should not be in the Sampling Environment

- Polytetrafluoroethylene (PTFE)
- Teflon® and Teflon containing materials
- Low-density polyethylene (LDPE)
- Glass
- Tyvek® or coated Tyvek
- Gore-Tex®

- Decon-90
- Fluoro-surfactants
- Any item in the ingredient list that includes the term “fluoro”

4.2.2 Materials that can be in the Sampling Environment

- High-density polyethylene (HDPE)
- Polypropylene (PP)
- Polyurethane
- Polyvinyl chloride (PVC)
- Silicon
- Alconox®
- Citronex®
- Nitriles
- Liquinox®
- Neoprene
- Waxed fabric or materials
- methanol

4.2.3 Items That Need to be Evaluated

- Clothing or boots described as waterproof, water-resistant, or stain-treated
- Plumber’s tape
- Internal valves and parts of pumping equipment
- Drilling fluids

If you are unsure about an item that you are considering having in the sampling environment, please consult with the manufacturer of the item, or consult with AECOM PFAS Global Practice resource or an AECOM analytical chemist with PFAS experience prior to using the item within the sampling environment. In addition, as described in Section 4.15, it is highly recommended that an equipment blank be collected from the specific item in question prior to use in a sampling event. In addition, it may be prudent to send a section or piece of the equipment (if practical) to the laboratory for leachate analysis.

4.3 Equipment and Supplies

Equipment and supplies typically used during environmental sampling may contribute PFAS contamination to the samples collected. The bullets below provide guidance on equipment to be used and avoided during PFAS sampling and handling.

- Do not use polytetrafluoroethylene (i.e., Teflon) containing materials (e.g., Teflon tubing, bailers, tape, plumbing paste, or other Teflon materials) because Teflon contains fluorinated compounds.

- Low-density polyethylene (LDPE) materials are also not acceptable for sampling.
- Before sampling, check pump materials (check valves, O-rings, and values) for parts made of fluoropolymer materials and replace with high-density polyethylene (HDPE) parts.
- HDPE, PP, silicon materials, and stainless steel are acceptable for sampling equipment (e.g., bottles, unlined screw caps, tubing, hydrasleeves, spoons, bowls).
- Do not use waterproof field books (Rite in the Rain®) as these may contain a plastic coating or adhesive containing PFAS.
- Field notes should be documented on loose paper on Masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable).
- Post-It Notes® are not allowed on project sites.
- Sharpies® and similar markers should not be used in PFAS sampling events.
- Ball point pens can be used when documenting field activities in field notebooks or on field forms, as well as, labeling sample containers and preparing chains of custody (CoC).
- Do not use chemical (blue) ice packs during the sampling program. This includes the use of ice packs for the storage of food if allowed at the site, and/or samples.
- Ziploc© bags are acceptable for use as ice containers.
- Do not use aluminum foil or recycled paper towels during sampling or sample handling.
- Do not use a vehicle with seat covers with water proofing or stain-resistant coatings such as Scotch Guard.

Again, if you are unsure about an item that you are considering having in the sampling environment, please consult with the manufacturer of the item, or consult with AECOM PFAS Global Practice resource, or an AECOM analytical chemist with PFAS experience prior to using the item within the sampling environment. In addition, as described in Section 4.15 below, it is highly recommended that an equipment blank be collected from the specific item in question prior to use in a sampling event.

4.4 Field Clothing and PPE

While preparing for sampling or sample handling, be particularly suspicious of clothing and PPE that refers to waterproof, water-repellant or stain resistant characteristics as these properties may reflect the use of PFAS in the manufacture of these articles. (see Section 4.1 for a list of materials which are known to be sources of PFAS cross contamination.)

- Do not wear water-resistant, waterproof, or stain-treated clothing during the field program.
- Outerwear made of PVC or wax-coated fabrics may be worn in rainy or cold weather.
- Neoprene may be worn in situations of extreme cold.
- Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable alternatives.
- Do not wear clothing or boots containing Gore-Tex while sampling or sample handling as it contains a PFAS membrane.
- All safety footwear will consist of steel-toed boots made with polyurethane and PVC.
- If the only safety footwear available is treated with water-resistant, waterproof, or stain-treated coating, then outer over boots made of PVC may be worn. The over boots must be put on and the hands washed after putting the over boots on prior to the beginning of the sampling activities. Over boots may only be removed in the staging area and after the sampling activities have been completed.
- Hip waders should be made of PVC.
- Do not wear Tyvek suits and clothing that contains Tyvek as it contains fluorinated compounds.
- Field clothing should be well laundered (a minimum of six times from time of purchase) as new clothing may be treated with PFAS-containing fabric treatments.
- Do not wear clothing that has been washed with fabric softener as fabric softeners may contain PFAS.
- In addition to water-resistant and waterproof clothing, chemical treated clothing for insect resistance and UV protection should also be avoided for PFAS sampling programs. However, this particularly poses a health and safety hazard given the prevalence of biologic hazards (e.g., ticks) and risks to prolonged sun exposure. Acceptable alternatives are provided below:
  - Field personnel should tuck pant legs into socks and/or boots and use duct tape to reduce the risk of being bitten by ticks.
  - Light colored shirts and pants should be worn to easily identify ticks during field activities.
  - Light colored clothing, long sleeves, and large-brimmed hats should also be worn to prevent sunburn.

  - Additional details pertaining to acceptable personal care products (e.g., sunscreen, insect repellants) are available in Section 4.12.

- Well washed (washed six times or more) cotton coveralls may be worn over other clothing if there are concerns with items of clothing being a potential PFAS cross-contamination source. If well washed cotton coveralls are worn, they are to be donned in the staging area prior to sampling. Hands must be washed after donning the coveralls, and powderless nitrile gloves must be worn during sample collection. Coveralls must also only be removed in the staging area after the sampling event has ended.

4.5 Sample Containers and Handling

Laboratories must have demonstrated awareness and remediation of possible cross contamination from equipment and supplies in the laboratory, including the supplying sample containers appropriate for PFAS sampling.

- Powderless nitrile gloves must be worn at all times while collecting and handling samples.
- Samples should be collected in HDPE or PP bottles fitted with an unlined (no Teflon) HDPE or PP screw cap. This is an especially important point as many laboratories use Teflon-lined bottle caps.
- For larger biota sampling, Ziploc bags should be used and aluminum foil must not be used.
- For other bulk sampling of media, sample containers must be evaluated prior to use.
- LDPE should not be used for sample containers or for passive sampling.
- Glass containers should also be avoided due to potential loss of analyte through adsorption.

4.6 Sample Collection

For all sampling media, the hands must be washed prior to commencing the sampling event and clean powderless nitrile gloves must be put on prior to handling sample containers and equipment. In addition, avoid putting the sample bottle cap or lid down if possible during sample collection.

4.7 Preferential Sampling Sequence

The following text describes a strategy for collection of water samples. The same concept of collecting samples from least to most contaminated locations, if known, applies to all media.

To mitigate potential cross-contamination, drinking water, surface water, and groundwater samples are to be collected in a pre-determined order from least impacted to more impacted based on previous analytical data. If no analytical data are available, samples are to be collected in the following order:

- Drinking water
- Surface water
- Groundwater
  - First sample the upgradient well(s).
  - Next, sample the well located furthest downgradient of the interpreted or known source.
  - The remaining wells should be progressively sampled in order from downgradient to upgradient, such that the wells closest to the interpreted or known source are sampled last.

4.8 Sample Shipment

Sample coolers should be packed with the samples in wet ice (not blue or chemical ice). The completed and relinquished CoC form should be taped to the inside of the cooler lid in a Ziploc storage bag. The cooler should be taped closed with a custody seal and shipped by overnight courier to the PFAS laboratory.

4.9 Recommended Sample Holding Times

The following guidance from EPA Method 537 is provided for drinking water samples:

- Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10°C when the samples are received at the laboratory. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen.
- Water samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction.

4.10 General Equipment Decontamination

It is recommended for PFAS sampling that PFAS-free disposable equipment be used. However, if equipment re-use is required, field sampling equipment that is used at each sample location will require decontamination between uses in accordance with AECOM or project field sampling SOP. However, several additional procedures should be followed by field personnel regarding decontamination when sampling for PFAS:

- Alconox, Liquinox, Citronox soap, or methanol is acceptable for use in decontamination because the Safety Data Sheets (SDS) do not list fluoro-surfactants as an ingredient.
- Decon 90 has been analyzed and shown to contain PFAS and therefore must not be used during decontamination activities.

- Prior to use, blank samples should be collected from site water supplies to be used for decontamination water to ensure that it is PFAS-free.
- Equipment to be decontaminated will be rinsed with PFAS-free water and then scrubbed using a plastic scrub brush and one of the recommended decontamination liquids listed above.
- Scrubbed equipment will then be triple rinsed with laboratory certified PFAS-free water or other available water provided it has been determined to be PFAS-free.

4.11 PFAS-Free Water

The laboratory will be asked to provide PFAS-free water to be used as final equipment rinses and to prepare field and equipment blanks during sampling (evaluating the potential for cross contamination). PFAS-free water will be demonstrated by the laboratory by analysis, for example, of method blanks.

As previously recommended, site or water from a public water supply can be used for decontamination purposes if the water has been analyzed and shown to be PFAS-free.

4.12 Personnel Hygiene

Many manufactured sunblock and insect repellants contain PFAS and should not be brought or used on-site. Some clothing alternatives to the use of sunscreen and insect repellant are provided in Section 4.4. If conditions require the use of sunblock and insect repellants, then these products should consist of 100% natural ingredients. The following products available within the United States are acceptable for use as sunscreen and/or insect repellent when sampling for PFAS:

- Sunscreens: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, and baby sunscreens that are “free” or “natural”
- Insect Repellents: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics
- Sunscreen and Insect Repellant: Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion

Sunscreen and insect repellant manufactured outside of the United States must be evaluated on a case-by-case basis.

4.13 Food Considerations

PFAS have commonly been used in the food packaging industry. The Food and Drug Administration in January 2016 banned the use of PFAS with eight or more carbon chains in food packaging materials. However, many food or snack products may still be packaged in wrappers treated with shorter carbon chain PFAS, which were not banned or may still contain PFAS, depending on the age of the packaging of the food item. Therefore, hands must be thoroughly washed after handling fast food, carry-out food, or snacks. Pre-wrapped food or snacks (like candy bars, microwave popcorn, etc.) must not be in the possession of field personnel on-site during sampling. Food and drinks may only be brought on-site and consumed as dictated by the HASP. When field personnel require a break to eat or drink, they should remove their gloves and coveralls, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, field personnel should wash their hands, and put their coveralls and gloves back on at the staging area, prior to returning to the work area.

4.14 Laboratory Considerations

Laboratories must have the ability to analyze and report PFAS compounds using an isotope dilution method on a liquid chromatograph tandem mass spectrometer (LC-MS-MS), and demonstrate awareness and remediation of possible cross contamination from equipment and supplies in the laboratory, including the LC-MS-MS instrument.

The laboratory quality control procedures for PFAS analysis should include in each preparatory batch (1) a method blank or laboratory reagent blank to be used as a negative control sample, (2) laboratory quality control sample to be used as a positive control sample, (3) a sample matrix spike, and (4) a matrix spike or laboratory duplicate to verify the absence of significant matrix interferences as well as the precision and accuracy of quantitation in the samples matrix.

4.15 Blanks

The use of blanks should be considered if unsure of the composition or suitable nature of equipment and supplies used during PFAS sampling.

- Equipment blanks should be collected by passing laboratory certified "PFAS-free" water over or through decontaminated field sampling equipment prior to the collection of samples to assess the adequacy of the decontamination process and/or to evaluate potential contamination from the equipment used during sampling. Recommended frequency is one blank/day/matrix or one blank/20 samples/matrix, whichever is more frequent. Subject to the sampling conditions, equipment blanks can be collected depending on whether dedicated sampling equipment is being used.

- Field blanks should be collected by pouring laboratory certified "PFAS-free" water into the sampling container in the field, preserving, and shipping to the laboratory with field samples. It is used to assess contamination from field conditions during sampling. Recommended frequency is one blank/day/matrix or one blank/20 samples/matrix, whichever is more frequent.
- Trip blanks should be provided by the laboratory. A laboratory certified "PFAS-free" water vial is provided by the laboratory to the sampling site and transported back to the laboratory without having been exposed to sampling procedures. Typically, a trip blank is only for volatile compounds, but it may be recommended for PFAS sampling to assess cross-contamination introduced from the laboratory and during shipping procedures. Recommended frequency is one blank/cooler containing PFAS samples.

4.16 Visitors

Visitors to the site will only be allowed if approved by the client and in accordance with the HASP and must have all necessary site training or other requirement to be on the site. Approved visitors on the site shall remain at least 30 feet from sampling areas, staging areas, and decontamination areas.

Appendix E - Accident Prevention Plan

ACCIDENT PREVENTION PLAN

DRAFT
Phase 2 Regional Site Inspections for Per-fluorinated Compounds at Multiple Air National Guard Installations

Contract Number: W9133L-14-D-0001
Task Order Number: 0007

Prepared for:

Air National Guard
Joint Base Andrews, Maryland

Prepared by:

AECOM
3101 Wilson Boulevard, Suite 900
Arlington, VA 22201

Project No: 60520893

This page intentionally left blank.

Table of Contents

List of Attachments

List of Figures

List of Tables

List of Acronyms and Abbreviations

AHA	Activity Hazard Analysis
ANG	Air National Guard
ANSI	American National Standards Institute
APP	Accident Prevention Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CO	Contracting Officer
CPR	Cardiopulmonary Resuscitation
DO	Delivery Order
ERP	Emergency Response Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HTRW	Hazardous Toxic Radiological Waste
IDW	Investigation-Derived Waste
MSDS	Material Safety Data Sheet
NFA	No Further Action
NGB	National Guard Bureau
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PPE	Personal Protective Equipment
PRL	Potential Release Locations
QC	Quality Control
RI	Remedial Investigation
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
U.S.	United States
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 at multiple Air National Guard (ANG) sites in the 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: ____________________

TBD
Site Safety and Health Officer, AECOM

Plan Approver:

____ Date: ____________________

Alberto Munuera
Safety and Health Manager, AECOM

Plan Concurrence:

____ Date: ____________________

Mike Myers
Project Manager, AECOM

Plan Concurrence:

____ Date: ____________________

Mark MacEwan, PE
Program Manager, AECOM

2 Background Information

2.1 Contractor

The prime contractor for the Phase 2 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations is AECOM.

2.2 Contract Number

The project is being conducted under the National Guard Bureau (NGB) Contract No. W9133L-14-D-0001, Delivery Order (DO) 0007.

2.3 Project Name

The project name is Phase 2 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations (hereinafter, PFC Site Investigation).

2.4 Project Description

The primary objective of the Task Order is to collect data to support Site Investigation (SI) reports at multiple Air National Guard Installations. NGB/A7OR's goal for the 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 Potential Release Locations (PRLs) that do not meet the criteria for No Further Action (NFA).

AECOM will conduct SIs at nineteen subject installations. This APP is applicable for all subject installations.

2.4.1 Description of Work to Be Performed

PFC 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 may include:

- **Utility Clearance and Geophysical Survey.** Utility clearance will be conducted by an approved entity. 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 ranging from 10 to 45 ft, or to probe refusal, whichever occurs first.
- **Monitoring Well Installation.** Permanent monitoring wells will be installed using DPT and or rotosonic methodology, consisting of 1 inch Schedule 40 PVC screen that will be installed in the borehole, ranging in depth from 10 to 45 ft; filter sand will be placed in the annulus surrounding the well screen to a depth of 1 foot above the top of screen.
- **Groundwater Measurement and Sampling.** Groundwater samples will be collected from existing and the new wells. Samples will be collected via low-flow sampling methods using bladder pumps.
- **Surface Water and Sediment Sampling.** Surface water and sediment will be collected from various locations utilizing industry standard techniques.

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
- Surface water and sediment sampling
- 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 can be provided upon request. An example copy of a blank AECOM OSHA 300 log is located in Attachment A.

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 as Attachment B.

4 Responsibilities and Lines of Authority

4.1 Statement of Responsibility

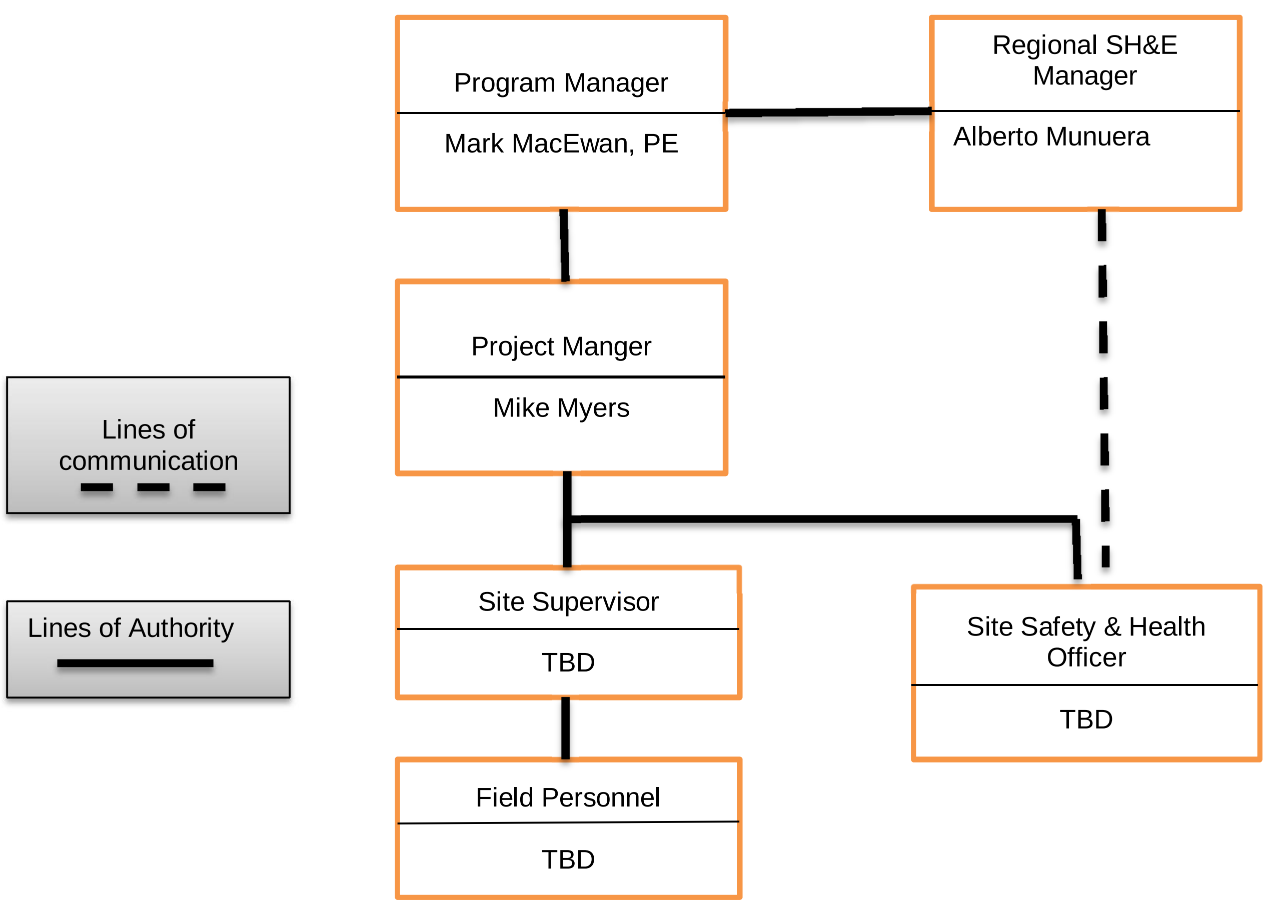
AECOM has the ultimate responsibility for the successful implementation and management of the PFC SI safety and health program.

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 PFC SI 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. Mark MacEwan 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 [Alberto Munuera]

The AECOM SH&E Manager is a safety professional 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. Mike Myers]

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 NGB;
- 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 Code of Federial Regulations (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 S3NA-202-PR, *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 NGB, 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 PFC SI 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 PFC SI 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.

This page intentionally left blank.

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 NGB 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 Cardiopulmonary Resuscitation (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 (ERP) 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 NGB 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 SI field work, and multiple locations of the ANG facilities, the PFC SI 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 PFC SI 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 NGB the opportunity to accompany AECOM on the inspection. AECOM will provide NGB a copy of any citations or reports issued by the inspector and any corrective action responses to the citation(s) or report(s).

This page intentionally left blank.

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 (Contracting Officer) 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, NGB 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-115-PR1) 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-123-PR1) 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-112-PR1) and Heat Stress Prevention Plan(S3NA-113- PR1) 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

This page intentionally left blank.

Attachment A

AECOM OSHA 300 Form

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ______________________

City ______________________ State ____________

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:		Remained at Work		Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness: (M)					
(A) Case no.	(B) Employee's name	(C) Job title (*e.g., Welder*)	(D) Date of injury or onset of illness	(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 record-able cases (J)	Away from work (K)	On job transfer or restriction (L)	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
					Page totals ➤	____	____	____	____	____	____	____ Injury (1)	____ Skin disorder (2)	____ Respiratory condition (3)	____ Poisoning (4)	____ Hearing loss (5)	____ All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Attachment B

AECOM Safety and Health Policy Statement

AECOM

Safety, Health and Environment Policy Statement

PURPOSE

This policy establishes the framework to attain Best-In-Class Safety, Health and Environmental (SH&E) performance for AECOM's employees in the global marketplace.

COMMITMENT

AECOM is committed to exceptional levels of performance in protecting its people and the environment. As stated in our Core Values, keeping our people safe is our most important measure of success. We strive to be the beacon of safety excellence in the industries and global communities in which we work.

To advance our SH&E program, we are committed to:

- Zero work-related injuries and illnesses to AECOM employees and protection of the environment as a result of our activities.
- Providing a highly effective SH&E management system that drives continual review and improvement.
- Meeting all client requirements and properly incorporating all safety, health and environmental rules and regulations at the local, state, provincial and national levels.
- Developing an exceptional safety culture where our people embrace ownership for the safety of themselves and others.
- Substantial improvements against our goals of pollution prevention, resource conservation and environmental sustainability.
- Setting and meeting aggressive SH&E performance goals and Core Value Metrics to promote continual improvement.
- Working with employees and business partners in order to continuously improve SH&E performance.
- Recognizing and celebrating those who contribute to excellent SH&E performance.
- Striving to make AECOM the provider of choice for the safe execution of design, build, finance, operate and maintenance work globally.

The commitment to this policy by the leadership, management and employees of AECOM provides the foundation for a safe workplace, operational excellence and long-term business success.

Safety for Life

EXPECTATIONS

Safety is a core value and a key to our success. We demand continual improvement in our journey towards a zero incident culture, where everyone is committed to safety, health and environmental excellence.

To that end, we demand that:

- Our leaders, managers, supervisors and employees demonstrate their commitment in their actions and decisions to assure that every person goes home safe every day.
- Our employees embrace safety a core value both on and off the job.
- We have an absolute commitment for our own safety and that of fellow employees.
- We will incorporate all Life-Preserving Principles into our work planning and execution.
- We proactively and aggressively identify, manage and eliminate hazards in the work place.
- We train and prepare our people to have the knowledge, skills, competency and equipment required to work safely.
- We stop our employees from working if the work cannot be executed safely or if conditions or behaviors on the work activity are unsafe.
- All employees immediately report safety, health and/or environmental incidents, near-misses, unsafe conditions, and at-risk behaviors to their supervisor; and that we diligently work to correct the problem.

Our SH&E expectations will be accomplished by the demonstrated leadership of management, implementation, and communications of industry recognized best practices and regulatory compliance.

COMMUNICATION

This Policy will be reviewed annually to ensure that it meets the needs of the company, and will be made available to all persons under the control of the company.

Sincerely,

M. Burke 10/10/14

Michael S. Burke
Chief Executive Officer

Date

Attachment C

AECOM SH&E Standard Operating Procedures Table of Contents

Americas

Safety, Health & Environment Procedures
Table of Contents

000 Series – SH&E Essentials

Procedure #	Topic
S3AM-001-PR	Safe Work Standards & Rules
S3AM-002-PR	Stop Work Authority
S3AM-003-PR	SH&E Training
S3AM-004-PR	Incident Reporting, Notifications & Investigation
S3AM-005-PR	Driving
S3AM-006-PR	Safety Moment
S3AM-007-PR	Behavior-Based Safety
S3AM-008-PR	Fitness for Duty
S3AM-009-PR	Fatigue Management
S3AM-010-PR	Emergency Response Planning
S3AM-011-PR	Fire Protection
S3AM-012-PR	First Aid
S3AM-013-PR	Housekeeping
S3AM-014-PR	Manual Lifting
S3AM-015-PR	Short Service Employees
S3AM-016-PR	Ergonomics
S3AM-017-PR	Injury & Illness Recordkeeping
S3AM-018-PR	Injury & Claims Management
S3AM-019-PR	Substance Abuse Prevention
S3AM-020-PR	Recognition & Rewards

100 Series – Exposure Management

Procedure #	Topic
S3AM-109-PR	Asbestos
S3AM-110-PR	Toxic & Hazardous Substances
S3AM-111-PR	Bloodborne Pathogens
S3AM-112-PR	Cold Stress
S3AM-113-PR	Heat Stress
S3AM-114-PR	Compressed Gases
S3AM-115-PR	Hazardous Materials Communication

S3AM-116-PR	Hazardous Materials Shipping
S3AM-117-PR	Hazardous Waste Operations
S3AM-118-PR	Hearing Conservation
S3AM-119-PR	Laboratories
S3AM-120-PR	Radiation
S3AM-121-PR	Non-Ionizing Radiation
S3AM-122-PR	Gauge Source Radiation
S3AM-123-PR	Respiratory Protection
S3AM-124-PR	High Altitude
S3AM-125-PR	Corrosive & Reactive Materials
S3AM-126-PR	Flammable & Combustible Liquids
S3AM-127-PR	Exposure Monitoring
S3AM-128-PR	Medical Screening & Surveillance

200 Series – Planning & Oversight

Procedure #	Topic
S3AM-202-PR	Competent Person Designation
S3AM-204-PR	Environmental Compliance
S3AM-208-PR	Personal Protective Equipment
S3AM-209-PR	Risk Assessment & Management
S3AM-211-PR	Regulatory Inspections
S3AM-213-PR	Subcontractor Management
S3AM-214-PR	International Travel
S3AM-215-PR	Management of Change
S3AM-216-PR	Compliance Assurance

300 Series - Field

Procedure #	Topic
S3AM-301-PR	Confined Spaces
S3AM-302-PR	Electrical Safety
S3AM-303-PR	Excavation
S3AM-304-PR	Fall Protection
S3AM-305-PR	Hand & Power Tools
S3AM-306-PR	Highway & Road Work
S3AM-309-PR	Heavy Equipment
S3AM-310-PR	Cranes & Lifting Devices

S3AM-311-PR	Scaffolding
S3AM-312-PR	Ladders
S3AM-313-PR	Wildlife, Plants & Insects
S3AM-314-PR	Working Alone
S3AM-315-PR	Working On & Near Water
S3AM-316-PR	Material Storage
S3AM-317-PR	Hand Safety
S3AM-318-PR	Aircraft Charters
S3AM-319-PR	All-Terrain Vehicles
S3AM-320-PR	Commercial Motor Vehicles
S3AM-321-PR	Drilling, Boring & Direct Push Probing
S3AM-322-PR	Overhead Lines
S3AM-323-PR	Aerial Work Platforms
S3AM-324-PR	Powered Industrial Trucks
S3AM-325-PR	Lockout Tagout
S3AM-326-PR	Machine Guarding
S3AM-327-PR	Powder-Actuated Tools
S3AM-328-PR	Process Safety Management
S3AM-329-PR	Railroad Safety
S3AM-330-PR	Underground Work
S3AM-331-PR	Underground Utilities
S3AM-332-PR	Hot Work
S3AM-333-PR	Marine Safety & Vessel Operations
S3AM-334-PR	Diving
S3AM-335-PR	Abrasive Blasting
S3AM-336-PR	Blasting & Explosives
S3AM-337-PR	Compressed Air Systems & Testing
S3AM-338-PR	Concrete
S3AM-339-PR	Demolition
S3AM-340-PR	Steel Erection
S3AM-341-PR	Mine Site Activities
S3AM-342-PR	Temporary Floors, Stairs, Railings & Toeboards
S3AM-343-PR	Hoists, Elevators & Conveyors
S3AM-344-PR	Cofferdams
S3AM-345-PR	Mining Operations
S3AM-346-PR	Signs, Signals & Barricades

Attachment D

Hazard Communication Program

Americas

Hazardous Materials Communication

S3AM-115-PR1

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, safety data sheets (SDS), and employee training.

1.2 This procedure applies to all AECOM Americas-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.

1.4 The program does not apply to general consumer products, for example, cleaners, printer toner, white out, etc.

2.0 Terms and Definitions

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 procedure, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.

2.9 **Location –** 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:

2.11.1 **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.

2.11.2 **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.

2.11.3 **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**.**

2.11.4 **Flammable Solid** – A solid, including a powdered, granular or pasty mixture of a substance 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**.**

Flammable Solids do not include blasting agents or explosives as defined in 8 CCR 5237(a).

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 **GHS** – The Globally Harmonized System of Classification and Labelling of Chemicals developed by the United Nations with the goal of an international system to define and classify the hazards of chemical products, and communicate health and safety information on labels and safety data sheets.

2.14 **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).

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

2.15.1 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

2.15.2 The carcinogen is 0.1% or more of the mixture or product;

2.15.3 Manufacturers, importers and distributors will be relied upon to perform the appropriate hazard determination for the substances they produce or sell.

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

Hazardous substance shall be considered the equivalent term to 'controlled substance'.

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 **National Fire Protection Association (NFPA)** – The NFPA is a trade association that issues standards and codes concerning risks associated with fire. A system of categories has been established by NFPA standard 704; colors and numbers, to provide basic hazard information concerning hazardous materials. 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. Refer to *S3AM-115-ATT1 Pictograms &Sample Labels* for an example.

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

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

2.21 **SDS –** A Safety Data Sheet prepared pursuant to state and federal regulations, OSHA Form 174 and Canada regulations (Controlled Products regulations, schedule 1).

2.22 **SDS Administrator –** The individual or group designated by the Office Manager (Operations) or Project Manager to maintain the location-specific inventory list or log and the SDS binder required if that location uses or stores hazardous substances.

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 safety data sheets (SDSs) and worker education and training programs.

3.0 References

3.1 Additional definitions can be found in the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Hazardous Material Regulations (HMR), the Transportation of Dangerous Goods (TDG) Regulations, and the International Air Transport Association (IATA) Dangerous Goods Regulation (DGR).

3.2 S3AM-003-PR1 SH&E Training

3.3 S3AM-117-PR1 Hazardous Waste Operations

3.4 S3AM-208-PR1 Personal Protective Equipment

3.5 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **SH&E Manager / SH&E Department**

- Audit their regional offices to confirm that they maintain a location-specific Hazardous Substance Inventory (HSI).
- Audit their regional offices to confirm that if a location-specific HSI is required, that current SDSs are available for each substance listed on the HSI.
- Provide interpretation of SDSs and hazard information for GHS labels/WHMIS labels/NFPA labels and other information to assist in training employees.
- Provide hazard communication training to AECOM employees and file documentation related to this training (e.g. trainer name, date trained, brief description of training, etc.).
- Review SDS for adequacy of completion to meet the OSHA and Canadian standard and returning them to supplier, if necessary.

4.1.2 **Manager / Site Safety Officer (SSO) / Supervisor**

- 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 SDS administrator for their location if they store or use hazardous substances.
- Confirm, if required, that the SDS Administrator maintains an HSI for their location.
- Confirm that a copy of this Procedure and the site-specific SDS are available to all employees (and/or their designated representative). Employees shall be instructed in the location of this Procedure and the SDSs.
- Confirm that all employees (including new employees) under their supervision have received the appropriate training required by this procedure prior to assigning employees to tasks involving the use of, or potential exposure to, hazardous substances.
- Notify employees of hazardous substances covered by this procedure 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 a current SDS (is replaced as new versions are issued) is available for each hazardous substance used, or potentially encountered, in the work areas or on the projects that are under their supervision.
- Confirm hazardous substances are properly labelled.
- 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 SDSs from all subcontractor organization for the relevant chemicals they bring onto an AECOM controlled site.
- Access or obtain, and maintain copies of SDS from:

  - The product manufacturer or supplier;
  - 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.

4.1.3 **Employee**

- Confirm that they have received appropriate hazard communication training prior to working with materials that fall under the procedure.
- Only work with materials for which they have been instructed on how to find an SDS and how to work with that material safely.
- Utilize the appropriate Personal Protective Equipment (PPE) and spill containment materials as per the SDS.
- Provide a copy of all SDSs received to the SDS Administrator at their facility.
- Verify that an SDS is available in their work area for each hazardous substance that they use.

4.2 General Procedure

4.2.1 Confirm that containers of hazardous substances that they use are properly labelled. All employees have a right to, and should, know the properties and potential hazards of substances to which they may be exposed.

4.2.2 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.

4.3 Employee Information and Training

4.3.1 Training of employees on hazardous substances in their work area shall be conducted:

- At the time of their initial assignment;
- Whenever a new hazardous substance is introduced into their work area; and
- According to jurisdictional requirements (e.g., GHS, WHMIS, etc.).

4.3.2 As a minimum, the training requirements apply to employees in the following job categories:

- All employees who perform field work that involves the use of, shipping / receiving of, or potential exposure to, hazardous substances covered under the OSHA Hazard Communication Standard and WHMIS; and
- Laboratory Employees.

4.3.3 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, including an explanation of the labelling system and the SDS, and how he/she can obtain and use appropriate hazard information;
- Any operations in their work area in which hazardous substances are present;
- Location and availability of this written hazard communications program (this procedure);
- 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; and
- Any relevant jurisdictional regulation, such as an employee's 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.

4.3.4 Periodic Training and Training for Non-Routine Tasks

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 significantly increased risk has been identified related to an existing hazardous substance (e.g. as identified in an updated SDS); and
- 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.

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

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; and
- Emergency procedures for spills, fire, disposal, and first aid.

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

4.3.5 Documentation of Initial and Periodic Training

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

4.4 Hazardous Waste Exemption

4.4.1 In the U.S., hazardous wastes are excluded from the state and federal Hazard Communication standards. AECOM employees who handle or are otherwise exposed to hazardous wastes are covered by the requirements of the Resource Conservation and Recovery Act (RCRA) and other local waste related laws and regulations and the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and *S3AM-117-PR1 Hazardous Waste Operations.*

4.5 Hazardous Substance Inventory and Chemical Usage

Establishment of a Specific Hazardous Substance Inventory (HSI) or WHMIS Log, as referenced or contained within the safe to work plan, refer *S3AM-209-PR1 Risk Assessment & Management*, shall include:

4.5.1 If an AECOM location uses or stores additional hazardous substances, a location-specific HSI or WHMIS Log shall be maintained at that location.

4.5.2 If it is determined that an office-specific HSI is needed, the Manager shall confirm that one is developed and maintained by someone appointed as the location's SDS Administrator.

4.5.3 The HSI or WHMIS Log may be hard copy or managed through an electronic SDS management system.

4.5.4 The content of the HSI or WHMIS Log shall be updated as new hazardous substances are procured for, or removed from the location, and shall be verified by the SH&E Manager through regular inspections of the location.

4.5.5 In order to meet the 30-years-after-employment-termination record retention requirement, the office or project specific HSIs shall be managed as a permanent record.

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 chemical (e.g. review the SDS to identify carcinogens or extremely hazardous chemicals), the tasks to be performed, and prescribe the Personal Protective Equipment (PPE) to be used, refer to *S3AM-208-PR1 Personal Protective Equipment.*

4.6 Safety Data Sheets (SDS)

4.6.1 Location-Specific SDS Inventory

- If it is determined that an AECOM location is required to maintain a location-specific inventory SDSs for the specific hazardous substances shall be maintained on file at that location.
- The SH&E Manager shall audit the local office or project for SDS request and maintenance and report deficiencies to the appropriate management level, as necessary, to confirm compliance with this procedure.

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 SDS from:
  - The product manufacturer or supplier;
  - 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 SDSs

SDSs should be maintained at the local location that uses that hazardous substance. Copies of this program and the SDS should be made available to the employee upon request to the office’s SDS Administrator.

4.6.4 Field Access to SDSs

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

4.6.5 SDSs for AECOM Products

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

4.6.6 Content of the SDS:

- Safety Data Sheets, previously referred to as Material Safety Data Sheets, will now require a 16-section format that is essentially the same as the ANSI standard for Hazardous Workplace Chemicals-Hazard Evaluation and Safety Data Sheets and Precautionary Labeling Preparation (ANSI Z400.1 & Z129.1 – 2010).
- Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- Section 2, Hazard(s) identification includes all information regarding the hazards of the chemical and the appropriate warning information associated with the hazards including classification, signal word, hazard statement, pictograms, and precautionary statement.

- Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.
- Section 4, First-aid measures includes important symptoms/ effects, acute, delayed; required treatment.
- Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.
- Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.
- Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.
- Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).
- Section 9, lists the physical and chemical properties of the hazardous substance.
- Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.
- Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
- Section 12, Ecological information
- Section 13, Disposal considerations
- Section 14, Transport information
- Section 15, Regulatory information
- Section 16, Other information, includes the date of preparation or last revision.

SDSs 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 SDSs is proprietary and not provide the information to AECOM.

When SDSs supplied to the SH&E Manager indicate that proprietary information has been withheld, the SH&E Manager will either obtain the necessary information to make a hazard assessment or reject the material for use within AECOM.

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

4.7 Labeling

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

- Product name or Identifier;
- Hazard Pictogram;
- Signal Word;
- Physical, Health, Environmental Statements;
- Supplemental Information;
- Precautionary Measures and Pictograms;

- First Aid Statements;
- Name and Address of Company; and
- Telephone Number.

4.7.2 Refer to *S3AM-115-ATT1 Pictograms & Sample Labels*.

4.7.3 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.

4.7.4 Formal and informal inspections shall include observing that hazardous materials are properly labeled.

4.7.5 Immediately replace lost or illegible labels provided the product can be conclusively identified. Any failure to have the appropriate labeling information on a container at any time, or illegible or missing labels will be cause to suspend use of the product until the product is conclusively identified and is properly labeled.

4.7.6 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.

4.7.7 Stationary Process Containers

If there is stationary process equipment within a work area, signs, placards, pictograms, 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.

4.7.8 Portable Containers

Portable containers of hazardous substances need not be labelled when the substance is transferred from labelled containers and will be used immediately by the employee who performs the transfer, however the container shall still contain the product identifier (name). Immediate use means the container will remain in the employee’s immediate possession and direct oversight until the container is fully emptied or contents are returned to a labelled container.

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 meeting workplace label requirements in accordance with the OSHA Hazard Communication Standard or WHMIS (as applicable to the given jurisdiction).

4.8 Chemical Storage

4.8.1 Hazardous chemicals are to be stored in labeled containers with the lids securely closed using appropriate undamaged caps or lids. Confirm liners are in place if used.

4.8.2 Flammable and combustible materials shall be stored in fire impervious cabinets in designated stockroom areas. Chemicals shall be stored in compliance with instructions provided on their labels, SDS, or the manufacturer’s specifications (e.g. compatibility with other substances, environmental conditions, etc.).

NOTE: Flammable gases or other compressed gases should not be stored in flammable material cabinets as these cabinets are not designed for containment of pressurized gases.

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

4.8.4 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, contact the SH&E Manager for guidance if this general requirement is infeasible.

4.9.2 General exceptions to this rule are the following:

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

4.9.3 Each office or location using or storing hazardous materials will develop a written office/ location-specific Hazard Communication/WHMIS Program.

4.9.4 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 Manager, document the changes, and communicate the differences to all affected employees.

4.10 Canada-specific

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

4.10.2 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 shall be communicated to workers through training programs. It is important for employees to be aware of and understand Client labelling requirements for these types of process systems.

5.0 Records

5.1 HSI or WHMIS Logs shall be retained in project or office files for a minimum of 30 years or according to jurisdictional requirements.

5.2 Training documentation shall be retained in accordance with *S3AM-003-PR SH&E Training*.

6.0 Attachments

6.1 S3AM-115-ATT1 Pictograms & Sample Labels

Attachment E

Respiratory Protection Plan

Americas

Respiratory Protection

S3AM-123-PR1

1.0 Purpose and Scope

1.1 This procedure establishes a written respiratory protection program with the required elements and work site-specific procedures for respirator selection, use, and maintenance for any workplace where respirators are necessary to protect the health of an Employee.

1.2 The primary objective shall be to prevent exposure to atmospheric contaminants as far as feasible by accepted engineering control measures (e.g. enclosure or confinement of the operation, general and local exhaust ventilation [LEV], and substitution of less toxic materials). If respiratory hazards remain, suitable administrative controls and respiratory protective equipment requirements shall be established.

1.3 This procedure applies to all AECOM Americas-based employees and operations, except where local or governmental regulations are more stringent**.**

2.0 Terms and Definitions

2.1 **Action Level (AL)** – An airborne concentration of a potentially toxic or hazardous substance, measured in parts per million by volume (ppm), microgram per cubic meter (µg/m3) milligram per cubic meter (mg/m3) or fibres per cubic centimetre (f/cc), that triggers certain provisions as required by the applicable jurisdictional legislation. In many cases the action level is 50% of the established exposure limit.

2.2 **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.

2.3 **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. Please note Canadian Standards Association (CSA) bases respirator selection on NIOSH criteria for the testing and certification of respirators.

2.4 **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.

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

2.6 **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.

2.7 **Established Exposure Limit** – The maximum regulatory exposure concentration to which an individual may be exposed to for an 8- hour time weighted average (TWA).

- This limit is referred to by different terminology depending upon the given jurisdiction (e.g. Permissible Exposure Limit (PEL), Contamination Limit, Occupational Exposure Limit (OEL), Threshold Limit Value (TLV), etc.).
- Acceptable methods of adjusting this limit to correspond to a different exposure period (e.g. 10 hours) vary by jurisdiction and substance.

2.8 **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.

2.9 **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.

2.10 **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].)

2.11 **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 or, where applicable, the Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists.

2.12 **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.

2.13 **Maximum use concentration (MUC)** – The maximum concentration of an airborne contaminant from which an employee is expected to be protected when wearing a respirator, determined by the assigned protection factor of the respirator or class of respirators and the occupational exposure limit for that contaminant. The MUC is usually determined mathematically by multiplying the assigned protection factor (APF) specified for a respirator by the established exposure limit, which can include a short-term exposure limit and a ceiling limit or any other exposure limit used for that chemical agent, as defined by the authority having jurisdiction.

MUC = APF x established exposure limit

2.14 **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.

2.15 **Oxygen-deficient atmosphere –** An atmosphere with oxygen content below 19.5 percent by volume.

2.16 **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 local or governmental respiratory protection standards.

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

2.18 **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.

2.19 **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.

2.20 **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.

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

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

2.23 **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.

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

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

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-114-PR1 Compressed Gases

3.3 S3AM-128-PR1 Medical Screening & Surveillance

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Respiratory Protection Program Administrator**

The Respiratory Protection Program Administrator will be established at each project/location where employees are required to wear respirators. The Respiratory Protection Program Administrator will:

- Verify full compliance with this procedure.
- Assist with the arranging of any required medical evaluations or any other additional medical attention related to the use of a respirator.
- Perform or arrange suitable providers to perform the program evaluations described in this procedure.
- Maintain required inspections and testing/certifications of SCBA units

4.1.2 **Manager /Supervisor**

- 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.
- Confirm that the emergency rescue service is available to respond prior to any employees entering the IDLH area.

4.1.3 **SH&E Manager (or designee)**

- 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 (e.g. determine cartridge change out schedule for negative air respirators).
- Audit company compliance with this procedure.

4.1.4 **Employee**

- Use respiratory protection in accordance with instructions and training received.
- Maintain the respirator in accordance with this procedure and the manufacturer's instructions.
- Immediately report any malfunction of the respirator to the Supervisor or Manager or other responsible person.
- For employees who wish to wear respirators on a voluntary basis when not required to by AECOM or a regulatory agency, the employee shall complete *S3AM-123-FM2 – Voluntary Use of Respirators* or an equivalent form.

4.2 Training

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

4.2.2 Employees that may be exposed to a respiratory hazard will be instructed on the hazard and the controls prior to beginning work.

4.2.3 Atmospheric testing will be carried out by qualified personnel trained in the use, calibration, and interpretation of the test equipment.

4.2.4 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.

4.2.5 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 each time respirator is donned. Refer to *S3AM-123-ATT1 Fit Testing Protocol*, *S3AM-123-FM1 Respiratory Equipment Fit Test* and *S3AM-123-ATT2 User Seal Check*;
- 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; and
- The general requirements of local or governmental Respiratory Protection Standards.

4.3 Medical Surveillance

4.3.1 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.

4.3.2 Prior to wearing a respirator and in accordance with the applicable jurisdictional requirements, Employees shall complete medical screening to identify any relevant psychological or physiological impediments to respiratory protection use. Screening may require an initial baseline medical surveillance examination, based on jurisdictional requirements or screening results, performed by a PLHCP in accordance with the requirements of *S3AM-128-PR1 Medical Screening & Surveillance Program.*

4.3.3 Additional medical examinations will be provided to employees who wear respirators when:

- An Employee reports medical signs or symptoms that are related to ability to use a respirator;
- A PLHCP, Supervisor, or the Respiratory Protection 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.

4.3.4 All medical surveillance examinations shall be at no cost to the employee and occur during normal working hours; shall be convenient, understandable, and confidential; and the Employee will be given the chance to discuss results with examining physician.

4.4 Respirator Selection

4.4.1 The location or project specific SH&E Plan shall identify applicable respiratory hazards and develop appropriate controls, which may include respiratory protection. If respiratory protection is necessary the SH&E Plan shall detail the requirements.

4.4.2 SH&E Managers or his/her designated representative shall select and provide an appropriate respirator based on:

- The respiratory hazard(s) to which the employee may be exposed, including oxygen deficiency. Identify potential contaminants, concentrations, and the physical state of airborne contaminants:
  - Particulates (dust, fibers, micro-organisms, smoke, fumes).
    - Indicate the presence of any oil in particulate hazards. (may be produced by motor vehicles, air compressor systems using oil lubricators) If unknown, oil shall be assumed to be present.
  - Vapor and gases
    - Gases which may produce an oxygen deficiency (i.e. helium, argon, carbon monoxide and nitrogen).
    - Gases which are acids or produce acids when in contact with moisture (i.e. sulphur oxides, carbon dioxide, hydrogen chloride).
    - Gases which are alkaline or produce alkalis in reaction with moisture (i.e. ammonia, amines, phosphine).
    - True gases or vapors from evaporation of organic liquids (i.e. acetone, toluene, benzene).
    - Metal reacted with an organic compound (i.e. tetra-ethyl lead: was used in leaded fuel and still in aviation fuel, organic phosphates).
    - Mercury vapor.
    - Radon.
- The eye and face hazards to which the employee may be exposed (absorption, irritant, impact).
- Workplace or user factors that may affect respirator performance and reliability.

4.4.3 SH&E Managers or his/her designated representative shall identify and evaluate the respiratory hazard(s) in the workplace. Evaluations shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form.

4.4.4 Respiratory protection is required for those operations in which engineering controls or work practice controls are not feasible to reduce toxic or hazardous substance exposure at or below the AL (or if applicable, established exposure limit).

4.4.5 Where the employee exposure cannot be identified or reasonably estimated, the atmosphere shall be considered IDLH.

4.4.6 Only approved respirators shall be selected and they shall be used in compliance with the conditions of their certification.

4.4.7 Respirators shall be selected from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

4.5 Fit Testing Procedures

4.5.1 After the medical assessment is complete, employees using a tight-fitting respirator shall pass an appropriate QLFT or QNFT prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually (or as required by the applicable jurisdiction) thereafter. Refer to *S3AM-123-ATT1 Fit Testing Protocol*.

4.5.2 Fit testing shall be performed using the same make, model, style and size of respirator the user would be expected to use.

4.5.3 Should the fit test fail, alternative makes, models, styles and sizes shall be tested to find a correct fit for the user.

4.5.4 Respiratory protective equipment shall not be used unless a satisfactory fit test has been achieved for that particular equipment.

4.5.5 Fit testing shall also verify user competency in donning, doffing, inspecting and performing of seal checks.

4.5.6 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);
- If the Employee notifies his/her Supervisor or SH&E Manager that the fit of his/her respirator is unacceptable.

4.6 Interference with Facepiece Seal

4.6.1 AECOM shall not permit respirators with tight-fitting facepieces to be worn by Employees who have:

- Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or
- Any condition that interferes with the face-to-facepiece seal or valve function.

4.6.2 If an employee wears corrective glasses or goggles or other personal protective equipment, the Supervisor or Manager shall confirm that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

4.6.3 Employees shall perform a user seal check each time they don the respirator. Refer to *S3AM-123-ATT2 User Seal Check Procedures*.

4.7 Specification of Proper Level of Respiratory Protection

4.7.1 The SH&E Manager or his/her designated and qualified representative shall provide guidance on 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 SH&E plan and Task Hazard Assessment (THA).

4.7.2 Employees engaged in activities not covered by a THA or SH&E plan shall stop work and consult with the SH&E Manager or his/her designated representative to determine the proper equipment to use prior to resuming activities. 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.

4.8 Cartridges

4.8.1 NIOSH certifies three classes of filters*:

Three categories of resistance to filter efficiency degradation:	Three levels of filter efficiency:
N (**N**ot resistant to oil)	95% (called "95")
R (**R**esistant to oil)	99% (called "99")
P (oil **P**roof)	99.97% (called "100")

*Filters are available in any combination of the above.

4.8.2 Generally cartridge color denotes the type of contaminant the cartridge was designed to filter:

Olive:	Multi-contaminant
White:	Acid gas
Black:	Organic vapors
Green:	Ammonia gas
Yellow:	Acid gas and organic vapors
Blue:	Carbon Monoxide
Purple (Magenta):	Radioactive material, except tritium & noble gases
Purple:	Any particulates - P100
Orange:	Any particulates - P95, P99, R95, R99, R100
Teal:	Any particulates free of oil - N95, N99, or N100

Please note; this is only a basic listing and should only be used as a reference. Combinations, deviations or additional types may be encountered. To ensure proper cartridge selection consult the cartridge supplier to ensure applicability to the contaminant(s) anticipated

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

4.8.4 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. A buddy system should be used so coworkers can monitor each other's cartridge color condition.

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

- Immediately if breakthrough is perceived or if resistance to breathing is detected by the user; and
- In accordance with the change out schedule based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturer.

4.8.6 When 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.

4.9 Air-Supplying Respirator Use

4.9.1 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 percent;
- 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 MUC of a full-face air-purifying respirator.

4.9.2 No Employee may engage in an operation requiring the use of an air-supplied respirator unless the SH&E Manager or his/her designated representative has reviewed the operation and approved its use.

4.9.3 The determination of the type of air-supplying respirator (i.e., SCBA, airline, demand, pressure demand, etc.) appropriate for the job, outside standby persons, communication, proper training and equipment, notification procedures, and necessary action should be part of the THA or SH&E Plan. Mandatory equipment including SCBA or SAR with auxiliary air supply and emergency appropriate retrieval equipment or equivalent rescue means shall be made by the SH&E Manager or his/her designated representative at the time of the THA or SH&E Plan review. The need for any additional precautions (i.e., equipment specific training, on-site health and safety support, etc.) shall also be determined by the SH&E Manager or his/her designated representative.

4.10 Minimum Procedures for IDLH Atmospheres

4.10.1 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.

4.10.2 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.

4.10.3 The Employee(s) located outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue or to initiate on-site rescue services.

4.10.4 If on-site rescue services are to be used, the Manager or Supervisor shall confirm that the service is available to respond prior to any employees entering the IDLH area.

4.10.5 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 Employees in the IDLH area.

4.11 Breathing Air

4.11.1 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).

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

4.11.3 Compressor Supplied Breathing Air

- All compressors used for filling SCBA air cylinders or for supplying airline respirators shall be equipped with the following safety and standby devices:
  - o 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.
  - o Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system.
  - o 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:
  - o A continuous reading carbon monoxide monitoring system set to alarm should the carbon monoxide concentration exceed 10 parts per million; and,
  - o A high temperature alarm which will activate when the discharge air exceeds 110 percent 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.

4.11.4 Compressed Air Cylinder Systems for Airline Respirators

- Compressed air cylinders shall meet the requirements of *S3AM-114-PR1 Compressed Gases*.
- Compressed air cylinder systems used to supply airline 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 pounds per square inch (psi). When such systems are used, one employee shall be assigned as safety standby within audible range of the low pressure alarm.
- Airline hose couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying airline respirators with non-respirable gases or oxygen.
- The air pressure at the hose connection to airline respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.
- Routine inspection and maintenance of the air compressor shall be performed.

4.11.5 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 3,000 psi.

4.11.6 Escape/Egress Units

- Escape/egress unit respirators are intended for use in areas where escape with a short-term (minimum 5 minutes) air supply is necessary. It is important that escape bottle size be provided that will allow the employee to get to a safe location considering breathing rate and distance.
- Escape bottles are required on air-line respirators used in IDLH and high hazard work conditions.
- 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 (minimum 5 minutes) shall never be used to enter a hazardous atmosphere or as primary standby respirators for confined space entry.

4.12 Respirator Inspection, Cleaning, Maintenance, and Storage

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

4.12.1 Inspection

- Respirators should be inspected before and after use using *S3AM-123-FM3 Respiratory Equipment Inspection*, or equivalent. The respirator should not be used and removed and marked out of service if any item on the checklist fails inspection.
- Respirators for emergency use should be inspected once per month.
- Defects shall be reported to their Supervisor or Manager. No defective respirator shall be issued or worn.

4.12.2 Cleaning and Maintenance

- Respirator facepiece assemblies shall be cleaned and sanitized minimally after each day of use in accordance with the requirements specified in *S3AM-123-ATT3 Respirator Cleaning*.
- The respirator should also be inspected for any damaged parts (repair should only be done by trained personnel with the proper tools).
- 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.
- In field situations, a pre-moistened towelette (e.g., baby wipes) can be used. The mask should then be rinsed with clean warm water and dried. Towelettes or wipes shall be compatible with the respirator materials.
- Alcohol should never be used to clean masks as it can damage the facepieces and rubber parts.
- 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.

4.12.3 Storage

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

4.13 Hygiene

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

4.14 Costs

4.14.1 The costs for training, medical examinations, fit testing, respirators, spectacle kits, and cleaning materials should be considered as operational costs.

4.15 Program Evaluation

4.15.1 The SH&E Manager or his/her designated representative shall 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.

4.15.2 The SH&E Manager shall 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.

5.0 Records

5.1 Medical records under this section shall be maintained at a minimum in accordance with *S3AM-128-PR1 Medical Screening & Surveillance.*

5.2 Fit Test Records shall be maintained in the Employee's health and safety records. *S3AM-123-FM1 Respiratory Equipment Fit Test*, or equivalent, will be used to document each fit test.

5.3 Training Records shall be maintained in accordance with *S3AM-003-PR1 SH&E Training*.

6.0 Attachments

6.1 S3AM-123-ATT1 Fit Testing Protocol

6.2 S3AM-123-ATT2 User Seal Check

6.3 S3AM-123-ATT3 Respirator Cleaning

6.4 S3AM-123-FM1 Respiratory Equipment Fit Test

6.5 S3AM-123-FM2 Voluntary Use of Respirators

6.6 S3AM-123-FM3 Respiratory Equipment Inspection

6.7

Americas

Fit Testing Protocol

S3AM-123-ATT1

1.0 Selection

1.1 Fit testing shall not be conducted until after the medical screening and any medical examination is concluded, to confirm there are no relevant psychological or physiological impediments or restrictions to respiratory protection use. A medical examination may result in clearance to use any type of respirator, total restriction for respiratory equipment use, or specific respiratory use restrictions (e.g. powered air-purifying respirator (PAPR) only).

1.2 Employees are expected to present themselves for a fit test in the same condition as when using the respiratory protective equipment in their job. These conditions include hair style and whether or not make-up, face creams, glasses, contact lenses, and/or dentures would be used.

1.3 Employees shall confirm that no jewelry, head-coverings or other items could interfere with the fit and the face is clean shaven where a tight-fitting respirator is required to seal. Any PPE required to be used concurrently with the RPE that could affect the fit of a tight-fitting facepiece shall be utilized during the fit test.

1.4 The Employee 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 Employee.

1.5 Prior to the selection process, the Employee 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 Employee in evaluating the fit and positioning of the respirator. This instruction may not constitute the Employee's formal training on respirator use, because it is only a review.

2.0 Comfort

2.1 The Employee 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 5 minutes to assess comfort.

2.3 If the Employee is not familiar with using a particular respirator, he/she 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 Employee and allowing he/she adequate time to determine the comfort of the respirator:

- Position of the mask on the nose;
- Room for eye protection;
- Room to talk; and
- 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; and
- Self-observation in mirror to evaluate fit and respirator position.

3.2 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, moustache, or sideburns that cross the respirator sealing surface. Any type of apparel that interferes with a satisfactory fit shall be altered or removed.

3.3 Before conducting the negative and positive pressure checks, the Employee 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 Employee is unable to seat the mask.

3.4 The Employee shall conduct a user seal check, either the negative and positive pressure seal checks described in *S3AM-123-ATT2 User Seal Check* or as recommended by the respirator manufacturer that provide equivalent protection to the procedures in *S3AM-123-ATT2 User Seal Check*.

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

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

4.0 Test Exercise Regimen

4.1 Prior to the commencement of the fit test, the Employee shall be given a description of the fit test and their responsibilities during the test procedure. The description of the process shall include a description of the test exercises that will be performed. 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 Employee 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 procedure, except for the Controlled Negative Pressure (CNP REDON) method. A separate fit testing exercise regimen is contained in the CNP protocol. The Employee shall perform exercises, in the test environment, in the following manner:

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

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

5.1.3 **Turning head side to side.** Standing in place, the Employee 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 Employee can inhale at each side.

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

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

- 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."

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

5.1.7 **Bending over.** The Employee 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.

5.1.8 **Normal breathing**. In a normal standing position, without talking, the Employee 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 Employee 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 shallt be repeated.

6.0 Qualitative Fit Test (QLFT) Protocols

6.1 **General**

6.1.1 QLFT test methods have been validated only for a fit factor of 100. A tight-fitting respirator operated in air-purifying (negative-pressure) mode can be tested by QLFT methods to validate a maximum APF of 10.

6.1.2 The maximum APF that can be applied for all tight-fitting respirators operated in air-purifying (negative-pressure) mode is 10 when fit tested using a QLFT method.

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

6.1.4 AECOM will confirm 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 QLFT 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 test conductor has the option of donning an air purifying respirator to protect himself/herself from the test agent.
- 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 Employee shall be used.
- The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the Employee'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 Employee can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the Employee.

- 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 Employee to be tested shall 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 Employee that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the Employee to keep his/her eyes closed while the test is performed.
- The Employee 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 Employee's direction to determine that he/she can detect it.

6.2.4 **Irritant Smoke Fit Test Procedure**

- The Employee being fit tested shall don the respirator without assistance, and perform the required user seal check(s).
- The Employee 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 Employee, using the low-flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece 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 6 inches of the respirator.
- If the Employee being tested has not had an involuntary response and/or has not detected the irritant smoke, proceed with the test exercises.
- The General Test Exercises shall be performed by the Employee while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of 6 inches.
- If the Employee being fit tested reports detecting the irritant smoke at any time, the test is failed. The Employee being retested shall repeat the entire sensitivity check and fit test procedure.
- Each Employee 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.

6.3 Isoamyl Acetate (IAA, Banana oil) Protocol

6.3.1 This protocol is not not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator shall be equipped with an organic vapor filter.

6.3.2 **General Requirements and Precautions**

- As smoke can be irritating to some employees, this test method is preferred to reduce risk of irritation to the employee tested and the person conducting the fit test.

- The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.
- The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.
- The respirator to be tested shall be equipped with a P100 series filter (for organic vapors).

6.3.3 **Sensitivity (Odor threshold) Screening Check**

- Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of IAA at low levels.
- Obtain the following supplies required to complete the screening:
  - Three 1 liter glass jars with metal lids
  - Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions
- The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1 liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.
- The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.
- A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.
- The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.
- The employee shall then be asked to sniff each bottle and indicate which bottle contains an odor.
- If the employee is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

6.3.4 **Isoamyl Acetate (IAA, banana oil) Fit Test Procedure**

- The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.
- After successfully completing the odor threshold test and the positive and negative pressure checks, the employee shall don their respirator prior to moving to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.
- A copy of the prepared text from which the subject is to read may be taped to the inside of the test chamber or should be provided to the employee to hold.
- Upon entering the test chamber, the employee shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.
- Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

- If at any time during the test, the employee detects the banana-like odor of IAA, the test is failed. The employee shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
- If the test is failed, the employee shall return to the selection room and remove the respirator. The employee shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the employee shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.
- If the employee passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.
- When the employee leaves the chamber, they shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

6.3.5 Other

- Additional Qualitative fit testing methods may be used provided they adequately test breakthrough or leakage of the respirator and testing is conducted according to manufacturer specifications.
- Qualitative fit testing may be conducted using manufacturer supplied hoods or equivalent test enclosures, and nebulizers using suitable fit testing solutions (e.g. sodium saccharin, Bitrex®, etc.).

7.0 Quantitative Fit Test (QNFT) Protocols

7.1 General

7.1.1 A quantitative fit test measures the adequacy of a respirator's fit by numerically measuring the amount of leakage into the respirator. A minimum fit factor of 500, and in some cases 1000, is required for a successful quantitative fit test.

7.1.2 AECOM will confirm that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly, and confirm that test equipment is in proper working order.

7.1.3 Quantitative fit testing is applicable to all tight fitting respirators. Quantitative fit tests (QNFT) are required for all full-face masks and SCBA and multi-functional SCBA air-line configurations.

7.1.4 AECOM will confirm 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 CNC quantitative fit testing (PortacountTM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for QNFTs. 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 facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the Employee 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., National Institute for Occupational Safety and Health, Title 42 Code of Federal Regulations 84 series 100, series 99, or series 95 particulate filter) according to the manufacturer's instructions.

- Instruct the Employee to be tested to don the respirator for 5 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 Employee 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 Employee shall be instructed to perform the exercises in General Test Exercises.
- After the test exercises, the Employee 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 Employee 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 shall contain the Employee's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

Americas

User Seal Check

S3AM-123-ATT2

1.0 Requirements

1.1 The Employee 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.

1.4 If either the positive or negative pressure checks fail, do not use the respirator and mark it as out of service.

2.0 Facepiece Positive and/or Negative Pressure Checks

2.1 **Positive pressure check**

- Close off the exhalation valve and exhale gently into the facepiece.
- If a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal, the face fit is considered satisfactory
- For some 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**

- 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.
- The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. If this is the case, the test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove.
- 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.

Americas

Respirator Cleaning

S3AM-123-ATT3

1.0 Requirements

1.1 These procedures are general in nature. The cleaning recommendations provided by the manufacturer for a respirator may be used, 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 (e.g., 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 (110 degree Fahrenheit [°F]; 43 degree Celsius [°C] 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 (110°F [43°C] maximum), preferably running water. Drain.

2.4 When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for 2 minutes in one of the following:

- Hypochlorite solution (50 parts per million [ppm] of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 110°F (43°C); 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 percent alcohol) to one liter of water at 110°F (43°C); 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 (110°F [43°C] 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.

2.10 Store the respirator according to manufacturer recommendations (e.g., away from direct sunlight, in a proper container to maintain cleanliness, etc.).

Americas

Respiratory Equipment Fit Test

S3AM-123-FM1

Date of Testing:	**Respirator Type(s):**
Employee Name:	**Respirator Model & Size:**
Method & Testing Agent:	
Corrective lenses needed: ☐ **Yes** ☐ **No**	
Is the employee medically qualified to wear a respirator? ☐ **Yes** ☐ **No**	**Date of last medical exam** (if applicable)**:**
Is the employee trained on the fundamental principles of respiratory protection, use, selection, inspection, cleaning, maintenance, and storage of equipment? ☐ **Yes** ☐ **No**	

Test Exercise		**Test Exercise**	
Sensitivity Check	☐ **Pass** ☐ **Fail**	Normal Breathing	☐ **Pass** ☐ **Fail**
Deep Breathing	☐ **Pass** ☐ **Fail**	Turning Head (side to side)	☐ **Pass** ☐ **Fail**
Moving Head (up/down)	☐ **Pass** ☐ **Fail**	Rainbow Passage*	☐ **Pass** ☐ **Fail**
Bending Over	☐ **Pass** ☐ **Fail**	Normal Breathing	☐ **Pass** ☐ **Fail**

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."*

Americas

Voluntary Use of Respirators

S3AM-123-FM2

Instructions: An employee that is opting to use a respirator for non-overexposure conditions shall read this page, and then sign on the bottom of the page. A copy shall be maintained in the employee's training file.

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for employees. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the employee.

Sometimes employees may wear respirators to avoid exposures to hazards, even if the amount of the hazardous substance does not exceed the limits set by regulatory standards. Voluntary masks may be used for nuisance dust, pollen, and sometimes noxious odors. If your employer provides respirators for your own voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not pose a hazard.

1. Read and follow all instructions provided by the manufacture on use, maintenance, cleaning, and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. A label or statement of certification should appear on the respirator or respirator packaging; it will tell you what the respirator is designed for and how it will protect you. “The National Institute for Occupational Safety and Health (NIOSH) certifies respirators in the U.S and Canada.”
3. Do not wear your respirator into atmospheres containing contaminants against which your respirator is not designed to protect. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, fumes, smoke, or very small solid particles.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.
5. If you have any health conditions (e.g., asthma; high blood pressure; emphysema; heart disease, etc.) that could be aggravated by using a respirator, you should check with your doctor before using one.

I have read and understand this information: Date: _____

____

Employee’s Name (Please Print):

____

Employee’s Signature:

Americas

Respiratory Equipment Inspection

S3AM-123-FM3

Date:		**Inspected by:**
Serial #:		

Examine Face Piece for:	N/A	Pass	Fail
Excessive dirt	☐	☐	☐
Cracks, tears, holes, or distortion from improper storage	☐	☐	☐
Inflexibility (stretch and massage to restore flexibility)	☐	☐	☐
Cracked or badly scratched lenses in full facepieces	☐	☐	☐
Incorrectly mounted full facepiece lens or broken or missing mounting clips	☐	☐	☐
Lens sealed properly in receptacle, retaining clamp secured	☐	☐	☐
Cracked / broken air-purifying element holder(s), badly worn threads, missing gasket(s)	☐	☐	☐
Examine the Head Straps or Head Harness for:			
Breaks	☐	☐	☐
Loss of elasticity	☐	☐	☐
Broken or malfunctioning buckles and attachments	☐	☐	☐
Excessively worn serrations on head harness that might permit slippage (full facepieces 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	☐	☐	☐
Proper insertion of the valve body in the facepiece	☐	☐	☐
Cracks, breaks, or chips in the valve body, particularly in the sealing surface	☐	☐	☐
Proper installation of the valve in the valve body	☐	☐	☐
Missing or defective valve cover	☐	☐	☐
Examine the Air Purifying Elements for:			
Incorrect cartridge, canister, or filter for the hazard	☐	☐	☐
Incorrect installation, loose connection, missing / worn gaskets, cross-threading in the holder	☐	☐	☐
Cracks or dents on the outside case of the filter, cartridges or canister, indicated by the absence of sealing material, tape, foil, etc. over the inlet	☐	☐	☐
Expired shelf life date on cartridge or canister	☐	☐	☐
Examine PAPR, SCBA and Escape Bottles for:			
Damage or wear evident on the regulator or hoses			
Cylinder pitted, dented or otherwise damaged			
Cylinder / tank certified to the standard of applicable jurisdiction, hydrostatic test current			
Defects Noted:			
Unit Deemed Suitable for Use	☐ Yes	☐ No	

Attachment F

Sanitation Plan

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

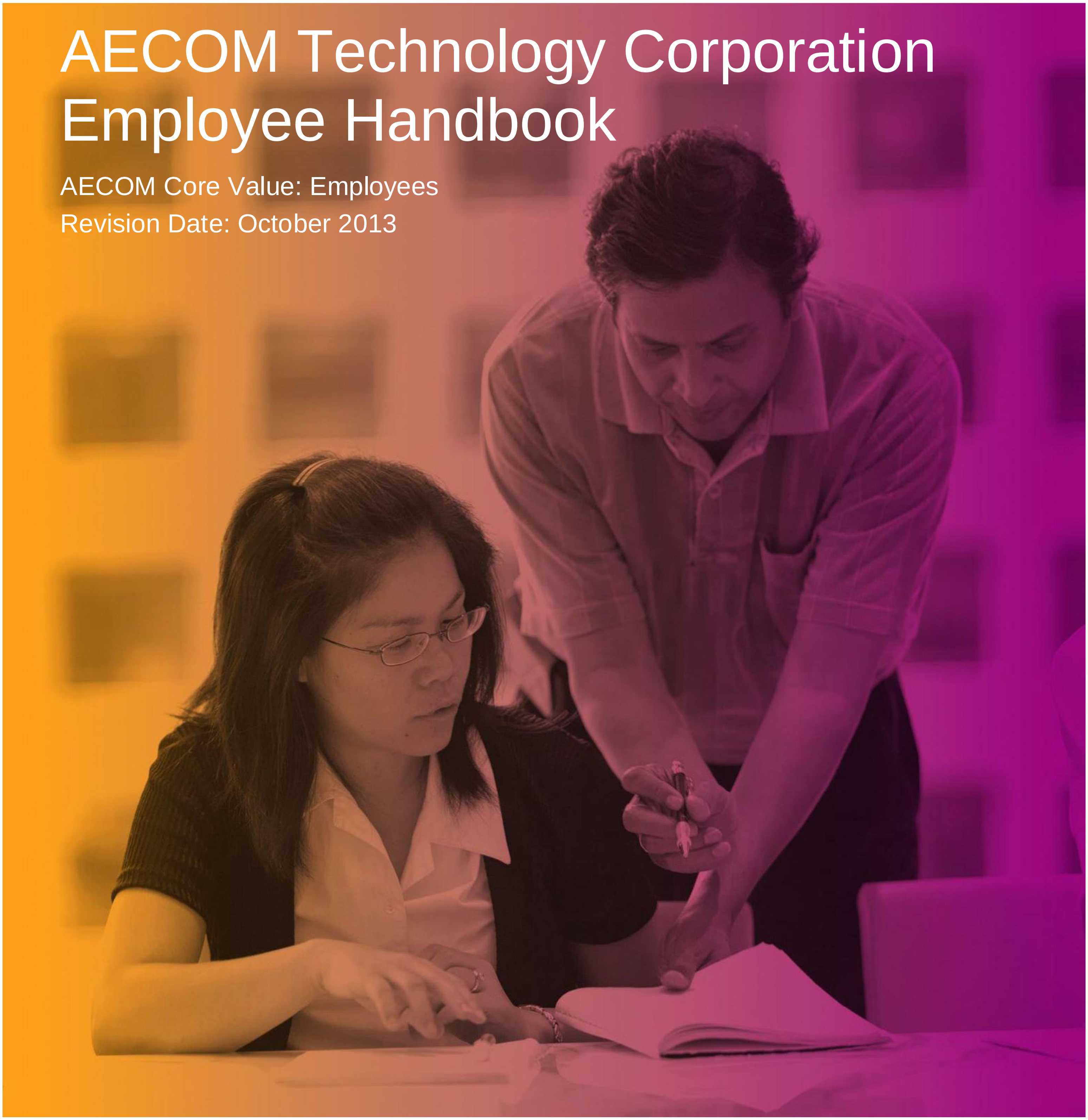
Alcohol and Drug Abuse Policy

AECOM

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.

Return to Contents

Americas

Substance Abuse Policy Statement

S3AM-019-ATT1

POST ON EMPLOYEE BULLETIN BOARD

A. PURPOSE

AECOM is committed to the establishment and maintenance of a safe and efficient work environment for all employees free from the effects of alcohol, illegal drugs, other controlled substances and prohibited items such as drug paraphernalia. This policy and procedure applies to all Americas - based employees and operations and is consistent with the Drug-Free Workplace Act of 1988 and in accordance with federal, state / provincial / territorial, and local laws and regulations.

B. POLICY

1. This policy prohibits the use, possession, presence in the body, manufacture, concealment, transportation, promotion or sale of the following items or substances on company premises.

   Company premises refer to all property, offices, facilities, land, buildings, structures, fixtures, installations, aircraft, automobiles, vessels, trucks and all other vehicles and equipment - whether owned, leased or used.

   - Illegal drugs (or their metabolites), designer and synthetic drugs, mood or mind altering substances, and drug use related paraphernalia unless authorized for administering currently prescribed medication;
   - Controlled substances that are not used in accordance with physician instructions or non-prescribed controlled substances;
   - Alcoholic beverages while at work or while on any customer- or AECOM-controlled property. This prohibition on alcohol applies whenever an employee is on-duty, including during meal or break periods, while on Company premises, or while representing AECOM. AECOM may make exceptions and permit the consumption of alcohol beverages at work-related events, such as Company-sponsored or approved business meals, conferences, or holiday events. Employees who choose to consume alcohol on approved occasions are expected to exercise good judgment and to refrain from becoming intoxicated or impaired. If an employee has consumed alcohol and needs transportation home, the Company will reimburse the cost of a taxicab or other reasonable costs of transportation so that the employee may avoid driving.
2. Employees who violate this policy or the established Substance Abuse Prevention program will be subject to disciplinary action up to and including termination.
3. AECOM reserves the right to establish drug and/or alcohol search and screening procedures consistent with applicable local, state, and national laws.
4. The Substance Abuse Program Manager shall be responsible for the development, implementation and administration of the substance abuse prevention program. Employees will comply with testing as directed by this policy.
5. Substance abuse awareness and control is a responsibility of all employees. Managers and supervisors are to be properly trained in abuse recognition and have authority and responsibility to deal with impaired personnel.
6. Projects will participate in and fully comply with any client-imposed substance abuse prevention program when such programs are a contractual condition.
7. Project and site labor agreements may include specific requirements for testing and reporting of results which will apply to affiliated employees.

Attachment H

Cold Stress Prevention Plan and Heat Stress Prevention Plan

Americas

Cold Stress

S3AM-112-PR1

1.0 Purpose and Scope

1.1 To protect employees from the severest effects of cold stress (hypothermia) and cold injury and to identify exposures to cold working conditions under which it is believed nearly all employees can be repeatedly exposed without adverse health effects.

1.2 This procedure applies to all AECOM Americas based employees and operations working outdoors in damp and cool (below 50 degrees Fahrenheit [°F] or 10 degrees Celsius [°C]) conditions or anytime temperatures are below 32°F or 0°C.

2.0 Terms and Definitions

2.1 **Cold Stress** – The production of physiological effects due to cold temperatures and\or wind chill.

2.2 **Equivalent Chill Temperature (ECT)** – Also known as Wind Chill (see below).

2.3 **Frostnip** – Superficial cooling of tissues without cellular destruction.

2.4 **Frostbite –** Freezing of tissue, resulting in tissue destruction.

2.5 **Hypothermia –** Condition of reduced core body temperature to 95^{o}F (35^{o}C) resulting in loss of dexterity, loss of mental alertness, collapse, and possible death.

2.6 **Wind Chill –** The combined effect of air temperature and wind. Also expressed as "equivalent chill temperature" (ECT), wind chill is defined as heat loss resulting from the effects of air temperature and wind velocity upon exposed skin.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-128-PR1 Medical Screening & Surveillance Program

3.3 S3AM-208-PR1 Personal Protective Equipment

3.4 S3AM-314-PR1 Working Alone

3.5 S3AM-315-PR1 Working On or Near Water

3.6 S3AM-333-PR1 Marine Safety & Vessel Operations

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager**

- Ensuring the safety of employees on their project sites, consistent with regulatory standards.
- Implement cold stress prevention measures as applicable at each work site.
- Develop/coordinate a work-warning regimen, as applicable.
- Confirm cold stress hazard assessments/evaluations were completed for the planned activities.
- Assign employees physically capable of performing the assigned tasks. Consider acclimation to cold weather when evaluating employee capability.
- Confirm employees are properly trained to recognize the symptoms of cold stress.

4.1.2 **Safety, Health and Environment (SH&E) Manager**

- Conduct/support cold stress assessments/evaluations.
- Conduct/support incident investigations related to potential cold stress-related illnesses.
- Assist project teams develop appropriate work-warming regimens.
- Provide cold stress awareness training.

4.1.3 **Supervisor**

- Identify the tasks that may be most impacted by cold stress and communicate the hazard to the assigned employees.
- Confirm that employees have been trained on the recognition of cold stress-related illnesses.
- Confirm that adequate supplies of warm fluids/drinks are readily available to employees.
- Confirm that a warm/sheltered rest area is available, as applicable.
- Conduct cold stress monitoring, as applicable.
- Implement the work-warming regimen.
- Confirm that first aid measures are implemented once cold stress symptoms are identified.
- Confirm that employees are physically capable of performing the assigned tasks and are not in a physically compromised condition.

4.1.4 **Employee**

- Observe each other for the early symptoms of cold stress-related illnesses.
- Maintain an adequate intake of available fluids.
- Report to work in a properly rested condition.
- Report all suspected cold stress-related illnesses.

4.2 Requirements

4.2.1 Carefully plan work anticipated to be performed in cool or cold conditions. If possible, heavy work should be scheduled during the warmer parts of the day or when the wind is most calm. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.

4.2.2 Staff working in extreme cold (wind chill or ECT below 10^{o}F or -12^{o}C) shall not work alone. The Buddy System shall be utilized to keep an eye on each other and to watch for signs of cold stress. Refer to *S3AM-314-PR1 Working Alone*. Watch for symptoms and signs of hypothermia

4.2.3 Monitor weather forecasts and weather conditions such as ambient temperature, wind speed, and precipitation. Use observations prior to entering and while in the field to ensure appropriate protections are in place:

- If possible, move the work to a warm location.
- If possible and as applicable, erect shelters or screens around the work area.
- If possible, heat the work area.
- If possible, adjust schedule according to the cold conditions, work level and worker acclimatization.
- Implement a work-warming regimen by taking breaks out of the cold. As applicable, consult *S3AM-112 ATT1 Temperature Thresholds* to determine wind chill and work-warming schedule.
- Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure to the cold. If shelter is not readily available, consider supplying temporary shelters.

- Provide assistance to prevent body heat loss, such as:
  - Providing appropriate sources of heat (e.g. warm packs, portable heaters, etc.).
  - Use of insulating materials on equipment handles when temperatures drop below 30°F (-1°C).

4.2.4 All staff working in extreme cold or snow conditions should understand the following guidelines for preventing and detecting hypothermia and frostbite; refer to *S3AM-112-ATT2 Symptoms & Treatment*:

- Ensure appropriate PPE requirements are established and adhered to.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Because prolonged exposure to cold air or to immersion in cold water at temperatures even well above freezing can lead to dangerous hypothermia, whole-body protection shall be used.
- Eat high calorie snacks to help maintain body metabolism.
- Confirm extra blankets or sleeping bags are on-site.
- Drink plenty of warm liquids. It is easy to become dehydrated in cold weather.
- Avoid caffeine and alcohol, which can act as diuretics. Alcohol consumption, depending upon quantity, can dilate blood vessels enhancing body heat loss or constrict blood vessels decreasing heat delivery to extremities.
- NEVER IGNORE SHIVERING. Persistent or violent shivering is a clear warning that you are on the verge of hypothermia.
- If you experience frost bite or hypothermia, find shelter and warmth and contact a medical practitioner if symptoms persist, refer to *S3AM-128-PR1 Medical Screening & Surveillance*.

4.3 Training

Before they begin work in a cold environment, employees that might be exposed to cold stress will be informed of the potential for cold stress and how to prevent cold stress. Employees that have not had the training within the twelve prior months shall repeat the training before exposure to cold stress, refer to *S3AM-003-PR1 SH&E Training*. Employees potentially exposed to cold stress will receive training including, but not limited to:

4.3.1 Sources of cold stress, the influence of protective clothing, and the importance of acclimatization.

4.3.2 How the body loses heat.

4.3.3 Recognition of cold-related illness symptoms.

4.3.4 Cold stress preventative/corrective measures including, but not limited to:

- Weather monitoring.
- Proper eating and drinking practices.
- Work-warming schedules and proper re-warming techniques.
- Buddy system.
- Safe cold work practices appropriate to the work that is to be performed.
- Proper use of cold environment personal protective clothing.

4.3.5 The harmful effects of excessive alcohol consumption in a cold stress environment.

4.3.6 The hazards associated with unstable snow or ice build ups.

4.3.7 First aid procedures for symptoms related to cold stress.

4.4 Personal Protective Equipment (PPE)

Wearing the right clothing is crucial to avoiding cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. Adequate insulating dry clothing will be required in air or wind chill temperatures below 40 °F (4.4°C)

All PPE will comply with the requirements of *S3AM-208-PR1 Personal Protective Equipment* and consider the following requirements:

4.4.1 Wear at least 3 layers of clothing to help prevent cold stress. It is important to preserve the air space between the body and the outer layer of clothing to retain body heat.

- Wear a middle layer of down, wool, or similar materials to provide insulation.
- Avoid cotton, especially blue jeans.
- Wear an outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon)
- Do not wear tight clothing. Loose clothing allows better ventilation.

4.4.2 Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.

4.4.3 Wear a hat or hardhat liner. Up to 40 percent of body heat can be lost when the head is left exposed.

4.4.4 Use insulated footwear with adequate traction to prevent slips and falls.

4.4.5 Wear insulated boots or other insulated footwear, and insulated gloves to help reduce the chance of frostbite.

4.4.6 Keep a change of dry clothing available in case work clothes become wet.

4.4.7 Eye and face protection for employees employed outdoors in a snow and/or ice-covered terrain should be supplied.

- Sunglasses (with UVA and UVB protection) and sunscreen should be used when there is a persistent combination of snow and direct sun.
- Special safety goggles to protect against blowing ice crystals and ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) should be required when there is an expanse of snow coverage causing a potential eye exposure hazard.
- Ensure face guards are used to protect skin in cold, windy conditions, including riding on an unshielded vehicle.

4.5 General Cold Stress Prevention Measures

4.5.1 In order to prevent hypothermia:

- Wear appropriate clothing and PPE as determined by the weather conditions.
- When active, ventilate excess heat by opening or removing outer layers of clothing to avoid sweating.
  - Start with the mitten or gloves, unless protection from ice, snow, or cold metal surfaces is needed.
  - Next remove head gear and neck wrappings.
  - Then coats/parkas should be opened at the waist and sleeves.
  - Finally, layers of clothing should be taken off.
  - When resting or tired, or colder conditions are encountered, add additional layers of clothing/ close outer layers in the reverse of the above order, or get out of the cold. Have a sweet drink but do not indulge in heavy eating.

- Garments worn to keep out rain and spray should also allow water vapor to escape.
- Take advantage of heat from the sun and stay out of the wind as much as possible.
- Have available emergency shelter providing protection from wind and rain and insulation from the ground.
- Replace wet clothing. If wet clothing cannot be replaced, then cover it with a layer of non-breathing material to prevent evaporation. Place an insulation layer over this non-breathing material.
- Get adequate rest; conserve energy.
- Get adequate nutrition to replenish energy stores; rest after meals.
- Drink adequate fluids to avoid dehydration.
- If any project / location staff member shows signs of hypothermia, stop and treat him/her.

4.5.2 In order to prevent frost bite:

- Dress to prevent hypothermia and protect the feet and hands.
- Avoid obstruction of circulation by, for example, tight boots or tightly fitting clothing.
- Avoid nicotine (particularly cigarettes) and do not consume alcohol.
- Keep ears and nose covered and out of the wind.
- Frostbite of the corneas of the eyes can be prevented by protective goggles.
- Adopt a “buddy system” of constantly watching the faces of others in the party for white skin tissue, which is evidence of frostbite (frostnip).
- Practice constant personal vigilance for signs of trouble in one’s own fingers and toes; when in doubt, investigate thoroughly before it is too late.

4.5.3 Adequate, insulating dry clothing that will help maintain core temperatures above 96.8°F (37°C) shall be provided to employees if work is performed in air temperatures below 40°F (4.4°C). Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

4.5.4 An Equivalent Chill Temperature (ECT) chart relating the actual dry bulb air temperature and the wind velocity is presented in *S3AM-112-ATT1 Temperature Thresholds*. Unless unusual or extenuating circumstances exist, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Superficial or deep local tissue freezing will occur only at temperatures below 32°F (0°C) regardless of wind speed. However, older employees, those with circulatory problems and those with previous cold injuries require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions that should be considered.

4.5.5 Continuous exposure of skin should not be permitted when the air speed and temperature results in an ECT of –25°F (-32°C) or below.

4.5.6 At air temperatures of 40°F (4.4°C) or less, it is imperative that employees who become immersed in water or whose clothing becomes wet be immediately removed from the cold environment, provided a change of clothing, and be treated for hypothermia.

4.5.7 If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

4.5.8 Adequate protection, such as general ventilation, shall be incorporated into any warming shelter design to prevent carbon monoxide poisoning.

4.5.9 Operation of internal combustion or similar devices within warming shelters is prohibited.

4.5.10 If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

4.5.11 Walking and working surfaces shall be cleared of ice and snow to prevent slips and falls.

4.5.12 Confirm that employees carry fire starter materials if working in remote areas.

4.5.13 Supplies such as PPE, fuels, enclosures, de-icing, traction aids, warm drinks, and batteries will be specified by the SH&E Manager and/or the Manager and made available. These supplies will be inspected at least weekly during cold weather projects and replaced when necessary.

4.6 Cold Stress Prevention Measures for the Hands

4.6.1 Special protection of the hands is required to maintain manual dexterity for the prevention of accidents including, but not limited to the following:

- If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 60^{o}F (15^{o}C), special provisions should be established for keeping the employees' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below 30^{o}F (-1^{o} C).
- If the air temperature falls below 60^{o}F (15^{o}C) for sedentary work, 40^{o}F (4.4^{o} C) for light work, or 20^{o}F (-6^{o}C) for moderate work, and fine manual dexterity is not required, employees should use gloves.

4.6.2 To prevent contact frostbite, employees should wear anti-contact gloves:

- When cold surfaces below 20°F (-6°C) are within reach, each employee should be warned to prevent inadvertent contact by bare skin.
- If the air temperature is 0°F (-18°C) or less, employees should protect their hands with mittens or appropriate gloves. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens or gloves.
- Ensure an adequate supply of dry gloves is available to replace wet gloves.

4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40^{o}F (4.4^{o}C). The employees should wear cold protective clothing appropriate for the level of cold and physical activity.

4.6.4 Additional Cold Stress Prevention Measures:

For work practices at or below 10^{o}F (-12^{o}C) ECT, the following will apply:

- The employee should be under constant protective observation (buddy system or supervision).
- The work rate should not be so high as to cause heavy sweating that will result in wet clothing. If heavy work is being performed, rest periods should be taken in heated shelters and opportunities to change into dry clothing should be provided.
- New employees should not be required to work full time in the cold during the first days of employment until they become acclimated to the working conditions and required protective clothing. Refer to *S3AM-112-ATT1 Temperature Thresholds* for guidance.
- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the employee.
- The work should be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats should not be used. The employee should be protected from drafts to the greatest extent possible.

4.6.5 Employees handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 40^{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.

4.6.6 Trauma sustained in freezing or subzero conditions requires special attention, because an injured employee is predisposed to cold injury. Special provisions should be made to prevent hypothermia and freezing of damaged tissue in addition to providing for first aid treatment.

4.7 Hypothermia in Water

4.7.1 Loss of body heat heat to the water is a major cause of deaths in boating and working near water incidents. Often the cause of death is listed as drowning; however, the primary cause is often hypothermia. It should also be noted that alcohol lowers the body temperature around 2 to 3 degrees by dilating the blood vessels. Do not drink alcohol around cold water. The following table shows the effects of hypothermia in water:

WATER TEMPERATURE		EXHAUSTION	SURVIVAL TIME
32.5°F	(0°C)	Under 15 minutes	Under 15 to 45 minutes
32.5 to 40°F	(0 to 4°C)	15 to 30 minutes	30 to 90 minutes
40 to 50°F	(4 to 10°C)	30 to 60 minutes	1 to 3 hours
50 to 60°F	(10 to 16°C)	1 to 2 hours	1 to 6 hours
60 to 70°F	(16 to 21°C)	2 to 7 hours	2 to 40 hours
70 to 80°F	(21 to 27°C)	3 to 12 hours	3 hours to indefinite
Over 80°F	(27°C)	Indefinite	Indefinite

4.7.2 Some points to remember when water is a potential hazard:

- Wear a personal flotation device when drowning is a potential hazard. Refer to *S3AM-315-PR1 Working On or Near Water*, and *S3AM-333-PR1 Marine Safety & Vessel Operations*.
- If the water is less than 50°F (10°C), wear a wet suit or dry suit for work in water (e.g., wading, or if a significant potential to fall in water exists).
- While in the water, do not attempt to swim unless to reach nearby safety. Unnecessary swimming increases the rate of body heat loss. Keep the head out of the water. This will increase survival time.
- Keep a positive attitude about rescue. This will increase chances of survival.
- If there is more than one person in the water, huddling is recommended to conserve body heat.

4.7.3 If an employee or equipment is to work on ice and the water beneath the ice is or may be more than 3¼ feet (1m) deep at any point:

- Test the ice prior to commencing to ensure it will support the load to be placed on it. Ongoing testing may be necessary.
- If there is any risk of falling through the ice employees must wear personal protective equipment that will ensure buoyancy and protect against hypothermia at all times while on the ice.

4.8 Work-Warming Regimen

4.8.1 If work is performed continuously in the cold at an equivalent chill temperature (ECT) at or below 19^{o}F (–7^{o}C), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The employees should be encouraged to use these shelters at regular intervals; the frequency will depend on the severity of the environmental exposure. Refer to *S3AM-112-ATT1 Temperature Thresholds* for guidance.

4.8.2 The onset of heavy shivering, minor frostbite (frostnip), the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter.

4.8.3 When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation or a change of dry work clothing provided.

4.8.4 A change of dry work clothing should be provided as necessary to prevent employees from returning to the cold environment with wet clothing.

5.0 Records

5.1 Exposure assessments will be documented in the location's files.

6.0 Attachments

6.1 S3AM-112-ATT1 Temperature Thresholds

6.2 S3AM-112-ATT2 Symptoms & Treatment

Heat Stress

1.0 Purpose and Scope

1.1 Establishes a Heat Illness Prevention Program to guide employees in preventing heat illness, recognition of the symptoms of heat stress-related illnesses and in taking the appropriate corrective action.

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

2.0 Terms and Definitions

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

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

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

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

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

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

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

2.8 **Sunburn** – Caused by unprotected exposure to ultraviolet radiation present in sunlight that is damaging to the skin (Refer to *S3AM-121-PR1 Non-Ionizing Radiation*). The injury is characterized by red painful skin, blisters, and/or peeling.

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

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3AM-010-PR1 Emergency Response Planning

3.4 S3AM-121-PR1 Non-Ionizing Radiation

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 Managers

- Evaluate the need for heat illness prevention measures and incorporate as appropriate into the Safe Work Plan or Task Hazard Analysis.
- Allocate sufficient resources for the management of heat illness in the field including the provision of water, a shaded break area, and sufficient schedule to allow for breaks.

4.1.2 Safety, Health and Environment (SH&E) Manager

- Provide heat illness awareness training.
- Assist in developing appropriate work-rest schedules.
- Conduct/support incident investigations related to potential heat stress-related illnesses.

4.1.3 Supervisor

- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned Employees.
- Confirm that Employees have been trained on the recognition of heat illness.
- Confirm that this procedure, along with any applicable Safe Work Plan and/or Task Hazard Analysis (and heat exposure control plan that may be contained therein) are made available to affected Employees.
- Confirm that adequate supplies of appropriate fluids are readily available to Employees.
- Confirm that a proper rest area is available.
- Conduct heat illness monitoring, as applicable.
- Implement the work-rest schedule.
- Confirm that first aid measures are implemented once heat stress symptoms are identified.
- Confirm personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
- Report all suspected heat illnesses.

4.1.4 Employee

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

4.2 Restrictions

4.2.1 The Buddy System is required when working in high heat conditions; Employees shall not work alone.

4.2.2 Employees shall not be exposed to levels exceeding those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Temperature Thresholds*.

4.2.3 Clothing corrections shall be applied in accordance with the tables provided in *S3AM-113-ATT1 Temperature Thresholds*.

4.3 Exposure Controls

4.3.1 It shall be determined whether Employees are or may be exposed to hazardous heat levels. The Supervisor shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of Employees. Assessment shall include, but not limited to:
  - Ambient temperature.
  - Amount of sunshine (cloudy, clear). Refer to *S3AM-121-PR1 Non-Ionizing Radiation* additional direction concerning ultraviolet radiation exposures.
  - Other radiant heat sources (e.g. motor, fire, etc.).
  - Humidity.
  - Air flow.
  - Amount or type of physical labor being performed,
  - Physical condition of the Employees (e.g., acclimated/not)
  - Protective clothing in use.
  - Referral to *S3AM-113-ATT1 Temperature Thresholds* to assist in determining whether hazardous heat exposures may exist.
- If potential for hazardous exposure is identified, the Supervisor shall develop and implement a heat stress exposure control plan within the Safe Work Plan and/or Task Hazard Analysis. Refer to *S3AM-209-PR1 Risk Assessment & Management.*

4.3.2 If Employees are or may be exposed, the Supervisor shall implement engineering controls (e.g., shelters, cooling devises, etc.) to reduce the exposure of Employees to levels below those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Temperature Thresholds*.

4.3.3 If engineering controls are not practicable, the Supervisor shall reduce the exposure of Employees to levels below those listed in *S3AM-113-ATT1 Temperature Thresholds* by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

4.3.4 If Employees are or may be exposed, the Supervisor shall provide and maintain an adequate supply of cool, fresh, potable water close to the work area for the use of a heat exposed Employee. Water shall be provided (paid) by the project or program; if Employees purchase their own drinking water because water is not otherwise available on site, they shall be reimbursed.

4.3.5 If an Employee shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant on site, if available, or by a physician, refer to *S3AM-113-ATT2 Symptoms & Treatment* for more specifics.

4.4 Heat Stress Planning

4.4.1 Heat stress can be a significant site hazard, especially for Employees wearing CPC. To prepare for emergency response planning, refer to *S3AM-010-PR1 Emergency Response Planning* procedure.

4.4.2 The project and site specific risks need to be planned using the SH&E Plan and the Task Hazard Assessments (THA). Refer to the *S3AM-209-PR1 Risk Assessment & Management* procedure.

4.4.3 The heat a worker is exposed to may be a combination of air temperature, radiant heat, and humidity. The WBGT (wet-bulb globe thermometer) is a useful index of the environmental contribution to heat stress. Because WBGT is only an index of the environment, the contributions of work demands, clothing, and state of acclimatization shall also be accounted for, as described in the following steps.

- Monitor ambient temperatures and conduct heat stress monitoring in accordance with the location specific SH&E Plan. Revise the heat stress monitoring and controls if there are any reports of discomfort due to heat stress.
- Monitor temperatures in each unique environment in which workers perform work (e.g., take WBGT measurements inside truck cabs for truck drivers, and take separate WBGT measurements in the outdoor area where field employees work, etc.). Follow manufacturer's instructions on proper use of the WBGT.
- Determine if individual workers are acclimatized or un-acclimatized. Full heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, or when there is a sustained increase in temperatures of 10 °F (5.6 °C) or more, and a noticeable loss occurs after 4 days. A worker can be considered acclimatized for the purpose of this procedure when they have been exposed to the site conditions (including level of activity) for 5 of the last 7 days.
- Determine the approximate workload of each worker or group of workers. The following examples (Table 1) can be used for comparison:

Table 1
Examples of Activities within Workload Categories

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on level at 3.5 miles/hr (6 km/hr) while carrying 6.6 lbs (3kg) weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

- Determine the approximate proportion of work within an hour during a typical shift. Typically, the initial work schedule will be 60 minutes of work per hour (100 percent work) with a small break in the morning and afternoon, as appropriate, and a 30-minute lunch break mid-day.
- For workers wearing cloth coveralls (e.g., Nomex fire resistant clothing), add 3 to the measured WBGT. For impermeable clothing, such as Tyvek or Saranex, the WBGT procedures cannot be used. For these situations, workers should begin physiological monitoring as soon as the temperature in the work area exceeds 70ºF (21°C).
- Use the collected information to develop appropriate work to rest schedules as detailed in *S3AM-113-ATT1 Temperature Threshold*.

4.4.4 Given the work demands (light, moderate, heavy or very heavy), heat of the work environment, and such aspects as PPE in use, workload will be adjusted appropriately to allow for proper acclimation.

- This is the process by which the body "gets used to" hot work environments. This is achieved by slowly increasing workloads.
- New and returning Employees (absent one week or more) who have not had time to acclimatize may be more susceptible to heat related illnesses, even in seemingly low risk heat exposures.
- All Employees shall be allowed time to acclimatize in the event of a heat wave. All Employees assigned to a new process with additional heat exposures shall be allowed to acclimatize.
- Minimize workload and gradually increase as tolerance is built up. Allow for more frequent breaks.
- While acclimatization normally takes approximately 5 to 7 days, heightened monitoring of these Employees will be maintained for the first 14 days.

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

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

4.5 Symptoms and Treatment

4.5.1 Refer to *S3AM-113-ATT2 Symptoms & Treatment*.

4.5.2 Employees who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin) shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.

4.5.3 Anyone exhibiting symptoms of heat stroke (red dry skin, or unconsciousness) shall be taken immediately to the nearest medical facility. Steps shall be taken to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

4.5.4 Severe heat stress (heat stroke) is a life-threatening condition that shall be treated by a competent medical authority.

4.6 Prevention

4.6.1 Requirements for working in extreme heat may be triggered by a regulatory established criteria (e.g. CAL/OSHA requires high heat procedures when temperature equals or exceeds 95°F) or as a result of a hazard analysis assessing various contributory factors (refer to *S3AM-113-ATT1 Temperature Thresholds*). Employees working in extreme heat or sun should understand and apply the following guidelines for preventing and detecting heat exhaustion and heat stroke.

- When possible, begin hydrating at least three days prior to working in high heat conditions.
- Review the heat stress exposure control plan within the Safe Work Plan and/or Task Hazard Analysis.
- If the supervisor is not immediately available confirm a reliable method of communication is in place to allow for contact with supervision. In the absence of cellular reception a satellite phone or similar device may be required.

- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
- Try to schedule work for the coolest part of the day, early morning and evening.
- Avoid strenuous physical activity outdoors during the hottest part of the day.
- Avoid sudden changes of temperature. Refer *to S3AM-113-ATT1 Temperature Thresholds*.
- Air out a hot vehicle before getting into it.
- Obtain medical direction if taking diuretics during hot weather (a lower dose may be necessary).
- When working in heat, drink 1 quart of water per hour of work.
- Avoid caffeine and alcohol as they increase dehydration.
- Monitor urine frequency and color to detect dehydration. Refer to the *S3AM-113-ATT3 Dehydration Chart.*
- The Buddy System is required when working in high heat conditions to enable effective communication and cross-observation for indications of heat stress.
- Initiate emergency response procedures when necessary, including contacting emergency medical services as appropriate and in accordance with the Emergency Response Plan.

4.6.2 Personal Protective Equipment

- Review the *S3AM-208-PR1 Personal Protective Equipment* procedure.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
- Wear sunglasses with UV protection.
- Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

4.7 Work-Rest Schedule Practices

4.7.1 Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.

- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 ounces (1 quart) per hour during the work shift; fluid replacement at frequent intervals is most effective.
- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.

4.7.2 Additional salt is usually not needed and salt tablets should not be taken.

4.7.3 Replacement fluids should be cool and fresh, but not cold.

4.7.4 Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.

- A relatively cool, shaded area shall be provided for breaks when working in hot environments. For hazardous waste sites, the rest area should be located in the support zone adjacent to the contamination reduction zone, situated so that part of it is in the decontamination area so workers can take breaks without going through full decontamination.

- If shade is not available, shaded areas shall be constructed. This same type of canopy can be set up to shade personnel performing various types of work in hot weather.
- Cooling measures other than shade (e.g., misting, air conditioned break areas, air conditioned vehicles, etc.) can be used in lieu of shade provided it can be demonstrated that they are at least as effective in cooling employees.
- Employees should have access to these rest areas at break times and at any other time when suffering from heat illness or believing a preventive recovery period is needed.

4.7.5 Dry clothing or towels will be available to minimize chills when taking breaks.

4.7.6 Manual labor will not be performed during breaks, other than paperwork or similar light tasks.

4.7.7 Other controls that may be used include:

- Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
- Erecting a cover or partition to shade the work area.
- Auxiliary cooling - wearing cooling devices beneath protective garments, but over any underclothing.
  - If cooling devices are worn, only physiological monitoring will be used to determine work activity.
  - These vests typically provide cooling via one of two methods: the use of ice or other frozen media, or the use of a vortex cooler. Each method has its advantages and disadvantages.
  - The frozen media vest requires a means for freezing the media, and the media (usually water or "blue ice") will melt, requiring replacement.
  - The vortex cooler tends to cool more uniformly. Instead of frozen media, this vest uses the expansion of compressed air to cool the wearer. The drawback is the compressed air requirement, but this is negated when the wearer is already using an airline respirator supplied by a compressor. A vortex cooler should not be supplied from air cylinders, as this will draw down the cylinders rapidly.
- Auxiliary cooling should be considered when the following conditions exist:
  - Ambient temperature over 80°F (26°C).
  - Workers are wearing impermeable garments (i.e., Tyvek, Saranex, Chemrel, etc.).
  - It is desirable to have long work shifts with minimum interruption.

4.8 Evaluating the Work-Rest Schedule's Effectiveness

4.8.1 Once a work-rest schedule is established, the Supervisor shall continually evaluate its effectiveness through observation of Employees for signs/symptoms of heat stress. Have workers assess themselves and their body's reaction to the heat and work conditions (self-assessment), and report any signs or symptoms of heat illness. These can include nausea or dizziness, heat cramps, extreme thirst, or very dark urine.

4.8.2 Measurement or physiological monitoring of each Employee's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate. Refer to *S3AM-113-ATT1 Temperature Thresholds* for additional guidance on when physiological monitoring should be conducted.

4.8.3 Frequency of physiological monitoring is increased or decreased depending upon such factors as worker fitness, acclimatization, temperature of the work environment, type of PPE, etc.

Based on the results of the physiological monitoring and on the workers' self-assessments, the work period may be adjusted as follows:

- The work period may be increased (generally, by 5- to 10-minutes intervals, up to a maximum of 4 hours) if the results of the first 2 hours of the physiological monitoring and the workers' self-assessments indicate that workers are recovering adequately (see below), and on the judgment of the SH&E Manager.
- The work period shall be decreased if the results of the physiological monitoring and the workers' self-assessment indicate that workers are NOT recovering adequately (see below).

4.8.4 If physiological monitoring is conducted, the Employee and/or the SH&E Manager (or appropriate designate) shall measure and record body temperature and pulse rate as described below.

4.8.5 Monitor body temperature to determine if Employees are adequately dissipating heat build-up. Ear probe thermometers which are adjusted to oral temperature (aural temperature) are convenient and the preferred method of measurement. Determine work/rest regimen as follows:

- Measure oral body temperature at the end of the work period. Oral body temperatures are to be obtained prior to the employee drinking water or other fluids.
- If temperature exceeds 99.6°F (37.5°C), shorten the following work period by 1/3 without changing the rest period.
- If, at the next rest period, temperature still exceeds 99.6°F (37.5°C), the worker should not be allowed to continue work until repeated temperature measurements are in the acceptable range (i.e., less than 99.6°F). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.
- Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6°F (38.1°C).

4.8.6 At the start of the workday each Employee's baseline pulse rate (in beats per minute [bpm]) is determined by taking a pulse count for 15 seconds and multiplying the result by four or by using an automated pulse count device. Pulse rates can then be measured at the beginning of each break period and two minutes thereafter to determine if the rest period allows for adequate recovery.

- Take the radial (wrist) pulse as early as possible in the rest period and determine the worker's heart rate in beats per minute. The heart rate is determined by counting the pulse for ten seconds and multiplying the number by 6 to get the beats per minute. Record this as P1.
- Wait 2 minutes and repeat the pulse measurement. Record this as P2.
- If P1 is greater than or equal to 110 beats per minute (bpm) and if (P1 – P2) is less than or equal to 10 bpm (indicating that workers are not recovering adequately), shorten the next work cycle by 1/3 without changing the rest period.
- At the next rest period, if P1 is still equal to or greater than 110 bpm, and if (P1 – P2) is still less than or equal to 10 bpm, shorten the following work cycle by 1/3 without changing the rest period.
- At the third rest period, if P1 is still equal to or greater than 110 bpm and (P1 – P2) is still less than or equal to 10 bpm, the worker should not be allowed to continue work until repeated pulse measurements are in the acceptable range (i.e., P1 is less than 110 bpm and (P1 – P2) is greater than 10 bpm). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.

4.8.7 Use of an automated or similar blood pressure device will be used to assess each Employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an Employee is outside of 90/60 to 150/90, then the Employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be re-measured and the end-of-break criteria again applied.

4.8.8 All physiological monitoring of heat stress will be documented using *S3AM-113-FM1 Heat Stress Monitoring Log.*

4.9 Training

4.9.1 Employees and their Supervisors that may be exposed to the hazard will be trained and oriented to the hazard and the controls prior to work commencing.

4.9.2 Those Employees, including Supervisors, potentially exposed to heat stress will receive training, refer to the *S3AM-003-PR1 SH&E Training* procedure. Training will include, but is not limited to:

- Sources of heat stress (environmental and personal), influence of protective clothing, and importance of acclimatization;
- How the body handles heat and acclimatization;
- Recognition of heat-related illness symptoms;
- Preventative/corrective measures including, but not limited to;
  - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
  - All Employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses; and
- Immediate reporting of any heat-related incident (injury, illness, near-miss), refer to the *S3AM-004-PR1 Incident Reporting, Notifications & Investigation* procedure.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3AM-113-ATT1 Temperature Thresholds

6.2 S3AM-113-ATT2 Symptoms & Treatment

6.3 S3AM-113-ATT3 Dehydration Chart

6.4 S3AM-113-FM1 Heat Stress Monitoring Log

Attachment I

Site Safety and Health Plan

SITE SAFETY AND HEALTH PLAN DRAFT

Phase 2 Regional Site Inspections for Per-fluorinated Compounds at Multiple Air National Guard Installations

Gabreski Air National Guard Base

West Hampton, New York

Contract Number: W9133L-14-D-0001
Task Order Number: 0007

Prepared for:

Air National Guard
Joint Base Andrews, Maryland

Prepared by:

AECOM
3101 Wilson Boulevard, Suite 900
Alexandria, VA 22201

Project No: 60520893

This page intentionally left blank.

Table of Contents

List of Attachments

List of Figures

List of Tables

List of Acronyms and Abbreviations

AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COC	Contaminant of Concern
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
EC	Emergency Coordinator
EEE	Eastern Equine Encephalitis
EZ	Exclusion Zone
GPS	Global Positioning System
IDW	Investigation-Derived Waste
MSDS	Material Safety Data Sheets
NEC	National Electric Code
NGB	National Guard Bureau
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PFC	Per-fluorinated Compound
PM	Project Manager
POV	Privately Owned Vehicle
PPE	Personal Protective Equipment
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
U.S.	United States
USEPA	United States Environmental Protection Agency
VOC(s)	Volatile Organic Compound(s)
µg/L	micrograms per liter

1 Introduction

AECOM is collecting data to support Per-fluorinated compounds (PFCs) Site Investigation (SI) reports at multiple Air National Guard Installations. The Installations included in this task order include:

Selfridge ANGB, MI	Moffett Field, CA
Phoenix Sky Harbor, AZ	Channel Islands, CA
Fresno Yosemite IAP, CA	Tucson IAP, AZ
Duluth IAP, MN	Jacksonville IAP, FL
Atlantic City IAP, NJ	Savannah Hilton Head IAP, GA
Francis Gabreski Airport, NY	Fort Wayne IAP, IN
Syracuse Hancock IAP, NY	Terre Haute IAP – Hulam Field, IN
Schenectady County Airport, NY	Louisville IAP – Standiford Field, KY
Montgomery Regional Airport, AL	WK Kellogg Airport, MI
Fort Smith Regional Airport, AR	

PFC 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:

- National Guard Bureau (NGB) Scope of Work;
- Air National Guard Investigation Guidance, 2009;
- PFC SI 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 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 AECOM Americas Standard Operating Procedures. In the event of a conflict between this SSHP, AECOM 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; 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 NGB before such modifications are implemented in the field.

2 Site Description and Contamination Characterization

AECOM will conduct environmental services at multiple ANG facilities under the PFC SI contract. 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 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 SI. The SI activities consist of the following:

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 S3NA-331-PR, *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. All activities will be completed in accordance with S3NA-321-PR. 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. When dealing with hazardous wastes, review S3NA-116-NA *Hazardous materials Shipping*, and S3NA-117-PR, *Hazardous Waste Operations.*

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, 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, PFCs	✓	
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 S3NA-013-PR, *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.
- Additional safety information is available in S3NA-302-PR, *Electrical Safety*.

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 S3NA-325-PR, *Lockout Tagout*, 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.
- All recommendations regarding hand safety are available in S3NA-317-PR, *Hand Safety*.

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.
- All applicable safety recommendations are detailed in S3NA-305-PR, *Hand & Tool Safety*.

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 as a summary of S3NA-005-PR, *Driving*, 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.
- Global Positioning System (GPS) 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. Review S3NA-309-PR, *Heavy Equipment*, for all requirements regarding heavy equipment use.

The company will keep records of tests and inspections. These records shall be made available in a timely manner upon request by NGB 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 S3NA-014-PR, *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 S3NA-321-PR*, 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 S3NA-306-PR, *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 (S3NA-118-PR *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. Procedures for managing biological hazards are summarized in S3NA-313-PR, *Wildlife, Plants & Insects*.

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 Centers for Disease Control (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.

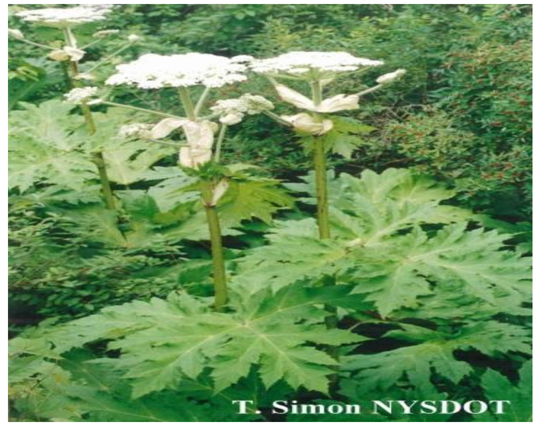
Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to the Site Supervisor or PM who will then forward the report to the Regional SH&E Manager.

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. Detailed procedures for the use of PPE are described in S3NA-208-PR, *Personal Protective Equipment*.

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.

<u>Inhalation</u> – 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.

<u>Skin Contact</u> – A contact hazard exists during well installation activities. Employees will don the prescribed PPE to avoid contact with impacted soils.

<u>Ingestion</u> – 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 <u>50 ppm</u> 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.

<u>Inhalation</u> – 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.

<u>Skin Contact</u> – 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.

<u>Ingestion</u> – 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.

This page intentionally left blank.

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:

- S3NA-003-PR, *SH&E Training*;
- S3NA-115-PR, *Hazardous Materials Communication*;
- S3NA-006-PR, *Project Safety Moments*; and
- S3NA-117-PR, *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:

- S3NA-115, *Hazardous Materials Communication*;
- S3NA-006-PR, *Project Safety Moments*; and
- S3NA-117-PR, *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 S3NA-121-PR, *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 S3NA-117-PR, *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 S3NA-202-PR *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. S3NA-208-PR, *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.

This page intentionally left blank.

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, Metals, and PFCs

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.

This page intentionally left blank.

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 S3NA-113-PR, *Heat Stress* or S3NA-112-PR, *Cold Stress*.

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties as specified in the APP.

Heat Stress monitoring and work-rest regiments will be implemented using the Adjusted Temperature Method outlined in S3NA-113-PR, *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.

This page intentionally left blank.

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 S3NA-013-PR *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 S3NA-314-PR, *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.

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 S3NA-002-PR, *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.

This page intentionally left blank.

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

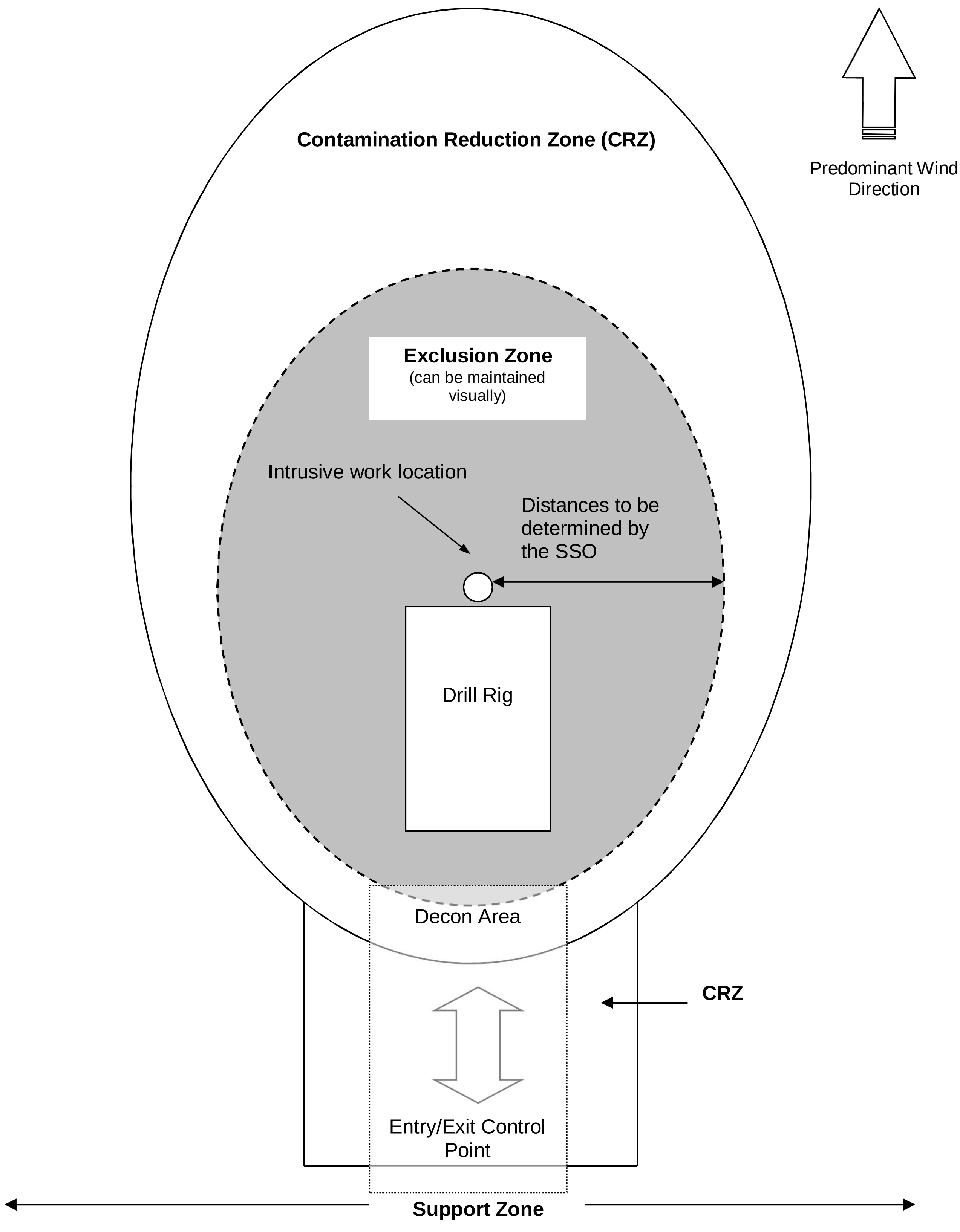
The EZ is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements 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.

This page intentionally left blank.

Figure 11-1
Example Drilling Site Control Layout



This page intentionally left blank.

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**
Mike Myers	Project Manager	(301) 820-3246	(202) 746-8283
TBD	SSHO	TBD	TBD
John Santacroce	Site Supervisor	(518) 951-2265	(518) 542-6333
Alberto Munuera	Regional SH&E Manager	(301) 820-3000	(757) 408-4276
Incident Reporting	Incident Reporting Line	(800) 348-5046	N/A
TBD	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)	(631) 726-8200
Hospital Information Southampton Hospital 240 Meeting House Ln. Southampton, NY 11968	
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	811

Figure 14-1
Emergency Hospital Route/Detail Map

(To be inserted prior to field operations)

This page intentionally left blank.

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

This page intentionally left blank.

Attachment A

Activity Hazard Analysis

This page intentionally left blank.

Attachment B

Material Safety Data Sheets (To Be Updated Prior to Operations)

This page intentionally left blank.

Attachment C

Equipment Safety Cards (To Be Updated Prior to Operations)

This page intentionally left blank.

aecom.com