Final

Work Plan

Long-Term Monitoring, Monitoring Well Installation, and Monitoring Well Abandonment at Site SS005

AIR FORCE PLANT 59
JOHNSON CITY, NEW YORK

Contract Number FA8903-17-C-0037

Prepared for

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November 2017

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LIST OF ACRONYMS

AFCEC	Air Force Civil Engineer Center
AFP 59	Air Force Plant 59
bgs	Below ground surface
DoD	United States Department of Defense
FPM	FPM Remediations, Inc.
FSP	Field Sampling Plan
ft	Feet
IDW	Investigation Derived Waste
MS/MSD	Matrix Spike / Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental Conservation
QAPP	Quality Assurance Project Plan
QA\QC	Quality Assurance / Quality Control
QSM	Quality Systems Manual
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WBV	Well Bore Volume

1 INTRODUCTION

This work plan (WP) describes the procedures and techniques that will be used to conduct long-term monitoring (LTM) activities, well decommissioning, and well installation activities at Air Force Plant 59 (AFP 59), Site SS005 in Johnson City, New York. FPM has prepared this WP under contract with the United States Air Force Civil Engineer Center (AFCEC) as part of the requirements for Contract FA8903-17-C-0037. This WP is supplemented by a Field Sampling Plan (FSP) (FPM, 2017) and Quality Assurance Project Plan (QAPP) (AECOM, 2009b) included in **Appendix A,** and a Health and Safety Plan (HSP) (FPM, 2017a) included in **Appendix B**.

This Work Plan contains the proposed project scope of work, reporting requirements, and project schedule.

1.1 Project Activities

The following activities will be completed during the execution of this task order:

1. Install two (2) new monitoring wells to replace previously abandoned wells SW-4 and SW-7.

2. Abandon an unidentified monitoring well located south of wells SW12 and DW12.

3. Survey all 14 wells identified in the FSP and in **Table 1-1** below.

4. Complete annual groundwater monitoring for nine (9) groundwater monitoring wells. There are six (6) on-site monitoring wells (SW-3, DW-3, SW-7 replacement, SW-4 replacement, DW-9, and SW-9) and **3** off-site monitoring wells (URS-2S, URS-5S, and BM-121) included in the annual event.

5. Complete semi-annual monitoring for two (2) offsite monitoring wells (URS-2D and URS-3D).

6. Complete quarterly monitoring for three (3) sample locations located at the Johnson City Municipal Well system. The samples will be taken from spigots at two (2) water supply wells (JC-2 and JC-3) and a post treatment, finished water sample.

7. Prepare three quarterly data summary letter reports and one annual LTM Report.

Table 1-1: AFP- 59 Monitoring Wells and Sampling Frequency

Sampling Frequency			
Well	**Annually**	**Semi-Annually**	**Quarterly**
JC-2	X	X	X
JC-3	X	X	X
Post-Treatment	X	X	X
SW-9	X		
SW-3	X		
SW-4RE (Replacement)	X		
SW-7RE (Replacement)	X		
BM-121	X		
URS-2S	X		
URS-5S	X		
DW-3	X		
DW-9	X		
URS-2D	X	X	
URS-3D	X	X	

Note: Monitoring well SW-1 water levels will be gauged concurrent with monitoring activities.

2 FIELD ACTIVITIES AND REPORTING

The overall objective of the scope of work is to collect groundwater samples to evaluate concentrations of chemicals in groundwater, and to implement approved changes to the groundwater monitoring program based on previous sampling results. To accomplish this, the field activities will be coordinated so that monitoring well installation and abandonment are completed in advance of the annual groundwater monitoring event so the replacement monitoring wells SW-4RE and SW-7RE are installed and incorporated into sampling activities. Additional field activity details are provided below and method details are provided in the FSP (**Appendix A**). Sample locations are identified in **Figure 1**.

2.1 Well Abandonment

FPM will retain a drilling contractor to abandon an unnamed monitoring well located south of wells SW12 and DW1. The well is located near a flood control levy, therefore, the well abandonment will be completed in general conformance with the New York State Department of Environmental Conservation (NYSDEC) Policy *CP-43: Groundwater Monitoring Well Decommissioning Policy* (NYSDEC, 2009) using a modified grout-in-place method to limit potential impacts to the levy, as requested by the NYSDEC Division of Water Resources.

The modified well abandonment method will include perforating the bottom of the monitoring well casing, and using a tremie rod to place a cement-bentonite grout mixture in the well from the bottom up. The cement bentonite grout will extend to within approximately 1 foot from the ground surface, consistent with NYSDEC requests. All materials, and the protective bollards around the well, will be removed from the surface to approximately 1 foot below ground surface (bgs). Following decommissioning activities, the area surrounding the well will be restored with top soil and grass seed.

A detailed description of well abandonment procedures is described in the FSP (**Appendix A**).

2.2 Well Installation

FPM will install two (2) monitoring wells (SW-4RE and SW-7RE) to replace abandoned wells SW-4 and SW-7. The wells will be installed within approximately 5-feet of the previously abandoned wells **(Figure 1)**. The total depth of the wells will be approximately 30 feet (ft) below ground surface (bgs) consistent with the original depths of monitoring wells SW-4 and SW-7 as depicted in the boring logs provided in Appendix C.

The wells will be constructed within a bore hole advanced to approximately 30 feet with 3¼ inch or 4¼ inch inside diameter hollow stem augers. The well will consist of a 2-inch diameter PVC solid riser with 10 ft of 0.01 inch slot well screen. A No. 2 sand filter pack will be installed from the bottom of the bore hole, extending to approximately two feet above the well screen. A two-foot bentonite seal will be placed above the well screen, and the remainder of the bore hole will be filled with a cement bentonite grout. The monitoring wells will be finished as a flush mount well with steel protective cover.

Approximately 24 hours after installation, the newly installed wells will be developed by removing a minimum of 5 well volumes of water from the well, consistent with the FSP (**Appendix A**). A detailed description of well installation procedures and well development procedures are described in the FSP (FPM, 2017).

All soil cuttings generated during well installation will be containerized and characterized for offsite disposal. A composite soil sample of soil cuttings will be collected and analyzed for VOCs, SVOCs and additional characterization analyses required by the selected disposal facility. Purge water generated during well development will be placed on the ground surface in proximity to the monitoring well and allowed to infiltrate.

2.3 Well Survey

Following the installation of the two (2) new monitoring wells, all 14 well locations (See **Table 1-1**) in the LTM network, and water level gauging well SW-1, will be surveyed using a State of New York licensed surveyor. The survey will identify the location of the well and the elevation of the well casing. At a minimum, the horizontal location of the well will be surveyed to the nearest one foot, and the elevation of the ground surface next to the protective casing will be surveyed to the nearest 0.10-foot, and the elevation of the measuring point on the well riser will be surveyed to the nearest 0.01-foot. A detailed description of survey requirements is provided in the FSP (**Appendix A**).

2.4 Groundwater Sampling Procedures

A description of the groundwater sampling efforts is provided in the following sections. All groundwater samples will be analyzed for volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) method SW8260C, and 1-4-dioxane using either USEPA method SW8270D SIM (monitoring wells), or USEPA Method 522SIM (Johnson City water supply wells).

Monitoring wells will be sampled using low-flow micro purge sampling techniques to reduce purge water volumes and to follow sampling procedures that were used in previous sampling events. At the water supply wells, samples will be collected at a sampling valve (spigot). The valve will be opened and allowed to purge for 5 minutes. The sample will be collected after the 5-minute purge with one set of groundwater quality readings collected immediately after sampling.

The construction material (e.g., polyethylene) of the sampling devices discussed below will be appropriate for the contaminants of concern and will not interfere with the chemical analyses being performed. All non-dedicated purging and sampling equipment will be decontaminated according to the specifications in *FSP* (FPM, 2017) prior to any sampling activities and will be protected from contamination until ready for use.

A detailed description of groundwater sampling methods is provided in the FSP (**Appendix A**).

2.4.1 Groundwater Sampling

When multiple monitoring wells are sampled in succession, monitoring wells expected to have low levels of contamination or no contamination will be sampled prior to sampling monitoring wells expected to have higher levels of contamination. This practice will help reduce the potential for cross contamination between monitoring wells. All sampling activities will be recorded in the field logbook. Additionally, all sampling data will be recorded on a monitoring well sampling form.

The following information will be recorded each time a monitoring well is purged and sampled: (1) depth-to-water (DTW) before and after purging, (2) well bore volume (WBV) calculation (using the well casing diameter), (3) sounded total depth of the monitoring well, (4) the condition of each monitoring well, (5) the thickness of any non-aqueous layer, (6) field parameters, such as pH, temperature, specific conductance, and turbidity. This information will be encoded in Environmental Resources Program Information Management System files when required.

Purging and sampling will be performed in a low-flow manner that minimizes aeration in the monitoring well bore and the agitation of sediments in the monitoring well and formation. Equipment will not be allowed to free-fall into a monitoring well.

2.4.1.1 Purging Prior to Sampling

Monitoring wells will be purged before sampling using a micropurge pump. The temperature, pH, specific conductivity, and turbidity will be measured and recorded on the monitoring well sampling form after removing each well volume during purging. Groundwater sampling methods for the on-site monitoring wells will follow protocols presented in FSP (**Appendix A**).

Micropurge is an acceptable procedure to use for AFCEC projects. Micropurge will be utilized for all on and off-site monitoring wells. At the public water supply wells, the valve will be opened and allowed to purge for 5 minutes. All purge water will be discharged to the ground surface, at a minimum of five feet away from the top of the well, and accordance with previously-accepted practice.

2.4.1.2 Sample Collection

Prior to sampling, all non-dedicated equipment will be decontaminated in accordance with **Section 3.6** of the FSP (**Appendix A**), and dedicated polypropylene tubing will be installed in each well to prevent cross contamination. Micropurge sampling will be completed using a bladder pump (or equivalent), and a low-flow rate to prevent volitalization or off-gassing. Water-quality indicators (turbidity, dissolved oxygen, specific conductance, temperature, etc.) will be monitored during sampling. When the sample is collected, the sample bottle will be capped and inverted and gently tapped to ensure air bubbles are not present in the vial.

2.4.1.3 Laboratory Analysis

Laboratory analyses of groundwater samples will be based on the chemicals previously detected in groundwater samples collected in the study area. A summary of the proposed laboratory analyses, including the number of environmental samples and quality assurance/quality control (QA/QC) samples, is provided in **Table 2-1**.

Groundwater monitoring well samples will be analyzed for VOCs by Method 8260C and for 1-4-Dioxane by Method 8270DSIM. The samples taken from the Johnson City Municipal Water wells will be analyzed for VOCs by Method SW8260C and for 1-4-Dioxane by Method 522SIM. The samples will be analyzed by ALS Environmental, a United States Department of Defense (DoD) Quality Systems Manual (QSM) laboratory. Analytical methods and reporting limits are described in **Section 7.2** of the QAPP (**Appendix A**).

Table 2-1. Sample Analysis Summary

Method	Matrix	Sample Quantity Qty	Equipment Blank Qty	Trip Blank Qty	Field Duplicate Qty	MS/MSD Sample Qty	Total Sample Qty
Annual Sampling Event[1]							
8260C	Groundwater	14	1	1	1	1	18
8270DSIM	Groundwater	11	1	0	1	1	14
522SIM	Groundwater	3	0	0	0	0	3
Semi-Annual Sampling Event							
8260C	Groundwater	5	1	1	1	0	7
8270DSIM	Groundwater	2	1	0	1	0	3
522SIM	Groundwater	3	0	0	0	0	3
Quarterly Sampling Event							
8260C	Groundwater	3	0	1	0	0	4
8270DSIM	Groundwater	0	0	0	0	0	0
522SIM	Groundwater	3	0	0	0	0	3

Key: - MS/MSD = Matrix Spike/Matrix Spike Duplicate

- Groundwater QA/QC samples will be collected as described in the QAPP. The QA/QC samples will be collected at the following rates:
- Trip Blanks – One trip blank will be sent with each cooler containing VOC samples.

•Duplicate Samples – Duplicate samples will be collected at a target frequency of approximately 10 percent of project samples.
•Equipment Blanks – One equipment blank will be collected during each sampling event.
•MS/MSD –Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a target frequency of approximately 20 percent of project samples.

2.4.1.4 Investigation Derived Waste (IDW)

The following section describes the procedures for handling and disposing of waste generated onsite during the field investigation. These wastes include monitoring well development/purge water, and equipment decontamination fluids.

All soil cuttings generated during well installation will be containerized and characterized for offsite disposal.

Monitoring well development water, purge water, and equipment decontamination fluids will be allowed to infiltrate the ground surface in proximity to the monitoring wells (minimum of five feet).

2.4.2 Site Personnel

Table 2-2 lists anticipated project personnel.

Table 2-2. Personnel Responsibilities

Name	Organization/Role	Email Address
Melvin Alli	AFCEC/ Contract Officer	melvin.alli@us.af.mil
Christina Blevins	AFICA/Contract Administrator	christina.blevins.5@us.af.mil
Tracy Harris	AFICA/Contract Officer	tracy.harris.8@us.af.mil
George Walters	AFCEC/CZOM	george.walters@us.af.mil
Corey Lam	AFCEC/CZOM	corey.lam@us.af.mil
Don Sorbello	FPM/Project Manager	d.sorbello@fpm-remediations.com
Joshua Wenzel	FPM/Site Supervisor	j.wenzel@fpm-remediations.com
Dan Ours	FPM/Quality Assurance Manager	d.ours@fpm-remediations.com

2.5 REPORTING

The results of the groundwater sampling will be summarized in either the Annual LTM Report (following the initial annual sampling event), or quarterly monitoring letter reports (following all subsequent sampling events). The reports that will be issued following the receipt of laboratory data. The annual LTM report will include the following:

- Summary of field activities;
- Summary of analytical results;
- Data tables summarizing groundwater elevation information, field parameters, and analyte concentrations;
- Updated groundwater elevation map; and
- A figure presenting analyte concentrations;
- Well construction and abandonment logs;
- Recommendations.

The annual, semi-annual, and quarterly monitoring event laboratory results will be evaluated for data usability in accordance with the QAPP. A Category B data deliverable will be provided by the laboratory, and used to prepare a data usability summary report for each monitoring event. The data will be reviewed and validated based on an evaluation of the results in relation to the QAPP in conjunction with the EPA National Functional Guidelines. The QAPP specifies accuracy and precision objectives while the EPA National Functional Guidelines provide data usability guidelines. The data usability reports will be included the annual LTM monitoring report. The results of semi-annual and quarterly sampling events will be reported in summary letter reports that provide data tables, laboratory reports, well sampling logs, and a brief summary of the data. Laboratory data will achieve the reporting limits identified in Section 7.2 of the QAPP. Laboratory results will be compared to Class GA standards as identified in NYSDEC Division of Water Technical and Operational Guidance Series *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (June 1998).

The monitoring reports will be provided in electronic format (i.e. PDF) as well as one hard copy. The sampling results, locational data, and field measurements will be submitted to the NYSDEC in EQuIS Database format.

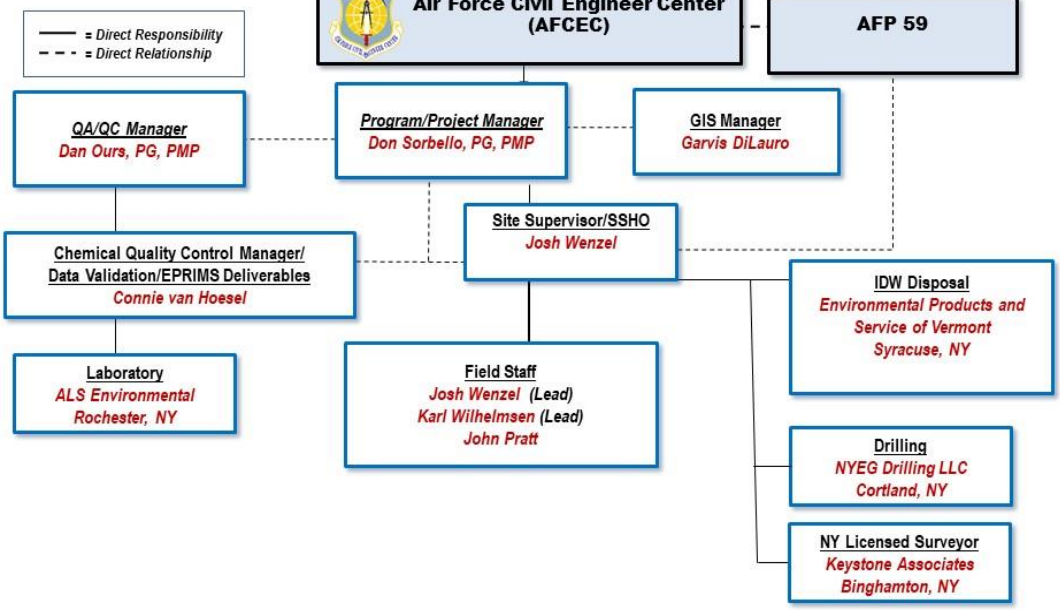
2.6 SCHEDULE

The tentative start date for well abandonment and installation is late November 2017. LTM groundwater sampling activities fieldwork is expected to begin in early December 2017, with the annual groundwater monitoring event. Groundwater samples will be collected two weeks after well installation and development. Following groundwater sampling it is anticipated that sample analysis and validation will require approximately 60 days, therefore, it is anticipated that the annual LTM report will be submitted for NYSDEC review in early April 2018. Subsequent semi-annual and quarterly monitoring events will be completed in March, June, and September of 2018.

3 PROJECT ORGANIZATION AND RESPONSIBILITY

FPM will manage the field services, including the sample collection, data analysis, site characterization, and reporting. The project organization is shown in **Figure 2** below. The following is a list of key FPM personnel and brief descriptions of their roles and responsibilities.

Figure 2 – Project Organizational Chart



Program/Project Manager

Don Sorbello, is responsible for overall direction, coordination, technical consistency and review of the entire contract. The Program Manager's responsibilities include:

- Approving budgets and schedules, as well as changes in budgets or schedules.
- Ensuring availability of key personnel assigned to the project for the duration of the contract.
- Overseeing coordination among management, field teams, and support personnel to ensure consistency of performance.
- Communicating as necessary, with the AFCEC Restoration Team Chief (RTC) to evaluate the progress of the program and to facilitate the early resolution of any potential problem.
- Frequently communicating with the Project Manager to ensure that project objectives are being completed in a timely manner.

- Reviewing and approving project deliverables including FPM's Final Work Plan (WP) and technical reports.
- Reviewing and approving of schedules, labor allocations, and sampling methods and quality assurance (QA) plans, including chemical analysis parameters.
- Overseeing project subcontractors and coordination of all field personnel.
- Establishing and enforcing work element milestones to ensure timely completion of project objectives.
- Communicating developments in the project to the Program Manager.
- Providing technical guidance to project staff.
- Assisting in resolving nonconformance issues.

Site Supervisor/Site Safety and Health Officer

The Site Supervisor/SSHO, Josh Wenzel, is responsible for implementing the Corporate Health and Safety Program, reviewing and approving all project-specific Health and Safety Plans (HASP), ensuring that all personnel have successfully completed health and safety training as necessary, conducting on-site health and safety inspections, providing health and safety advice and assistance to project teams, and advising the Program Manager. The Site Supervisor/SSHO has the authority to immediately STOP ALL WORK at the site for health and safety reasons

Project Quality Assurance and Quality Control Coordinator

Dan Ours is designated as the Project QA/QC Coordinator. Mr. Ours remains independent of the cost, scheduling, and other performance constraints that are the responsibility of the Program Manager and/or the Project Manager. The Project QA Coordinator's primary functions and responsibilities are to prepare, maintain, and verify compliance with the project-specific SAP, ensure that established laboratory and field procedures as identified in the SAP are being followed; ensure that QC documentation is provided, and ensure that all QA/QC problems are handled in an expeditious manner. He is responsible for project audits (internal and field) to verify conformance with QA/QC objectives and for informing the Program Manager and the Project Manager of QA/QC findings. The Project QA/QC Coordinator also will be responsible for the final review of all client deliverables.

Chemical Quality Control Manager/Data Validation/ERPIMS Deliverables

Connie van Hoesel is designated as the Project Chemical Quality Control Manager. Ms. van Hoesel will serve as the lead on all chemistry related issues and conducting data validation activities. Ms. van Hoesel is a senior chemist whose experience includes managing/overseeing laboratories; preparing project/site-specific Chemical Quality Control Plans (CQCP) and QAPP for environmental activities at military installations nationwide; developing DQOs; reviewing and validating the laboratory analytical data in accordance with the AFCEC QAPP, UFP-QAPP, USACE Data Quality Evaluation Guidance (if applicable), DoD QSM, and the USEPA National Functional Guidelines; coordinating and interacting with laboratory personnel during QAPP development and data verification; preparing data validation reports and Quality

Control Summary Reports (QCSRs) for documentation of compliance with DQOs; evaluating data completeness and usability with respect to project-specific DQOs; preparing data usability reports; and participating in laboratory audits.The lead regulatory agency for groundwater monitoring activities is the NYSDEC.

3.1 SUBCONTRACTORS

ALS Environmental (Rochester, NY) will be used for analyzing the samples taken during the groundwater monitoring event. NYEG Drilling LLC (Brewerton, NY) will be used for the installation and decommissioning of monitoring wells. Environmental Products and Service (EPS) of Vermont (Syracuse, NY) will be used for IDW disposal. Keystone Associates (Binghamton, NY) will be used for surveying needs.

4 REFERENCES

AECOM, 2010. *Final Work Plan Addendum, Long-Term Monitoring Activities at Air Force Plant 59, Johnson City, New York.* November.

AECOM, 2009b. *Final Quality Assurance Project Plan for the Vapor Intrusion Investigation, Groundwater Monitoring Activities, and Well Abandonment at Air Force Plant 59, Johnson City, New York.* August.

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Figures

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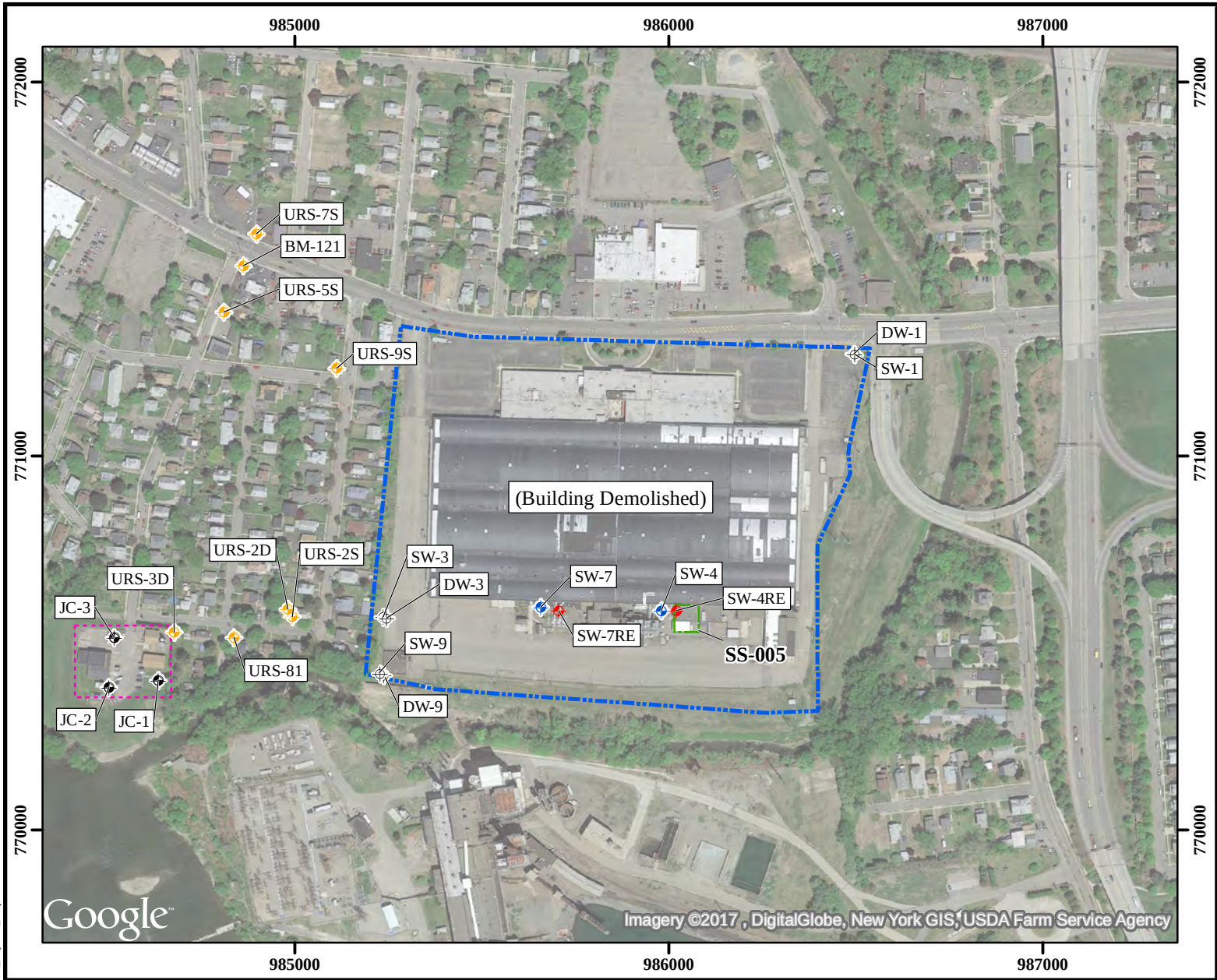

Key Features

- Approximate Location of AFP 59 On-Site Monitoring Well
- Approximate Location of Abandoned Monitoring Well
- Approximate Location of Off-Site Monitoring Well
- Approximate Location of Off-Site Municipal Well
- Proposed Replacement Well Location (Within 5 ft. of Previously Abandoned Well)
- Approximate Property Boundry
- Location of Johnson City Municipal Supply Well Field
- Site SS005

Air Force Plant 59
Site SS005
Johnson City, New York

FIGURE 1

Site Location

FPM Remediations Inc.

2017

Notes:

1. All circled wells are currently in the monitoring program.
2. SW-1 is included as a water level gauging well only.
3. Date Saved: 11/17/2017

Coordinate System: NAD 1983 StatePlane New York Central FIPS 3102 Feet
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US
Service Layer Credits: No credits for this map.
Basemap Date: 11/17/2017

1 inch = 400 feet

0 100 200
Meters

0 400 800
Feet

N W E S

Path: Y:\GIS_Projects\AFP59_Johnson_City\Site_Map.mxd

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Appendix A
Field Sampling Plan (FSP)

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Final
Field Sampling Plan
LONG-TERM MONITORING AND
REMEDIAL ACTION OPERATIONS AT SITE SS005
AT
AIR FORCE PLANT 59
JOHNSON CITY, NEW YORK

Contract Number FA8903-17-C-0037

Prepared for

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ATTACHMENT A Final Quality Assurance Project Plan

LIST OF ACRONYMS AND ABBREVIATIONS

AFCEC	Air Force Civil Engineer Center
AFP	Air Force Plant
ASTM	American Society for Testing and Materials
°C	degrees Celsius
CoC	chain-of-custody
CHSM	Corporate Health and Safety Manager
DQOs	Data Quality Objectives
ERPIMS	Environmental Resources Program Information Management
FSP	Field Sampling Plan
HSA	Hollow Stem Auger
HSP	Health and Safety Plan
HGL	HydroGeoLogic, Inc.
IDW	investigation-derived waste
L/min	liters per minute
LTM	long-term monitoring
MS	matrix spike
MSD	matrix spike duplicate
NTU	nephlometric forbidity unit
NYSDEC	New York State Department of Environmental Conservation
OD	Outside Diameter
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RTC	Restoration Team Chief
SAP	Sampling and Analysis Plan
SSHO	Site Safety and Health Officer

TAL	Test America Laboratory
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WBV	well bore volume
WP	Work Plan

1 Introduction

This Field Sampling Plan (FSP) presents, in specific terms, the requirements and procedures for groundwater monitoring in support of long-term monitoring (LTM), well decommissioning and well installation at Air Force Plant (AFP) 59, Johnson City, New York. This project-specific FSP has been prepared by FPM Remediations, Inc. (FPM) to ensure that (1) data quality objectives (DQOs) specified for this project are met, (2) the field sampling protocols are documented and reviewed in a consistent manner, and (3) the data collected are scientifically valid and defensible. This project-specific FSP and the *Final Quality Assurance Project Plan (QAPP) for the Vapor Intrusion Investigation, Groundwater Monitoring Activities, and Well Abandonment* (AECOM, 2009b) shall constitute, by definition, an Air Force Civil Engineer Center (AFCEC) Sampling and Analysis Plan (SAP)

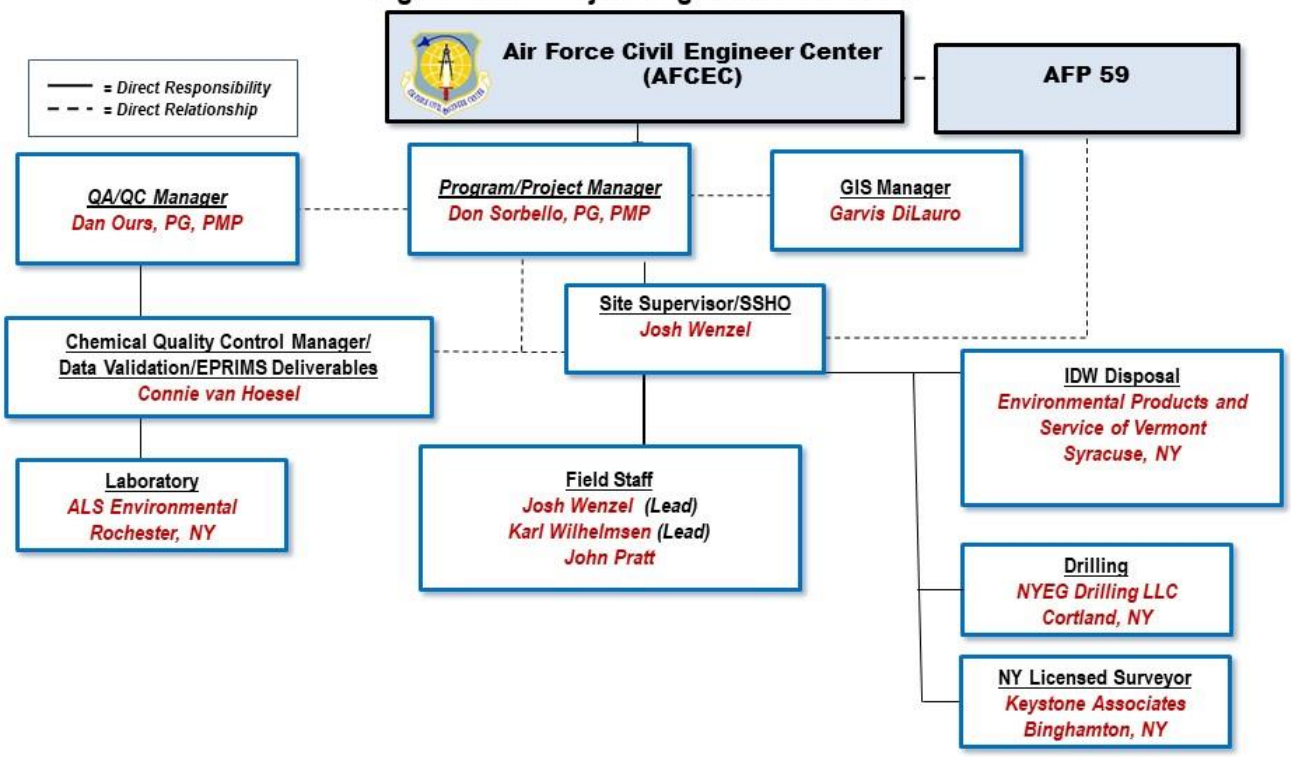
The previously submitted QAPP by AECOM (AECOM, 2009b) was approved by the New York State Department of Environmental Conservation (NYSDEC) and will remain in effect to be consistent with previous sampling requirements.

This FSP is required reading for all staff participating in the work effort. The FSP shall be in the possession of the field teams collecting the samples. All contractors and subcontractors shall be required to comply with the procedures documented in the FSP in order to maintain comparability and representativeness of the collected and generated data.

2 PROJECT ORGANIZATION AND RESPONSIBILITY

FPM will manage the field services, including the sample collection, data analysis, site characterization, and reporting. The project organization is shown in **Figure 2-1** below. The following is a list of key FPM personnel and brief descriptions of their roles.

Figure 2 -1 – Project Organizational Chart



Program/Project Manager

Don Sorbello, is responsible for overall direction, coordination, technical consistency and review of the entire contract. His responsibilities include:

- Approving budgets and schedules, as well as changes in budgets or schedules.
- Ensuring availability of key personnel assigned to the project for the duration of the contract Overseeing coordination among management, field teams, and support personnel to ensure consistency of performance.
- Communicating as necessary, with the AFCEC Restoration Team Chief (RTC) to evaluate the progress of the program and to facilitate the early resolution of any potential problem.
- Frequently communicating with the Project Manager to ensure that project objectives

are being completed in a timely manner.

- Reviewing and approving project deliverables including FPM's Final Work Plan (WP) and technical reports.
- Reviewing and approving of schedules, labor allocations, and sampling methods and quality assurance (QA) plans, including chemical analysis parameters.
- Managing all funds of labor and materials procurement.
- Overseeing project subcontractors and coordination of all field personnel.
- Establishing and enforcing work element milestones to ensure timely completion of project objectives.
- Communicating developments in the project to the Program Manager.
- Frequently communicating with the AFCEC RTC with regard to day-to-day progress of the project.
- Providing technical guidance to project staff.
- Assisting in resolving nonconformance issues.

Site Supervisor/Site Safety and Health Officer

The Site Supervisor/Site Safety and Health Officer (SSHO), Josh Wenzel, is responsible for implementing the Corporate Health and Safety Program, reviewing and approving all project-specific Health and Safety Plans (HSP), ensuring that all personnel have successfully completed health and safety training as necessary, conducting on-site health and safety inspections, providing health and safety advice and assistance to project teams, and advising the Program Manager. The Site Supervisor/SSHO has the authority to immediately STOP ALL WORK at the site for health and safety reasons

Project Quality Assurance and Quality Control Coordinator

Dan Ours, is designated as the Project Quality Assurance and Quality Control (QA/QC) Coordinator. Mr. Ours remains independent of the cost, scheduling, and other performance constraints that are the responsibility of the Program Manager and/or the Project Manager. The Project QA Coordinator's primary functions and responsibilities are to prepare, maintain, and verify compliance with the project-specific SAP, ensure that established laboratory and field procedures as identified in the SAP are being followed; ensure that QC documentation is provided, and ensure that all QA/QC problems are handled in an expeditious manner. He is responsible for project audits (internal and field) to verify conformance with QA/QC objectives and for informing the Program Manager and the Project Manager of QA/QC findings. The Project QA/QC Coordinator also will be responsible for the final review of all client deliverables.

The lead regulatory agency for groundwater monitoring activities is the NYSDEC.

2.1 SUBCONTRACTORS

ALS Environmental (Rochester, NY) will be used for analyzing the samples taken during the groundwater monitoring event. NYEG Drilling, LLC (Brewerton, NY) will be used for the installation and decommissioning of monitoring wells. Environmental Products and Service (EPS) of Vermont (Syracuse, NY) will be used for Investigation Derived Waste (IDW) disposal. Keystone Associates (Binghamton, NY) will be used for surveying needs.

3 FIELD OPERATIONS

3.1 Monitoring Well Construction

The following sections describe field operating procedures to be followed while performing monitoring well construction activities at AFP 59. The on-site field manager shall supervise the drilling, soil boring and monitoring well construction and shall be an experienced geologist, hydrogeologist or environmental engineer. The supervising field manager shall affix his/her signature to all, as-built well construction diagrams, , sampling records, and similar documents

3.1.1 Equipment and Materials List

This section details the required equipment, drilling and installation procedures, and documentation procedures for installation of groundwater monitoring wells at AFP 59.

The following is an equipment list for monitoring well installation:

Hollow-stem auger rig capable of installing wells to the desired depth in the expected formation materials and conditions

Weighted tape measure

Water level probe

Photoionization Detector (PID) (with 10.2 eV lamp)

Well casing and well screen

Bentonite pellets

Filter pack sand (16-40 silica sand)

Portland Type I or II Cement and powdered bentonite or high solids bentonite for grouting

High pressure grout pump

Protective well casing with locking cap or flush mount manhole assembly with padlock

Steel guard posts (bollards) for stick-up wells

Inertial Pump (Waterra® pump or similar)

High-pressure steamer/cleanser

Long-handled bristle brushes

Wash/rinse tubs or pails

Liquinox® detergent

Plastic bags (Ziploc®)

Self-adhesive labels

Deionized water

Appropriate health and safety equipment

Log book

Boring log sheets

Well construction logs

Appropriate sample containers

Sample cooler and ice

3.1.2 Drilling Requirements

All Drilling and well installations shall conform to state and local regulations, and the contractor shall obtain and pay for all permits, applications, and other documents required by state and local authorities. The location of all borings shall be coordinated in writing with the project engineer or equivalent before drilling commences. Water-table monitoring wells will be installed using a truck-mounted hollow-stem auger drill rig.

3.1.3 Drilling Method

An auger section is a section of pipe with flanges welded onto it. Each auger section is referred to as a flight. Flights are typically five feet in length. The flights are linked together as each flight is advanced to the ground surface. Sampling tools and the center bit are advanced through the open pipe. The cutting bit has a finger plug which prevents loose soil from entering the open pipe. A split-spoon sampling device may be lowered inside the drill string and driven through the finger plug and ahead of the cutting bit for an in-situ sample as required. The drill string, therefore, serves as a form of casing because it does not have to be withdrawn each time a sample is collected. For the 2-inch-diameter wells that are planned, a 3¼-inch or 4¼ inch inside diameter hollow stem auger (HSA) will be used.

There are several advantages of HSA boreholes. First, the method is rapid in most unconsolidated, fine- to medium-grained geologic materials. Second, drilling fluids are not used to remove cuttings and, therefore, the in-situ chemical conditions of the borehole are not further degraded by either diluting contaminants with added water or contributing suspended solids from drilling mud used to stabilize the borehole walls in soft materials. Third, HSA flights are easily cleaned and decontaminated. Fourth, the auger flights serve as a form of casing, which allows monitoring wells to be constructed by raising the flights as needed.

If flowing sands are encountered, potable water may be added to the augers to equalize the hydrostatic pressure in the boring. If water is added to the augers or borehole, it must be potable and the quantity used recorded in the field logbook.

3.1.4 Stratigraphic Logging

Boring logs from the previously installed monitoring wells SW-4 and SW-7 (Appendix C of the WP) will be used as a reference for borehole stratigraphy at replacement wells SW-4RE and SW-7RE. These replacement wells will be installed within 5 ft. of the respective original wells. Since the newly installed wells will be in proximity to the original wells, the stratigraphy is not

expected to change significantly. Therefore, soil samples will not be collected for stratigraphic logging purposes during replacement well installation.

3.1.5 Well Material Specifications

This section describes the well materials to be used for groundwater monitoring well installations.

3.1.5.1 Well Casings

Well casing will consist of new, threaded, flush-joint, 2-inch ID, schedule 40 PVC. O-rings will be used at all joints. Heat-welded joints and/or gaskets will not be used. The tops of all well casings will be fitted with caps (J-plug) which can be easily removed by hand. The well casing will be brought to the site in its factory post-cleaning plastic wrapping and steam cleaned before installation will not be required.

3.1.5.2 Well Screens

Well screens will consist of new, 2-inch ID threaded PVC with factory machined slots. The screen slot sizes are 0.010-inches and 0.020-inches. An end-plug will be placed at the bottom of the screen. The screen depth will intersect the uppermost portion or the saturated zone. All well screens will have an inside diameter equal to or greater than that of the well casing. Well screen length will be 10 or 15 feet.

3.1.5.3 Filter Pack

The filter pack material for the monitoring wells will consist of a #2 pre-washed environmental grade silica sand or equivalent. For shallow wells, less than 30 ft bgs, the filter pack will be poured into the open boring. For deeper wells, the filter pack will be placed by tremie pipe from the bottom of the borehole to two feet above the top of the screen interval. Surging of the well may be necessary during filter pack placement to obtain an adequate pack placement around the well screen. The depth of the filter pack will be continuously probed with a weighted tape during placement to monitor pack placement and avoid bridging.

3.1.5.4 Bentonite Seal and Annular Seal

A bentonite seal will be installed above the filter pack in the monitoring wells. The seal will consist of a two- to three-foot interval of bentonite chips or pellets placed by gravity feed from the ground surface and will be hydrated prior to placement of the annular seal. The annular seal will be placed by gravity feed from just above the bentonite seal to within three feet of the ground surface and shall consist of cement grout, neat cement, concrete, or bentonite grout.

3.1.5.5 Well Completion

Two well completion types may be used. These include the flush mount and stick-up well completions.

For high traffic areas, flush mount completions will be installed. The flush mount includes a 8-inch outside diameter (OD) traffic rated manhole and concrete pad. Following manhole installation, a locking water-tight security plug will be installed on top of the PVC riser. At a minimum the monitoring well identification number and installation date will be stamped or engraved on to the tag.

For areas with no traffic, stick-up completions will be installed. The stick-up completions include a steel 8-inch OD stick-up pipe, traffic bollards, and concrete pad. Following stick-up completion installation, a locking water-tight security plug will be installed on top of the PVC riser. At a minimum the monitoring well identification number and installation date will be stamped or engraved on to the tag.

3.1.6 Well Installation Procedure

The procedure for monitoring well installation using HSA methods is as follows:

1. Decontaminate all well materials (if necessary) See Section 3.6 for decontamination procedures. Following decontamination, all personnel that handle the casing will don a clean pair of rubber or nitrile gloves.
2. Measure each joint of casing and screen to nearest 0.10 foot.
3. Assemble screen and casing as it is lowered into the boring or inside the HSA pipe. Attach stainless steel centralizers if required.
4. Lower screen and casing to the bottom of the boring.
5. Record level of top of casing and calculate screened interval. Adjust screen interval by raising or lowering assembly to desired interval if necessary and add sand to raise the bottom of the boring to the base of the screen. A 1.5-inch diameter, 10-foot long pipe may be lowered into the well to check for straightness. If the pipe will not pass the entire length of the well casing, the well will have to be removed and reset or, if this is not possible, a new well will be installed.
6. Begin adding filter pack sand around the annulus of the casing by slowly gravity feeding the sand (through the tremie pipe if required). Repeated depth soundings should be taken to monitor the level of the sand.
7. Allow sufficient time for the filter sand to settle through the water column outside the screen and casing before measuring the sand level.
8. Extend the filter pack sand to two feet above the top of the well screen. Surging of the well may be required to obtain a good pack around the well screen.

9. Following sand filter pack placement, install a minimum 2-foot thick bentonite seal by slowly adding the pellets to avoid bridging. The bentonite will be hydrated with potable water if the seal is above the water table.
10. Grout the remaining annulus from the top of the bentonite seal to the ground surface using bentonite grout or similar. The grout will be placed into the borehole until the annulus is filled to within three feet of the ground surface.
11. Record the volume of the filter pack, bentonite seal, and grout used.
12. After the grout sets for 24 hours the well completion (flush mount or stick-up) enclosure will be installed. The enclosure will consist of a traffic-rated manhole. Completions will be flush with the surrounding surface. Completions will have a concrete pad sloped slightly away from the manhole. Manholes will have covers secured by bolts.

3.1.7 Surveys

The locations and elevations of any new and existing monitoring wells will be surveyed by a surveyor licensed in the State of New York. At a minimum, the horizontal location of the well will be surveyed to the nearest one foot, the elevation of the ground surface next to the protective casing will be surveyed to the nearest 0.10-foot, and the elevation of the measuring point on the well riser will be surveyed to the nearest 0.01-foot.

3.1.8 Documentation

Observations and data acquired in the field during drilling and installation of monitoring wells will be recorded to provide a permanent record. These observations will be recorded with waterproof ink in a bound weatherproof field logbook and drilling log with consecutively numbered pages. Notes will be recorded daily when in the field. The information in the field book will include the following as a minimum:

<u>Field Logbook</u>

Project name and number

Observer's name

Visitors and contractors on site

Drilling and well installation observations as described in Section 3.1

Decontamination observations as described in Section 3.6

Weather conditions

The well installation details will be shown in a diagram which will be drawn in the field book.

Each well diagram will consist of the following (denoted in order of decreasing depth from ground surface):

Bottom of the boring

Casing depth (if intermediate casing is left in the hole)

Screen location(s)

Filter pack intervals

Bentonite seal intervals

Cave-in locations

Height of riser without cap (above ground surface)

Protective casing detail

Additional documentation for well construction in the field book will include the following:

Grout, sand, and bentonite volume calculations prior to well installation

The quantity and composition of the grout, seals, and filter pack actually used during construction

Screen slot size (in inches), slot configuration, outside diameter, nominal inside diameter, schedule/thickness, composition, and manufacturer

Coupling/joint design and composition

Protective casing composition and nominal inside diameter

Start and completion dates

Discussion of all procedures and any problems encountered during drilling and well construction.

3.2 Well Development

The purpose of well development is to remove well drilling fluids, solids, or other particulates which may have been introduced or deposited on the boring wall in a recently installed well during drilling and construction activities. This restores the hydraulic conductivity of the aquifer material surrounding the well to near pre-well installation conditions. Properly developed monitoring wells allow for the collection of groundwater samples that are chemically and physically representative of the aquifer. The procedure is also applicable to older or improperly developed wells which are suspected of not providing representative groundwater samples. This section describes the equipment, methods, and documentation that will be used for developing groundwater monitoring wells.

3.2.1 Equipment and Materials List

The following items are required to properly develop groundwater monitoring wells:

Well keys

Electronic water level indicator (oil/water interface probe for fuel sites)

Calculator

Field notebook

Waterproof pen

Electric inertial pump

Electric submersible pump and controller of appropriate size for the well diameter

Portable electric generator for submersible pumps

Disposable PE bailer (sized appropriately for well)

Nylon or polypropylene rope or wireline (for deep wells) for bailing

Multi-parameter water quality system with a flow-through cell for real-time groundwater parameter monitoring (temperature, pH, specific conductance, DO and ORP), with appropriate calibration solutions

Nephelometric turbidity meter

Polyethylene or glass container (for field parameter measurements)

Plastic spray bottle filled with deionized water

Drums or other large container for development water

Appropriate health and safety equipment

Liquinox® solution

Potable water for decontamination

Distilled or deionized water

Decontamination buckets/pails

Plastic brushes

Well completion information

Well development log

3.2.2 Procedure

The development of a newly installed monitoring well will proceed only after the cement/bentonite grout has been allowed to set for a minimum of 24 hours if such grout was used for constructing a well, and after the completed well has been allowed to equilibrate for at least 48 hours. Monitoring well development activities will be completed prior to purging and groundwater sampling for analytical testing. Before development begins, the development equipment will be decontaminated according to the procedures described in Section 3.6. Equipment coming in contact with the well will also be decontaminated between wells.

Before development begins, the field personnel will verify that the multi-parameter water quality system, and water level probe are operating properly. The electronic water quality instruments require daily calibration or calibration checks prior to use. Calibration times and readings will be recorded in the field notebook and on calibration forms.

Monitoring well development at AFP 59 will be accomplished by using a bailer, a submersible pump, or an inertial pump to flush the screen, sand pack material, and borehole wall of fine

sediment resulting from well drilling and installation activities. This procedure also allows for the removal of fine sediment which may have accumulated within the inner well casing.

Development consists of removing a minimum of five well casing volumes of water during repeated surging and well evacuation episodes. Well surging is the process of causing water to move through the screen and into and out of the sand pack and aquifer formation. This will be accomplished by surging the entire length of well screen using bailer or pump. Surging may also be used during well construction to compact the sand filter pack around the well screen.

Well evacuation is the process of removing water from throughout the entire water column by periodically lowering and raising the pump intake or the point to which the bailer is lowered. Development water will be collected in drums or holding tanks for characterization. The volume of water required for removal during development is calculated using the following method:

1. Measure the depth to water in the well from the measuring point. This is usually the top of the well riser cap which has previously been surveyed.
2. Measure the total depth of the well from the same measuring point used for measuring the depth to water.
3. Calculate the height of water in the well casing by subtracting the depth of water from the total well depth.
4. Calculate the number of gallons of water corresponding to one well volume. This is done by multiplying the height of water column in the well casing by the conversion factor corresponding to the inside diameter of the well casing. The following equation shall be used to calculate the volume of water to be removed during well evacuation:

   For 2-inch well: Well Volume = (Total Well Depth – Water Level Depth X 0.17 gal/ft = gallons/1 well casing volume

   Multiply the volume of one well casing volume by five to obtain the minimum volume of water to be evacuated.

During the well development activities field measurements of temperature, pH, nephelometric turbidity, specific conductance, and dissolved oxygen are made, and the clarity, color, any presence of odors, and other comments regarding water quality are noted in the field notebook and on the well development log. The date, time, and volume of water removed are also recorded at this time. All measurements will be recorded for each well volume of water removed. A sample of water will be collected for measurement of the field water quality parameters at the beginning of well development in order to establish a baseline for comparison with the water quality as well development proceeds.

Initial monitoring well development activities with the bailer or pump will continue until at least five well casing volumes have been removed and measurements of the field parameters have stabilized within 10 percent or 0.1 units and the water removed from the well is as clear of sediment as is practical. Regardless of the clarity of the water removed, a minimum of five well volumes of water will be removed during the bailing/surging phase of well development. If the

well is bailed dry, it will be allowed to recover. After initial development activities with the bailer are completed, the well will be further developed by purging after installing the submersible pump and lift pipe. Purging will continue with the submersible pump until the field water quality parameters are within 10 percent or 0.1 units for three consecutive readings.

3.2.3 Documentation

Documentation of observations and data acquired in the field will provide information on well development and also provide a permanent record. These observations and data will be recorded with waterproof ink in a bound weatherproof field book with consecutively numbered pages and on the well development form.

As part of the development process, the following information will be recorded in the field book:

Well designation

Well location

Field personnel

Date(s) and time of well development

Static water level from top of well casing before and after development

Volume of water in well prior to development

Volume of water removed and time of removal

Depth from top of well casing to bottom of well

Screen length

Depth from top of well casing to top of sediment inside well, if present, before and after development

Field measurements of pH, conductivity, turbidity, dissolved oxygen, and temperature taken during and after development

Physical character of removed water throughout development (color, odor, and turbidity)

Type and size/capacity of pump and/or bailer

Description of development technique

Decontamination observations

Instrument calibration record

3.3 Monitoring Well Abandonment

This section provides the procedure for abandoning monitoring wells at AFP 59.

3.3.1 Equipment and Materials List

The following is an equipment and materials list for monitoring well abandonment:

High solids bentonite grout or granular bentonite

Potable water

Logbook

Boring log sheets

Waterproof and permanent marking pens

Appropriate health and safety equipment

3.3.2 Abandonment Procedures

Monitoring Wells:
All abandonment of monitoring wells, shall be performed in general accordance with the NYSDEC Policy *CP-43: Groundwater Monitoring Well Decommissioning Policy* (NYSDEC, 2009) the 2009 version Ground-Water Monitoring Well Decommissioning Procedures. NYSDEC approved abandonment methods into grout and pull, grout in place or over drilling. These are described below:

Grout and Pull
Well casing is pulled out of the ground using a drill rig and a slurry is applied to bore hole.

Grout in place
Well casing remains in the ground; however, a slurry is applied to the well to close all potential pathways.

Over Drilling
Well casing is over drilled by a drilling company. An auger is advanced to the bottom of the well and a slurry is applied to bore hole.

When slurry is used, a mud balance and/or Marsh Funnel shall be used to ensure that the density (lbs/gal) of the abandonment mud mixture conforms to the manufacturer's specification. All abandoned monitoring wells shall be checked 24 to 48 hours after mud/solid bentonite emplacement to determine whether curing is occurring properly. More specific curing specifications or quality assurance checks may be recommended by the manufacturer and shall be followed. Additionally, if significant settling has occurred, a sufficient amount of mud/solid bentonite shall be added to attain its initial level. These slurry/solid bentonite curing checks and any addition of mud/solid bentonite shall be recorded in the field logs.

3.3.3 Pavement Repair

Where borings or monitoring wells penetrate concrete or asphalt pads, it will be necessary to patch the pavement surface following backfilling. Concrete pavements should be filled with low slump (less than 4 inches) concrete mix. Asphaltic or concrete pavements should be filled with asphaltic concrete patch mix and thoroughly compacted by ramming. The surface of any patch

should be level upon completion. In freezing weather the concrete mix must be protected from freezing for 48 hours after placement.

3.3.4 Documentation

Observations and data acquired in the field during boring abandonment will be recorded to provide a permanent record. These observations will be recorded with waterproof black ink in a bound weatherproof field book with consecutively numbered pages. A note shall be placed on the boring log for the boring that was abandoned and backfilled that identifies the date and method of abandonment. The type of material used to patch a pavement surface (if done) will also be noted on the boring log and the field book

3.3.5 Special Considerations

An unidentified monitoring well south of SW12 and DW12 will be decommissioned at AFP59. This well is located in close proximity to a levy near the site. With NYSDEC concurrence, due to the close proximity of the well to the levy, well materials will only be removed to approximately 1 ft. bgs in order to not compromise the integrity of the levy. The well casing will be first be perforated by the drill rig and then filled will a grout mixture to approximately 1 ft. bgs. All materials that are above 1 ft. bgs will be removed and properly disposed of. Following decommissioning activities, restoration work will be performed using top soil and grass seed.

3.4 GROUNDWATER SAMPLING PROCEDURES

The following sections describe field operating procedures to be followed while performing groundwater monitoring activities at AFP 59. All groundwater samples collected from monitoring wells will be analyzed for volatile organic compounds (VOC) using U.S. Environmental Protection Agency (USEPA) Method SW8260C and 1,4-dioxane using USEPA Method SW8270DSIM. Four Johnson City Municipal Well water sample will be analyzed for VOCs using USEPA Method SW8260C and 1,4-dioxane using USEPA Method 522SIM.

All the monitoring wells will be sampled using micropurge methodology to reduce purge water volumes. The municipal well field sample will be collected at a sampling valve.

The construction material of the sampling devices (e.g., polyethylene) discussed below will be appropriate for the contaminants of concern and will not interfere with the chemical analyses being performed.

All purging and sampling equipment will be decontaminated according to Section 3.6 prior to any sampling activities and will be protected from contamination until ready for use.

3.4.1 GROUNDWATER SAMPLING

When numerous monitoring wells are to be sampled in succession, those monitoring wells expected to have low levels of contamination or no contamination will be sampled prior to those monitoring wells expected to have higher levels of contamination. This practice will help reduce the potential for cross contamination between monitoring wells.

Before groundwater sampling begins, monitoring wells will be inspected for signs of tampering or other damage. If tampering is suspected, (i.e., casing is damaged, lock or cap is missing) this will be recorded in the field logbook and on the monitoring well sampling form, and reported to the Project Manager.
Water in the protective casing or in the vaults around the monitoring well casing will be removed prior to venting and purging. Every time a casing cap is removed to measure water level or collect a sample, the air in the breathing zone will be checked with a PID. Procedures in the HSP will be followed when high concentrations of organic vapors are detected. Air monitoring data will be recorded on the monitoring well sampling form.
Purge pump intakes will be equipped with a positive foot check valve to prevent purged water from flowing back into the monitoring well. Purging and sampling will be performed in a manner that minimizes aeration in the monitoring well bore and the agitation of sediments in the monitoring well and formation. Equipment will not be allowed to free-fall into a monitoring well The following information will be recorded each time a monitoring well is purged and sampled:

- Sample identification,
- Date and time of sample collection,
- Depth to water before and after purging,
- Well bore volume,
- Sounded total depth of the well,
- The condition of the well,
- Thickness of any non-aqueous layer,
- Field parameters such as pH, temperature, specific conductance and turbidity,
- Identity of samplers,
- Sampling methods and devices, and
- CoC protocols and records used to track samples from sampling point to analysis.

This information will be encoded into the Environmental Resources Program Information Management System (ERPIMS) files when required

3.4.2 PURGING PRIOR TO SAMPLING MONITORING WELLS

Purging of monitoring wells is performed to evacuate water that has been stagnant in the monitoring well and may not be representative of the aquifer. The temperature, pH, specific conductivity and turbidity will be measured and recorded on the monitoring well sampling form during purging.

Micropurge is an acceptable procedure to use for AFCEC projects and will be utilized for sampling all the monitoring wells. Micropurge is a low flow-rate monitoring well purging and sampling method that induces laminar (non-turbulent) flow in the immediate vicinity of the

sampling pump intake, thus drawing groundwater directly from the sampled aquifer horizontally through the monitoring well screen and into the sampling device. Low-flow pumping rates associated with the micropurge technique are in the approximate range of 0.2 to 0.5 liters per minute (L/min). The low-flow rates minimize disturbance in the screened aquifer, resulting in: (1) minimal production of artificial turbidity and oxidation, (2) minimal mixing of chemically distinct zones, (3) minimal loss of VOCs, and (4) collection of representative samples while minimizing purge volume.

3.4.3 SAMPLE COLLECTION

Table 3-1 details monitoring well and municipal well field locations to be purged and sampled. The monitoring well samples will be collected after the temperature, pH, specific conductivity, oxidation-reduction potential, and turbidity have been stabilized. Stabilization will be defined as follows: temperature ±3 percent, dissolved oxygen ±10 percent, pH ± 0.1 units, specific conductivity ±3 percent, oxidation-reduction potential ±10 millivolts, and turbidity ±10 nephelometric turbidity unit (NTU). Field equipment will be calibrated in accordance with the user's manual for each respective piece of equipment.

Micropurge sampling will use bladder pumps (or equivalent). Samples to be analyzed for volatile or gaseous constituents will not be withdrawn with pumps or at flows that degas the samples. Water quality indicators will be monitored during micropurge (turbidity, dissolved oxygen, specific conductance, temperature, etc.).

The three public water supply sampling locations, will be collected at a sampling valve. The valve will be opened and allowed to purge for 5 minutes. The sample will be collected after the 5 minute purge with one set of groundwater quality readings collected immediately after sampling.

Before collecting groundwater samples, the sampler will put on clean, phthalate-free protective gloves. Samples to be analyzed for volatile or gaseous constituents will not be withdrawn with pumps that exert a vacuum on the sample (e.g., centrifugal). New polypropylene tubing will be used for each well to prevent cross contamination. The preservative hydrochloric acid will be added to the VOC sample bottle before introducing the sample water. The sample will be collected from the pump tubing using a slow, controlled pour down the side of a tilted sample vial to minimize volatilization. The sample vial will be filled until a meniscus is visible and immediately sealed. When the bottle is capped, it will be inverted and gently tapped to ensure air bubbles are not present in the vial. Vials with trapped air will be refilled until bubbles are not present. After the containers are sealed, sample degassing may cause bubbles to form. These bubbles will be left in the container

Table 3-1
AFP 59 Monitoring Wells/Johnson City Municipal Wells

Monitoring Well ID	Location	Sampling Method
SW-1	On Site	Bladder Pump
SW-3		
SW-4		
SW-7		
DW-3		
DW-9		
URS-2S	Off Site	
URS-5S		
URS-2D		
URS-3D		
BM-121		
Water Supply Sampling Locations		Sampling Valve
JC-2		
JC-3		
Post Treatment		

3.4.4 SAMPLE HANDLING

The following sections review the sample handling procedures that will be followed based on the approved Final QAPP (AECOM, 2009b).

3.4.4.1 Sample Containers

Sample containers are purchased precleaned and treated according to USEPA specifications for the methods. Sampling containers that are reused are decontaminated between uses by the USEPA-recommended procedures (i.e., USEPA 540/R-93/051). Containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

3.4.4.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEC samples are listed in Table 5.1.2-1 of the QAPP.

Sample holding time tracking begins with the collection of sample and continues until the analysis is complete. Holding times for methods required routinely for AFCEC work are specified in Table 5.1.2-1 in Section 5.1.2 of the QAPP. Samples not preserved or analyzed in accordance with these requirements shall be resampled, and analyzed, at no additional cost to AFCEC.

3.4.5 SAMPLE CUSTODY

Samples collected for analysis at the off-site laboratories will be maintained under strict chain-of-custody (CoC) procedures.

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

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

The sample coolers shall be sealed in a manner that shall prevent or detect tampering if it occurs (through the use of custody seals). In no case shall tape be used to seal sample containers. Samples shall not be packaged with activated carbon unless prior approval is obtained from AFCEC.

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

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

The samples shall be uniquely identified, labeled, and documented in the field at the time of collection as specified in section 3.4.6 below.

Samples collected in the field shall be transported to the laboratory site as expeditiously as possible. When a 4°C requirement for preserving the sample is indicate (for samples analyzed

at the off-site laboratory), the samples shall be packed in ice or chemical refrigerant to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a VOC sampling vial filled with water) shall be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory.

3.4.5.1 Sample Analysis Summary

The proposed laboratory analyses for the groundwater samples are based on types of chemicals used at AFP 59 and those chemicals previously detected in groundwater samples collected in the study area. A summary of the proposed laboratory analyses, including the number of environmental samples and quality assurance/quality control (QA/QC) samples, is provided in Table 2-1.

All groundwater samples will be analyzed for VOCs by Method SW8260C and for 1-4 Dioxane by Method SW8270SIM. The samples will be analyzed at an off-site laboratory.

3.4.5.2 Equipment Blank

The equipment blank is a sample of the American Society for Testing and Materials (ASTM) Type II reagent grade water poured into, over, or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures. The frequency of collection for equipment blanks is specified in Section 2.2 of the Final WP (FPM, 2017). Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the s i t e .

3.4.5.3 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes. Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. One trip blank shall accompany each cooler of samples sent to the laboratory for analysis of VOCs.

3.4.5.4 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that

they cannot be identified (blind duplicate) as duplicate samples by the laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of the sample collection.

Duplicate sample results are used to assess precision of the sample collection process. The frequency of collection for field duplicates is specified in Section 2.2 of the Final WP (FPM, 2017).

3.4.6 Sample Identification

The sampling locations, sample types, and naming conventions will be established prior to field activities. On-site personnel will obtain assistance in defining any special sampling requirements from the FPM Project Manager or designated Task Manager. Each sample will have a discrete, alpha-numeric sample identification (ID). A unique sample ID is needed to track each sample during the life of this project. In addition, the sample IDs will be used in the database to identify and retrieve the analytical results received from the laboratory. Each sample ID will be assigned at the time of sampling.

Sample ID

The sample ID will be the same as the Monitoring well idea as shown in **Table 3-1**.

Duplicate Samples

Duplicate Samples (Field duplicate, Matrix Spike and Matrix Spike Duplicate) will be designated with one of the following 1 to 2 character suffixes attached to the sample ID.

- C Field duplicate groundwater sample
- D Matrix Spike Duplicate (MSD)
- MS Matrix Spike (MS)

A sample ID showing: *SW-1C* would indicate a field duplicate sample was taken at monitoring well SW-1. A sample ID showing *URS-2DD* would indicate a matrix spike duplicate sample was taken at monitoring well URS-2D.

Blanks

Blank samples (Field Blank, Equipment Blank, and Trip Blank) will be designated with one of the following 1 to 2 character prefixes followed by the date:

- EB Equipment blank
- FB Ambient blank
- TR Trip blank

A sample ID showing: EB-061216 would indicate an equipment blank was taken on June 12th 2016.

3.5 FIELD MEASUREMENTS

3.5.1 FIELD PARAMETERS

The field parameters consist of air monitoring to determine on-site health and safety protective measures. Health and safety-related air monitoring will be performed using a PID. Air monitoring activities related to health and safety protective measures are discussed in the HSP (FPM, 2017a). Additional information on organic vapor screening is provided in Section 6.0 of the QAPP.

3.5.2 EQUIPMENT CALIBRATION AND QUALITY CONTROL

Field equipment will be maintained and calibrated to the standards contained within the respective operations manual for each piece. At a minimum, all monitoring equipment will be calibrated at least daily, prior to initiation of field activities. The results of the calibration will be entered into the field notebook, including instrument type, serial number, calibration gas, fluid, etc., and concentration, and calibration results. The calibration of the field instruments shall be performed by a qualified individual. Additional information on air monitoring equipment calibration is contained in the HSP (FPM, 2017a). Equipment that is out of calibration will be returned to the rental subcontractor for recalibration by a qualified technician.

3.5.3 EQUIPMENT MAINTENANCE AND DECONTAMINATION

It is not expected that air monitoring equipment will come into direct contact with groundwater samples. Upon completion of sampling at a location, the instruments shall be wiped with clean paper towels to remove any dust that may have accumulated.

3.5.4 FIELD MONITORING MEASURMENTS

3.5.4.1 Groundwater Level Measurements

Water-level measurements may be taken in the sampled monitoring wells. Any conditions that may affect water levels shall be recorded in the field log. Water-level measurements will be collected within the same time interval to evaluate groundwater flow.

Water-level measurements shall be taken with electronic sounders. Devices that may alter sample composition shall not be used. All measuring equipment shall be decontaminated according to the specifications presented in Section 3.6 of this document. Groundwater level shall be measured to the nearest 0.01 foot (two or more sequential measurements shall be taken at each location until two measurements agree to within ±0.01 foot.)

If the casing cap is airtight, time will be allowed prior to measurement for equilibration of pressures after the cap is removed. Measurements will be repeated until the water level has stabilized.

3.6 EQUIPMENT DECONTAMINATION

The equipment that may directly or indirectly contact samples shall be decontaminated in a designated decontamination area. The following procedure shall be used to decontaminate large pieces of equipment. Scrub the equipment with a solution of potable water and Alconox, or equivalent laboratory-grade detergent. Then rinse the equipment with copious quantities of potable water. Air dry the equipment on a clean surface or rack, such as Teflon®, stainless steel, or oil-free aluminum elevated at least 2 feet above ground. If the sampling device shall not be used immediately after being decontaminated, it shall be wrapped in oil-free aluminum foil, or placed in a closed stainless steel, glass or Teflon® container.

New polyethylene or Teflon®-lined polyethylene sampling tubing will be used for groundwater sampling at each monitoring well. Therefore, decontamination of the tubing is not required.

3.7 WASTE MANAGEMENT AND DISPOSAL

During field activities, various types of investigative-derived waste (IDW) may be generated from groundwater sampling and decontamination of sampling equipment. The anticipated types of IDW generated will include soil cuttings, development water, purge water, decontamination water, personal protective equipment (PPE), and general site cleanup trash. Where practicable, FPM will use sampling and waste handling practices compatible with minimizing IDW.

3.8 GENERAL WASTE HANDLING PROCEDURES

Waste handling shall be dealt with on a site-by-site basis. Waste may be classified as non-investigative waste or investigative waste.

Waste, such as disposable PPE, litter, and household garbage, shall be collected on an as-needed basis to maintain each site in a clean and orderly manner. This waste shall be containerized and transported to the designated sanitary landfill or collection bin. Acceptable containers shall be sealed boxes or plastic garbage bags.

Purge water and decontamination water will be generated during the monitoring well sampling. This water will be disposed of by pouring on the ground in the vicinity of each monitoring well sampled and allowed to infiltrate. Any excess water samples collected during the field activities will be disposed of by the laboratory subcontractors. Development water will be generated following the installation of new monitoring wells. This water will be disposed of by pouring on the ground in the vicinity of each newly installed well and allowed to infiltrate.

Soil cuttings generated during well installation will be containerized and characterized for offsite disposal.

3.9 CORRECTIVE ACTION

The corrective action and nonconformance program will be conducted to discern, identify, and correct errors and defects at any point in the project. Corrective action may occur during field and laboratory activities, data validation, and data assessment. If action is required to correct problems associated with a variance or nonconformance, the proposed corrective action will be approved by the Project Manager.

A nonconformance is defined as a malfunction, failure, deficiency, or deviation that renders the quality of an item unacceptable or indeterminate. The nonconformance will pertain to all field equipment, measurements, and activities associated with the collection of data needed to fulfill the project requirements.
Corrective action in the field may be required when the sampling procedures need modifications because of unexpected circumstances. Corrective action for field measurements may include repeating the measurement to check the error, checking for proper adjustments for ambient conditions, checking the batteries, checking calibration, replacing instruments, and if necessary, stopping work. Technical staff and project personnel will be responsible for reporting all technical QA nonconformance or suspected deficiency of any activity or issue. Corrective actions will be implemented and documented in the field logbook. If the nonconformance does not significantly affect the technical quality of the work, the work may continue pending resolution of the nonconformance. If corrective action is insufficient, work may be stopped.

The nonconformance and corrective action proposed and implemented will be documented in a QA Report to management.

4 REFERENCES

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FPM, 2017. Work Plan for Basewide Long-Term Monitoring at AFP 59, Johnson City, New York. November.

FPM, 2017a. *Health and Safety Plan for Basewide Long-Term Monitoring at AFP 59, Johnson City, New York.* October.

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ATTACHMENT A

Final Quality Assurance Project Plan

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FINAL
QUALITY ASSURANCE PROJECT PLAN

Vapor Intrusion Investigation, Groundwater Monitoring Activities, and Well Abandonment
at
Air Force Plant 59
Johnson City, New York

Prepared for:

Air Force Center for Engineering and the Environment
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and

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August 2009

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TITLE PAGE AND APPROVAL SIGNATURES

QUALITY ASSURANCE PROJECT PLAN
VAPOR INTRUSION INVESTIGATION, GROUNDWATER MONITORING ACTIVITIES, AND WELL ABANDONMENT AT AFP 59

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LIST OF ACRONYMS AND ABBREVIATIONS

A2LA	American Association of Laboratory Accreditation
AAB	AFCEE Analytical Batch
AES	Atomic Emission Spectroscopy
AFCEE	Air Force Center for Engineering and the Environment
AFP	Air Force Plant
amu	Average Measured Mass
ASTM	American Society for Testing and Materials
ARAR	Applicable or Relevant and Appropriate Requirements
BFB	4-Bromofluorobenzene
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CL	Control Limit
COC	Chain of Custody
COD	Coefficient of Determination
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DERP	Defense Environmental and Restoration Program
DFTPP	Decafluorotriphenylphosphine
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EICP	Extracted Ion Current Profile
ERPIMS	Environmental Resources Program Information Management System
FID	Flame Ionization Detector
FSP	Field Sampling Plan
GALP	Good Automated Laboratory Practices
GCD	Guidance for Contract Deliverables
GC	Gas Chromatography
GFAA	Graphite Furnace Atomic Absorption
GRO	Gasoline Range Organic
HPLC	High Performance Liquid Chromatography

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

ICAL	Initial Calibration
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
IDL	Instrument Detection Limit
IRP	Installation Restoration Program
IS	Internal Standard
LCL	Lower Control Limit
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NELAC	National Environmental Laboratory Accreditation Conference
NIST	National Institute Standards and Technology
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
ORP	Oxidation-Reduction Potential
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PFTBA	Perfluorotributylamine
PID	Photoionization Detector
ppbv	Parts per Billion by Volume
PQO	Project Quality Objective
PT	Proficiency Testing
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QC	Quality Control
RCA	Recommendations for Corrective Action
RCRA	Resource Conservation and Recovery Act
RF	Response Factors
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RPD	Relative Percent Difference
RRT	Relative Retention Time
RSD	Relative Standard Deviation

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDG	Sample Delivery Group
SIM	Selected Ion Monitoring
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	Spill Prevention Control and Countermeasure
SVOCs	Semivolatile Organic Compounds
S	Standard Deviation
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
UCL	Upper Control Limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WP	Work Plan

1.0 INTRODUCTION

This *Final Quality Assurance Project Plan (QAPP)* presents in specific terms the policies, organization, functions, and quality assurance/quality control (QA/QC) requirements designed to achieve the data quality goals described in the approved project-specific *Work Plan (WP)*. It establishes the analytical protocols and documentation requirements to ensure the data are collected, reviewed, and assessed in a consistent manner to meet the overall project goals, and that the data are scientifically valid and defensible. This *QAPP* guidance presents, in specific terms, the policies, organization, functions, and QA/QC requirements designed to achieve the data quality goals to be described in the approved *Sampling and Analysis Plan (SAP)*. This *QAPP* and *Field Sampling Plan (FSP)*, also developed using Air Force Center for Engineering and the Environment (AFCEE) guidance, shall constitute, by definition, the project *SAP*.

The United States Environmental Protection Agency (USEPA) QA policy requires a *QAPP* for every monitoring and measurement project mandated or supported by the USEPA through regulations, contracts, or other formalized means not currently covered by regulation. Guidelines followed in the preparation of this plan are set out in the USEPA *Guidance for QAPPs*, (QA/G-5, December 2002), *Requirements for QAPPs* (EPA QA/R-5, March 2001), and *Guidance for the Data Quality Objectives (DQOs) Process* (EPA QA/G-4, August 2000). Other documents that have been used in the preparation of this *QAPP*, include the *Department of Defense Quality Systems Manual for Environmental Laboratories, Version 2, 2002; National Environmental Laboratory Accreditation Conference (NELAC) 2002 Standards (Effective 2004)*; *Uniform Federal Policy for QAPPs; Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1, UFP-QAPP Manual*, Intergovernmental Data Quality Task Force, Draft Version 1, August 2003; *Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Development of DQOs (American Society for Testing and Materials [ASTM] D579)*; *Guidance for Conducting Remedial Investigations and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Interim Final* (USEPA, 1988); *Compendium of Superfund Field Operations Methods* (USEPA, 1987a); *and Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA SW-846, Third Edition and its subsequent updates).

This project *QAPP*, developed under guidance of the *AFCEE QAPP*, shall be read by all essential staff participating in the work effort. This project *QAPP* shall be in the possession of the field teams and in all laboratories performing analytical services. All contractors and subcontractors shall be required to comply with the procedures documented in this project *QAPP* in order to maintain comparability and representativeness of the data produced.

Controlled distribution of this project *QAPP* shall be implemented by the prime contractor to ensure the current version is being used. A sequential numbering system shall be used to identify controlled copies of this project *QAPP*. Controlled copies shall be provided to applicable Air Force managers, regulatory agencies, remedial project managers, project managers, and QA coordinators. Whenever Air Force revisions are made or addenda added to this project *QAPP*, a document control system shall be put into place to assure (1) all parties holding a controlled copy of this project *QAPP* shall receive the revisions/addenda and (2) outdated material is removed from circulation. The

document control system does not preclude making and using copies of this project *QAPP*; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations.

The distribution list for controlled copies shall be maintained by the prime contractor.

2.0 PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

Air Force Plant (AFP) 59 is located in south-central New York in the Westover area of the Town of Union, Broome County, immediately west of Johnson City (mailing address); the site is about 3 miles west of the central business district of the City of Binghamton and about 4 miles east of the center of the Village of Endicott. The plant occupies 29.6 acres (including Parking Lot #5, located north of Main Street) and is situated in a highly urbanized area.

AFP 59 is a government-owned, contractor-operated facility. Remington Rand, Inc., the first manufacturer to occupy the plant, manufactured aluminum aircraft propellers at the plant from 1942 to 1945. The plant closed at the end of World War II and remained idle until April 1949, when it was reopened as an aircraft controls manufacturing facility. GE Aerospace was contracted to operate the facility and to direct manufacturing (primarily of parts for electro-mechanical aircraft control systems). Martin Marietta Aircraft Controls acquired GE Aerospace in 1993 and took over the operation of the facility and the manufacturing activities. BAE Systems currently manufactures flight control, laser, weapons control, internal navigation, and guidance systems at AFP 59.

Past and present activities at AFP 59 have generated a variety of waste products including cutting, lubricating, and coolant oils; degreasing agents; plating acids; caustics; chromium; cyanide solutions; and paint residues.

AFP 59 is listed as a Class 2 Site on the New York State Department of Environmental Conservation (NYSDEC) List of Inactive Hazardous Waste Disposal Sites (Site Code 7-04-020). A Class 2 Site is categorized as posing a "significant threat to the public health or environment." AFP 59 is not on the National Priorities List and is not under a Federal Facility Agreement.

2.2 PROJECT SCOPE AND OBJECTIVES

This *QAPP* covers the following activities to be completed at AFP 59 and adjacent areas by AECOM and its subcontractors:

1. Vapor intrusion investigation in manufacturing building and adjacent areas at AFP 59
2. Off-site residential vapor-intrusion investigation
3. Soil Sampling
4. United States Geological Survey (USGS) well abandonment
5. Groundwater monitoring activities both on- and off-site

The objectives of this project are:

1. Determine if contaminants in the subsurface environment underneath and adjacent to the manufacturing building at AFP 59 pose a threat to the health of BAE employees

2. Determine if subsurface contaminants have migrated into residential areas adjacent to AFP 59 and if these contaminants pose a threat to the health of those living in said residences
3. Determine if the 2005 removal of trichloroethene (TCE)-contaminated soil from the East Basement of the manufacturing building had any impact on groundwater contaminant levels on-site.
4. Determine if contaminated groundwater has migrated off-site
5. Characterize the nature and extent of groundwater and soil contamination along the Fire Suppression Reservoir at AFP 59

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The project organization and responsibility discussion including (1) a project organizational chart identifying task managers and individuals responsible for performance of the project, (2) a list of names of all key participants, including organization names and telephone numbers for project, field, and laboratory QA officers, (3) a description of the authority given to each key participant with an emphasis on the authority of the key individuals to initiate and approve corrective actions, and (4) the role of regulatory representatives are included in Section 4.0 of the *FSP*.

All contractors and subcontractors are identified and the scope of their performance in the project is clearly defined. Subcontractors proposed to provide backup services are identified. An organizational chart, a list of key personnel, and the previously described descriptive text are included for each subcontractor in Sections 4.0 and 4.1 of the *FSP*.

4.0 PROJECT QUALITY OBJECTIVES AND ELEMENTS OF QUALITY CONTROL

Project quality objectives (PQOs) specify the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. PQOs are developed by the contractor with inputs from various sources, including stakeholders, regulators, and environmental professionals, for site-specific applications and become incorporated into the overall project decision-making process. Some factors which may influence the process are existing site location data, the affected media and its current or projected use, local soil and groundwater chemistry, budget, time, and political constraints. Specific project objectives, as summarized in the *FSP*, provide the basis for decision diagrams which specify the quantity and quality of data to be collected and evaluated. An example of a decision diagram is provided to assist the contractor in the overall PQO development thought process and to illustrate the potential complexity and the interdisciplinary nature of the overall data collection program needed for quality, defensible data.

Specific measurement performance criteria for the data quality indicators (precision, accuracy, representativeness, completeness, comparability, and sensitivity [commonly referred to as "PARCCS parameters"]) are developed in the planning phase and become essential elements in the assessment of overall data quality. The goals of these indicators (field and laboratory) are incorporated into the overall PQOs and are included in this project *QAPP*.

4.1 DATA TYPES

The two general types of data are screening data and definitive data. The uses and measurement performance criteria for each must be described in this project *QAPP*.

Screening data are analytical data that are of sufficient quality to support an intermediate or preliminary decision but must eventually be supported by definitive data before the project is complete. Screening data are often generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or QC requirements. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise. Physical test methods (e.g., dissolved oxygen measurements, temperature, pH, moisture content, turbidity, conductance, etc.) have been designated by definition as screening methods (see Section 6).

Screening methods may be confirmed, as required in Section 3.2 of the *FSP*, by definitive analytical methods. Whenever screening data is confirmed by definitive analysis, comparability criteria must be established and documented in this project *QAPP* prior to data collection.

Confirmation samples shall be selected to include both detected and non-detected results from the screening method.

Definitive data are analytical data that are suitable for final decision-making. Often, they are generated using rigorous analytical methods (see Section 7) such as approved USEPA SW-846 reference methods. It is also possible, depending upon the PQOs, that definitive data can be generated in a mobile or off-site laboratory with prior approval of AFCEE. Definitive data are not

restricted in their use unless quality problems require data qualification. All screening and definitive methods to be used must be clearly presented in this project *QAPP*.

4.2 DATA QUALITY INDICATORS

Measurement performance criteria should be determined for each matrix, analytical group, concentration level, and analyte, as appropriate. The criteria should relate to the data quality indicators (DQIs): PARCCS parameters. The DQIs are discussed in the following subsections. Procedures to measure data quality and the use of these indicators must be clearly presented in this project *QAPP*. AFCEE recommended measurement performance criteria for precision, accuracy, and sensitivity for each method and matrix are identified in Sections 6 and 7.

4.2.1 Precision

Precision refers to the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar or prescribed conditions. Precision reflects random error and may be affected by systematic error. It also reflects variation imposed by a given matrix.

Laboratory precision is measured by the variability associated with duplicate (two) or replicate (more than two) analyses. One type of sample that can be used to assess laboratory precision is the laboratory control sample or laboratory control sample (LCS). Multiple LCS analyses over the duration of the project can be used to evaluate the overall laboratory precision for the project. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, rather the comparison is between LCSs analyzed in multiple batches.

Total precision is the measurement of the variability associated with the entire sampling and analytical process. It is determined by analysis of duplicate or replicate (split) field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples shall be analyzed to assess field and laboratory precision. The precision is evaluated using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in Table 4.2.1-1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined and used as the measure of precision. The formula for the calculation of RSD is provided in Table 4.2.1-1.

The required level of precision should be identified in the PQOs. AFCEE recommended values are listed in the accuracy and precision tables in Section 7.

Table 4.2.2-1
Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\overline{X}$	$\frac{\left(\sum_{i=1}^{n} x_i\right)}{n}$	Measure of central tendency.	Used to determine average value of measurements.
Standard Deviation	S	$\left(\frac{\Sigma(x_i-\overline{x})^2}{(n-1)}\right)^{1/2}$	Measure of relative scatter of the data.	Used in calculating variation of measurements.
Relative Standard Deviation	RSD	$(S/\overline{X}) \times 100$	RSD adjusts for magnitude of observations.	Used to assess precision for replicate results.
Percent Difference	%D	$\frac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of 2 observations.	Used to assess accuracy.
Relative Percent Difference	RPD	$\left(\frac{(X_1 - X_2)}{(X_1 + X_2)/2}\right) \times 100$	Measure of variability that adjusts for the magnitude of observations.	Used to assess total and analytical precision of duplicate measurements.
Percent Recovery	%R	$\left(\frac{X_{meas}}{X_{true}}\right) \times 100$	Recovery of spiked compound in clean matrix.	Used to assess accuracy.
Percent Recovery	%R	$\frac{\left(\begin{array}{c}\text{value of}\\ \text{spiked}\\ \text{sample}\end{array} - \begin{array}{c}\text{value of}\\ \text{unspiked}\\ \text{sample}\end{array}\right)}{\text{Value of added spike}} \times 100$	Recovery of spiked compound in sample matrix.	Used to assess matrix effects and total precision.
Correlation Coefficient	r	see SW8000B Section 7.5.3		Evaluation of "goodness of fit" of a regression line.
Coefficient of Determination	COD	see SW8000B Section 7.5.3		Evaluation of "goodness of fit" of a polynomial equation.

x = Observation (concentration)
n = Number of observations

4.2.2 Accuracy

Accuracy is of the degree of agreement between an observed value and a "true" value (correctness) and includes a combination of the random error (precision) and systematic error (bias) components that result from the sampling and analytical procedures. It therefore reflects the total error associated with a measurement. A measurement is considered accurate when the reported value agrees with the true value or known concentration of the spike or standard within acceptable limits Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit (CL). For volatile and semivolatile organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of proficiency testing (PT) samples may also be used to provide additional information for assessing the accuracy of the analytical data being produced.

Both accuracy and precision are calculated for each AFCEE analytical batch, and the associated sample results are interpreted by considering these specific measurements. The formula for calculation of accuracy is included in Table 4.2.1-1 as percent recovery (%R) from pure and sample matrices. Accuracy requirements are listed for each method in Section 7.

4.2.3 Representativeness

Representativeness is a qualitative term, which refers to the degree in which data accurately and precisely depicts the characteristics of a population, whether referring to the distribution of contaminant within a sample, a sample within a matrix, or the distribution of a contaminant at a site. Representativeness is determined by appropriate program design, with consideration of elements such as proper well locations, drilling and installation procedures, and sampling locations. Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Assessment of representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Decisions regarding sample/well/boring locations and numbers, and the statistical sampling design shall be documented in Section 3.3 of the project *FSP*.

4.2.4 Completeness

Completeness is a measure of the amount of valid data obtained compared with the amount that was expected to be obtained under correct, normal conditions. It is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples (e.g., by site) as set out in the PQOs. Valid data is data which is usable in the context of the project goals. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set.

For completeness requirements, valid results are all results not qualified with an R-flag after a usability assessment has been performed. Completeness should not be determined only on the basis of laboratory data qualifiers. (See Section 8 for an explanation of flagging criteria.) The goal for completeness, which should be based on specific project goals, is typically 95 percent for aqueous

samples and 90 percent for soil samples. The prime contractor must evaluate completeness with respect to project goals to determine its impact on the decision-making process.

The formula for calculation of completeness is presented below:

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

4.2.5 Comparability

Comparability is a qualitative indicator of the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of comparability. Analysis of PT samples and reports from audits shall also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project. Assessment of comparability is primarily subjective and results should be interpreted by experienced environmental professionals with a clear knowledge of the PQOs and project decisions. Assessment should include a discussion of the level of uncertainty associated with the comparability of the specific data set and the potential consequences of using non-comparable data.

4.2.6 Sensitivity

Sensitivity is the ability of an analytical method or instrument to discriminate between measurement responses representing different concentrations. This capability is established during the planning phase to meet project-specific objectives. It is important to be able to detect the target analytes at the levels of interest. Sensitivity requirements include the establishment of various limits, which are described in Section 4.3, such as calibration requirements, instrument detection limits (IDLs), method detection limits (MDLs), and project-specific reporting limits (RLs). Both the IDLs and MDLs are normally based on an interference-free matrix (i.e. reagent water or purified solid), which do not take into account matrix effects and may not be achievable for environmental samples.

4.3 METHOD DETECTION LIMITS, REPORTING LIMITS, AND INSTRUMENT CALIBRATION REQUIREMENTS

The MDLs, RLs, and instrument calibration procedures shall be provided in this project *QAPP* according to guidelines set forth below.

4.3.1 Method Detection Limits

Laboratories participating in this work effort shall demonstrate the MDLs for each instrument, including confirmatory columns, method of analysis, analyte, and matrix (i.e., water and soil) using the following instructions:

1. Estimate the MDL using one of the following:
   a) The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5.
   b) The concentration equivalent of 3 times the standard deviation of replicate measurement of the analyte in reagent water.
   c) The region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve).
2. Prepare (i.e., extract, digest, etc.) and analyze seven samples of a matrix spike (MS) (ASTM Type II water for aqueous methods, Ottawa sand for soil methods, glass beads of 1 mm diameter or smaller for metals) containing the analyte of interest at a concentration three to five times the estimated MDL.
3. Determine the variance (S^2) for each analyte as follows:

$$S^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2\right]$$

where x_i = the ith measurement of the variable x and $\bar{x}$ = the average value of x

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

4. Determine the standard deviation (s) for each analyte as follows:

$$s = (S^2)^{1/2}$$

5. Determine the MDL for each analyte as follows:

   MDL = 3.14(s)
   (note: 3.14 is the one-sided t-statistic at the 99 percent confidence level appropriate for determining the MDL using 7 samples)

6. If the spike level used in step 2 is more than 10 times the calculated MDL, repeat the process using a smaller spiking level.

Where multiple instruments are used, the MDL used for reporting purposes shall represent the least sensitive instrument.

4.3.2 Method Detection Limit Verification

An MDL verification check shall be performed on each instrument immediately following an MDL study and can be performed quarterly in place of the annual (every 12 months) MDL study. However, this may not substitute for the initial MDL determination. The MDL check sample shall be spiked at approximately two times the current reported MDL and taken through all preparatory and analytical steps. The MDL is verified if the laboratory can reliably detect and identify all analytes in the check sample by the method-specific criteria. If the method has no confirmation criteria, the check sample must produce a signal that is at least three times the instrument's noise level. If the MDL is not verified, spike at successively higher concentrations until the verification criteria are met, and use the first successful concentration as the reported MDL.

4.3.3 Reporting Limits

The laboratories participating in this work effort shall compare the results of the MDL demonstrations to the RLs for each method that is listed in Section 7.0. The MDL may not be more than one-half the corresponding RL. The laboratories shall also verify RLs by including a standard at or below the RL as the lowest point on the calibration curve. All results shall be reported at or above the MDL values; however, for those results falling between the MDL and the RL, an "F" flag shall be applied to the results indicating the variability associated with the result (see Section 8.0). Results shall not be reported below the MDL.

4.3.4 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations, and these calibrations shall meet the acceptance criteria specified in Section 7.0. All results reported shall be within the calibration range. Results outside the calibration range are unsuitable for quantitative work and will only give an estimate of the true concentration. or SW6010 and SW6020, results shall be within the working range determined by linear range studies. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to standard materials.

Instrument calibration shall be checked using all of the analytes listed in the QC acceptance criteria table in Section 7.0 for the method. This applies equally to multi-response analytes (except as noted in Section 7.0). All calibration criteria shall satisfy SW-846 requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Multipoint calibrations shall contain the minimum number of calibration points specified in the method with all points used for the calibration being contiguous. If more than the minimum number of standards is analyzed for the initial calibration, all of the standards analyzed shall be included in the initial calibration. The only exception to this rule is a standard that has been statistically determined as being an outlier can be dropped from the calibration, providing the requirement for the minimum number of standards is met. Acceptance criteria for the calibration check are presented in Section 7.0. Analyte concentrations are determined with either calibration curves or response factors (RFs). For gas chromatography (GC) and GC/mass spectrometry methods, when using RFs to determine analyte concentrations, the

average RF from the initial five-point calibration shall be used. The continuing calibration shall not be used to update the RFs from the initial five-point calibration. The continuing calibration verification cannot be used as the LCS, except volatile organic compound (VOC) analysis. In addition, the concentration used for the calibration verification sample shall be at or below the middle of the calibration curve. Finally, the lowest standard used must be at or below the RL for each analyte in the method.

4.4 ELEMENTS OF QUALITY CONTROL

QC elements relevant to screening data are presented in Section 6.0. This section presents QC requirements relevant to analysis of environmental samples that shall be followed during the analytical activities for fixed-base, mobile, and field laboratories producing definitive data. The purpose of this QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

Laboratory QC samples (e.g., blanks and laboratory control samples) shall be included in the preparation batch with the field samples. An AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of reagents. Matrix spikes and matrix spike duplicates (MSDs) count as environmental samples. The term AFCEE analytical batch also extends to cover samples that do not need separate extraction or digestion (e.g., volatile analyses by purge and trap). This AFCEE analytical batch is a number of samples (20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and analyzed sequentially. AFCEE allows 20 field samples plus MS/MSD pair per batch. The identity of each AFCEE analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples. The references to the analytical batch in the following sections and tables in this *QAPP* refer to the AFCEE analytical batch.

The type of QC samples and the frequency of use of these samples are discussed below and in the method-specific subsections of Section 7.0.

4.4.1 Laboratory Control Sample

The LCS is analyte-free water for aqueous analyses or a choice of Ottawa sand, sodium sulfate, or glass beads 1 mm or smaller in diameter for soil spiked with all analytes listed in the QC acceptance criteria table in Section 7.0 for the method. Each analyte in the LCS shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. (The midpoint is defined as the median point in the curve, not the middle of the range.) The LCS shall be carried through the complete sample preparation and analysis procedure.

The LCS is used to evaluate each AFCEE analytical batch and to determine if the method is in control. Except for VOCs, the LCS cannot be used as the continuing calibration verification.

One LCS shall be included in every AFCEE analytical batch. If more than one LCS is analyzed in an AFCEE analytical batch, results from all LCSs analyzed shall be reported. A QC failure of an analyte in any of the LCSs shall require appropriate corrective action including qualification of the failed analyte in all of the samples as required.

The performance of the LCS is evaluated against the QC acceptance limits given in the tables in Section 7.0. Whenever an analyte in an LCS is outside the acceptance limit, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, all samples in the AFCEE analytical batch shall be reanalyzed for the out-of-control analyte(s). When an analyte in an LCS exceeds the upper or lower control limit (UCL or LCL) and no corrective action is performed or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to all affected results.

4.4.1.1 Marginal Exceedance

A number of sporadic marginal exceedances of the LCS CLs are allowed. The number of exceedances is based on the total number of analytes spiked into the LCS and may not exceed 5 percent of the total number of analytes in the LCS. The table below presents the allowable number of marginal exceedances for a given number of analytes in the LCS.

Number of Analytes in LCS	Allowable Number of Marginal Exceedances of LCS CLs
>90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
< 11	0

A *marginal exceedance* is defined as beyond the LCS CLs but within the marginal exceedance limits, which are set at 4 standard deviations around the mean. This outside boundary prevents a grossly out-of-control LCS from passing.

Marginal exceedances must be sporadic (i.e., random). If the same analyte exceeds the LCS CLs repeatedly (e.g., 2 out of 3 consecutive LCS), that is an indication that the problem is systematic, not random. The source of error should be located and appropriate corrective actions taken. The allowance for marginal exceedance is a new policy being introduced Department of Defense (DoD)-wide.

4.4.1.2 Laboratory Control Sample Failure

Each LCS must be evaluated against the LCS CLs and marginal exceedance limits before being accepted. The recoveries for the analytes spiked into the LCS should first be compared with the LCS CLs. If a recovery is less than the LCL or greater than the UCL, that is an exceedance. The

laboratory should note which analytes exceeded the CLs and make a comparison to the list of project-specific analytes of concern. If a project-specific analyte of concern exceeds its LCS control limit, the LCS has failed. Next, the laboratory should add up the total number of exceedances for the LCS. Based on the number of analytes spiked into the LCS, the total number of exceedances is compared with the allowable number in the table. If an LCS has more than the allowable number of marginal exceedances, the LCS has failed. Finally, the recoveries for those analytes that exceeded the LCS CLs should be compared to the marginal exceedance limits. If a single analyte exceeds its marginal exceedance limit, the LCS has failed. (This only applies to methods with greater than 10 analytes.)

Note: The target analytes from Section 7.0 should not be considered project-specific analytes of concern unless the client separately specifies the analytes. A requirement to analyze all compounds on the target analyte list does not define a project-specific analyte.

In summary, failure of the LCS can occur several ways:

- Exceedance of an LCS control limit by any project-specific analyte of concern.
- Marginal exceedance of the LCS CLs by more than the allowable number of analytes.
- Exceedance of the marginal exceedance limits by one or more analytes.

Once an LCS has failed, corrective action is required.

4.4.1.3 Corrective Action

If a sample fails based on any criteria in Section 4.4.1.2, correction is required. The corrective action requirement applies to all analytes that exceeded the LCS CLs, even if one specific analyte's exceedance was not the trigger of LCS failure. All exceedances of the LCS CLs, marginal or otherwise, are subject to corrective action. If an LCS fails, an attempt must be made to determine the source of error and find a solution. All findings and corrective action should be documented. After the system problems have been resolved and system control has been reestablished, all samples in the AFCEE analytical batch shall be reprepped and reanalyzed for the out-of-control analyte(s) or the batch rerun with a new LCS. The corrective action applied shall be based on professional judgment in the review of other QC measures (i.e., surrogates). If an analyte falls outside the LCS CLs a second time or if there is not sufficient sample material available to be reanalyzed, then all the results in the AFCEE analytical batch for that analyte must be flagged. The recoveries of those analytes subject to corrective action must be documented in the cast narrative, whether flagging is needed or not.

4.4.2 Matrix Spike/Matrix Spike Duplicate

A MS and MSD is an aliquot of sample spiked with known concentrations of all analytes listed in the QC acceptance criteria table in Section 7.0 for the method. The spiking occurs prior to sample preparation and analysis. Each analyte in the MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. Only AFCEE samples shall be used for spiking. The MS/MSD shall be designated on the chain of custody.

The MS/MSD is used to document the bias of a method due to sample matrix. Thus, for soil samples, laboratories may use the same container for the parent sample, the MS sample, and the MSD sample (except for volatile organics analyses [VOAs]), if there is enough sample. AECOM will select the samples for MS/MSDs. The sample replicates will be generated in the field, to be used by the laboratory to prepare the appropriate MS/MSDs. They are used to document potential matrix effects associated with a site. The MS/MSD results and flags must be associated or related to samples that are collected from the same site from which the MS/MSD set were collected. AFCEE does not use MSs and MSDs to control the analytical process.

A site-specific MS/MSD should be specified for each media, e.g., any different soil, water, soil gas, or sediment for each site during each sampling event, which should not exceed 5 working days in 1 week. A minimum of one MS and one MSD shall be designated by the field manager for each site and analyzed with every batch of AFCEE samples in a sample delivery group (SDG) of up to 20 field samples (i.e., collect up to 20 field samples followed by 2 additional samples designated as MS and MSD). More than one MS/MSD pair may be submitted as part of the sample group of environmental samples; however, project managers must coordinate with the laboratory providing analytical services for most cost effective sampling.

The performance of the MS and MSD is evaluated against the QC acceptance limits given in the tables in Section 7.0. If either the MS or the MSD is outside the QC acceptance limits, the analytes in all related samples shall be qualified according to the data flagging criteria in Sections 7.0 and 8.0. Please note: The laboratory will not report batch QC samples such as MS/MSD from another project.

4.4.3 Surrogates

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

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency.

Surrogates shall be added to environmental samples, controls, and blanks, in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limit, corrective action must be performed. After the system problems have been resolved and system control has been reestablished, reprepare and reanalyze the sample. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.4 Internal Standards

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

ISs shall be added to environmental samples, controls, and blanks, in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions shall be performed. After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.5 Retention Time Windows

Retention time windows are used in GC analysis for qualitative identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are given in SW-846 Method 8000C.

When the retention time is outside of the acceptance limits, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, reanalyze all samples analyzed since the last acceptable retention time check. If corrective actions are not performed, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.6 Interference Check Sample

The interference check sample (ICS), used in inductively coupled plasma (ICP) analyses only, contains both interfering and analyte elements of known concentrations.

The ICS is used to verify background and interelement correction factors.

The ICS is run at the beginning and end of each run sequence for SW6010B and SW6020B.

When the interference check sample results are outside of the acceptance limits stated in the method, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, reanalyze the ICS. If the ICS result is acceptable, reanalyze all affected samples. If corrective action is not performed or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to all affected results.

4.4.7 Method Blank

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

The method blank is used to document contamination resulting from the analytical process.

A method blank shall be included in every AFCEE analytical batch.

The presence of analytes in a method blank at concentrations equal to or greater than the RL indicates a need for corrective action. Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples containing the analyte(s) found in the method blank above the RL shall be reprepared and reanalyzed. No analytical data shall be corrected for the presence of analytes in

blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results. If the target compounds detected in the method blank is greater than or equal to the MDL, then the lab will flag all associated samples with a "B" qualifier. The lab will perform a corrective action if the target compounds are greater than $^1/_2$ of the RL or greater than the RLs.

4.4.8 Ambient Blank

The ambient blank consists of ASTM Type II reagent grade water poured into a VOC sample vial at the sampling site (in the same vicinity as the associated samples). It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes.

Ambient blanks are used to assess the potential introduction of contaminants from ambient sources (e.g., active runways, engine test cells, gasoline motors in operation, etc.) to the samples during sample collection.

An ambient blank shall be collected for each VOCs sampling event where the potential for introduction of contaminants from surrounding sources exist. Ambient blank samples shall be collected downwind of possible VOC sources. Flagging of sample results associated with contaminated ambient blanks is discussed in Section 8.

4.4.9 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent grade water poured into or over or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis.

Equipment blanks are used to assess the effectiveness of equipment decontamination procedures.

The frequency of collection for equipment blanks is specified in Section 3.2 of the project-specific *WP*. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site.

When an analyte is detected in the equipment blank the appropriate validation flag, as described in Section 8, shall be applied to all sample results from samples collected with the affected equipment.

4.4.10 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes.

Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. Each cooler of samples sent to the laboratory for

analysis of VOCs shall contain one trip blank. For methanol preserved soil samples being analyzed for gasoline range organic (GRO) or VOC, a methanol blank shall be utilized.

When an analyte is detected in the trip blank the appropriate validation flag, as described in Section 8, shall be applied to all sample results from samples in the cooler with the affected trip blank.

4.4.11 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned a unique identification number in the field. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest.

The frequency of collection for field duplicates is specified in Section 3.2 of the project-specific *WP*.

4.4.12 Field Replicates

A field replicate sample, also called a split, is a single sample divided into two equal parts for analysis. The sample containers are assigned a unique identification number in the field. Specific locations are designated for collection of field replicate samples prior to the beginning of sample collection.

Replicate sample results are used to assess precision. The frequency of collection for field replicates is specified in Section 3.2 of the project-specific *WP*.

4.5 QUALITY CONTROL PROCEDURES

4.5.1 Holding Time Compliance

All sample preparation and analysis shall be completed within the method-required holding times. The holding time for a sample begins at the time of sample collection. Some methods have more than one holding time requirement (e.g., methods SW8081A, SW8270C, etc.). The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required reanalyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required reanalyses.

If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section 8.

4.5.2 Confirmation

Quantitative confirmation of results at or above the RL for samples analyzed by GC or high performance liquid chromatography (HPLC) shall be required, unless otherwise specified for the method in Section 7, and shall be completed within the method-required holding times. For GC methods, a second column is used for confirmation. For HPLC methods, a second column or a different detector will be used. The result from the primary column/detector is the result that shall be reported. If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section 8.

4.5.3 Control Charts

Control charts are used to track the performance of laboratory control sample recoveries over time. All analytes spiked into the LCS should be tracked via control charts. These charts are useful in identifying trends and problems in an analytical method. Updating these charts on an annual basis and reviewing them on a quarterly basis for possible trends that could compromise data quality is recommended. These charts can also be used to benchmark a laboratory's performance against AFCEE requirements to determine possible areas to look for improvement.

4.5.4 Standard Materials

Standard materials, including second source materials, used in calibration and to prepare samples shall be traceable to National Institute Standards and Technology (NIST), USEPA, American Association of Laboratory Accreditation (A2LA) or other equivalent AFCEE approved source, if available. If an NIST, USEPA or A2LA standard material is not available, the standard material proposed for use shall be included in an addendum to the *SAP* and approved before use. The standard materials shall be current, and the following expiration policy shall be followed: The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date or one year from the date of receipt, whichever comes first. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be either revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory shall label standard and QC materials with expiration dates.

A second source standard is used to independently confirm initial calibration. A second source standard is a standard purchased from a different vendor than the vendor supplying the material used in the initial calibration standards. The second source material can be used for the continuing calibration standards or for the LCS (but shall be used for one of the two). Two different lot numbers from the same vendor do not constitute a second source.

4.5.5 Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents shall be monitored by analysis of LCSs. An inventory and storage system for these materials shall assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

5.0 SAMPLING PROCEDURES

5.1 FIELD SAMPLING

The field sampling procedures for collecting samples and sampling methods shall be included in Section 4.3 of the project-specific *WP*.

5.1.1 Sample Containers

Sample containers are purchased precleaned and treated according to USEPA specifications for the methods. Sampling containers that are reused are decontaminated between uses by the USEPA-recommended procedures (i.e., USEPA 540/R-93/051). Containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

5.1.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 5.1.2-1. The required sample volumes, container types, and preservation requirements for analytical methods proposed for project work not listed in use.

Table 5.1.2-1
Requirements for Containers, Preservation
Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Containers	Preservation	Maximum Holding Time
Air VOCs	TO15	SUMMA® canister or equivalent	N/A	30 days
Volatile organics (VOCs)	SW8260B	**Aqueous**: 3 x 40ml glass VOA vial, polytetrafluoroethylene (PTFE) septum caps **Solid**: Encore or equivalent samplers	**Aqueous**: pH ≤ 2 with HCl **Solid**: Cool to 4°C.	**Aqueous**: 14 days **Solid**: 48 hours
1,4-dioxane (Semivolatile organics)	SW8270C SIM	**Aqueous**: 2 x 1-liter amber glass bottles with Teflon-lined cap(s)	**Aqueous**: If no residual chlorine present, cool to 4°C. If residual chlorine present, add 1 mL sodium thiosulfate per liter of water, cool to 4°C.	**Aqueous**: 7 days until extraction and 40 days after extraction

Table 5.1.2-1
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times (Continued)

Name	Analytical Methods	Containers	Preservation	Maximum Holding Time
IDW Soil/Sludge				
TCLP Volatile fraction	SW1311	**Aqueous**: 500 mL glass bottle with PTFE-lined septum **Solid**: 125 mL glass jar with PTFE septum or Encore sampler	**Aqueous & Solid:** Cool to 4°C.	**Aqueous & Solid:** 14 days to TCLP extraction and extracts analyzed within 14 days after extraction
TCLP Extractable fraction	SW1311	**Aqueous**: 3 x 1-liter amber glass bottle with PTFE-lined lid **Solid**: 500 mL wide-mouth glass jar with PTFE lined lid	**Aqueous & Solid:** Cool to 4°C.	**Aqueous & Solid:** 14 days to TCLP extraction, 7 days to prep extraction and extracts analyzed within 40 days after prep extraction
TCLP Inorganic fraction (except Hg)	SW1311	**Aqueous**: N/A **Solid**: N/A	N/A	180 days to TCLP extraction, 180 days after TCLP extraction
TCLP Inorganic fraction (Hg)	SW1311	**Aqueous**: N/A **Solid**: N/A	N/A	28 days to TCLP extraction, 28 days after TCLP extraction
Ignitability	SW1010/SW1020	**Aqueous**: 250 mL glass or HDPE bottle **Solid**: N/A	**Aqueous:** Cool to 4°C	N/A
Corrosivity	SW9040/SW9045	**Aqueous**: 60 mL glass or HDPE bottle **Solid**: 125 mL wide-mouth glass bottle	**Aqueous**: Non required **Solid**: Cool to 4°C.	**Aqueous**: 24 hours **Solid**: As soon as possible
Reactivity-cyanide or sulfide	SW-846, Section 7.3	**Aqueous**: 1-liter glass or HDPE bottle **Solid**: 250 mL wide-mouth glass jar	**Aqueous**: Adjust pH to ≥ 12 with 50% NaOH. If oxidizing agents present, add 5 mL $NaAsO_2$ per liter, or 0.6g ascorbic acid per liter. Cool to 4°C **Solid**: Cool to 4°C	14 days

PTFE = Polytetrafluoroethylene

5.2 SAMPLE HANDLING AND CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

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

The following information concerning the sample shall be documented on the AFCEE chain of custody (CoC) form (as illustrated in Section 8):

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

All samples shall be uniquely identified, labeled, and documented in the field at the time of collection.

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

Once the samples reach the laboratory, they shall be checked against information on the CoC form for anomalies. For the safety of the personnel involved, coolers containing AFCEE samples shall be

opened in a hood in case there has been any breakage of container of potentially contaminated sample material. The condition, temperature, and appropriate preservation of samples shall be checked and documented on the CoC form. Checking an aliquot of the sample using pH paper is an acceptable procedure except for VOCs where an additional sample is required to check preservation. The occurrence of any anomalies in the received samples and their resolution shall be documented in laboratory records. All sample information shall then be entered into a tracking system, and unique analytical sample identifiers shall be assigned. A copy of this information shall be reviewed by the laboratory for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods required routinely for AFCEE work are specified in Table 5.1.2-1. **Samples not preserved or analyzed in accordance with these requirements shall be resampled and analyzed, at no additional cost to AFCEE.** Subcontracted analyses shall be documented with the AFCEE CoC form. Procedures ensuring internal laboratory CoC shall also be implemented and documented by the laboratory. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory, samples shall be stored in limited-access, temperature-controlled areas. Refrigerators, coolers and freezers shall be monitored for temperature seven days a week. Acceptance criterion for the temperatures of the refrigerators and coolers is 4°C ± 2°C. Acceptance criterion for the temperatures of the freezers shall be less than 0°C. All of the cold storage areas shall be monitored by thermometers that have been calibrated with a NIST-traceable thermometer. As indicated by the findings of the calibration, correction factors shall be applied to each thermometer. Records that include acceptance criteria shall be maintained. Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Samples shall be stored after analysis until disposed of IAW applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory. Refrigerators storing AFCEE VOA samples shall contain a blank that shall be analyzed at a minimum of every two weeks.

Standard operating procedures (SOPs) describing sample control and custody shall be maintained by the laboratory.

6.0 SCREENING ANALYTICAL METHODS

The analytical screening methods contained in this section are shown in Table 6-1. This section includes brief descriptions of the methods and QC required for screening procedures commonly used to conduct work efforts. The methods and QC procedures were taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA SW-846, Third Edition, and its first, second and third update), *Methods for Chemical Analysis of Water and Waste* (USEPA 1979), *ASTM Annual Book of Standards* (1993), and from manufacturers' literature.

Table 6-1
Screening Analytical Methods

Method	Parameter
SW846 (3550)	Moisture (as % solids)
SW1020A / SW1010/ SW1030	Ignitability
SW1110	Corrosivity
SW9040B	pH (water)
SW9045C	pH (soil)
SW9050A	Conductance
E170.1	Temperature
E180.1	Turbidity
E360.1	Dissolved oxygen
Organic vapor-analysis using an instrument equipped with photoionization detector (PID)	Soil gas screening-halogenated, aromatic, and petroleum hydrocarbons. Screening of drill cuttings, borings, monitoring wells, and temporary probes.
ASTM D1498	Oxidation-reduction potential

6.1 ANALYTICAL SCREENING METHOD DESCRIPTIONS

Section 6.1 contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description
- The RL (if applicable)

6.1.1 Methods SW1010/SW1020A/SW1030 – Ignitability

Method SW1010 makes use of the Pensky-Martens tester to determine the flash point of liquid samples, including those that form surface films and/or contain non-filterable suspended solids.

Method SW1020A makes use of the Setaflash Closed Tester to determine the flash point of liquids that have flash points between 0 and 110 °C and viscosities lower than 150 stokes at 25 °C. If a

sample contains non-filterable suspended solids, use SW1010 (Pensky-Martens Ignitability) instead of Method SW1020.

Method SW1030 is used to determine the ignitability of solids and is suitable for the pastes, granular materials, solids that can be cut into strips, and powdery substances.

6.1.2 Method SW1110 – Corrosivity

This test exposes steel to liquid waste to determine the corrosivity of the waste.

6.1.3 Methods SW9040B (Water)/SW9045C (Soil) – pH

pH measurements shall be performed for aqueous samples using Method SW9040. pH measurements of soil or solid samples are performed using Method SW9045C. Measurements are determined electrometrically using either a glass electrode in combination with a reference potential, or a combination electrode. pH measurements are important tools for predicting the extent of contamination as well as providing information regarding the potential ionization forms of contaminants in groundwater. This can be used to predict their respective fate and transport.

6.1.4 Method SW9050A – Conductance

Standard conductivity meters are used. Temperature is also reported. Conductivity is an important parameter used in fate and transport modeling of contaminants.

6.1.5 United States Environmental Protection Agency Method 170.1 – Temperature

Temperature measurements are made with a mercury-filled or dial type centigrade thermometer or a thermistor.

6.1.6 United States Environmental Protection Agency Method 180.1 – Turbidity

This method is based on a comparison of the light scattered by the sample under defined conditions with the light intensity scattered by a standard reference suspension - the higher the intensity, the greater the turbidity. Turbidity measurements are made in a nephelometer and are reported in terms of nephelometric turbidity units (NTUs). The working range for the method is from 0 - 40 NTU. Higher levels of turbidity can be measured by diluting the sample with turbidity-free de-ionized water.

6.1.7 United States Environmental Protection Agency Method 360.1 – Dissolved Oxygen

An instrumental probe, usually dependent upon an electrochemical reaction, is used for determination of dissolved oxygen in water. Under steady-state conditions, the current or potential can be correlated with dissolved oxygen concentrations. This measurement is used in fate and transport modeling as well as a factor in the determination of natural attenuation potential. It is also useful in predicting the chemical forms of the contaminants and their breakdown products.

6.1.8 American Society for Testing and Materials D1498 – Oxidation-Reduction Potential

This method is designed to measure the oxidation-reduction potential (ORP) in water, which is defined as the electromotive force between a noble metal electrode and a reference electrode when immersed in a solution. This measurement is used in fate and transport modeling as well as a factor in the determination of natural attenuation potential.

6.1.9 SW-846 (Described in Method SW3550) – Percent Solids

Percent solids is determined for solid samples undergoing analysis for inorganic and organic analytes. The sample is weighed, dried, and then reweighed. Percent solids is calculated as:

$$\frac{\text{Dried Weight}}{\text{Initial Weight}} \times 100 = \%\ \text{solids}$$

The solid content is used to calculate results for soil samples on a dry weight basis using the calculation presented below:

$$\frac{\text{Result of analysis on a wet weight basis}}{\%\ \text{solids} / 100} \quad \text{Result of analysis on a dry weight basis}$$

All MDLs for solids samples shall be reported on a dry-weight basis. Soil sample results shall be reported on a dry-weight basis.

6.1.10 Real-Time Portable Organic Vapor Analyzers

Two types of portable analyzers shall be used to perform real-time nonspecific analyses of hydrocarbon vapors. The instruments include a PID (e.g., HNu® Systems [HNu®] trace gas analyzer) organic vapor monitor. One or more of these instruments may be used at a specific site, depending on the contaminant species of interest. When used together, the instruments provide complementary information because they are sensitive to different types of hydrocarbon vapors.

The portable analyzers shall be used as a screening tool to help determine the optimum locations for the collection of samples. Field data recorded on the CoC forms give the laboratory analysts an indication of the approximate concentration of contaminants and aid in calculating dilution factors before analysis. Additionally, the real-time instruments are used to aid in selecting the proper level of personal protective equipment and monitoring air emissions during sampling activities. The comparability of results obtained from the PID instrument can be considered only to be within the variability of this type of screening instrument. Comparability is greatest when the instruments are calibrated with the same standards and operated within similar concentration ranges.

The PID uses a photoionization detector to detect and measure total hydrocarbon vapors. The instrument has an operating range of 0 to 2,000 ppm. During operation, a gas sample is drawn into the probe and past an ultraviolet light source by an internal pumping system. Contaminants in the sample are ionized, producing an instrument response if their ionization potential is equal to or less

than the ionizing energy supplied by the lamp. The radiation produces a free electron for each molecule of ionized contaminant, which generates a current directly proportional to the number of ions produced. This current is measured and displayed on the meter. The PID measures the *total* value for all species present with ionization potentials less than or equal to that of the lamp.

6.2 CALIBRATION AND QUALITY CONTROL PROCEDURES FOR SCREENING METHODS

All screening data shall be flagged with an "S" data qualifier to show the reported data are screening data (see Section 8). The other data qualifiers that shall be used with screening data are also shown in Table 6.2-1 and Section 8. Flagging criteria are applied (except for the "S" flag) when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Table 6.2-1 presents the calibration and QC procedures for each method. These requirements as well as the corrective actions and data flagging criteria are included. In this table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that must be applied in the event that the method-required calibration and QC acceptance criteria are not met.

Table 6.2-1
Summary of Calibration and Quality Control Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Flagging Criteria[b]
SW-846[c]	Moisture	Field duplicate	1 per 20 samples	% solid RPD ≤ 15%	Correct problem, repeat measurement. If still out, flag data	J if RPD > 15% and ~. Q if RPD > 30%
SW9040B	pH (water)	2-point calibration with pH buffers	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	Flagging criteria are not appropriate
		pH 7 buffer	At each sample location	± 0.1 pH units	Correct problem, recalibrate	Flagging criteria are not appropriate
		Field duplicate	10% of field samples	± 0.1 pH units	Correct problem, repeat measurement	J
SW9045C	pH (soil)	2-point calibration with pH buffers	Once per day	± 0.05 pH unit	Check with new buffers; if still out, repair meter; repeat calibration check	Flagging criteria are not appropriate
		pH 7 buffer	At each sample location	± 0.1 pH unit	Recalibrate	Flagging criteria are not appropriate
		Field duplicate	10% of field samples	± 0.1 pH unit	Correct problem, repeat measurement. If still out, repeat calibration and reanalyze samples	J
SW9050A	Conductance	Calibration with KCl standard	Once per day at beginning of testing	± 5%	If calibration is not achieved, check meter, standards, and probe; recalibrate	Flagging criteria are not appropriate
		Field duplicate	10% of field samples	± 5%	Correct problem, repeat measurement	J
E170.1	Temperature	Field duplicate	10% of field samples	± 1.0 C	Correct problem, repeat measurement	J

Table 6.2-1
Summary of Calibration and Quality Control Procedures for Screening Methods (Continued)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Flagging Criteria[b]
E180.1	Turbidity	Calibration following manufacturer's instructions (minimum one blank and three standards	As needed	In accordance with manufacturer's instructions	If calibration is not achieved, check meter; replace if necessary, recalibrate	Flagging criteria are not appropriate
		Calibration verification (mid-range)	Daily, before sample analysis	± 10% of expected value	Correct problem, repeat measurement, recalibrate	Flagging criteria are not appropriate
		Field duplicate	10% of field samples	RPD ≤ 20%	Correct problem, repeat measurement	J
None	Organic vapor concentrations (PID)	3 point calibration	Monthly	correlation coefficient ≥ 0.995	Recalibrate; check instrument and replace if necessary	Flagging criteria are not appropriate
		Calibration verification and check	Daily at beginning and end of day	Response ± 20% of expected value	Correct problem, recalibrate	Flagging criteria are not appropriate
ASTM D1498	Oxidation-reduction potential	Sensitivity verification	Daily	ORP should decrease when pH is increased	If ORP increases, correct the polarity of electrodes. If ORP still does not decrease, clean electrodes and Repeat procedure	Flagging criteria are not appropriate
		Calibration with one standard	Once per day	Two successive readings ± 10 millivolts	Correct problem, recalibrate	Flagging criteria are not appropriate
		Field duplicate	10% of field samples	± 10 millivolts	Correct problem, repeat measurement	J
SW1110	Corrosivity	Duplicate	10% of field samples	RPD ≤ 20%	Correct problem, repeat measurement	J
E360.1	Dissolved oxygen	Field duplicate	10% of field samples	RPD ≤ 20%	Correct problem, repeat measurement	J

a. All corrective actions shall be documented, and the records shall be maintained by the prime contractor.
b. All screening results are typically flagged with an "S" and also any other appropriate validation flags identified in the Data Flagging Criteria column of the table. For example "SJ", "SB", "SR". However, because the limited amount of screening data that will be generated will only be from health and safety monitoring (and potentially the measurement of *in-situ* groundwater parameters), the screening data will not be subjected to the typical data review, qualification, and validation process.

7.0 DEFINITIVE DATA ANALYTICAL METHODS AND PROCEDURES

Section 7.1 contains brief descriptions of preparation methods. Section 7.2 contains subsections for each analytical procedure. Each subsection contains the following information:

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

This information was obtained from the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA SW-846, Third Edition, and its first, second and third update); *Guidance for Contract Deliverables (GCD),* Version 1.1, March 1998. Definitions of terms are given in Section 4.0, and data validation procedures are presented in Section 8.0.

7.1 PREPARATIVE METHODS

Typical SW-846 and other USEPA extraction and digestion procedures for liquid and solid matrices are presented in Table 7.1-1. These preparatory methods are also listed with the associated analytical procedures in Table 7.1-2. Method specific preparations are covered in the appropriate determinative methods.

Table 7.1-1
Sample Preparation Methods

Method	Parameter
Volatile Organics	
SW5030B	Purge and Trap for Volatile Organic Compounds (aqueous samples)
SW5035A	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
Extractable Organics	
SW3510C	Separatory Funnel Liquid-Liquid Extraction (aqueous samples)
SW3520C	Continuous Liquid-Liquid Extraction (aqueous samples)
Leaching Procedures	
SW1311	Toxicity Characteristic Leaching Procedure (aqueous and solid samples)

Table 7.1-2
Analytical Methods

Analytical Method	Parameter	Preparation Methods	
		Water/Aqueous	Soil/Solid
GC/Mass Spectrometry			
SW8260B	Volatile organics	5030B	5035A
TO-15	Volatile Organics in Air	N/A	N/A
GC/Mass Spectrometry SIM			
SW8270C SIM	1,4-dioxane	3510C, 3520C	N/A

7.1.1 Method SW5030B – Purge and Trap for Volatile Organic Compounds

Method SW5030B describes sample preparation and extraction for the analysis of VOCs. This method is applicable to aqueous samples.

An inert gas is then bubbled through the sample solution at ambient temperature to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column is heated and back flushed with inert gas to desorb the components onto a GC column.

7.1.2 Method SW5035A – Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

Method SW5035A describes sample preparation and extraction for the analysis of VOCs in solid matrices. The method involves a heated purge of volatile components followed by analysis on a GC or GC/mass spectrometry. Analyzing the sample unpreserved within the prescribed 48-hour holding time is the preferred option.

7.1.3 Method SW3510C – Separatory Funnel Liquid-Liquid Extraction

Method SW3510C is designed to quantitatively extract nonvolatile and semivolatile organic compounds (SVOCs) from liquid samples using standard separatory funnel techniques. The sample and the extracting solvent must be immiscible in order to yield recovery of target compounds. Subsequent cleanup and detection methods are described in the organic analytical method used to analyze the extract.

7.1.4 Method SW3520C – Continuous Liquid-Liquid Extraction

Method SW3520C is a procedure for isolating organic compounds from aqueous samples and is designed for extraction solvents with greater density than the sample.

7.1.5 Method SW1311 – Toxicity Characteristic Leaching Procedure

Method SW1311 is used to prepare samples for determination of the concentration of organic (semivolatile and volatile) and inorganic constituents that are leachable from waste or other

material. It is applicable for estimating the mobility of specific contaminants in wastes that are destined for disposal in municipal landfills.

QC is accomplished by preparing a toxicity characteristic leaching procedure (TCLP) blank at a rate of one blank for every 20 extractions conducted in the extraction vessel. Additional extract is prepared so one MS is performed for each waste type (samples of similar waste types shall be batched together). One MS must be analyzed in each AFCEE analytical batch. These QA measures are in accordance with USEPA Method SW1311, Section 8.0.

7.2 DETERMINATIVE METHODS

The analytical methods presented in this section are listed in Table 7.2-1. This section is organized by methodologies including GC/mass spectrometry and GC/mass spectrometry SIM.

A brief description and two tables for each method are included in the following subsections. The first table presents the RLs for the default analytes in the method. The RLs are presented for both soil and water matrices. The analytes included in these tables are not all inclusive lists. Specific lists of analytes for each method should be determined by regulatory requirements and site-specific information. The analytes in these tables should be used as defaults when no other target analyte list has been developed. The second table presents acceptance criteria for the accuracy of spiked analyte and surrogate recoveries. This table also presents acceptance criteria for the precision of matrix spike, field duplicate, and laboratory duplicate samples.

An additional table presents the calibration and QC procedures for each methodology (i.e., GC, GC/mass spectrometry, etc.). Corrective actions and data flagging criteria are also included in this table. The first two columns in this table designate the QC check and minimum frequency that the check is to be preformed. The third column designates the acceptance criteria for each calibration and QC element, and the fourth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that shall be applied by the laboratory in the event that the method-required calibration and QC acceptance criteria or acceptance criteria are not met. It should be clearly understood that these are laboratory data qualifiers. If a laboratory has more and they are consistent with these and properly defined, the laboratory may use them. When other flags are required contractually, they shall be used. Data usability should be carefully assessed by an individual experienced in data review who represents the data user or the user's agent.

It should be clearly understood that each analyst must demonstrate his or hers ability to generate acceptable accuracy and precision using at least four replicate analyses of a QC check sample. If the acceptance criteria are not met, then the problem must be located and fixed and demonstration successfully rerun prior to the analyst analyzing project samples. All data analyzed by an unqualified analyst (i.e., failing to meet QC criteria) shall be flagged R.

7.2.1 Gas Chromatography/Mass Spectrometry Methods

7.2.1.1 Method SW8260B – Volatile Organics

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8260B. This method uses a capillary column GC/mass spectrometry technique. Volatile compounds are

introduced into the GC by purge and trap (SW5030B or SW5035) or other approved method (see Table 7.1-1). An inert gas is bubbled through the water samples (or soil-water slurry for soil samples) to transfer the purgeable organic compounds from the liquid to vapor phase. The vapor is then swept through a sorbent trap where the purgeable organics are trapped. The trap is backflushed and heated to desorb the purgeable organics onto a capillary GC column where they are separated and then detected with a mass spectrometer. The analytes detected and RLs (using a 25 mL purge) for this method are listed in Table 7.2.1.1-1. Soil samples with higher contaminant levels can be extracted using methanol before purging. However, the RLs arising from the use of this preparatory method will be higher than those listed in Table 7.2.1.1-1 and the accuracy and precision requirements listed in Table 7.2.1.1-2 will not be met as well. Project specific DQOs and analytical protocols will need to be established if this preparatory method is used.

Calibration – The mass spectrometer is tuned daily to give an acceptable spectrum for 4-Bromofluorobenzene (BFB). The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

mass 50	15 percent to 40 percent of mass 95
mass 75	30 percent to 60 percent of mass 95
mass 95	base peak, 100 percent relative abundance
mass 96	5 percent to 9 percent of mass 95
mass 173	less than 2 percent of mass 174
mass 174	greater than 50 percent of mass 95
mass 175	5 percent to 9 percent of mass 174
mass 176	greater than 95 percent, but less than 101 percent of mass 174
mass 177	5 percent to 9 percent of mass 176

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample. Table 7.2.1.1-2 provides acceptance criteria for accuracy of spiked analytes and ISs, precision of duplicate/replicate analyses, and recommended IS associations. Also included in Table 7.2.1.1-2 are the marginal exceedances limits taken from the DoD QSM. Table 7.2.1.1-3 identifies the, QC checks, minimum frequencies, acceptance criteria, corrective actions, and flagging criteria.

Table 7.2.1.1-1
Reporting Limits for Method SW8260B

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
VOCs SW8260B	1,1,1,2-Tetrachloroethane	0.5	µg/L	0.003	mg/kg
	1,1,1-TCA	1.0	µg/L	0.005	mg/kg
	1,1,2,2-Tetrachloroethane	0.5	µg/L	0.003	mg/kg
	1,1,2-TCA	1.0	µg/L	0.005	mg/kg
	1,1-DCA	1.0	µg/L	0.005	mg/kg
	1,1-DCE	1.0	µg/L	0.006	mg/kg
	1,1-Dichloropropene	1.0	µg/L	0.005	mg/kg
	1,2,3-Trichlorobenzene	1.0	µg/L	0.005	mg/kg
	1,2,3-Trichloropropane	1.0	µg/L	0.005	mg/kg
	1,2,4-Trichlorobenzene	1.0	µg/L	0.005	mg/kg
	1,2,4-Trimethylbenzene	1.0	µg/L	0.006	mg/kg
	1,2-DCA	0.5	µg/L	0.003	mg/kg
	1,2-DCB	1.0	µg/L	0.005	mg/kg
	1,2-Dibromo-3-chloropropane	2.0	µg/L	0.01	mg/kg
	1,2-Dichloropropane	1.0	µg/L	0.005	mg/kg
	1,2-Dibromoethane (EDB)	1.0	µg/L	0.005	mg/kg
	1,3,5-Trimethylbenzene	1.0	µg/L	0.005	mg/kg
	1,3-DCB	1.0	µg/L	0.006	mg/kg
	1,3-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,4-DCB	0.5	µg/L	0.002	mg/kg
	1-Chlorohexane	1.0	µg/L	0.005	mg/kg
	2,2-Dichloropropane	1.0	µg/L	0.005	mg/kg
	2-Chlorotoluene	1.0	µg/L	0.005	mg/kg
	4-Chlorotoluene	1.0	µg/L	0.005	mg/kg
	Acetone	10	µg/L	0.05	mg/kg
	Benzene	0.4	µg/L	0.002	mg/kg
	Bromobenzene	1.0	µg/L	0.005	mg/kg
	Bromochloromethane	1.0	µg/L	0.005	mg/kg
	Bromodichloromethane	0.5	µg/L	0.002	mg/kg
	Bromoform	1.0	µg/L	0.006	mg/kg
	Bromomethane	3.0	µg/L	0.01	mg/kg
	Carbon tetrachloride	1.0	µg/L	0.005	mg/kg
	Chlorobenzene	0.5	µg/L	0.002	mg/kg
	Chloroethane	1.0	µg/L	0.005	mg/kg
	Chloroform	0.3	µg/L	0.002	mg/kg
	Chloromethane	1.0	µg/L	0.005	mg/kg
	Cis-1,2-DCE	1.0	µg/L	0.005	mg/kg
	Cis-1,3-Dichloropropene	0.5	µg/L	0.003	mg/kg
	Dibromochloromethane	0.5	µg/L	0.003	mg/kg
	Dibromomethane	1.0	µg/L	0.005	mg/kg
	Dichlorodifluoromethane	1.0	µg/L	0.005	mg/kg
	Ethylbenzene	1.0	µg/L	0.005	mg/kg
	Hexachlorobutadiene	0.6	µg/L	0.003	mg/kg

Table 7.2.1.1-1
Reporting Limits for Method SW8260B (Continued)

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
VOCs SW8260B (concluded)	Isopropylbenzene	1.0	µg/L	0.005	mg/kg
	Methylene chloride	1.0	µg/L	0.005	mg/kg
	Methyl t-butyl ether (MTBE)	5.0	µg/L	0.02	mg/kg
	MEK (2-Butanone)	10	µg/L	0.02	mg/kg
	MIBK (methyl isobutyl ketone)	10	µg/L	0.02	mg/kg
	n-Butylbenzene	1.0	µg/L	0.005	mg/kg
	n-Propylbenzene	1.0	µg/L	0.005	mg/kg
	m,p-Xylene	2.0	µg/L	0.005	mg/kg
	Naphthalene	1.0	µg/L	0.005	mg/kg
	o-Xylene	1.0	µg/L	0.005	mg/kg
	p-Isopropyltoluene	1.0	µg/L	0.006	mg/kg
	Sec-Butylbenzene	1.0	µg/L	0.005	mg/kg
	Styrene	1.0	µg/L	0.005	mg/kg
	TCE	1.0	µg/L	0.005	mg/kg
	Tert-Butylbenzene	1.0	µg/L	0.005	mg/kg
	Tetrachloroethene	1.0	µg/L	0.005	mg/kg
	Toluene	1.0	µg/L	0.005	mg/kg
	Trans-1,2-DCE	1.0	µg/L	0.005	mg/kg
	Trans-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg
	Trichlorofluoromethane	1.0	µg/L	0.005	mg/kg
	Vinyl chloride	1.0	µg/L	0.005	mg/kg

Table 7.2.1.1-2
Quality Control Acceptance Criteria for Method SW8260B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS
SW8260B	1,1,1,2-Tetrachloroethane	81-129	≤ 20	74-125	≤ 30	2
	1,1,1-TCA	67-132	≤ 20	68-130	≤ 30	1
	1,1,2,2-Tetrachloroethane	63-128	≤ 20	59-140	≤ 30	3
	1,1,2-TCA	75-125	≤ 20	62-127	≤ 30	1
	1,1-DCA	69-133	≤ 20	73-125	≤ 30	1
	1,1-DCE	68-130	≤ 20	65-136	≤ 30	1
	1,1-Dichloropropene	73-132	≤ 20	70-135	≤ 30	1
	1,2,3-Trichlorobenzene	67-137	≤ 20	62-133	≤ 30	3
	1,2,3-Trichloropropane	73-124	≤ 20	63-130	≤ 30	3
	1,2,4-Trichlorobenzene	66-134	≤ 20	65-131	≤ 30	3
	1,2,4-Trimethylbenzene	74-132	≤ 20	65-135	≤ 30	3
	1,2-DCA	69-132	≤ 20	72-137	≤ 30	1
	1,2-DCB	71-122	≤ 20	74-120	≤ 30	3
	1,2-Dibromo-3-chloropropane	50-132	≤ 20	49–135	≤ 30	3
	1,2-Dichloropropane	75-125	≤ 20	71-120	≤ 30	1
	1,2-EDB	80-121	≤ 20	70-124	≤ 30	2
	1,3,5-Trimethylbenzene	74-131	≤ 20	65-133	≤ 30	3
	1,3-DCB	75-124	≤ 20	72-124	≤ 30	3
	1,3-Dichloropropane	73-126	≤ 20	76-123	≤ 30	2
	1,4-DCB	74-123	≤ 20	72-125	≤ 30	3
	1-Chlorohexane	70-125	≤ 20	60–135	≤ 30	2
	2,2-Dichloropropane	69-137	≤ 20	67-134	≤ 30	1
	2-Chlorotoluene	73-126	≤ 20	69-128	≤ 30	3
	4-Chlorotoluene	74-128	≤ 20	73-126	≤ 30	3
	Acetone	40-135	≤ 20	40-141	≤ 30	1
	Benzene	81-122	≤ 20	73-126	≤ 30	1
	Bromobenzene	76-124	≤ 20	66-121	≤ 30	3
	Bromochloromethane	65-129	≤ 20	71-127	≤ 30	1
	Bromodichloromethane	76-121	≤ 20	72-128	≤ 30	1
	Bromoform	69-128	≤ 20	66-137	≤ 30	2
	Bromomethane	53-141	≤ 20	45-141	≤ 30	1
	Carbon Tetrachloride	66-138	≤ 20	67-133	≤ 30	1
	Chlorobenzene	81-122	≤ 20	75-123	≤ 30	2
	Chloroethane	58-133	≤ 20	41-141	≤ 30	1
	Chloroform	69-128	≤ 20	72-124	≤ 30	1
	Chloromethane	56-131	≤ 20	51-129	≤ 30	1
	Cis-1,2-DCE	72-126	≤ 20	67-125	≤ 30	1
	Cis-1,3-Dichloropropene	69-131	≤ 20	72-126	≤ 30	1
	Dibromochloromethane	66-133	≤ 20	66-130	≤ 30	2
	Dibromomethane	76-125	≤ 20	73-128	≤ 30	1
	Dichlorodifluoromethane	53-153	≤ 20	34-136	≤ 30	1

Table 7.2.1.1-2
Quality Control Acceptance Criteria for Method SW8260B (Continued)

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS
SW8260B (Concluded)	Ethylbenzene	73-127	≤ 20	74-127	≤ 30	2
	Hexachlorobutadiene	67-131	≤ 20	53-142	≤ 30	3
	Isopropylbenzene	75-127	≤ 20	77-129	≤ 30	3
	m,p-Xylene	76-128	≤ 20	79-126	≤ 30	2
	Methylene chloride	63-137	≤ 20	63-137	≤ 30	1
	Methyl t-butyl ether (MTBE)	65-123	≤ 20	50-135	≤ 30	1
	MEK (2-Butanone)	49-136	≤ 20	40-135	≤ 30	1
	MIBK (methyl isobutyl ketone)	58-134	≤ 20	47-147	≤ 30	3
	n-Butylbenzene	69-137	≤ 20	65-138	≤ 30	3
	n-Propylbenzene	72-129	≤ 20	63-135	≤ 30	3
	Naphthalene	54-138	≤ 20	51-135	≤ 30	3
	o-Xylene	80-121	≤ 20	77-125	≤ 30	2
	p-Isopropyltoluene	73-130	≤ 20	75-133	≤ 30	3
	Sec-Butylbenzene	72-127	≤ 20	63-132	≤ 30	3
	Styrene	65-134	≤ 20	74-128	≤ 30	2
	TCE	70-127	≤ 20	77-124	≤ 30	1
	Tert-butylbenzene	70-129	≤ 20	65-132	≤ 30	3
	Tetrachloroethene	66-128	≤ 20	67-139	≤ 30	2
	Toluene	77-122	≤ 20	71-127	≤ 30	1
	Trans-1,2-DCE	63-137	≤ 20	66-134	≤ 30	1
	Trans-1,3-Dichloropropene	59-135	≤ 20	65-127	≤ 30	1
	Trichlorofluoromethane	57-129	≤ 20	49-139	≤ 30	1
	Vinyl Chloride	50-134	≤ 20	58-126	≤ 30	1
	Surrogates:					
	Dibromofluoromethane	85-115		65–135		
	Toluene-D8	81-120		84-116		
	4-Bromofluorobenzene	76-119		84-118		
	1,2-DCA-D4	72-119		52–149		
	Internal Standards:					
	Fluorobenzene					1
	Chlorobenzene-D5					2
	1,4-Dichlorobenzend-D					3

Table 7.2.1.1-3
Summary of Calibration and Quality Control Procedures for Method SW8260

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8260B	VOCs	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥ 0.30[c] and %RSD for RFs for calibration check compounds (CCCs) ≤ 30% and one option below	Correct problem then repeat initial calibration	Problem must be corrected. Samples may not be analyzed until is a valid initial calibration (ICAL).
				option 1 linear- mean RSD for all analytes ≤15% with no individual analyte RSD >30%		Problem must be corrected. Samples may not be analyzed until is a valid ICAL.
				option 2 linear – linear least squares regression r ≥ 0.995 for each analyte		Problem must be corrected. Samples may not be analyzed until is a valid ICAL.
				option 3 non-linear – COD ≥ 0.990 (6 points shall be used for second order, 7 points shall be used for third order)		Problem must be corrected. Samples may not be analyzed until is a valid ICAL.
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Problem must be corrected. Samples may not be analyzed until the calibration has been verified.

Table 7.2.1.1-3
Summary of Calibration and Quality Control Procedures for Method SW8260 (Continued)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8260B	VOCs	Retention time window calculated for each analyte	Each sample	Relative retention time (RRT) of the analyte within ± 0.06 RRT units of the RRT	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply Q-flag to all results for the specific analyte(s) in the sample which are outside the established window.
		Continuing Calibration verification	Daily, before sample analysis and after every 12 hours of analysis time	SPCCs average RF ≥ 0.30[c]; and CCCs ≤ 20% difference (when using RFs) or drift (when using least squares regression or non-linear calibration)	Correct problem then repeat initial calibration	Apply Q-flag to all results for the specific analyte(s) >20% D for all samples associated with the calibration verification.
				All calibration analytes within ±20% of expected value		Apply Q-flag to all results for the specific analyte(s) >20% D for all samples associated with the calibration verification.
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.1.1-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply Q to all results for all samples analyzed by the analyst

Table 7.2.1.1-3
Summary of Calibration and Quality Control Procedures for Method SW8260 (Continued)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8260B	VOCs	ISs	Each sample	Retention time ±30 seconds from retention time of the IS in the ICAL mid-point std. Extracted Ion Current Profile (EICP) area within -50% to +100% of area from IS in ICAL mid-point std.	Inspect mass spectrometer and GC for malfunctions; if system was malfunctioning, mandatory reanalysis of associated samples	Apply Q to all results for analytes associated with a failed IS unless a matrix effect can be verified, then apply M.
		Method blank	One per analytical batch	No analytes detected ≥ ½ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) above the RL in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.1.1-2 See Section 4.4.1.1 for guidance on determining marginal exceedances.	Correct problem then reanalyze If still out, reprep and reanalyze the LCS and all samples in the affected AFCEE batch	If corrective action fails, apply Q-flag to the specific analyte(s) which are not marginal exceedances in all samples in the associated preparatory batch.

Table 7.2.2.1-3
Summary of Calibration and Quality Control Procedures for Method SW8260 (Continued)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8260B	VOCs	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.1.1-2	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Potential matrix effects should be communicated to the prime contractor so an evaluation can be made with respect to the PQOs.	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL
SW8260B	VOCs	Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (Section 7.2.1)	Retune instrument and verify	Not appropriate
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.1.1-2	Correct problem then reextract and analyze sample	For the samples; if the %R > UCL for a surrogate, apply J to all positive results if the %R < LCL for a surrogate, apply J to all positive results; apply UJ to all non-detect results If any surrogate recovery is <10%, apply Q to all results

Table 7.2.2.1-3
Summary of Calibration and Quality Control Procedures for Method SW8260 (Continued)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
		MDL study	Once per 12 month period	Detection limits established shall be ≤ ½ the RLs in Table 7.2.1.1-1. All analytes must be detected and identified by method-specified criteria for the verification check to be valid.	Run MDL verification check at higher level and set higher MDL or reconduct MDL study	N/A
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.
c. Except > 0.10 for bromoform, and > 0.10 for chloromethane and 1,1-DCA.

7.2.1.2 Methods TO-15 – Volatile Organics in Ambient Air

VOCs in air samples are analyzed using Method TO-15. Whole air samples are collected in evacuated stainless steel canisters. In the laboratory, the VOCs are concentrated in a trap, revolatilized onto a capillary GC column where they are separated and then detected with a mass spectrometer. The mass spectrometry may be operated in either the SCAN or selected ion monitoring (SIM) mode. The GS/mass spectrometry/SCAN provides positive identification for a wide range of compounds, while the GC/mass spectrometry/SIM procedure has greater sensitivity for a more limited list of preselected VOCs. The project-specific requirements will determine which mode is appropriate.

Method TO-15 is strictly a GC/mass spectrometry method, and AFCEE requires that TO-14A also be performed with a mass spectrometer detector. In addition, Method TO-15 differs from Method TO-14A in its approach to water management. As a result, it addresses a more extensive analyte list than Method TO-14A. Table 7.2.1.2-1 lists the default analytes and RLs for these methods. The analytes in Table 7.2.1.2-1 represent an abbreviated analyte list common to both methods. If a more extensive analyte list is required, Method TO-15 is recommended. Table 7.2.1.2-1 also provides the accuracy and precision acceptance criteria for these methods. Also included are the marginal exceedances limits.

Table 7.2.1.2-2 identifies the QC checks, minimum frequencies, acceptance criteria, corrective actions, and flagging criteria for these analyses. Method TO-15 uses internal standards and has enhanced provisions for inherent QC. AFCEE requires that Method TO-14A analyses meet these same criteria.

Tuning - The mass spectrometer must be hardware tuned to give an acceptable spectrum for BFB. There are slight differences in the tuning criteria between Methods TO-14A and TO-15. Table 7.2.1.2-2 gives the tuning acceptance criteria for each method in terms of ion abundances for each specified mass. The more stringent requirements of TO-14A may be used for TO-15; however, that is not an AFCEE requirement.

Table 7.2.1.2-1
Reporting Limits and Quality Control Acceptance Criteria for Methods TO-15

Analyte	RL (ppbv)	Accuracy (% R)	Precision RPD (%)	ME Limits
1,1,1-TCA	0.5	70 - 130	≤ 25	60 - 140
1,2-DCA	0.5	70 - 130	≤ 25	60 - 140
1,2-Dibromoethane	0.5	70 - 130	≤ 25	60 - 140
Benzene	0.5	70 - 130	≤ 25	60 - 140
Carbon tetrachloride	0.5	70 - 130	≤ 25	60 - 140
Chloroform	0.5	70 - 130	≤ 25	60 - 140
Styrene	0.5	70 - 130	≤ 25	60 - 140
TCE	0.5	70 - 130	≤ 25	60 - 140
m,p-Xylene	0.5	70 - 130	≤ 25	60 - 140
o-Xylene	0.5	70 - 130	≤ 25	60 - 140
Tetrachloroethylene	0.5	70 - 130	≤ 25	60 - 140
Toluene	0.5	70 - 130	≤ 25	60 - 140
Ethylbenzene	0.5	70 - 130	≤ 25	60 - 140
cis-1,2-DCE	0.5	70 - 130	≤ 25	60 - 140
cis-1,2-Dichloropropene	0.5	70 - 130	≤ 25	60 - 140
Methylene chloride	0.5	70 - 130	≤ 25	60 - 140
Chloromethane	0.5	70 - 130	≤ 25	60 - 140
Chloroethane	0.5	70 - 130	≤ 25	60 - 140
Chlorobenzene	0.5	70 - 130	≤ 25	60 - 140
Vinyl chloride	0.5	70 - 130	≤ 25	60 - 140
1,1,2,2-Tetrachloroethane	0.5	70 - 130	≤ 25	60 - 140
1,1-Dichloroethene	0.5	70 - 130	≤ 25	60 - 140
1,1,2-Trichloroethane	0.5	70 - 130	≤ 25	60 - 140
1,1-DCA	0.5	70 - 130	≤ 25	60 - 140
1,2-Dichloropropane	0.5	70 - 130	≤ 25	60 - 140
trans-1,2-DCE	0.5	70 - 130	≤ 25	60 - 140
Trans-1,2-Dichloropropene	0.5	70 - 130	≤ 25	60 - 140
Surrogates:				
1,2-Dichloroethane-*d4*	-	60 - 140	-	-
Toluene-*d8*	-	60 - 140	-	-
4-Bromofluorobenzene	-	60 - 140	-	-
Internal Standards:				
Bromochloromethane	-	-	-	-
Chlorobenzene-*d5*	-	-	-	-
1,4-Difluorobenzene	-	-	-	-

Table 7.2.1.2-2
Summary of Calibration and Quality Control Procedures for Methods TO-15

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Mass spectrometry tuning check (Use BFB)	Prior to initial calibration and calibration verification	Refer to criteria listed in Table 7.2.1.2-1.	Retune instrument and verify.	Not appropriate
Initial multipoint calibration for all analytes (minimum five standards) (ICAL)	Initial calibration prior to sample analysis	One of the options below: *Option 1*: linear – RSD for each analyte ≤ 30%. *Option 2*: linear – least squares regression r ≥ 0.995 for each analyte. *Option 3*: non-linear – COD ≥ 0.99. (six points shall be used for second order, seven points shall be used for third order)	Correct problem then repeat initial calibration.	Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.
Second-source calibration verification	Once per ICAL	All analytes within ± 30% of expected value	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. Samples may not be analyzed until the calibration has been verified.
Calibration verification (CCV)	Daily, before sample analysis unless ICAL performed on same day and every 24 hours of analysis time	All analytes within ± 30% of expected value	Correct problem, rerun CCV. If that fails, repeat initial calibration.	Apply Q-flag to all results for the specific analyte(s) > 30 %D for all samples associated with the calibration verification.

Table 7.2.1.2-2
Summary of Calibration and Quality Control Procedures for Methods TO-15 (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Internal Standards (ISs)	Each sample	Retention time ± 0.33 minutes from retention time of the IS in the most recent valid calibration. (ICAL mid-point standard or CCV) EICP area within ± 40% of area of the IS in most recent valid calibration	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while the system was malfunctioning is mandatory.	Apply Q-flag to all results for analytes associated with a failed IS unless a matrix effect can be verified, then apply M-flag.
Method blank (humid zero air)	Immediately after ICAL or daily CCV	No analytes detected ≥ RL	Assess data. Correct problem. If necessary,-reprep and analyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all associated positive results for the specific analyte(s) as appropriate. See guidance Section 8.2.
LCS for all analytes	One LCS per analytical batch	Acceptance criteria: Table 7.2.1.2-1	Correct problem then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected AFCEE analytical batch.	If corrective action fails, apply Q-flag to the specific analyte(s) in all samples in the associated preparatory batch.
MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	Acceptance criteria: Table 7.2.1.2-1	Potential matrix effects should be communicated to the prime contractor so an evaluation can be made with respect to the PQOs	For specific analyte(s) in all samples collected from the same site matrix as the parent, apply M-flag
Sample duplicate	One sample duplicate per analytical batch	Acceptance criteria: Table 7.2.1.2-1	Correct problem and reanalyze sample and duplicate.	If corrective action fails, apply J-flag to the specific analyte(s) in the sample.

Table 7.2.1.2-2
Summary of Calibration and Quality Control Procedures for Methods TO-15 (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
MDL study	At initial setup and subsequently once per 12-month period or quarterly MDL verification checks.	Detection limits established shall be ≤ ½ the RLs in Table 7.2.1.2-1. See 40 CFR, Part 136 Appendix B. Verification checks must produce a response at least 3X instrument noise level and must produce a response greater than the blanks associated with the MDL study.	Run MDL verification check at higher level and set higher MDL or reconduct MDL study.	N/A
Results reported between MDL and RL	None	None	None	Apply F-flag to all results between MDL and RL.

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

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

7.2.2 Gas Chromatography/Mass Spectrometry Selected Ion Monitoring Method

7.2.2.1 Method SW8270-SIM for 1,4-Dioxane

A GC/mass spectrometry method with SIM is used for detection of 1,4-dioxane in water. Samples are extracted and then concentrated by evaporation. Compounds of interested are separated by capillary column GC and quantitated using the method of internal standards.

Tuning – Prior to analysis, the mass spectrometer must be tuned to give an acceptable spectrum. Possible tuning compounds include perfluorotributylamine (PFTBA) and decafluorotriphenylphosphine (DFTPP). Tuning should meet manufacturer's specifications or other documented source.

RLs are listed in Table 7.2.2.1-1. Table 7.2.2.1-2 provides acceptance criteria for Method 8270-SIM along with suggested surrogates and internal standards. Table 7.2.2.1-3 identifies the QC checks, minimum frequencies, acceptance criteria, corrective actions, and flagging criteria.

Table 7.2.2.1-1
Reporting Limits for Method 8270-SIM
for 1,4-Dioxane

Parameter	Water		Soils	
	RL	Unit	RL	Unit
1,4-dioxane	0.2	µg/L	--	--

Table 7.2.2.1-2
Quality Control Acceptance Criteria Method 8270-SIM
for 1,4-Dioxane

Analyte	Accuracy (% R)	Precision RPD (%)	ME Limits
1,4-dioxane	70 - 130	≤ 40	60 - 140

Table 7.2.2.2-3
Summary of Calibration and Quality Control Procedures for Method SW8270-SIM for 1,4-Dioxane

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Mass spectrometry tuning check DFTPP (SW 8270C)	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description.	Retune instrument and verify.	Not appropriate
GC Performance Check (8270C only)	Daily prior to analysis of sample or calibration standards	No visible peak tailing for benzidine or pentachlorophenol (As a default, tailing factors should be less than 3.0 and 5.0, respectively.)	Correct problem, then repeat performance check.	Not appropriate
Initial multipoint calibration for all analytes (minimum five standards) (ICAL)	Initial calibration prior to sample analysis	**SPCCs**: Average RF $\geq$ 0.030 [c] (SW8260B), $\geq$ 0.050 (SW8270C) **CCCs:** % RSD for RFs $\leq$ 30% **and** one of the options below: *Option 1*: linear – RSD for each analyte < 15% *Option 2 linear* – linear least squares regression r $\geq$ 0.995 for each analyte *Option 3 non-linear* – COD $\geq$ 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem, then repeat initial calibration.	Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.

Table 7.2.2.2-3
Summary of Calibration and Quality Control Procedures for Method SW8270-SIM for 1,4-Dioxane (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Second-source calibration verification	Once per ICAL	All analytes within ± 25% of expected value	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. Samples may not be analyzed until the calibration has been verified.
Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	N/A	N/A
Retention time window verified for each analyte	Each sample	Relative retention time (RRT) of the analyte within ± 0.06 RRT units of ICAL	Correct problem, then reanalyze all samples analyzed since the last retention time check.	Apply Q-flag to all results for the specific analyte(s) in the sample which are outside the established window.
Continuing Calibration verification (CCV)	Daily, before sample analysis unless ICAL performed on same day and after every 12 hours of analysis time	**SPCCs:** average RF ≥ 0.050 (SW8270C); **CCCs:** ≤ 20% D All analytes within ± 20% D of expected value from ICAL **Note:** D = difference when using RFs or drift when using least squares, regression or non-linear calibration.	Correct problem, then rerun CCV. If that fails, repeat initial calibration.	Apply Q-flag to all results for the specific analyte(s) > 20% D for all samples associated with the calibration verification.

Table 7.2.2.2-3
Summary of Calibration and Quality Control Procedures for Method SW8270-SIM for 1,4-Dioxane (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Internal Standards (ISs)	Each sample	Retention time ± 30 seconds from retention time of the IS in the ICAL mid-point std. EICP area within -50% to +100% of area from IS in ICAL mid-point standard	Inspect mass spectrometer and GC for malfunctions and corrections made as appropriate. Reanalysis of samples analyzed while the system was malfunctioning is mandatory.	Apply Q-flag to all results for analytes associated with a failed IS unless a matrix effect can be verified, then apply M-flag.
Method blank	One per analytical batch	No analytes detected > ½ RL For common lab contaminants no analytes detected > RL	Assess data. Correct problem. If necessary,-reprep and analyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all associated positive results for the specific analyte(s) as appropriate.
LCS for all analytes	One LCS per analytical batch	Acceptance criteria: Table 7.2.2.2-2	Correct problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected AFCEE batch.	If corrective action fails, apply Q-flag to the specific analyte(s) which are not marginal exceedances in all samples in the associated preparatory batch.
MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	Acceptance criteria: Table 7.2.2.2-2	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Potential matrix effects should be communicated to the prime contractor so an evaluation can be made with respect to the PQOs.	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M-flag if: (1) %R for MS or MSD > UCL, (2) %R for MS or MSD < LCL, or (3) MS/MSD RPD > CL

Table 7.2.2.2-3
Summary of Calibration and Quality Control Procedures for Method SW8270-SIM for 1,4-Dioxane (Continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
Surrogate spike	Every sample, spiked sample, standard, and method blank	Acceptance criteria: Table 7.2.2.2-2	Correct problem, then reprep and reanalyze the affected samples. If matrix effect is verified, discuss in case narrative.	For the samples: If the %R > UCL for any surrogate, apply J-flag to all positive results for associated analytes. If the %R < LCL for any surrogate, apply J-flag to all positive results for associated analytes and UJ -flag to all associated non-detects. If any surrogate recovery is <10%, apply Q-flag to all results for all associated analytes.
MDL study	At initial setup and subsequently once per 12-month period or quarterly MDL verification checks.	Detection limits established shall be ≤ ½ the RLs in Tables 7.2.2.2-1. See 40 CFR, Part 136 Appendix B. All analytes must be detected and identified by method-specified criteria for the for the verification check to be valid.	Run MDL verification check at higher level and set higher MDL or reconduct MDL study.	N/A
Results reported between MDL and RL	None	None	None	Apply F-flag to all results between MDL and RL.

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

8.0 DATA MANAGEMENT AND EVALUATION

The data reduction, verification, validation, assessment and reporting procedures described in this section will ensure (1) the data are reviewed and documented (2) transcription and data reduction errors are minimized, (3) complete documentation is maintained, and (4) the reported results are accurate, or qualified if necessary. Laboratory data reduction and verification procedures are required to ensure the data deliverable(s) meet the overall project objectives. Data reduction, whether performed by instrumentation or manually, shall follow methodologies specified in the laboratory SOPs or approved analytical methods. Project-specific variations of general procedures, statistical approach, or formulas must be identified and be detailed in this project *QAPP*. Any variances from established procedures must be requested and approved in advance. Automated procedures shall be verified as required by USEPA's *Guidance on Good Automated Laboratory Practices* (GALP, EPA 2185); all software shall be tested with a sample set of data to verify its correct operation via accurate capture, processing, manipulation, transfer, recording, and reporting of data. Data are reported in hardcopy data package(s) and as electronic data deliverable(s) (EDDs).

8.1 DATA REVIEW REQUIREMENTS FOR SCREENING DATA

The prime contractor shall complete a 100 percent review of all screening data. The screening data methods are identified in Table 6-1 of Section 6. Applicable screening data shall be qualified with an S-flag and shall be further qualified if critical calibration and QC requirements are not within acceptable limits. The calibration, QC requirements, corrective action requirements, and flagging criteria required are shown in Table 6.2-1 in Section 6. The flagging criteria should be applied when acceptance criteria are not met and corrective action was either not successful or not performed. S- flags shall be maintained in the final data qualification. Also, any data that has been affected by multiple qualifiers shall retain these qualifiers in the final reviewed data package.

Screening data deliverables shall be prepared for all field analyses as described in Section 8.8. The screening data shall be reported on the AFCEE screening data report forms (AFCEE Forms S-1 through S-3), as illustrated in Section 8.8. The prime contractor's project manager shall be responsible for the review of the entire screening data report package, including the associated field records. The results of this review shall (1) determine if the project objectives have been met, and (2) calculate the completeness of the screening data for the project. These results shall be included in the screening data deliverable.

8.2 DATA REVIEW REQUIREMENTS FOR DEFINITIVE DATA

Scientifically sound data of known and documented quality which meet PQOs are essential for use in the decision-making process. Data review is the process whereby data are examined and evaluated to varying levels of detail and specificity by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessment. There must be persuasive records which document data review activities to afford effective assessment of the data for its quality and usability. The data can then move forward with associated qualifiers indicating the overall usability of the data.

Data verification is the first step in data review. As used here, data verification is confirmation that the specified requirements have been performed, i.e., it is a completeness check.

Data validation extends this and is confirmation that the requirements for a specific intended use are fulfilled. Data validation is the systematic process of evaluating the compliance of the data with the pre-defined requirements of the project, including method, procedural, or contractual requirements and the comparison of the data with criteria based on the quality objectives documented in the project *QAPP*. The purpose of data validation is to assess the performance associated with the analysis in order to determine the quality of the data. Data validation includes a determination, to the extent possible, of the reasons for any failure to meet performance requirements, and an evaluation of the impact of such failures on the usability of the data.

The data usability assessment is an evaluation based on the results of data validation and verification in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet project quality objectives. Both the sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

The requirements for data reporting and data review must be clearly defined in this project *QAPP* and be appropriate for the project-specific decision goals. In general, the standard data package required by AFCEE does not allow for complete independent reconstruction of the analytical data. Depending upon the project objectives and intended use of the data, a more rigorous data validation regimen may be required. This more extensive review requires a more comprehensive data deliverable package. This data package must contain sufficient information to completely reconstruct the chemical analyses and includes all batch QC results, instrument QC results (e.g., initial calibration verification, continuing calibration verification, and instrument performance checks), MDL studies, and raw data (e.g., run logs, sample preparation logs, standard preparation logs, and printed instrumental output such as chromatograms).

8.2.1 Laboratory Requirements

The chemistry data package must contain adequate information and be presented in a clear and concise manner. Minimum requirements include cover sheet which identifies the project; table of contents; case narrative which summarizes samples, analyses, and discusses any issues which may affect data usability; analytical results; laboratory reporting limits; sample management records; and internal laboratory QA/QC information. The AFCEE Forms (Section 8.8) may be used for this. Equivalent formats are acceptable, provided they include all essential information. The laboratory data package should be organized such that the analytical results are reported on a per AFCEE analytical batch (AAB) basis, unless otherwise specified. This will facilitate subsequent review, validation, and assessment. Based on the information in the data package, a reviewer should be able to determine the PARCCS and completeness of the data. The amount of information required to demonstrate attainment of PQOs depends upon the acceptable level of uncertainty for the intended data use and should be addressed in this project *QAPP*. Additional information may be required, depending on the detail of data review performed.

A schedule for data delivery should be established so that data packages (i.e. SDGs) are provided in a timely manner to the prime contractor for data review/validation, assessment and use. This

includes identifying the anticipated number or frequency of these data packages in light of project objectives, i.e., the amount of data produced or project duration.

8.2.1.1 Laboratory Data Reporting Requirements

An important part of the laboratory documentation is the case narrative. The case narrative contains essential information which affords an informed evaluation of data usability. The case narrative shall include but not be limited to:

- Table summarizing samples received, correlating field sample numbers, laboratory sample numbers, and laboratory tests completed.
- Discussion of sample appearance and integrity issues which may affect data usability (temperature, preservation, pH, sample containers, air bubbles, multiphases, etc.).
- Samples received but not analyzed and why.
- Discussion of holding time excursions for sample prep and analyses.
- Analysis of all out-of-control or discrepancies of calibrations, continuing calibrations or QC.
- sample results (surrogates, LCS, MS/MSD, post-digestion spikes, etc.), raw data/chromatograms and corrective actions taken.
- Identification of samples and analytes for which manual integration was necessary.
- Discussion of all qualified data and definition of qualifying flags.
- Discussion and recommendations of potential data usability of qualified data including detailed discussion of conditions associated with Q-flagged data.

Reporting details:

- DLs and sample results should be reported to one decimal place more than the corresponding RL, unless the appropriate number of significant figures for the measurement dictates otherwise.
- Soil samples shall have results reported on a dry weight basis. A wet weight aliquot of sample equivalent to the method specified dry weight aliquot of sample should be taken for analysis. Alternatively, the lab may choose to use a consistent wet weight aliquot that is expected to be large enough to compensate for the moisture in the sample (e.g., 50% more) and use this as a consistent weight.

  Note: RLs are project specific requirements and are NOT adjusted for sample moisture. Detection limits may have to be adjusted for moisture; however, the laboratory should ensure that the minimum relationship between adjusted MDLs and corresponding RLs are maintained.
- If possible, samples should be analyzed undiluted and non-detects reported to the AFCEE specified RLs. RLs for minority constituents in highly contaminated samples may have to be adjusted for dilutions.

8.2.1.2 Manual Integrations

Manual integrations are an integral part of the chromatographic analysis process; they should be used judiciously to correct any incorrect integration by the automated instrumentation and not as a routine procedure for the purpose of meeting calibration or method QC acceptance criteria. Improper use of manual integrations (for example, peak shaving or peak enhancement) are considered improper, unethical, or illegal actions if performed solely to meet QC requirements. Manual integrations shall be done only as a corrective action measures. Examples of instances where manual integration would be warranted include, but are not limited to, co-eluting compounds resulting in poor peak resolution, a misidentified peak, an incorrect retention time, or a problematic baseline. When manual integrations are used, the following procedures are to be implemented for documenting the event and for consistency in performing the manual integration:

- There be a laboratory or section SOP for manual integrations. This SOP shall specify when automated integrations by the instrument are likely to be unreliable, what constitutes an unacceptable automated integration, and how the problems should be resolved by the analyst.
- This includes procedures for the analyst to follow in documenting any required manual integrations.
- When manual integrations are performed, raw data records shall include a complete audit trail for those manipulations. The raw data records shall include the results of both the automated and manual integrations (i.e., "before" and "after" chromatograms of manually integrated peaks), notation of the cause and justification for performing the manual integrations, and date, and signature/initials of person performing the manual operations.
- All manual integrations must be reviewed and approved by the Section supervisor and/or the QA officer.

  Note: Both the primary and secondary reviews (analyst's and supervisory) may be performed electronically, provided all documentation and data integrity are maintained.

- All manual integrations must be identification in the case narrative.

This will ensure consistency when manual integrations are performed and facilitate review and acceptance of manually integrated data.

8.2.1.3 Tentatively Identified Compounds

Tentatively identified compounds (TICs) are compounds not associated with the calibration standards which are identified in methods with mass spectrometry detection. All peaks with a response greater than 10% of the nearest internal standard are potential TICs and should be examined. Qualitative identification of TICs is by computer searches of standard reference libraries and may be reported as a specific chemical or as a member of a chemical family. Concentrations are estimated assuming a response factor of 1 between the TIC and the nearest internal standard. The laboratory must have established procedures for reporting TICs.

8.2.1.4 Laboratory Data Review Requirements

All analytical data generated by the laboratory shall be verified prior to submittal to the AFCEE prime contractor. This internal data review process, which is multi-tiered, shall include all aspects of data generation, reduction, and QC assessment. Procedures for laboratory verification and validation of data should be summarized in this project *QAPP*. In each laboratory analytical section, the analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the supervisor of the respective analytical section using the same criteria.

The following elements for review/verification at each level must include but not be restricted to:

- Sample receipt procedures and conditions.
- Sample preparation.
- Appropriate SOPs and analytical methodologies.
- Accuracy and completeness of analytical results.
- Correct interpretation of all raw data, including all manual integrations.
- Appropriate application of QC samples and compliance with established CLs.
- Verification of data transfers.
- Documentation completeness (e.g., all anomalies in the preparation and analysis have been identified, appropriate corrective actions taken, and have been documented in the case narrative(s), associated data have been appropriately qualified, anomaly forms are complete).

Accuracy and completeness of data deliverables (hard copy and electronic).

8.2.1.5 Laboratory Data Evaluation

The calibration, QC, corrective actions, and flagging requirements for definitive data are shown in the tables in Section 7.2. Data qualifiers shall be applied by the laboratory according to the requirements in the tables in Sections 6 and 7 as part of their validation activities. The allowable data qualifiers for definitive data are *Q, M, J, F, B, U, UJ* and *T*. The definitions of the data qualifiers are provided in Table 8.2.1.5-1. Flagging criteria apply when acceptance criteria are not met and corrective actions were not successful or not performed. The data qualifiers are reviewed by the supervisor of the respective analytical sections after the first and second level reviews of the laboratory data have been performed.

The one exception to these data flagging criteria is for TICs. The TIC numerical results will always be qualified with one and only one flag: the T-flag.

The laboratory QA section shall perform a 100 percent review of 10 percent of the completed data packages, and the laboratory project representative shall complete a final review on all the completed data packages.

The prime contractor subsequently evaluates the flags applied by the laboratory as part of their data validation and usability assessment activities. The flags may be accepted, modified, or rejected. For all data qualifiers which are changed, the prime contractor must provide clear justification for those modifications based on project-specific quality objectives. All Q-flagged data must be evaluated by the prime contractor and either accepted without qualification, accepted with qualification, or rejected.

Table 8.2.1.5-1
Data Qualifiers

Qualifier	Description
J	The analyte was positively identified, the quantitation is an estimation.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
F	The analyte was positively identified but the associated numerical value is below the RL.
Q	One or more quality control criteria (for example, LCS recovery, surrogate spike recovery) failed. Data must be carefully assessed by the prime contractor (or project team) with respect to the project-specific requirements and evaluated for usability. Subsequent assessment by DoD may result in rejection of data.
B	The analyte was found in an associated blank above one-half the RL, as well as in the sample.
M	A matrix effect was present.
S	To be applied to all field screening data.
T	Tentatively identified compound: The analyte is a tentatively identified compound (mass spectrometry methods only).

8.2.1.6 Method Blank Evaluation Guidance

The following criteria shall be used to evaluate the acceptability of the blank data, unless project quality objectives specify otherwise. For method blanks, the source of contamination shall be investigated and measures taken to correct, minimize, or eliminate the problem if the concentration exceeds one-half the RL. (Use the RL for common laboratory contaminants.) If one-half the RL is exceeded, the laboratory shall evaluate whether reprocessing of the samples is necessary, based on the following criteria: 1) the method blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated preparation batch, or 2) there is evidence the blank contamination otherwise affects the sample results. Except when the sample analysis resulted in a non-detect, all samples associated with method blank contamination and meeting these criteria shall be reprocessed in a subsequent preparation batch. If no sample volume remains for reprocessing, the results shall be reported with a B-flag, along with any other appropriate data qualifier. If an analyte is found only in the method blank, but not in any batch samples, no flagging is necessary. Method blanks should also be examined to verify that any TICs present in the samples are not found in the blank. Method blank contamination must be addressed in the case narrative.

8.2.2 Prime Contractor Requirements

The ultimate goal of data review is to ensure that the decisions, which are made as a result of the environmental data collection effort, are supported by data of the type and quality suitable for their intended use. The prime contractor has overall responsibility for data quality and may be assisted in its review by external organizations. Parties performing data review should be clearly identified in this project *QAPP*.

8.2.2.1 Responsibility and Qualifications

The data validation/usability assessment processes involves exercise of professional judgment. Regardless of who performs these, the individual(s) should possess the disciplinary expertise, experience, and theoretical knowledge to perform the task. It is also imperative that these individuals possess a complete understanding of the intended use of the data and the relationship of the QC results to the usability of the data. For this reason, it is essential that they be involved during project planning in the systematic planning process, choice of preparation and analytical methods, and decisions made regarding data verification and data validation. When this is not feasible, such as when a third party is contracted for data validation, all project planning documents and procedures, as well as sample collection information must be made available to the individuals assigned to the task.

Although discussed sequentially below, certain steps in the data review process may be performed simultaneously.

8.2.2.2 Data Verification Guidelines

The data verification performed by the laboratory should be reviewed for completeness and accuracy. Data verification may be done electronically or manually, or by a combination of both, and shall include (but is not limited to):

- Sampling documentation (CoC form, etc.),
- Preservation summary and technical holding times,
- Presence of all analyses and analytes requested,
- Use of the required sample preparation and analysis procedures,
- Method detection and reporting limits evaluated against the project requirements,
- The correctness of the concentration units, and
- Case narrative.

8.2.2.3 Data Validation Guidelines

The data validation process builds on data verification. The laboratory case narrative, QC sample results, and calibrations shall be reviewed and data qualifiers removed or added in light of project knowledge for 100 percent of the data. Method-specific instrument calibration and QC parameters shall be reviewed for compliance with calibration and QC requirements specified in Section 7.0.

An in-depth review of the raw data to verify accuracy shall be performed on 10 percent of the data and include the following, but is not limited to:

- Instrument calibration and QC parameters (method-specific) (these shall be reviewed for compliance with the criteria specified in the applicable Summary of Calibration and QC Procedures tables, and flagged as necessary).
- Review of raw data such as instrument print outs, preparation logs, and run logs.
- Review of system performance.
- Random check of calculations, including, but not limited to, sample and QC results, initial calibration response factors and RSDs, calibration verification standard response factors, and percent differences or percent drifts from the expected values.
- Random verification of sample results to the raw data.
- Check for interference problems or system performance problems.
- Estimated results (F-qualifiers).
- Resolution by the laboratory of any identified problems, as necessary.

8.2.2.3.1 Raw Data Review

This may include, but is not limited to:

- Instrument Calibration and QC Parameters (Method-Specific). These shall be reviewed for compliance with the criteria specified in the applicable Summary of Calibration and QC Procedures tables, and flagged as necessary.
- Review of raw data and inspections of chromatograms.
- Review of System Performance.
- Review for proper integration (if applicable).
- Review of spectral matches, and/or retention times to verify analyte identification (where applicable).
- TIC data.
- Random check of calculations, including, but not limited to sample and QC results, initial calibration response factors and RSDs, calibration verification standard response factors, and percent differences or percent drifts from the expected values.
- Check for interference problems or system performance problems, such as chromatographic baseline anomalies and drifts, evidence of column degradation, etc.
- Estimated Results (F-qualifiers).
- Resolution by the laboratory of any identified problems, as necessary.

8.2.2.3.2 Data Analysis and Interpretation

This phase of the data validation process (assessment) relies heavily on the validator's professional judgment. It may include, but is not limited to:

- Evaluation of all Q-flagged data and final determination of its usability. All Q-flagged data must be accepted without qualification, accepted with qualification, or rejected. The Q-flag is not to be used in the final assessment (see Section 8.2.1.5).
- Evaluation of all B-flagged data and final determination of its usability (see Section 8.2.2.3.3).
- Evaluation of duplicate, replicate, and split sample analyses. Indications of poor precision should be investigated for cause and the impact on the overall usability of the data must be discussed (see Section 8.2.2.3.4).
- Evaluation of all M-flagged data. Only the matrix spike sample is qualified by the laboratory. The prime contractor shall apply any additional qualifying flag for a matrix effect to all samples collected from the same site as the parent sample or all samples showing the same lithologic characteristics as the MS/MSD (see Section 8.2.2.3.5).
- Evaluation of the impact of multiple data issues on the final analytical results (for example, variability of results obtained from different dilutions, or different methods; chromatographic issues; etc.).
- Evaluation of the deficiencies identified during data verification and assessment of their impact on the sample results.
- Incorporation of site-specific factors and assessment of their impact on the data.
- Assessment of data usability and assignment of final data qualifiers, as necessary.
- Discussion of completeness, representativeness, and comparability.

A data validation report will be prepared summarizing the findings and discussing their impact on the overall data usability. This may be incorporated into the final usability assessment.

8.2.2.3.3 Blank Evaluation Guidelines

The prime contractor is expected to evaluate laboratory B-qualified data such as method blanks, as well as other blanks (field blanks such as trip blanks, or equipment blanks, etc.) based on the concentration of the analyte in the samples in relation to the concentration in the blank, during the data validation process. The B-flag may be removed and not utilized if the analyte concentrations in the samples are much higher ($\geq$ 5X) than in the blank. ($\geq$ 10X in case of common laboratory contaminants). Any blank contamination which may impact data usability must be discussed by the prime contractor in conjunction with project-specific goals.

8.2.2.3.4 Duplicate/Replicate Evaluation Guidance

As discussed in Section 4, QC measures for precision include field duplicates, laboratory duplicates, matrix spike duplicates, analytical replicates, and surrogates. These measures are evaluated by the laboratory and qualified according to the guidelines in Sections 7 and 8 with the exception of the field duplicates. Specifically, field duplicates (replicates) or split samples should be sent to the laboratory(ies) as blind samples and should be given unique sample identification numbers. These sample results can then be associated by the prime contractor and can be used to assess field

sampling precision, laboratory precision, and, potentially, the representativeness of the matrix sampled. The prime contractor must use experience and site specific knowledge to assess the value of the field duplicate samples as a measure of precision or representativeness. Flagging of results associated with field duplicates should be assigned such that the level of uncertainty required, as provided by the project-specific objectives, is taken into account. Poor overall precision may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques should be evaluated by the prime contractor, and both field and analytical duplicate/replicate sample results should be reviewed. If poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error. If data validation reports indicate that analytical imprecision exists for a particular data set or SDG, then the impact of that imprecision on usability must be discussed in the report.

8.2.2.3.5 Matrix Interface Evaluation Guidance

In the case of matrix interference, the laboratory will follow the guidelines specified in appropriate Tables in Section 7. However, the prime contractor must apply M flags to additional samples from the same site and same matrix, as applicable.

8.2.2.4 Flagging Conventions

The allowable final data qualifiers for definitive data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are *R*, *M*, *J*, *F*, *B*, *U*, and *UJ*. Their definitions are summarized in Table 8.2.1.5-1. The T-flag is used only for TICs.

Tables 8.2.2.4-1 and 8.2.2.4-2 present the general guidelines for applying these data qualifiers. The tables in Section 7 should be consulted for specific details.

8.3 QUALITY ASSURANCE REPORTS

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors, and task leaders. These reports shall describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

8.4 ENVIRONMENTAL RESOURCES PROGRAM INFORMATION MANAGEMENT SYSTEM ELECTRONIC DATA REPORTS

The prime contractor shall provide an electronic deliverable report in the Electronic Resources Program Information Management System (ERPIMS) format as specified by the Statement of Work (SOW) for the project.

Table 8.2.2.4-1
General Flagging Conventions

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	R	All analytes in the sample
LCS	% R > UCL %R < LCL	J for the positive results J for the positive results, R for the nondetects	The specific analyte(s) in all samples in the associated AAB
Method Blank	Analyte(s) detected ≥ 1/2 RL	B	The specific analyte(s) in all samples in the associated AAB with results above the RL
Equipment Blank	Analyte(s) detected ≥ ½ RL	B	The specific analyte(s) in all samples with the same sampling date as the equipment blank
Field duplicates	Field duplicates > RLs AND RPD outside CL	J for the positive results UJ for the nondetects	The specific analyte(s) in all samples collected on the same sampling date
MS/MSD	MS or MSD % R > UCL OR MS or MSD % R < LCL OR MS/MSD RPD > CL	M for all results	The specific analyte(s) in all samples collected from the same site as the parent sample
Sample Preservation/ Collection	Preservation/collection requirements not met	R for all results	All analytes in the sample
Sample Storage	< 2°C or > 6°C or as required	J for the positive results R for the nondetects	All analytes in the sample

UCL = upper control limit LCL = lower control limit CL = control limit

	Criteria	Flag*
Quantitation	≤ MDL	U
	> MDL < RL	F
	≥ RL	as needed
	≥ high std / linear range	J

* Example 1: if the MDL is 0.04, the RL is 0.9 and the result is 0.03, the concentration reported on the result form would be 0.04 (the MDL) and the qualifier flag would be U.

Example 2: if the MDL is 0.04, the RL is 0.9 and the result is 0.07, the concentration reported on the result form would be 0.07 and the qualifier flag would be F.

Example 3: if the MDL is 0.04, the RL is 0.9 and the result is 1.2, the concentration reported on the result form would be 1.2 and the qualifier would be any flag needed because of a data quality problem (e.g., R, J, B, etc.).

Table 8.2.2.4-2
Flagging Conventions Specific to Organic Methods

QC Requirement	Criteria	Flag	Flag Applied To
Ambient Blank (VOC samples only)	Analyte(s) detected ≥ RL	B	The specific analyte(s) in all samples with the same matrix and sampling date
Trip Blank (VOC samples only)	Analyte(s) detected ≥ RL	B	The specific analyte(s) in all samples shipped in the same cooler as the blank
Initial Five Point Calibration (GC & HPLC methods)	Linearity criterion not met	N/A	Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.
Initial Five Point Calibration (GC/mass spectrometry methods)	SPCC or CCC criteria not met	N/A	Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.
	Linearity criterion not met	N/A	Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.
Second Source Calibration Verification	CL exceeded	N/A	Problem must be corrected. Samples may not be analyzed until the calibration has been verified.
Initial Daily Calibration Verification (GC & HPLC methods)	CL exceeded	N/A	Problem must be corrected. Samples may not be analyzed until the calibration has been verified.
Calibration Verification (GC/mass spectrometry methods)	SPCC or CCC criteria not met	Q	All analytes in all samples associated with the calibration verification
Retention time	Retention time of analyte outside of established retention time window	Q	The specific analyte(s) in the sample
Surrogates	surrogate % R >UCL OR surrogate % R < LCL OR surrogate recovery < 10%	J for the positive results J for the positive results UJ for the nondetects Q for all results	All analytes in the sample associated with the surrogate
Mass Spectrometer Tune	Ion abundance criteria not met	R for all results	All analytes in all samples associated with the tune

UCL = upper control limit LCL = lower control limit CL = control limit

Table 8.2.2.4-2
Flagging Conventions Specific to Organic Methods (Continued)

QC Requirement	Criteria	Flag	Flag Applied To
Second Column/Second Detector Confirmation (GC & HPLC methods)	Not performed Agreement between results not within ±40%	R J	All analytes ≥RL All affected analytes
Internal Standard	Retention time not within ±30 seconds: EICP area not within -50% to +100% of last calibration verification	Q	Apply Q to all results for specific analytes associated with the IS
Tentatively Identified Compounds (TICs)		T	All TICs

ERPIMS is a data management system designed to accommodate all types of data collected for IRP projects. Specific codes and data forms have been developed to allow consistent and efficient input of information to the system. The database information shall be provided by the prime contractor via ASCII files in specified ERPIMS format on 3.5" floppy diskettes. The information transferred shall include all required technical data such as site information; well characteristics; and hydrogeologic, geologic, physical, and chemical analysis results. Electronic data reporting formats and requirements are given in the most current version of the *ERPIMS Data Loading Handbook*.

8.5 ARCHIVING

Hardcopy and electronic data shall be archived in project files and on electronic archive tapes for the duration of the project or a minimum of five years, whichever is longer.

8.6 PROJECT DATA FLOW AND TRANSFER

The data flow from the laboratory and field to the project staff and data users shall be sufficiently documented to ensure the data are properly tracked, reviewed, and validated for use.

8.7 RECORD KEEPING

The laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted pursuant to the Scope of Work. The minimum records the laboratory shall keep contain the following: (1) CoC forms, (2) initial and continuing calibration records including standards preparation traceable to the original material and lot number, (3) instrument tuning records (as applicable), (4) method blank results, (5) IS results, (6) surrogate spiking records and results (as applicable), (7) spike and spike duplicate records and results, (8) laboratory records, (9) raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports, (10) corrective action reports, (11) other method and project required QC samples and results, and (12) laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.

8.8 HARD COPY DATA REPORT FORMS FOR REPORTING SCREENING DEFINITIVE DATA

AFCEE forms described below shall be included in this project *QAPP* and used unless a variance is requested and approved in advance and that the forms included in this project *QAPP*, to be used by the contractor can be verified that they contain at a minimum the information requested on the AFCEE forms.

A screening data report package shall consist of the following AFCEE forms: CoC, S-1, S-2, and S-3.

A definitive data inorganic report package shall consist of the following AFCEE forms: CoC, I-1, I-2, I-3, I-3A, I-3B, I-4, I-5, I-6, I-7, I-8, I-9, I-10, I-11, and I-12, for each AAB with inorganic analyses performed.

A definitive data organic report package shall consist of the following AFCEE forms: CoC, O-1, O-2, O-3, O-3A, O-4, O-5, O-5A, O-6, O-7, O-8, O-9, O-10, O-11, and O-12 for each AAB with organic analyses performed.

A definitive data wet chemistry report package shall consist of the following AFCEE forms: CoC, W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, and W-9 for each AAB with wet chemistry analyses performed.

Exceptions to these report forms are as follows: for mercury analysis, form I-3A shall be substituted for form I-3 in the inorganic report package; for cyanide analysis, form I-3B shall be substituted for form I-3 in the inorganic report package; for GC/mass spectrometry analyses, forms O-3A and O-5A shall be used and form O-11 shall be added to the organic report package. A complete list and description of forms is provided in Table 8.8-1. Other forms shall be included in this project *QAPP*, as needed.

INSTRUCTIONS FOR COMPLETING AFCEE REPORT FORMS

The following instructions shall be used in completing the AFCEE report forms for screening and definitive data. The bold lettering identifies the fields on the AFCEE report form.

Use as many sheets as necessary. Sheets may be duplicated with only those sections necessary to be completed filled out (i.e., you do not have to duplicate previously reported information from one sheet to the next). Sequentially number the sheets at the bottom of the page if more than one sheet is necessary.

Reporting Dilutions: Justification for diluting samples shall be provided in the comments section on the appropriate form (i.e., I-2, O-2, or W-2). If the result for any analyte is outside the calibration range (i.e., greater than the highest calibration standard), the sample shall be diluted appropriately and reanalyzed. Results from the undiluted and diluted sample shall be reported on the appropriate form (i.e., I-2, O-2, or W-2). The results of the analysis of the diluted sample shall be reported with the dilution

ALL INORGANIC, ORGANIC AND WET CHEM FORMS

- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Lab Name**: enter the laboratory name (e.g., Garland Labs, Inc.)
- **Contract #**: enter the Air Force contract number and delivery order number under which the analytical work is being performed (e.g., F21625-94-D-8005/0001)
- **Comments**: enter any comments

FORM I-1

- **Base/Command:** enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)
- **Prime Contractor:** enter the name of the prime contractor (e.g., RDS, Inc)

Table 8.8-1
List of AFCEE Analytical Forms

AFCEE Form Number	Description
I-1	Inorganic Analyses Data Package
I-2	Inorganic Analyses Data Sheet 2 – Results
I-3	Inorganic Analyses Data Sheet 3 – Initial Multipoint Calibration
I-3A	Inorganic Analyses Sheet 3a – Mercury Initial Multipoint Calibration
I-3B	Inorganic Analyses Data Sheet 3b – Cyanide Initial Multipoint Calibration
I-4	Inorganic Analyses Sheet 4 – Calibration Verification
I-5	Inorganic Analyses Data Sheet 5 – ICP-Mass Spectrometry Tune
I-6	Inorganic Analyses Data Sheet 6 –Serial Dilution
I-7	Inorganic Analyses Data Sheet 7 – Post-Digestion Spike Sample Recovery
I-8	Inorganic Analyses Data Sheet 8 – Blanks
I-9	Inorganic Analyses Data Sheet 9 – Laboratory Control Sample
I-10	Inorganic Analyses Data Sheet 10 – Matrix Spike/Matrix Spike Duplicate Sample Recovery
I-11	Inorganic Analyses Data Sheet 11 – Holding Times
I-12	Inorganic Analyses Data Sheet 12 – Instrument Analysis Sequence Log
O-1	Organic Analyses Data Package
O-2	Organic Analyses Sheet 2 – Results
O-3	Organic Analyses Data Sheet 3a – Initial Multipoint Calibration
O-3A	Organic Analyses Data Sheet 3A – Initial Multipoint Calibration-GC/Mass Spectrometry Analysis
O-4	Organic Analyses Data Sheet 4 – Second Source Calibration Verification
O-5	Organic Analyses Data Sheet 5 – Calibration Verification
O-5A	Organic Analyses Data Sheet 5A – Calibration Verification-GC/Mass Spectrometry Analysis
O-6	Organic Analyses Data Sheet 6 – Second Column/Detector Confirmation
O-7	Organic Analyses Data Sheet 7 – Blank
O-8	Organic Analyses Data Sheet 8 – Laboratory Control Sample
O-9	Organic Analyses Data Sheet 9 – Matrix Spike/Matrix Spike Duplicate Sample Recovery
O-10	Organic Analyses Data Sheet 10 – Holding Times
O-11	Organic Analyses Data Sheet 11 – Instrument Analysis Sequence Log
O-12	Organic Analyses Data Sheet 12 – GC/Mass Spectrometry Performance Check (BFP OR DFTPP)
W-1	Wet Chem Analyses Data Package
W-2	Wet Chem Analyses Data Sheet 2
W-3	Wet Chem Analyses Data Sheet 3 – Initial Multipoint Calibration
W-4	Wet Chem Analyses Data Sheet 4 – Calibration Verification
W-5	Wet Chem Analyses Data Sheet 5 – Blanks
W-6	Wet Chem Analyses Data Sheet 6 – Laboratory Control Sample

Table 8.8-1
List of AFCEE Analytical Forms (Continued)

AFCEE Form Number	Description
W-7	Wet Chem Analyses Data Sheet 7 – Matrix Spike/Matrix Spike Duplicate Sample Recovery
W-8	Wet Chem Analyses Data Sheet 8 – Holding Times
W-9	Wet Chem Analyses Data Sheet 9 – Instrument Analyses Sequence Log
S-1	Screening Data Package
S-2	Screening Data Sheet 2 – Results
S-3	Screening Data Sheet 3 – Field Duplicates
MDL Form (Method Specific)	MDL Study Report Form
CoC	Chain of Custody Record

- **Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate, and field blanks)
- **Lab Sample ID:** enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM I-2

This form is completed for all environmental samples including the MS and MSD.

- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate, and field blanks)
- **Lab Sample ID:** enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID
- **Matrix:** enter the sample matrix (e.g., water and soil)
- **% Solids:** enter the % solids
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the sample results
- **Date Received/Prepared/Analyzed:** enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 04)
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg dry weight)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **MDL:** enter the laboratory derived method detection limit
- **RL:** enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Concentration:** enter the numeric result
- **Dilution:** enter the dilution (if applicable) (e.g., 1:5)
- **Q:** enter the qualifier flag (see *QAPP* Sections 7 and 8)

FORM I-3

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)

- **Date of Initial Calibration:** enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 04)
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Analyte:** enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Std 1, Std2, Std3, …:** enter the concentrations of the standards
- **r**: enter the correlation coefficient
- **Q:** enter a "*" for all corresponding correlation coefficients that were not acceptable as per *QAPP* Section 7

FORM I-3A

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Date of Initial Calibration:** enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 04)
- **Initial Calibration ID:** enter the unique identifying number given to this initial calibration event
- **Concentration Units:** enter the appropriate units (i.e., mg/L or mg/kg)
- **Std 1, Std 2, Std 3, Std 4, Std 5, …:** enter the concentrations of the standards
- **r:** enter the correlation coefficient
- **Q:** enter a "*" for all corresponding correlation coefficients that were not acceptable as per *QAPP* Section 7

FORM I-3B

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Date of Initial Calibration:** enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 04)

- **Initial Calibration ID:** enter the unique identifying number given to this initial calibration event
- **Concentration Units:** enter the appropriate units (i.e., mg/L or mg/kg)
- **Std 1, Std 2, Std 3, Std 4, Std 5, Std 6, …:** enter the concentrations of the standards
- **r:** enter the correlation coefficient
- **Q:** enter a "*" for all corresponding correlation coefficients that were not acceptable as per *QAPP* Section 7
- **Expected:** enter the expected result (i.e., the concentration of the calibration material)
- **Found:** enter the measured result
- **%D**: enter the percent difference between the expected and found

FORM I-4

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if these calibration events pertain to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the calibration verification results
- **2nd Source ID:** enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., 2S040603])
- **CCV #1 ID:** enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., CCV040603-1])
- **CCV #2 ID:** enter the unique identification number for the second CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., CCV040603-2])
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **Expected:** enter the expected result (i.e., the concentration of the calibration material)
- **Found, Found 1, and Found 2:** enter the measured result. Found 1 corresponds to the first CCV run, Found 2 corresponds to the second CCV run, etc.
- **%D:** enter the percent difference between the expected and found
- **Q:** enter a "*" for any %D that was not acceptable as per *QAPP* Section 7

FORM I-5

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Injection Date/Time:** enter the date (in the format DD-MMM-YY) and time (in 24-hour format) of the performance check
- **Element:** enter element as appropriate
- **Mass:** enter the mass of the ion used for tuning (see *QAPP* Section 7)
- **Average Measured Mass (amu):** enter the average measured mass
- **Average Peak width at 10% Peak Height (amu):** enter average peak width at 10% peak height (amu)
- **% RSD:** enter the percent relative standard deviation in the average measured mass

FORM I-6

- **AAB#:** enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Analytical Method:** enter the analytical method
- **Lab Sample ID:** enter the unique identifying number given to the sample by the laboratory
- **Concentration Units**: enter the appropriate units (e.g., mg/L, mg/kg)
- **Matrix:** enter the sample matrix (e.g., water, soil)
- **Date of Analysis:** enter the date of analysis
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **Initial Sample Result**: enter the initial sample result and any data qualifier (See *QAPP* Sections 7 and 8)
- **Serial Dilution Result**: enter the measured result of the diluted sample and any data qualifier (See *QAPP* Sections 7 and 8)
- **% Difference**: enter the percent difference
- **Q**: enter a "*" for any %D that was not acceptable as per *QAPP* Section 7

FORM I-7

- **AAB#:** enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Lab Sample ID:** enter the unique identifying number given to the sample by the laboratory
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Matrix:** enter the sample matrix (e.g., water, soil)
- **Date of Analysis:** enter the date of analysis
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **CLs:** enter the CLs required to be met (see *QAPP* Section 7)
- **Spiked Sample Result:** enter the numeric result of the spiked sample and any data qualifier (See *QAPP* Sections 7 and 8)
- **Sample Result:** enter the numeric result of the parent sample and any data qualifier (See *QAPP* Sections 7 and 8). If an analyte was not detected above the MDL, leave this column blank
- **Spike Added:** enter the amount of spike added to the parent sample
- **%R:** enter the percent recovery
- **Q:** enter a "*" for any %R that was not acceptable as per *QAPP* Section 7

FORM I-8

- **AAB#**: enter the unique AFCEE analytical batch number for the method blank (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Concentration Units**: enter the appropriate units (e.g., mg/L, mg/kg)
- **Initial Calibration Blank ID**: enter the identification number for the calibration blank (the same ID number will be found in the run sequence log (e.g., CB040603)
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the initial calibration blank results
- **Method Blank ID:** enter the unique identifying number given to the method blank (the same ID number will be found in the run sequence log (e.g., MB040603)
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the method blank results
- **CCB #1 ID**: (used for 6010B/6020 analysis) enter the identification number for the first CCB (the same ID number will be found in the run sequence log [e.g., CCB040603-1])

- **CCB #2 ID**: (used for 6010B/6020 analysis) enter the identification number for the second CCB (the same ID number will be found in the run sequence log [e.g., CCB040603-2])
- **CCB #3 ID**: (used for 6010B/6020 analysis) enter the identification number for the third CCB (the same ID number will be found in the run sequence log [e.g., CCB040603-3])
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **Initial Calibration Blank**: enter a numeric result for the calibration blank
- **Continuing Calibration Blank 1**: enter a numeric result for the first continuing calibration blank run
- **Continuing Calibration Blank 2**: enter a numeric result for the second continuing calibration blank run
- **Continuing Calibration Blank 3**: enter a numeric result for the third continuing calibration blank run
- **Method Blank**: enter a numeric result for the method blank
- **RL**: enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Q**: enter a "*" for any calibration or method blank analytes that were not acceptable as per *QAPP* Section 7

FORM I-9

- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **LCS ID**: enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., LCS040603])
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the LCS results
- **Concentration Units**: enter the appropriate units (e.g., mg/L, mg/kg)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **Expected**: enter the expected result (i.e., the concentration at which the analyte was spiked in LCS material)
- **Found**: enter the measured result of the LSC analytes
- **%R**: enter the percent recovery
- **CLs:** enter the CLs required to be met (see *QAPP* Section 7)

- **Q**: enter a "*" for any %R that was not acceptable as per *QAPP* Section 7

FORM I-10

- **Concentration Units**: enter the appropriate units (e.g., mg/L, mg/kg)
- **% Solids:** enter the % solids of the parent field sample
- **Parent Field Sample ID:** enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)
- **MS ID:** enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log [e.g., MS040603])
- **MSD ID:** enter the unique identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log [e.g., MSD040603])
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **Parent Sample Result:** enter the numeric result of the parent sample. If an analyte was not detected above the MDL, leave this column blank
- **Spike Added:** enter the amount of spike added to the parent sample
- **Spiked Sample Result:** enter the numeric result of the MS
- **%R:** enter the percent recovery
- **Duplicate Spiked Sample Result:** enter the numeric result of the MSD
- **%RPD:** enter the relative percent difference between the spike (MS) and spike duplicate (MSD)
- **CLs %R:** enter the CLs required to be met (see *QAPP* Section 7)
- **CLs %RPD:** enter the CLs required to be met (see *QAPP* Section 7)
- **Q:** enter the qualifier flag as needed (see *QAPP* Sections 7 and 8)

FORM I-11

- **AAB#:** enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)
- **Date Collected**: enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Date Received:** enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 6 Jun 04)

- **Date Analyzed:** enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Max. Holding Time:** enter the maximum allowable holding time in days (see *QAPP* Section 5)
- **Time Held:** enter the time in days elapsed between the date collected and the date analyzed
- **Q:** enter a "*" for any holding times that were greater than the maximum allowable holding time as per *QAPP* Section 5

FORM I-12

- **Instrument ID**: enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Field Sample ID/Std ID/Blank ID/QC Sample ID:** enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed
- **Date Analysis Started:** enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Time Analysis Started:** enter the time the sample analysis was started in 24-hour format (e.g., 0900 and 2130)
- **Date Analysis Completed:** enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Time Analysis Completed:** enter the time the sample analysis was completed in 24-hour format (e.g., 0900 and 2130)

FORM O-1

- **Base/Command**: enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)
- **Prime Contractor**: enter the name of the prime contractor (e.g., RDS, Inc)
- **Field Sample ID**: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)
- **Lab Sample ID**: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM O-2

This form is completed for all environmental samples including the MD and MSD.

- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Field Sample ID**: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

- **Lab Sample ID**: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID
- **Matrix**: enter the sample matrix (e.g., water, soil)
- **% Solids**: enter the % solids
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the sample results
- **Date Received/Prepared/Analyzed**: enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)
- **Concentration Units**: enter the appropriate units (i.e., µg/L or mg/kg dry weight)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **MDL:** enter the laboratory derived method detection limit
- **RL**: enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Concentration**: enter the numeric result
- **Dilution**: enter the dilution (if applicable) (e.g., 1:5)
- **Confirm:** enter the numeric result from the confirmation column/detector
- **Qualifier**: enter the qualifier flag as needed (see *QAPP* Section 7)
- **Surrogate**: enter the name of the surrogate(s) used
- **Recovery**: enter the percent recovery of the surrogate
- **CLs**: enter the CLs for the recovery of the surrogate (see *QAPP* section 7)
- **Internal Std**: (used for 8260B and 8270C analysis) enter the name of the internal standard(s) used

<u>FORM O-3 and 3A</u>

- **AAB#**: (optional) enter the unique AFCEE analytical batch number if this calibration pertains to all of the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID**: enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Date of Initial Calibration**: enter the appropriate date in the format DD-MMM-YY (e.g.,
  3 Jun 96)
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event
- **Concentration Units**: enter the appropriate units (i.e., µg/L or mg/kg)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7. (On form 3A, some analyte names already appear on the form as provided, leave those analytes in that order.)

- **RF1, RF2, RF3, RF4, RF5, RF6, RF7**: enter the response factor corresponding to the standard with the same number (RF6 and RF7 are used for nonlinear calibrations)
- **Std 1, Std 2, Std 3, Std 4, Std 5, Std 6, Std 7**: enter the concentration of the standard (Std 6 and Std 7 are used for nonlinear calibrations)
- **%RSD**: enter the percent relative standard deviation of the response factors
- **Mean %RSD**: enter the mean of the RSDs of all analytes for those analytes not using a least squares regression or non-linear calibration
- **r**: (optional) if least squares regression is used for the calibration of an analyte, enter the correlation coefficient
- **COD**: (optional) if a non-linear calibration is used for the calibration of an analyte, enter the coefficient of determination
- **Q**: enter a "*" for any calibration that was not acceptable as per *QAPP* Section 7 and for any RFs not meeting minimum requirements for SPCCs and/or CCCs

FORM O-4

- **AAB#**: (optional) enter the unique AFCEE analytical batch number if this calibration event pertains to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID**: enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the second source calibration verification results
- **2nd Source ID**: enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7
- **Expected**: enter the expected result (i.e., the concentration of the calibration material)
- **Found**: enter the measured result
- **%D**: enter the percent difference between the expected (i.e., the concentration of the second source calibration material) and measured result
- **Q**: enter a "*" for any % D that was not acceptable as per *QAPP* Section 7

FORM O-5 and O-5A

- **AAB#**: (optional) enter the unique AFCEE analytical batch number if these calibration events pertain to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID**: enter the instrument identifier (e.g., the serial number or other identifying number/name)

- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the calibration verification results
- **ICV ID**: enter the unique identification number for the ICV such that the ICV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., ICV960603-1)
- **CCV #1 ID**: enter the unique identification number for the CCV run after the first 12 hours of operation such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)
- **CCV #2 ID**: enter the unique identification number for the CCV run after the second 12 hours of operation such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)
- **Analyte:** enter all analyte names in the same order as listed in the tables in *QAPP* Section 7 (On form O-5A, some analyte names already appear on the form as provided, leave those analytes in that order.)
- **RF**: (form O-5A) enter the response factor for the SPCCs only
- **% D**: enter the percent difference
- **% D or % drift:** (form O-5) enter the percent difference if using RFs or % drift if using CFs
- **Q**: enter a "*" for any % drift that was not acceptable as per requirements in *QAPP* Section 7
- **AAB#**: enter the unique AFCEE analytical batch number for the method blank (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Concentration Units**: enter the appropriate units (i.e., µg/L or mg/kg)
- **Method Blank ID**: enter the unique identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)

FORM O-6

- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the method blank results
- **Analyte**: enter the name of the analyte (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Method Blank**: enter a numeric result for the method blank
- **RL**: enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Q**: enter a "*" for any method blank analyte result that was not acceptable as per *QAPP* Section 7
- **Surrogate**: enter the name of the surrogate(s) used
- **Recovery**: enter the percent recovery of the surrogate

FORM O-7

- **CLs**: enter the CLs for the recovery of the surrogate (see *QAPP* section 7)
- **Internal Std**: (used for 8260B and 8270C analysis) enter the name of the internal standard(s) used
- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **LCS ID**: enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., LCS960603)
- **Concentration Units**: enter the appropriate units (i.e., µg/L or mg/kg)
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the LCS results
- **Analyte**: enter the name of the analyte (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Expected**: enter the expected result (i.e., the concentration at which the analyte was spiked in the LCS)
- **Found**: enter the measured result of the LSC analytes
- **%R**: enter the percent recovery
- **CLs:** enter the CLs required to be met (see *QAPP* Section 7)
- **Q**: enter a "*" for any % R that was not acceptable as per *QAPP* Section 7
- **Surrogate**: enter the name of the surrogate(s) used
- **Recovery**: enter the percent recovery of the surrogate
- **Internal Std**: (used for 8260B and 8270C analysis) enter the name of the internal standard(s) used

FORM O-8

- **Concentration Units**: enter the appropriate units (i.e., µg/L or mg/kg)
- **Parent Field Sample ID**: enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)
- **% Solids**: enter the % solids
- **MS ID**: enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MS960603)
- **MSD ID**: enter the identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MSD960603)
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the MS/MSD results

- **Analyte**: enter the name of the analyte (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Parent Sample Result**: enter the result of the parent sample. If an analyte was not detected above the MDL, leave this column blank.
- **Spike Added**: enter the amount of spike added to the parent sample
- **Spiked Sample Result**: enter the numeric result of the MS
- **%R**: enter the percent recovery
- **Duplicate Spiked Sample Result**: enter the numeric result of the MSD
- **%RPD**: enter the relative percent difference between the spike (MS) and spike duplicate (MSD)
- **CLs %R:** enter the CLs required to be met (see *QAPP* Section 7)
- **CLs %RPD:** enter the CLs required to be met (see *QAPP* Section 7)
- **Q**: enter the qualifier flag as needed (see *QAPP* Sections 7)

FORM O-9

- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Field Sample ID**: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)
- **Date Collected**: enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 3 Jun 96)
- **Date Received**: enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)
- **Date Extracted**: enter the date the sample was extracted by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)
- **Max. Holding Time E**: enter the maximum allowable holding time in days until the sample is extracted (if applicable - see *QAPP* Section 5)
- **Time Held Ext.**: enter the time in days elapsed between the date collected and the date extracted (if applicable)
- **Date Analyzed**: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)
- **Max. Holding Time A**: enter the maximum allowable holding time in days until the sample is analyzed (see *QAPP* Section 5)
- **Time Held Anal.**: enter the time in days elapsed between the date collected and the date analyzed
- **Q**: enter a "*" for any holding time (Max. Holding Time E, or Max. Holding Time A, or Time Held Anal.) that was greater than the maximum holding time that was not acceptable as per *QAPP* Section 5

FORM O-10

- **Instrument ID**: enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Field Sample ID/Std ID/Blank ID/QC Sample ID:** enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed
- **Date Analysis Started**: enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 3 Jun 96)
- **Time Analysis Started**: enter the time the sample analysis was started in 24-hour format (e.g., 0900, 2130)
- **Date Analysis Completed**: enter the date the sample analysis was completed in the format
  DD-MMM-YY (e.g., 3 Jun 96)
- **Time Analysis Completed**: enter the time the sample analysis was completed in 24-hour format (e.g., 0900, 2130)

FORM O-11

- **Instrument ID**: enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Compound**: enter BFB or DFTPP as appropriate
- **Injection Date/Time**: enter the date (in the format DD-MMM-YY) and time (in 24-hour format) of the performance check
- **Initial Calibration ID**: enter the unique identifying number given to the initial calibration event used in the determination of the MS/MSD results
- **Mass**: enter the mass of the ion used for tuning (see *QAPP* Section 7)
- **Ion Abundance Criteria**: enter the criteria for the specific mass (see *QAPP* Section 7)
- **% Relative Abundance**: enter the percent relative abundance as the result of the tune
- **Q**: enter a "*" for any % relative abundance results that was not acceptable as per *QAPP* Section 7

FORM O-12

- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Compound:** enter BFB or DFTPP as appropriate
- **Injection Date/Time:** enter the date (in the format DD-MMM-YY) and time (in 24-hour format) of the performance check
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the MS/MSD results
- **Mass:** enter the mass of the ion used for tuning (see *QAPP* Section 7)

- **Ion Abundance Criteria:** enter the criteria for the specific mass (see *QAPP* Section 7)
- **% Relative Abundance:** enter the percent relative abundance as the result of the tune
- **Analyte**: enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)
- **MDL:** enter the laboratory derived method detection limit
- **RL**: enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Concentration**: enter the numeric result
- **Dilution**: enter the dilution (if applicable) (e.g., 1:5)
- **Q**: enter the qualifier flag (see *QAPP* Sections 7 and 8)

FORM W-3

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Date of Initial Calibration**: enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 04)
- **Initial Calibration ID:** enter the unique identifying number given to this initial calibration event
- **Analyte:** enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Std 1, Std2, Std3:** enter the concentration of the standard
- **r:** enter the correlation coefficient
- **Q:** enter a "*" for any correlation coefficients that were not acceptable as per *QAPP* Section 7

FORM W-4

- **AAB#:** (optional) enter the unique AFCEE analytical batch number if these calibration events pertain to all the samples from one batch (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the calibration verification results

- **2nd Source ID:** enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., 2S040603])
- **ICV ID:** enter the unique identification number for the ICV such that the ICV could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., ICV040603])
- **CCV #1 ID:** enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., CCV040603-1])
- **CCV #2 ID:** enter the unique identification number for the second CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., CCV040603-2])
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Analyte:** enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Expected:** enter the expected result (i.e., the concentration of the calibration material)
- **Found, Found 1, Found 2:** enter the measured result. Found 1 corresponds to the first CCV run, Found 2 corresponds to the second CCV run, etc.
- **%D:** enter the percent difference between the expected and found
- **Q:** enter a "*" for any %D that was not acceptable as per *QAPP* Section 7

FORM W-5

- **AAB#:** enter the unique AFCEE analytical batch number for the method blank (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Calibration Blank ID:** enter the identification number for the calibration blank (the same ID number will be found in the run sequence log [e.g., CB040603])
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the calibration blank results
- **Method Blank ID:** enter the identification number for the method blank (the same ID number will be found in the run sequence log [e.g., MB040603])
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the method blank results
- **Analyte:** enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Calibration Blank:** enter a numeric result for the calibration blank
- **Method Blank:** enter a numeric result for the method blank

- **RL:** enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Q:** enter a "*" for any calibration or method blank analyte that was not acceptable as per *QAPP* Section 7

FORM W-6

- **AAB#:** enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **LCS ID:** enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log [e.g., LCS040603])
- **Initial Calibration ID:** enter the unique identifying number given to the initial calibration event used in the determination of the LCS results
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Analyte:** enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Expected:** enter the expected result (i.e., the concentration at which the analyte was spiked in LCS material)
- **Found:** enter the measured result of the LCS analyte\
- **%R:** enter the percent recovery
- **CLs:** enter the CLs required to be met (see *QAPP* Section 7)
- **Q:** enter a "*" for any %R that was not acceptable as per *QAPP* Section 7

FORM W-7

- **% Solids:** enter the % solids
- **Parent Field Sample ID:** enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)
- **MS ID:** enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log [e.g., MS040603])
- **MSD ID:** enter the unique identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log [e.g., MSD040603])
- **Concentration Units:** enter the appropriate units (e.g., mg/L, mg/kg)
- **Analyte:** enter the name of the analytes (use the same name as used in the tables in Section 7 of the *QAPP*)

- **Parent Sample Result:** enter the numeric result of the parent sample. If an analyte was not detected above the MDL, leave this column blank
- **Spike Added:** enter the amount of spike added to the parent sample
- **Spiked Sample Result:** enter the numeric result of the MS
- **%R:** enter the percent recovery
- **Duplicate Spiked Sample Result:** enter the numeric result of the MSD
- **%RPD:** enter the relative percent difference between the spike (MS) and spike duplicate (MSD)
- **CLs %R:** enter the CLs required to be met (see *QAPP* Section 7)
- **CLs %RPD:** enter the CLs required to be met (see *QAPP* Section 7)
- **Q:** enter the qualifier flag as needed (see *QAPP* Sections 7 and 8)

FORM W-8

- **AAB#**: enter the unique AFCEE analytical batch number (see Section 4.4 of the *AFCEE QAPP* for a definition of a batch)
- **Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate, and field blanks)
- **Date Collected:** enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Date Received**: enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Date Analyzed**: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Max. Holding Time**: enter the maximum allowable holding time in days (see *QAPP* Section 5)
- **Time Held**: enter the time in days elapsed between the date collected and the date analyzed
- **Q:** enter a "*" for any holding time that was greater than the maximum allowable holding time as per *QAPP* Section 5

FORM W-9

- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Field Sample ID/Std ID/Blank ID/QC Sample ID:** enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

- **Date Analysis Started:** enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Time Analysis Started:** enter the time the sample analysis was started in 24-hour format (e.g., 0900 and 2130)
- **Date Analysis Completed:** enter the date the sample analysis was completed in the format DDMMM-YY (e.g., 6 Jun 04)
- **Time Analysis Completed:** enter the time the sample analysis was completed in 24-hour format (e.g., 0900 and 2130)

FORM S-1

- **Base/Command:** enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)
- **Prime Contractor:** enter the name of the prime contractor (e.g., RDS, Inc)
- **Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate, and field blanks)
- **Signature:** signature of person completing data package
- **Name:** name of person completing data package
- **Date:** enter the date the in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Title:** title of person completing data package

FORM S-2

- **Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate, and field blanks)
- **Matrix:** enter the sample matrix (e.g., water and soil)
- **Date Analyzed:** enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 04)
- **Units:** enter the appropriate units (e.g., µg/L, mg/kg, degrees C …)
- **Analyte/Test:** enter the name of the analyte or test performed (e.g., pH)
- **MDL:** enter the method detection limit if applicable
- **RL:** enter the project AFCEE reporting limit as stated in the *QAPP* or approved variance for each analyte
- **Result:** enter the result
- **Q:** enter the qualifier needed (see *QAPP* Sections 7 and 8)

FORM S-3

- **Units:** enter the appropriate units (e.g., µg/L, mg/kg, degrees C…)

- **Analyte/Test:** enter the name of the analyte or test performed (e.g., pH)
- **Sample Result:** enter the result of the sample
- **Duplicate Sample Result:** enter the result of the duplicate sample
- **%D or %RPD:** enter the percent or difference relative percent difference between the sample and duplicate as appropriate
- **Acceptance Criteria:** enter the acceptance criteria required to be met (see *QAPP* Section 6)
- **Q:** enter a "*" for any % D or % RPD that was not acceptable as per *QAPP* Section 6

MDL FORM

- **Matrix:** enter the sample matrix (e.g., water and soil)
- **Analysis Date:** enter the date (or inclusive dates if performed over a period of days) the MDL was performed in the format DD-MMM-YY (e.g., 6 Jun 04)
- **Instrument ID:** enter the instrument identifier (e.g., the serial number or other identifying number/name)
- **Analyte:** enter the name of the analyte (use the same name as used in the tables in Section 7 of the *QAPP*)
- **Amt. Spiked:** enter the amount of spike added to the matrix
- **Replicate 1, 2, 3, 4, 5, 6, 7…:** enter the result of the replicate
- **Std. Dev.:** enter the standard deviation of the replicates
- **MDL:** using the appropriate Student t value for the number of replicates, enter the calculated MDL
- **Relinquished by: (SIG):** enter the signature of the person relinquishing custody of the samples
- **Representing:** enter the company name or affiliation employing the person relinquishing/receiving custody
- **Received by: (SIG):** enter the signature of the person receiving custody of the samples
- **Date:** enter the date in the format M/D/YY (e.g., 6/3/04) when the samples were relinquished/received
- **Time:** enter the time in 24-hour format (e.g., 0900) when the samples were relinquished/received

AFCEE
INORGANIC ANALYSES DATA SHEET 1
DATA PACKAGE

Analytical Method: _____ **AAB #:** _____

Lab Name: _____ **Contract #:** _____

Base/Command: _____ **Prime Contractor:** _____

Field Sample ID	Lab Sample ID
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Comments:
_____
_____
_____
_____

I certify this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ **Name:** _____

Date: _____ **Title:** _____

AFCEE FORM I-1

AFCEE
INORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: _____ Preparatory Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Field Sample ID: _____ Lab Sample ID: _____ Matrix: _____

% Solids: _____ Initial Calibration ID: _____

Date Received: _____ Date Prepared: _____ Date Analyzed: _____

Concentration Units (mg/L or mg/kg dry weight): _____

Analyte	MDL	RL	Concentration	Dilution	Qualifier

Comments:
_____
_____
_____
_____

AFCEE FORM I-2 Page ___ of _____

AFCEE
INORGANIC ANALYSES DATA SHEET 3
INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Date of Initial Calibration: _____ **Initial Calibration ID: _____**

Instrument ID: _____ **Concentration Units: _____**

Analyte	Std 1	Std 2	Std 3	Std 4	Std 5	Std 6	r	Q

r = correlation coefficient

Comments:

_____
_____
_____

AFCEE FORM I-3

AFCEE
INORGANIC ANALYSES DATA SHEET 3A
MERCURY INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Instrument ID: _____ **Date of Initial Calibration: _____**

Initial Calibration ID: _____ **Concentration Units (mg/L or mg/kg): _____**

Analyte	Std 1	Std 2	Std 3	Std 4	Std 5	r	Q
Mercury							

r = correlation coefficient

Comments:
_____
_____
_____

AFCEE FORM I-3A

AFCEE
INORGANIC ANALYSES DATA SHEET 3B
CYANIDE INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Instrument ID: _____ **Date of Initial Calibration: _____**

Initial Calibration ID: _____ **Concentration Units (mg/L or mg/kg): _____**

Analyte	Std 1	Std 2	Std 3	Std 4	Std 5	Std 6	r	Q
Cyanide								

r = correlation coefficient

	Expected	Found	%D	Q
High Distilled Standard				
Low Distilled Standard				

Comments:
_____
_____
_____

AFCEE FORM I-3B

AFCEE
INORGANIC ANALYSES DATA SHEET 4
CALIBRATION VERIFICATION

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Instrument ID: _____ **Initial Calibration ID: _____**

2nd Source ID: _____ **ICV ID: _____**

CCV #1 ID: _____ **CCV #2 ID: _____**

Concentration Units: _____

Analyte	2nd Source Calibration Verification			Initial Calibration Verification			Continuing Calibration Verification					Q
	Expected	Found	%D	Expected	Found	%D	Expected	Found 1	%D	Found 2	%D	

Comments:_____
_____
_____

AFCEE FORM I-4 Page ____ of ____

AFCEE
INORGANIC ANALYSES DATA SHEET 5
ICP-MASS SPECTROMETRY TUNE

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

ICP-Mass Spectrometry Instrument ID: _____ Date: _____
Time: _____

Element -Mass	Avg. Measured Mass (amu)	Avg. Peak Width at 10% Peak Height (amu)	%RSD

Comments:
_____
_____
_____

AFCEE FORM I-5 Page ___ of ___

AFCEE
INORGANIC ANALYSES DATA SHEET 6
ICP-AES and ICP-MASS SPECTROMETRY SERIAL DILUTIONS

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Lab Sample ID: _____ **Date of Analysis: _____**

Concentration Units: _____ **Matrix (soil/water): _____**

Analyte	Initial Sample Result	Qual	Serial Dilution Result (S)	Qual	% Difference	Q

Comments:

_____
_____
_____

AFCEE FORM I-6 Page ___ of ___

AFCEE
INORGANIC ANALYSES DATA SHEET 7
POST-DIGESTION SPIKE SAMPLE RECOVERY

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Lab Sample ID: _____ **Date of Analysis: _____**

Concentration Units: _____ **Matrix (soil/water): _____**

Analyte	Control Limit %R	Spiked Sample Result	Qual	Sample Result	Qual	Spike Added	%R	Q

Comments:
_____
_____
_____

AFCEE FORM I-7 Page ___ of ___

AFCEE
INORGANIC ANALYSES DATA SHEET 8
BLANKS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Concentration Units: _____

Initial Calibration Blank ID: _____ Initial Calibration ID: _____

CCB #1 ID: _____ CCB #2 ID: _____ CCB #3 ID: _____

Method Blank ID: _____

Analyte	Initial Calibration Blank	Continuing Calibration Blank			Method Blank	RL	Q
		1	2	3			

Comments:
_____
_____
_____

AFCEE
INORGANIC ANALYSES DATA SHEET 9
LABORATORY CONTROL SAMPLE

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

LCS ID: _____ **Date of Analysis: _____**

Concentration Units: _____ **Initial Calibration ID: _____**

Analyte	Expected	Found	%R	CLs	Q

Comments:
_____
_____
_____

AFCEE FORM I-9

AFCEE
INORGANIC ANALYSES DATA SHEET 10
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Concentration Units: _____ **% Solids: _____**

Parent Field Sample ID: _____ **MS ID: _____** **MSD ID: _____**

Date of Analysis: _____

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	%R	Duplicate Spiked Sample Result	%R	%RPD	CLs %R	CLs %RPD	Q

Comments:_____
_____
_____

AFCEE FORM I-10

AFCEE
INORGANIC ANALYSES DATA SHEET 11
HOLDING TIMES

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Field Sample ID	Date Collected	Date Received	Date Analyzed	Max. Holding Time (days)	Time Held (days)	Q

Comments:
_____
_____
_____

AFCEE FORM I-11

AFCEE
INORGANIC ANALYSES DATA SHEET 12
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: _____

Lab Name: _____ Contract #: _____

Instrument ID #: _____

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:
_____
_____
_____

AFCEE FORM I-12 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA PACKAGE

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Base/Command: _____ Prime Contractor: _____

Field Sample ID	Lab Sample ID
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Comments:
_____
_____
_____

I certify this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: _____

Date: _____ Title: _____

AFCEE FORM O-1

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: _____ Preparatory Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Field Sample ID: _____ Lab Sample ID: _____ Matrix: _____

% Solids: _____ Initial Calibration ID: _____

Date Received: _____ Date Prepared: _____ Date Analyzed: _____

Concentration Units (ug/L or mg/kg dry weight): _____

Analyte	MDL	RL	Concentration	Dilution	Confirm	Qualifier

Surrogate	Recovery	CLs	Qualifier

Internal Std	Qualifier

Comments:
_____
_____
_____
_____

AFCEE FORM O-2 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 3A
INITIAL MULTIPOINT CALIBRATION-GC/MASS SPECTROMETRY ANALYSIS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Date of Initial Calibration: _____

Initial Calibration ID: _____ Concentration Units (ug/L or mg/kg): _____

Analyte	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	Std 6	RF 6	Std 7	RF 7

* SPCCs # CCCs

Comments:
_____
_____
_____

AFCEE FORM O-3A Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 3A
INITIAL MULTIPOINT CALIBRATION-GC/MASS SPECTROMETRY ANALYSIS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Date of Initial Calibration: _____

Initial Calibration ID: _____ Concentration Units (ug/L or mg/kg): _____

Analyte	% RSD	mean %RSD	r	COD	Q

* SPCCs # CCCs

Comments:
_____
_____
_____

AFCEE FORM O-3A Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 3
INITIAL MULTIPOINT CALIBRATION-GC/MASS SPECTROMETRY ANALYSIS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Date of Initial Calibration: _____

Initial Calibration ID: _____ Concentration Units (ug/L or mg/kg): _____

Analyte	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	Std 6	RF 6	Std 7	RF 7

Comments:
_____
_____
_____

AFCEE FORM O-3 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 3
INITIAL MULTIPOINT CALIBRATION-GC/MASS SPECTROMETRY ANALYSIS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Date of Initial Calibration: _____

Initial Calibration ID: _____ Concentration Units (ug/L or mg/kg): _____

Analyte	% RSD	mean %RSD	r	COD	Q

Comments:
_____
_____
_____

AFCEE FORM O-3 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 4
SECOND SOURCE CALIBRATION VERIFICATION

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Initial Calibration ID: _____

2nd Source ID: _____ Concentration Units (ug/L or mg/kg): _____

Analyte	Expected	Found	%D	Q

Comments:
_____
_____
_____

AFCEE FORM O-4 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 5A
CALIBRATION VERIFICATION-GC/MASS SPECTROMETRY ANALYSIS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Initial Calibration ID: _____

ICV ID: _____ CCV #1 ID: _____ CCV #2 ID: _____

Analyte	ICV		CCV #1		CCV #2		
	RF	% D	RF	% D	RF	% D	Q
Chloromethane *							
1,1-DCA *							
Bromoform *							
Chlorobenzene *							
1,1,2,2-TCA *							
1,1-DCE #							
Chloroform #							
1,2-DCP #							
Toluene #							
Ethylbenzene #							
Vinyl chloride #							

* SPCCs # CCCs

Comments:
_____
_____
_____

AFCEE FORM O-5A Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 5
CALIBRATION VERIFICATION

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Initial Calibration ID: _____

ICV ID: _____ CCV #1 ID: _____ CCV #2 ID: _____

Analyte	ICV %D or % drift	CCV#1 %D or % drift	CCV#2 %D or % drift	Q

Comments:
_____
_____
_____

AFCEE FORM O-5 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 6
BLANK

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Concentration Units (ug/L or mg/kg): _____ Method Blank ID: _____

Initial Calibration ID: _____

Analyte	Method Blank	RL	Q

Surrogate	Recovery	CLs	Qualifier

Internal Std	Qualifier

Comments:
_____
_____
_____

AFCEE FORM O-6 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 7
LABORATORY CONTROL SAMPLE

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

LCS ID: _____ Initial Calibration ID: _____

Concentration Units (ug/L or mg/kg): _____

Analyte	Expected	Found	%R	CLs	Q

Surrogate	Recovery	CLs	Qualifier

Internal Std	Qualifier

Comments:
_____
_____
_____

AFCEE FORM O-7 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 8
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method: _____

Lab Name: _____ Contract #: _____

Concentration Units (ug/L or mg/kg): _____ % Solids: _____

Parent Field Sample ID: _____ MS ID: _____ MSD ID: _____

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	% R	Duplicate Spiked Sample Result	% R	% RPD	CLs %R	CLs %RPD	Q

Comments:
_____
_____
_____

AFCEE FORM O-8 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 9
HOLDING TIMES

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Field Sample ID	Date Collected	Date Received	Date Extracted	Max. Holding Time E	Time Held Ext.	Date Analyzed	Max. Holding Time A	Time Held Anal.	Q

Comments:
_____
_____
_____

AFCEE FORM O-9 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 10
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: _____

Lab Name: _____ Contract #: _____

Instrument ID #: _____

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:
_____
_____
_____

AFCEE FORM O-10 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 11
INSTRUMENT PERFORMANCE CHECK
(BFB or DFTPP)

Analytical Method: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Compound: _____ Injection Date/Time: _____

Initial Calibration ID: _____

Mass	Ion Abundance Criteria	% Relative Abundance	Q

AFCEE FORM O-11 Page ___ of _____

AFCEE
WET CHEM ANALYSES DATA SHEET 3
INITIAL MULTIPOINT CALIBRATION

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Instrument ID: _____ **Date of Initial Calibration: _____**

Initial Calibration ID: _____ **Concentration Units (mg/L or mg/kg): _____**

Analyte	Std 1	Std 2	Std 3	Std 4	Std 5	r	Q

r = correlation coefficient

Comments:_____
_____
_____

AFCEE FORM W-3

AFCEE
WET CHEM ANALYSES DATA SHEET 4
CALIBRATION VERIFICATION

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Instrument ID: _____ Initial Calibration ID: _____

2nd Source ID: _____ CCV #1 ID: _____ CCV #2 ID: _____

Analyte	2nd Source Calibration Verification			Continuing Calibration Verification					Q
	Expected	Found	%D	Expected	Found 1	%D	Found 2	%D	

Comments:_____
_____
_____

AFCEE FORM W-4

AFCEE
WET CHEM ANALYSES DATA SHEET 5
BLANKS

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

Concentration Units (mg/L or mg/kg): _____

Calibration Blank ID: _____ Initial Calibration ID: _____

Method Blank ID: _____ Initial Calibration ID: _____

Analyte	Calibration Blank	Method Blank	RL	Q

Comments:_____
_____
_____

AFCEE FORM W-5

AFCEE
WET CHEM ANALYSES DATA SHEET 6
LABORATORY CONTROL SAMPLE

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

LCS ID: _____ **Initial Calibration ID: _____**

Concentration Units (mg/L or mg/kg): _____

Analyte	Expected	Found	%R	CLs	Q

Comments:_____
_____
_____

AFCEE FORM W-6

AFCEE
WET CHEM ANALYSES DATA SHEET 7
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method: _____ AAB #: _____

Lab Name: _____ Contract #: _____

% Solids: _____ Initial Calibration ID: _____

Parent Field Sample ID: _____ MS ID: _____ MSD ID: _____

Concentration Units (mg/L or mg/kg): _____

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	%R	Duplicate Spiked Sample Result	%R	%RPD	CLs %R	CLs %RPD	Q

Comments:_____
_____
_____

AFCEE FORM W-7

AFCEE
WET CHEM ANALYSES DATA SHEET 8
HOLDING TIMES

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Field Sample ID	Date Collected	Date Received	Date Analyzed	Max. Holding Time (days)	Time Held (days)	Q

Comments:_____
_____
_____

AFCEE FORM W-8

AFCEE
WET CHEM ANALYSES DATA SHEET 9
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: _____ **AAB #: _____**

Lab Name: _____ **Contract #: _____**

Instrument ID #: _____

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:_____
_____
_____

AFCEE FORM W-9 Page ___ of _____

AFCEE
SCREENING DATA PACKAGE

Analytical Method: _____ Contract #: _____

Base/Command: _____ Prime Contractor: _____

Field Sample ID

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Comments:
_____
_____
_____

Signature: _____ Name: _____

Date: _____ Title: _____

AFCEE FORM S-1

AFCEE
SCREENING DATA SHEET 2
RESULTS

Analytical Method: _____

Contract #: _____ Field Sample ID: _____

Matrix: _____ Date Analyzed: _____

Concentration Units (ug/L, mg/kg dry weight or ^{o}C): _____

Analyte/Test	MDL	RL	Result	Qualifier

Comments:
_____
_____
_____
_____

AFCEE FORM S-2 Page ___ of _____

AFCEE
SCREENING DATA SHEET 3
FIELD DUPLICATES

Analytical Method: _____ Contract #: _____

Units: _____

Analyte/Test	Sample Result	Duplicate Sample Result	%D or %RPD	Acceptance Criteria	Q

Comments:
_____
_____
_____

AFCEE FORM S-3 Page ___ of _____

MDL STUDY REPORT FORM

Lab Name: ____________________ Analytical Method: ____________________ Matrix: ____________

Analysis Date: __________________ Instrument ID: _____________________

Concentration Units (mg/L or mg/kg): _______________

Analyte	Amt. Spiked	Replicate							Std. Dev.	MDL
		1	2	3	4	5	6	7		

MDL FORM Method ___________ Page ____ of ____

9.0 SYSTEMS AND PERFORMANCE AUDITS, PERFORMANCE EVALUATION PROGRAMS, MAGNETIC TAPE AUDITS, AND TRAINING

Technical systems and performance audits shall be performed as independent assessments of sample collection and analysis procedures. Audit results will be used to evaluate the ability of an analytical contractor to (1) produce data that fulfill the objectives established for the program, (2) comply with the QC criteria, and (3) identify any areas requiring corrective action. The systems audit is a qualitative review of the overall sampling or measurement system, while the performance audit is a quantitative assessment of a measurement system. Audit guidance can be found in the *HQ AFCEE Technical Services Quality Assurance Program*, current version. Full data review/validation is also a quantitative check of the analytical process, where all documentation and calculations are evaluated and verified. Data review/validation procedures are discussed in Section 8.

9.1 PROJECT AUDITS

9.1.1 State/Federal Project Audits

Audits by various state and federal agencies are commonly conducted for the laboratories that will analyze project samples. Audit reports from these agencies should be reviewed by the prime contractor to determine whether data produced by the subcontractor analytical laboratory can fulfill the objectives of the program. All laboratories shall participate in the USEPA Water Supply and Water Pollution Studies programs or equivalent programs for state certifications. Satisfactory performance in these nonproject-specific PT sample programs also demonstrates proficiency in methods used to analyze AFCEE samples. The laboratory shall document the corrective actions to unacceptable PT sample results to demonstrate resolution of the problems. Audit findings shall be transmitted from the laboratory to the prime contractor and to AFCEE. The prime contractor shall review the audit findings and provide a written report to AFCEE. This report shall include the recommended corrective actions or procedures to remedy any deficiencies identified during the state/federal audit(s). The audit results and discussion shall be incorporated into the QA report for each sampling effort.

9.1.2 Technical Systems Audits

A technical systems audit is an on-site, qualitative review of the sampling or analytical system to ensure that the activities are being performed in compliance with the project *SAP* specifications. Sampling, field procedures, and analytical laboratories shall be audited by the prime contractor at the beginning of the project. In addition, a laboratory systems audit may be performed by AFCEE if previous audit reports indicate corrective actions have not been completed, a recent audit has not been conducted, or quality concerns have arisen based upon the use of that laboratory for other projects. The laboratory systems audit results will be used to assess the prime contractor's oversight and to review laboratory operation and ensure the technical procedures and documentation are in place and operating to provide data that fulfill the project objectives and to ensure corrective actions have been implemented.

Critical items for a laboratory systems audit include: (1) sample custody procedures, (2) calibration procedures and documentation, (3) completeness of data forms, notebooks, and other reporting requirements, (4) data review and validation procedures, (5) data storage, filing, and record keeping procedures, (6) QC procedures, tolerances, and documentation, (7) operating conditions of facilities and equipment, (8) documentation of training and maintenance activities, (9) systems and operations overview, and (10) security of laboratory automated systems.

Critical items for field sampling systems audit include: (1) appropriate sampling plans (*QAPP*, *FSP*) (2) calibration procedures and documentation for field equipment, (3) documentation in field logbooks and sampling data sheets, (4) organization and minimization of potential contamination sources while in the field, (5) proper sample collection, storage, and transportation procedures, and (6) compliance with established CoC and transfer procedures.

After each on-site audit, a debriefing session will be held for all participants to discuss the preliminary audit results**.** The auditor will then complete the audit evaluation and submit an audit report including observations of the deficiencies and the necessary recommendations for corrective actions (RCAs) to the prime contractor. Compliance with the specifications presented in the *SAP* will be noted and noncompliance or deviations shall be addressed in writing by the prime contractor to AFCEE with corrective actions and a time frame for implementation of the corrective actions. Follow-up audits will be performed prior to completion of the project to ensure corrective actions have been taken.

AFCEE personnel must be notified at least three weeks prior to conducting the field audit. Also, if AFCEE personnel plan to observe field activities during the audit, the prime contractor must provide the AFCEE attendee(s) with any needed personal protective equipment. This should be coordinated directly with AFCEE attendee(s).

9.1.3 Project-Specific Performance Evaluation Audits

Performance audits quantitatively assess the data produced by a measurement system. A performance audit involves submitting project-specific PT samples for analysis for each analytical method used in the project. The prime contractor shall submit project-specific PT samples once per quarter per project. The project-specific PT samples are selected to reflect the expected range of concentrations for the sampling program. The performance audit answers questions about whether the measurement system is operating within CLs and whether the data produced meet the analytical QA specifications.

The project-specific PT samples are made to look as similar to field samples as possible and are submitted as part of a field sample shipment so that the laboratory is unable to distinguish between them and project samples. This approach ensures unbiased sample analysis and reporting by the laboratory.

The critical elements for review of PT sample results include: (1) correct identification and quantitation of the PT sample analytes, (2) accurate and complete reporting of the results, and (3) measurement system operation within established CLs for precision and accuracy.

The concentrations reported for the PT samples shall be compared to the known or expected concentrations spiked in the samples. The percent recovery shall be calculated and the results assessed according to the accuracy criteria for the LCS presented in Section 7 and/or the values from the PT sample provider. If the accuracy criteria are not met, the cause of the discrepancy shall be investigated and a second PT sample shall be submitted. The prime contractor shall notify the project staff, AFCEE, and agencies of the situation at the earliest possible time, and the prime contractor shall keep AFCEE informed of corrective actions and subsequent PT sample results.

9.1.4 Magnetic Tape Audits

Magnetic tape audits involve the examination of the electronic media used by the analytical laboratory and by the prime contractor to collect, analyze, report, and store data. These audits are used to assess the authenticity of the data generated and the implementation of good automated laboratory practices. AFCEE may perform magnetic tape audits of the laboratories or of the prime contractors when warranted by project PT sample results, on-site audit results, or by other state/federal investigations.

9.2 TRAINING

Training shall be provided to all project personnel to ensure compliance with the health and safety plan and technical competence in performing the work effort. Documentation of this training shall be maintained in the records of the contracted organizations.

10.0 PREVENTATIVE MAINTENANCE

A preventive maintenance program shall be in place to promote the timely and effective completion of a measurement effort. The preventive maintenance program is designed to minimize the downtime of crucial sampling and/or analytical equipment due to unexpected component failure. In implementing this program, efforts are focused in three primary areas: (1) establishment of maintenance responsibilities, (2) establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and (3) establishment of an adequate inventory of critical spare parts and equipment.

10.1 MAINTENANCE RESPONSIBILITIES

Maintenance responsibilities for equipment and instruments are assumed by the respective facility managers. The managers then establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although the managers retain responsibility for ensuring adherence to the prescribed protocols.

10.2 MAINTENANCE SCHEDULES

The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted as needed. Manufacturers' recommendations provide the primary basis for the established maintenance schedules, and manufacturers' service contracts provide primary maintenance for many major instruments (e.g., GC/mass spectrometry instruments, AA spectrometers, and analytical balances).

10.3 SPARE PARTS

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment downtime. The inventory includes those parts (and supplies) that are subject to frequent failure, have limited useful lifetimes, or cannot be obtained in a timely manner should failure occur.

Field sampling task leaders and the respective laboratory managers are responsible for maintaining an adequate inventory of spare parts. In addition to spare parts and supply inventories, the contractor shall maintain an in-house source of backup equipment and instrumentation.

10.4 MAINTENANCE RECORDS

Maintenance and repair of major field and laboratory equipment shall be recorded in field or laboratory logbooks. These records shall document the serial numbers of the equipment, the person performing the maintenance or repairs, the date of the repair, the procedures used during the repair, and proof of successful repair prior to the use of the equipment.

11.0 CORRECTIVE ACTION

Corrective actions, if necessary, shall be completed once. If acceptance criteria were not met and a corrective action was not successful or corrective action was not performed, apply the appropriate flagging criteria. Requirements and procedures for documenting the need for corrective actions are described in this section.

11.1 CORRECTIVE ACTION REPORT

Problems requiring corrective action in the laboratory shall be documented by the use of a corrective action report. The QA coordinator or any other laboratory member can initiate the corrective action request in the event QC results exceed acceptability limits, or upon identification of some other laboratory problem. Corrective actions can include reanalysis of the sample or samples affected, resampling and analysis, or a change in procedures, depending upon the severity of the problem.

11.2 CORRECTIVE ACTION SYSTEM

A system for issuing, tracking, and documenting completion of formal RCA exists for addressing significant and systematic problems. RCAs are issued only by a member of the QA group or a designee in a specific QA role. Each RCA addresses a specific problem or deficiency, usually identified during QA audits of laboratory or project operations. An RCA requires a written response from the party to whom the RCA was issued. A summary of unresolved RCAs is included in the monthly QA report to management. The report lists all RCAs that have been issued, the manager responsible for the work area, and the current status of each RCA. An RCA requires verification by the QA group that the corrective action has been implemented before the RCA is considered to be resolved. In the event there is no response to an RCA within 30 days, or if the proposed corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

12.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

At a minimum, the QA coordinator of the laboratory shall prepare a summary report quarterly of the status of the project, of QA/QC problems, corrective actions taken, and unresolved RCAs with recommended solutions for management. The report shall also include results from all PE samples, audit findings, and periodic data quality assessments. This report shall be available for review by AFCEE auditors upon request.

13.0 REFERENCES

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Appendix B
Health and Safety Plan (HSP)

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Draft
Site Specific Health and Safety Plan
AT
SITE SS005
AIR FORCE PLANT 59 JOHNSON CITY, NEW YORK

Prepared for:

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Enterprise Sourcing Squadron 2261
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Prepared by:

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LIST OF ACRONYMS AND ABBREVIATIONS

AFP	Air Force Plant
ANSI	American National Standards Institue
AWQS	Ambient Water Quality Standards
bgs	below ground surface
COC	contaminant of concern
FPM	FPM Remediations, Inc.
ft	feet
HCL	Hydrochloric Acid
HSP	Health and Safety Plan
H&S	Health and Safety
mg/L	milligrams per liter
MSL	mean sea level
µg/L	micrograms per liter
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PID	Photoionization Detector
ppm	parts per million
QA/QC	Quality Assurance and Control
SDS	Safety Data Sheets

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SSO	Site Safety Officer
VI	vapor intrusion
VOC	Volatile Organic Compound

1 SITE BACKGROUND

Site SS005, Air Force Plant (AFP) 59, is located in Johnson City, New York. The AFP 59 site occupies approximately 30 acres in a combined residential and commercial area. It is adjoined to the north by Route 17C, across which are residential and commercial properties; to the east by the ramp to Route 201 and Little Choconut Creek, which is a tributary of the Susquehanna River; to the south by Little Choconut Creek, across which is a coal- fired power generation plant; and, to the west by residential properties and the Camden Street well field, which is a municipal water supply well field for Johnson City and is located about two blocks away from the AFP 59 site.

1.1 SITE HISTORY

Site SS005 was a building formerly located on the south side of AFP 59 and was used for plating operations between 1942 and 1991. A groundwater monitoring well adjacent to Site SS005 revealed several chlorinated volatile organic compounds (VOCs) at concentrations above the New York State Department of Environmental Conservation (NYSDEC) Ambient Water Quality Standards (AWQS). Since then, additional groundwater monitoring has identified VOCs and 1,4- Dioxane in several of the other monitoring wells associated with the AFP 59 site. Additionally, vapor sampling revealed a widespread vapor intrusion (VI) issue beneath the building. However, major flooding damaged the AFP 59 building in September 2011, at which time operations ceased. AFP 59 has since been demolished and therefore VI is no longer an issue for the site.

The AFP 59 site is listed on the NYSDEC's List of Inactive Hazardous Waste Sites and has been assigned Site No. 7- 04- 020. Based on NYSDEC recommendation, the groundwater at the site is currently undergoing long term monitoring, which was initiated in November 2004.

1.2 CONCEPTUAL SITE MODEL

The surficial geology of the AFP 59 site consists of alluvium and/or outwash, consisting of fine to coarse grained soils in addition to anthropogenic fill material. The bedrock unit beneath the site is located at approximately 90 feet below the site surface and is comprised of shale and siltstone. The bedrock beneath the site been identified to slope downwards towards the south of the site.

The aquifer beneath the AFP 59 site has been designated as the Clinton Street Ballpark and was deemed a single- source aquifer by the United States Environmental Protection Agency in 1985. This highly productive aquifer is comprised of permeable ice contact and glacial outwash deposits. Previous groundwater investigations at the site have identified shallow and deep aquifer units, which are separated by a layer of fine- grained ice contact deposits, to exist within the surficial geological unit beneath the site. Groundwater flow is toward the west- northwest in both aquifer units.

1.3 PLANNED ACTIVITIES

The activities planned for the AFP 59 site include the purging and sampling of six on- site monitoring wells and five off- site monitoring wells, and the sampling of two municipal supply wells located within the Camden Street well field. Additionally, several Quality Assurance and Control (QA/QC) samples will also be collected in the field. Purged groundwater will be poured directly to the ground.

One monitoring well will be decommissioned and two new monitoring wells will be installed as well.

Decontamination solutions, spent tubing, gloves, paper towels and other disposable supplies will be carried off- site by FPM field staff daily to be properly disposed of.

This Site Specific Health and Safety Plan (HSP) only covers the planned activities to be conducted by FPM Remediations personnel as described in this section.

2 HEALTH AND SAFETY PROGRAM ORGANIZATION

The health and safety (H&S) program includes both safety training and safety information in the form of HSP prepared for site and is designed to keep employees safe during their field activities by imparting knowledge of known site hazards, potential site hazards, and safety precautions and practices. This HSP identifies the safety requirements for the field activities by FPM personnel. The H&S guidelines in this HSP were prepared to encompass known hazards and potential hazards associated with the AFP 59
site.

Key FPM team members will be responsible for the development and implementation of this HSP. Each staff member will be given a specific role in relation to the H&S program, as detailed below.

DON SORBELLO, PROGRAM MANAGER

Description:
- Report to upper- level management.
- Review HSP and HSP revisions.

Responsibilities:
- Prepare and organize a review of site tasks and scope of work, potential or actual hazards, the HSP, and the field team.
- Coordinates site access with appropriate officials, tenants, and subcontractors to execute field activities.
- Prepare final incident reports and supporting documentation.
- Serves as liaison with between COR, public, and local government officials.

Required Training and Surveillance:
- 40- hour HAZWOPER with annual 8- hour refresher training (29 CFR 1910.120)
- 8- hour HAZWOPER Supervisor training

Contact Information:
- E- mail: d.sorbello@fpm-remediations.com
- Office telephone: (315) 336- 7721 x226

JOSH WENZEL, FIELD SUPERVISOR

Description:
- Responsible for directing field team operations and safety measures.

Responsibilities:
- Prepare HSP.
- Coordinate with field staff to manage and execute field operations and scope of work.
- Enforce safety procedures
- Coordinates with Site Safety Officer (SSO) to determine personal protective equipment (PPE) levels and appropriate safety measures, documents and maintains field records, reports to program manager.

Required Training and Surveillance:
- 40- hour HAZWOPER with annual 8- hour refresher training (29 CFR 1910.120)
- 8- hour HAZWOPER Supervisor training
- Medical surveillance participant

Contact Information:
- E- mail: j.wenzel@fpm-remediations.com
- Office telephone: (315) 336- 7721
- Cellular telephone: (315) 269- 6913

JOSH WENZEL, SITE SAFETY OFFICER (SSO)

Description: Oversees field activities implementation in relation to health and safety protocols.

Responsibilities:
- Implement H&S measures as prescribed in the HSP.
- Conduct initial and daily safety meetings.
- Recommend work stoppage if unsafe conditions are noted. Monitor field team for signs of stress or exposure. Maintain PPE.
- Prepare incident reports and report to program manager.

Required Training and Surveillance:
- 40- hour HAZWOPER with annual 8- hour refresher training (29 CFR 1910.120)
- 8- hour HAZWOPER Supervisor training
- Medical surveillance participant

Contact Information:
- E- mail: j.wenzel@fpm-remediations.com
- Office telephone: (315) 336- 7721
- Cellular telephone: (315) 269- 6913

3 SITE MAP

A site map has been prepared for this HSP which identifies important areas related to the field activities and H&S (including evacuation routes). This map is included as **Figure 1**.

The exclusion zones and work staging areas will consist of a 15' x 15' area around each sampling location. The decontamination areas will consist of a 10' x 10' area immediately adjacent to the exclusion zones. Evacuation routes will lead north from each sampling location and will travel along Main Street, leading to the parking lot of the Westover Plaza across the street from the site, where the evacuation rally point is located. All emergency response equipment brought to the site by FPM personnel will be located within the field vehicle. Additionally, no telephones are located on the site and FPM personnel will use their cellular phones for such purposes.

The route to the nearest hospital, UHS Medical Center, has been included as **Figure 2**.

4 HAZARD ANALYSIS

4.1 GROUNDWATER SAMPLING

Previous groundwater sampling at the site has shown the groundwater to be impacted by chlorinated VOCs and 1,4- Dioxane. Several of these compounds have been known to be human carcinogens, so precautions must be taken when handling groundwater or sampling equipment. Safety precautions include donning gloves and safety glasses to minimize the risk of contact with the contaminants.

In addition to the groundwater contaminants, sample bottles will contain two types of chemicals as preservatives: hydrochloric acid (HCL) and sodium bisulfate. Each of these chemicals is known to be corrosive and can cause irritation and damage to human. Therefore, gloves and safety glasses will also be worn while handling sample bottles. Lastly, gloves will be removed and hands will be washed prior to eating, drinking or using tobacco products to minimize the risk of accidental ingestion of groundwater or bottle chemicals. Eating, drinking, or the use of tobacco products will not occur within the exclusion zone. The safety data sheets (SDS) for both HCL and sodium bisulfate are included as **Attachment 1**.

4.2 HOLLOW STEM AUGER DRILLING

Hollow stem auger drilling may be employed to aid in the installation of new monitoring wells. In this case, the installation of monitoring wells will be completed by an independent drilling company which will be subcontracted and must adhere to this SSHP for all work completed. The drilling subcontractor will be observed by the SSHO.

Level D personal protective equipment is anticipated to be utilized by the drilling crew and field personnel during drilling and decontamination events. Level D personal protective equipment is described in **Section 6: Personal Protection.**

Based on previous investigations at AFP59, it has been determined that the chemical compounds of concern consist of VOCs and SVOCs. VOC/SVOC concentrations shall be monitored in the work zone during well installment activities by utilizing a photoionization detector (PID). The PID shall be "zeroed" by exposing the PID to a canister of hydrocarbon-free air (<0.1 parts per million (ppm) hydrocarbons). If ambient air conditions are void of any hydrocarbon emitting sources, then ambient air may be used as the zero gas. Calibration of the PID will be performed at the beginning of each work day. PID calibration is discussed in detail in Section 8.0.

4.3 DRILL RIG SAFETY

Only necessary personnel for drilling operations should be present in the operation area. Other parties present should remain outside the drilling area until their presence is needed.

Potential electrical hazards consist mainly of underground and overhead power lines. Hazards of underground utilities will be minimized by having all utilities identified and marked for each site where subsurface drilling will occur. Drill rigs can come in contact with overhead power lines. Before raising the tower, determine if overhead utilities are present. Never raise the tower if visibility is restricted.

If well installation locations are on uneven terrain, care must be taken to assure the rig remains upright. Travel on hills and slope should be avoided if at all possible. The rig must not be moved with the tower in the raised position and all equipment must be properly stowed when moving the rig. The rig must also be prevented from moving once setup by braking and/or blocking wheels.

The mast should not be moved during high wind conditions and work must be suspended during electrical storms.

Rigging failure is a drilling hazard. All rigging equipment must be inspected daily, in accordance with 29 CFR 1926.522 and 29 CFR 1926.251. Each member of the drilling crew or field personnel should report any item that he/she observes to be defective, worn or unsafe and immediately place the equipment out of service.

All personnel working at elevations greater than 6 feet above the derrick floor or other working surfaces must wear a full body harness, with an attached lanyard secured to the derrick, except during the rig up and rig down.

All boring equipment used should have an emergency stop device. All field personnel and members of the drilling crew should be aware of the location and use of this device. This device must be confirmed to be in working order before and after completion of drilling activities. Moving augers should not be handled unless an additional person is standing by to activate the emergency stop device. The drilling crew should not leave the controls of the boring apparatus while it is in operation unless all personnel are removed from the boring area.

Being caught in moving parts of the rig is a hazard. A long-handled tool such as a shovel should be used to remove any drill cuttings from the boring hole and machinery in motion. Hand and/or feet are not acceptable as a substitute for this purpose. Never reach around augers for any purpose. No loose clothing or jewelry is allowed and long hair must be pulled back when working on the drill rig. Never place a finger between augers when hoisting them into place.

Minimum PPE required when working with the drill rig included; hard hat, safety glasses, and safety shoes (steel toe/shank). Due to the fact that drilling operations are loud, hearing protection must be worn when the drill rig is in operation.

Additionally, physical hazards associated with routine sampling/drilling activities are present. These hazards include the use of heavy machinery or overhead equipment, slip/trip/fall hazards, noise hazards when heavy machinery is in use, and cold temperatures. Therefore, FPM personnel will don additional PPE, as described in *Section 6*: *Personnel Protection.*

5 SITE WORKER TRAINING

All FPM personnel have undergone 40- hour HAZWOPER certification with annual 8- hour refresher training in accordance with 29 CFR 1910.120. This training has included topics relating to the identification and hazards associated with hazardous wastes as well as procedures to minimize the risk of exposure to these chemicals, such as best practices and the selection of appropriate PPE.

Prior to arrival at the site, FPM site personnel will meet with the Program Manager to discuss safety concerns, known and potential site hazards, and to review this HSP. Upon arrival but before the initiation of any field activities, site personnel will have a tailgate safety meeting to review the H&S information and site hazards. This meeting will be documented on FPM's tailgate safety meeting form, which is included as **Attachment 2**.

6 PERSONNEL PROTECTION

While on- site, FPM site personnel will be required to wear Modified Level D PPE, which is defined by the Occupational Safety and Health Administration (OSHA) as PPE affording minimal protection, used for nuisance contamination. Specifically, the PPE required to be worn by FPM site personnel will include:

- Steel- toed boots
- American National Standards Institute (ANSI) Class 2 high- visibility safety vests
- Impact- resistant safety glasses
- Nitrile gloves (whenever coming in contact with any samples and bottle ware)
- Hard hat (when heavy equipment is in use at the site)
- Ear plugs (as needed, when heavy equipment is in use at the site)

Each piece of PPE will be inspected for any signs of damage or excessive wear before being used by FPM site personnel. If any PPE is found to be defective, it will be immediately replaced. All PPE to be used is single- use/disposable and does not require decontamination.

7 MEDICAL SURVEILLANCE

In accordance with 29 CFR 1910.120 (f)(2) et seq., all site personnel currently participate in a medical surveillance program. This program includes pre- employment and annual physical and medical exams to ensure each site worker is fit for work and has not been adversely impacted by working hazardous substances. FPM site personnel have been deemed to be fit for work in the field.

8 MONITORING

To ensure the safety of site personnel, the exclusion zone will be monitored for gross organic vapors using a photoionization detector (PID), since VOCs are the main contaminant of concern at this site. The PID will use the appropriate lamp capable of detecting all VOC compounds which may be encountered during work. PID monitoring will be conducted every 15 minutes, or whenever there is any indication that concentrations have changed (odors, visible gases, etc.) since the last regular measurement. All measurements will be recorded in the field logbook.

If ambient breathing zone concentrations of VOCs exceed 5 parts per million (ppm) above background for the 15 minute average, activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases during this interval below 5 ppm, work may recommence. If ambient concentrations of VOCs persist above 5 ppm, but do not exceed 25 ppm above background, activities will be temporarily halted while monitoring continues, and the source of the high VOC emissions must be identified and corrective actions to reduce exposure will be employed. Upon employment of these measures work may recommence while monitoring continues provided that the 15 minute average VOC concentration remains below 5 ppm.

At no time will the ambient VOC concentration be allowed to exceed 25 ppm for the 15 minute average. If at any point, the ambient VOC concentration exceeds 25 ppm for the 15 minute average, all work will be stopped and the site activities will be re- evaluated.

Calibration of the PID will be conducted daily, prior to the start of any site activities and will be performed according to the instrument manufacturer's specifications. If the PID does not calibrate or operate properly, it will be replaced immediately. Work shall not be conducted unless proper monitoring for all potential contaminants can be implemented.

9 SITE CONTROL

The exclusion zone will be clearly marked using cones and/or caution tape, and all non- essential site personnel will be kept out of the exclusion zone. Anyone who enters the exclusion zone must have the proper OSHA HAZWOPER training and must don the Level D PPE required. Additionally, FPM site personnel will use the buddy system and work together. If for some reason they must split up, a line of sight will be maintained between personnel and cellular telephones will be used to maintain communication, as needed.

10 EMERGENCY RESPONSE

IN CASE OF EMERGENCY, DIAL 911 AS SOON AS POSSIBLE!!!

Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures that are addressed here include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred onsite, record keeping, and emergency site evacuation procedures.

Emergencies which may be potentially encountered at this site may include:

- Fire
- Acute chemical exposures
- Physical injuries to site personnel
- Minor chemical spills

The SSO, Field Supervisor, and Program Manager must be notified as soon as possible of any on- site emergency or potential emergency including fire, explosive conditions or OSHA- recordable physical injury. Response equipment is to be provided and available for each project and personnel are to be trained and qualified to respond to the types of emergencies described within this plan. For emergency responses outside of this plan, municipal or contracted response personnel and agencies will be used.

A comprehensive list of all emergency contacts for this site is included as **Attachment 3** and along with directions to the nearest urgent care medical facility are shown on **Figure 2** of this HSP.

10.1 PRE- EMERGENCY PLANNING

As part of the initial Health and Safety briefing prior to beginning work at the site, the SSO will make all workers aware of the location of the nearest hospital with an emergency room/urgent care facility. The site- specific HSP shall also have clear directions from the site to the nearest hospital along with a route map. The site- specific HSP shall also contain a listing of non- emergency phone numbers for local authorities (e.g. police, fire, utility companies).

The initial safety briefing will also cover types of emergency response equipment to be brought to the site and will include first aid kits, fire extinguishers, and spill containment kits. Each of these pieces of equipment will be located in the field vehicle while on- site. Site personnel will review and confirm the presence and location of each of these pieces of emergency response equipment during the tailgate safety meeting while on- site.

10.2 EMERGENCY RECOGNITION AND PREVENTION

10.2.1 Fires

In the event of a fire or explosion, procedures will include immediate evacuation of the site and notification of the Program Manager. Portable fire extinguishers will be provided at the work site and will be kept within the field vehicle. No personnel shall fight a fire beyond the stage where it can be put out using a portable fire extinguisher.

10.2.2 Chemical Exposures

The following are standard procedures to treat chemical exposure. Other specific procedures detailed on the SDS will be followed, when necessary.

EYE: Use copious amount of potable water from eye- wash kits for at least 15 minutes.

SKIN CONTACT: Wash affected areas with mild soap and rinse thoroughly, then provide appropriate medical attention. Skin shall be rinsed for 15 minutes if contact with caustics, acids, or hydrogen peroxide occurs. Affected items of clothing shall also be removed from contact with skin.

INHALATION: Move affected personnel to fresh air, upwind of work zone.

INGESTION: Contact Poison Control Center immediately, do not induce vomiting

If a person experiences any acute symptoms of exposure, such as dizziness, nausea, shortness of breath, or recognizes any of them in a fellow worker, work will stop immediately and, the necessary measures to mitigate the exposure will be taken. Medical evaluation by a physician will also be sought. Immediately report all such incidents to the SSO and Program Manager.

10.2.3 Physical Injuries

First- aid kits will be available on- site and their location will be made known to all site workers during the tailgate safety meeting. Unless they are in immediate danger, severely injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instruction that can be obtained from doctors or paramedics, before an emergency- response squad arrives at the site or before the injured person can be transported to a hospital, will be followed closely. Personnel with current first aid and/or CPR certification will be identified. Basic first aid procedures for treatment of minor physical injuries can be found in **Attachment 4**. All incidents shall be reported to the SSO and Program Manager.

10.2.4 Spill Containment

Small quantities of hazardous materials, including HCl and sodium bisulfate, will be in use at this site and will be contained within the sample bottleware. If a spill should occur, the material will be contained and cleaned up using chemically compatible absorbent pads. Any used absorbent pads will be placed in a plastic trash bag and secured sealed and properly disposed.

10.2.5 Emergency Response Documentation

Any and all emergency responses will be documented on FPM's Incident Report form, which shall be completed be completed with all applicable information as soon as possible after

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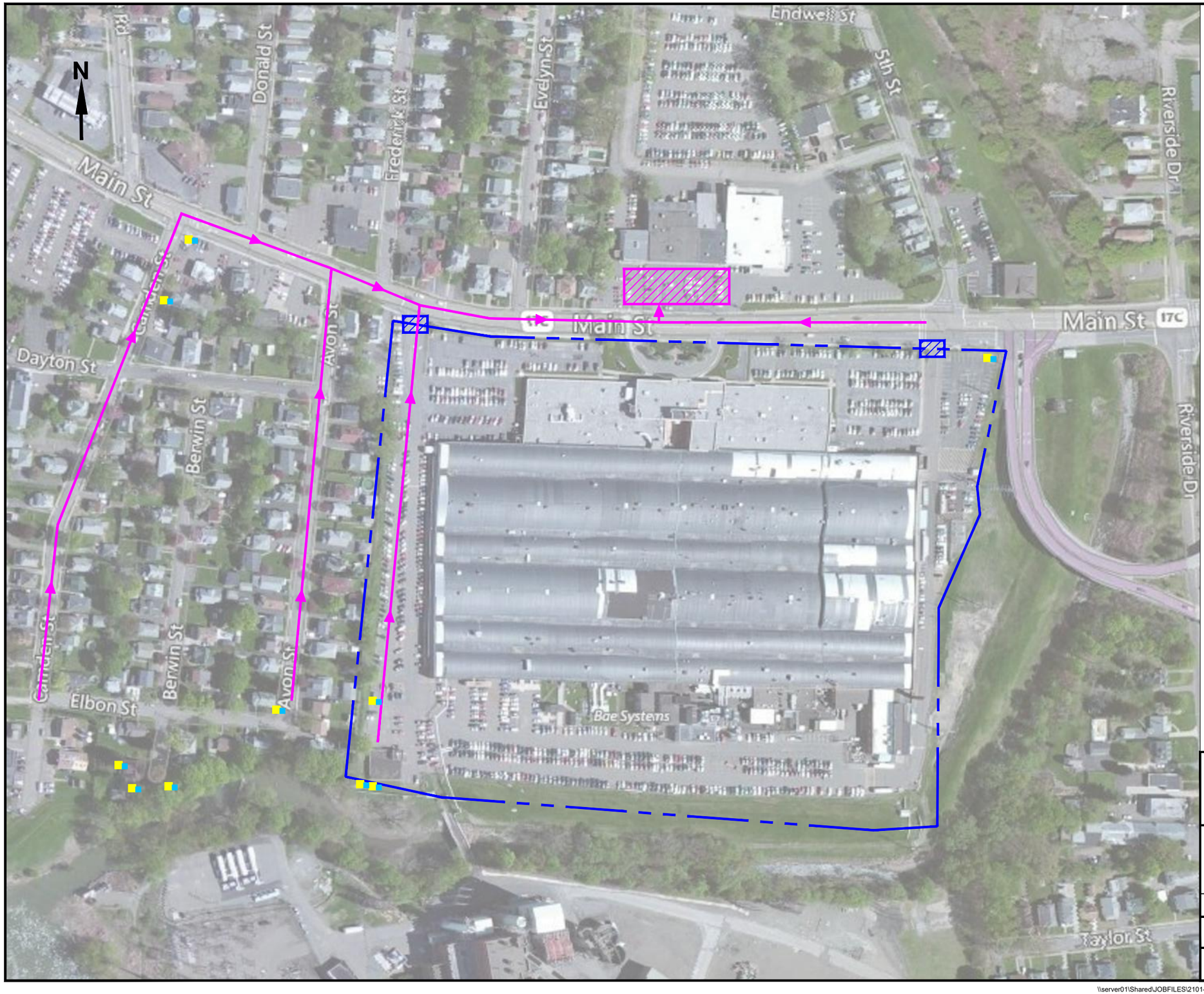
termination of the emergency situation. Completed Incident Reporting forms will be maintained by the SSO and submitted to the Program Manager and AFCEC as soon as possible following the incident. Copies of the Incident Report forms are included as an **Attachment 5** to this HSP.

FIGURES



EXPLANATION

- APPROXIMATE PROPERTY BOUNDARY
- EVACUATION MEETING PLACE
- EVACUATION ROUTE
- SITE ENTRANCE/EXIT LOCATIONS
- EXCLUSION ZONES
- DECONTAMINATION ZONES

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0 200 FT.

APPROXIMATE SCALE

FPM Remediations Inc.

HSP – SITE MAP

AIR FORCE PLANT 59 – JOHNSON CITY, NEW YORK

Prepared By: FPM	Date: OCTOBER 2017
	Figure: 1

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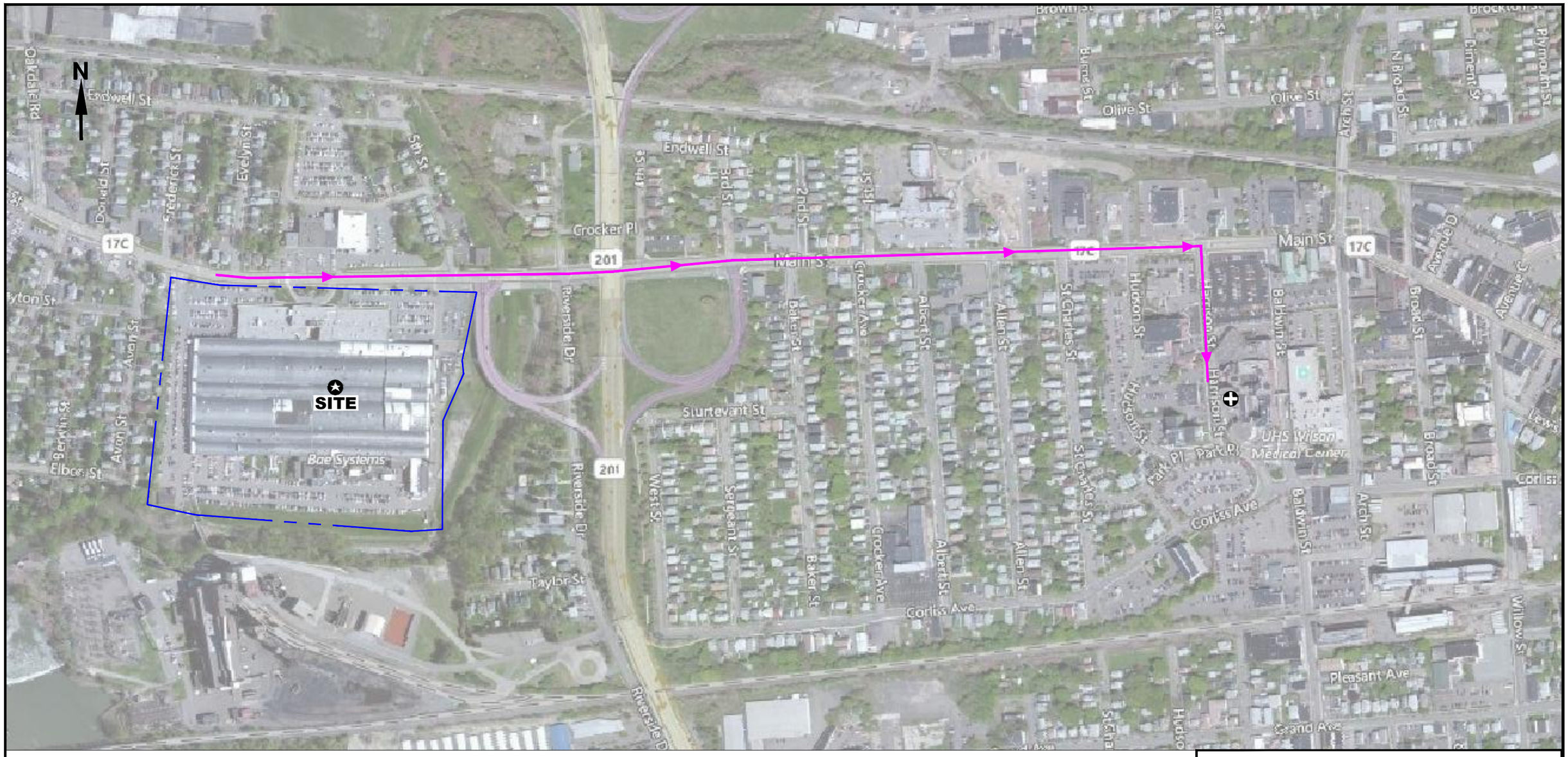

EXPLANATION

APPROXIMATE PROPERTY BOUNDARY

SITE

UHS WILSON MEDICAL CENTER
33–57 HARRISON STREET
JOHNSON CITY, NY 13790
(607) 763–6000

DIRECTIONS
RIGHT ONTO MAIN STREET
RIGHT ONTO HARRISON STREET

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0 400 FT.

APPROXIMATE SCALE

FPM Remediations Inc.

HSP – HOSPITAL ROUTE

AIR FORCE PLANT 59 – JOHNSON CITY, NEW YORK

Prepared By: FPM

Date: OCTOBER 2017

Figure: 2

ATTACHMENT 1
Chemical Safety Data Sheets

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Fisher Scientific

Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Creation Date 24-Aug-2009 **Revision Date** 16-Aug-2016 **Revision Number** 2

1. Identification

Product Name **Hydrochloric acid, Trace Metal Grade**

Cat No. : **A508-4; A508-212; A508-212LC; A508-500; A508P212; A508P500; A508SK-212**

Synonyms Muriatic acid; Hydrogen chloride, HCl

Recommended Use Laboratory chemicals.

Uses advised against No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTRECÒ, Inside the USA: 800-424-9300
CHEMTRECÒ, Outside the USA: 001-703-527-3887

•2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Skin Corrosion/irritation	Category 1 B
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	Category 2
Specific target organ toxicity - (repeated exposure)	
Target Organs - Kidney, Liver.	

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep only in original container
Response Immediately call a POISON CENTER or
doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

•3. Composition / information on ingredients

Component	CAS-No	Weight %
Water	7732-18-5	62-65
Hydrochloric acid	7647-01-0	35-38

•4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms/effects	Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Notes to Physician	Treat symptomatically

•5. Fire-fighting measures

Suitable Extinguishing Media	Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	
Explosion Limits	No information available
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Corrosive Material. Causes burns by all exposure routes. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products

Hydrogen chloride gas

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. **NFPA**

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Do not get in eyes, on skin, or on clothing.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Do not ingest.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH

Hydrochloric acid	Ceiling: 2 ppm	Ceiling: 5 ppm Ceiling: 7 mg/m^3 (Vacated) Ceiling: 5 ppm (Vacated) Ceiling: 7 mg/m^3	IDLH: 50 ppm Ceiling: 5 ppm Ceiling: 7 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Hydrochloric acid	Ceiling: 5 ppm Ceiling: 7.5 mg/m^3	Ceiling: 5 ppm Ceiling: 7 mg/m^3	CEV: 2 ppm

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	pungent
Odor Threshold	No information available
pH	< 1
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	57 °C / 135 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	125 mbar @ 20 °C
Vapor Density	1.27
Specific Gravity	1.18
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	1.8 mPa.s @ 15°C
Molecular Formula	HCl.H2O
Molecular Weight	36.46

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat.

Incompatible Materials Metals, Strong oxidizing agents, Bases, sodium hypochlorite, Amines, Fluorine, Cyanides, Alkaline

Hazardous Decomposition Products Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions Contact with metals may evolve flammable hydrogen gas.

•11. Toxicological information

Acute Toxicity

Product Information

Oral LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC50 Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	-	Not listed	Not listed
Hydrochloric acid	LD50 238 - 277 mg/kg (Rat)	LD50 > 5010 mg/kg (Rabbit)	LC50 = 1.68 mg/L (Rat) 1 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed
Hydrochloric acid	7647-01-0	Not listed	Not listed	Not listed	Not listed	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available. **Teratogenicity** No information available.

STOT - single exposure Respiratory system **STOT - repeated exposure** Kidney Liver

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Large amounts will affect pH and harm aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Hydrochloric acid	-	282 mg/L LC50 96 h Gambusia affinis mg/L LC50 48 h Leucscus idus	-	56mg/L EC50 72h Daphnia

Persistence and Degradability Persistence is unlikely based on information available. **Bioaccumulation/ Accumulation** No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT UN-

- **No** UN1789
- **Proper Shipping Name** HYDROCHLORIC ACID
- **Hazard Class** 8
- **Packing Group** II

TDG UN-

- **No** UN1789
- **Proper Shipping Name** HYDROCHLORIC ACID
- **Hazard Class** 8
- **Packing Group** II

IATA

- **UN-No** UN1789
- **Proper Shipping Name** Hydrochloric acid
- **Hazard Class** 8
- **Packing Group** II

IMDG/IMO UN-

- **No** UN1789
- **Proper Shipping Name** Hydrochloric acid
- **Hazard Class** 8
- **Packing Group** II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	X
Hydrochloric acid	X	X	-	231-595-7	-		X	X	X	X	X

Legend:
X - Listed
E- Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F- Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R- Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S- Indicates a substance that is identified in a proposed or final Significant New Use RuleT - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Hydrochloric acid	7647-01-0	35-38	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Hydrochloric acid	X	5000 lb	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Hydrochloric acid	X		-

OSHA Occupational Safety and Health Administration
Not applicable

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Hydrochloric acid	-	TQ: 5000 lb

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Hydrochloric acid	5000 lb	5000 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Water	-	-	X	-	-
Hydrochloric acid	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ):	Y
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security

This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Hydrochloric acid	0 lb STQ (anhydrous); 11250 lb STQ (37% concentration or greater)

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class D1A Very toxic materials
E Corrosive material

•16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 24-Aug-2009
Revision Date 16-Aug-2016
Print Date 16-Aug-2016
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

•End of SDS

Section 1 - Product and Company Identification

Product Name: Sodium Bisulfite
Chemical Formula: $NaHSO_3$
CAS Number: 007631-90-5
Other Designations: Sodium Bisulfite Solution, Sodium Hydrogen Sulfite Solution.
General Use: Food and pharmaceutical preservative, waste water dechlorination agent, laboratory reagent, reducing agent, dietary supplement, and color preservative.

Manufacturer: Calabrian Corporation
5500 Hwy. 366
Port Neches, Texas77651

Telephone: 409-727-1471
Fax: 409-727-5803
Emergency Contact: CHEMTREC 800-424-9300

Section 2 - Hazards Identification

Emergency Overview
Target Organs: Respiratory system, eyes, skin
GHS Classification: Acute Toxicity, Oral (Category 4)
Acute Toxicity, Dermal (Category 5)
Serious Eye Irritant (Category 2A)

GHS Label Elements: Signal Word – Warning

Pictogram

Corrosive

Irritant

Hazard Statements: H302 – Harmful if swallowed
H313 – May be harmful to skin
H319 – Causes serious eye irritation

Precautionary Statements: P280 – Wear protective equipment for hands, eyes, face and respiratory tract
P305, P351 and P338 – IF IN EYES: Rinse with water for several minutes. Remove contact lenses if present and continue rinsing. **Other Hazards**: Contact with acids liberates toxic sulfur dioxide gas.

HMIS Classification: Health Hazard 2

0 **NFPA Rating**: Hazard 2	Flammability	0
	Physical	0
	Health	
	Fire	0
	Reactivity	0

Potential Health Effects:	Inhalation:	Irritant to respiratory tract
	Eye:	Irritant
	Skin:	Irritant
	Ingestion:	Harmful if swallowed
	Aggravated Medical Condition:	Capable of provoking bronchospasm in sulfite sensitive individuals with asthma.

Section 3 - Composition / Information on Ingredients

Composition	CAS Number	% Wt
Water	-	50 – 70
Sodium bisulfite	007631-90-5	30 – 50
Sodium Sulfite	007757-83-7	< 1.0
Sodium Sulfate	007757-82-6	< 3.5

Section 4 - First Aid Measures

Exposure Route	Symptom	Treatment
Inhalation:	Sore throat, shortness of breath coughing, and congestion.	Remove from exposure to fresh air. Seek medical attention in severe cases or if recovery is not rapid.
Eye Contact:	Irritation to eyes and mucous membranes.	Irrigate with water until no evidence of chemical remains. Obtain medical attention.
Skin Contact:	Irritation, itching, dermatitis	Wash with soap and drench with water. Remove contaminated clothing and wash before reuse.
Ingestion:	Irritation to mucous membranes.	Give large quantities of water or milk immediately. Obtain medical attention.

Seek appropriate medical attention *and provide this SDS to attending doctor*
Note to physician: Exposure may aggravate acute or chronic asthma, emphysema and bronchitis.

Section 5 - Fire-Fighting Measures

Flash Point:	Not combustible.
Flash Point Method:	Not Applicable.
Burning Rate:	Not Applicable.
Auto Ignition Temperature:	Not Applicable.

LEL: Not Applicable.
UEL: Not Applicable.
Flammability Classification: Not Flammable.
Extinguishing Media: Use extinguishing agent appropriate for surrounding fire conditions.
Unusual Fire or Explosion Hazards: None indicated.
Hazardous Combustion Product: May release hazardous gas.
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full face piece operated in pressure-demand or positive- pressure mode.

Section 6 - Accidental Release Measures

Spill / Leak Procedures: Wear appropriate PPE - See Section 8.
Small Spills / Leaks: Spills can be neutralized with an alkaline material such as caustic soda. Leaks may be located by spraying the area with ammonium hydroxide solution which forms a white fume in the presence of sulfur dioxide.
Large Spills / Leaks: Large spills should be handled according to a predetermined plan.
Containment: For large spills, dike far ahead of contaminated runoff for later disposal.

Section 7 - Handling and Storage

Handling Precautions: Avoid contact with product. Do not breathe dust or vapor.
Storage Requirements: Store in areas, away from heat and moisture and protect from *physical* damage. Segregate from acids and oxidizers.

Section 8 - Exposure Controls / Personal Protection:

Component: Sodium Bisulfite **CAS Number:** 007631-90-5

ACGIH (TLV) **TWA:** 5 mg/m^3

OSHA (PEL) **TWA:** 5 mg/m^3

NIOSH (REL) **TWA:** 5 mg/m^3

I**DLH** – None established

IDLH - Immediately Dangerous to Life or Health
PEL – Permissible Exposure Limit
REL – Recommended Exposure Limit
TLV – Threshold Limit Value
ACGIH – American Conference of Governmental Industrial Hygienists
TWA – Time Weighted Average based on 8 hour exposure days and a 40 hour week.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA limits (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at the source.

Respiratory Protection: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or non-routine operations (cleaning spills, reactor vessels, or storage tanks), wear a SCBA. ***Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.***

Protective Clothing / Equipment: Wear protective gloves, boots, and clothing when necessary to prevent excessive skin contact. Wear protective eyeglasses or goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Safety Stations: Make emergency eyewash stations, showers, and washing facilities available in the work area.

Contaminated Equipment: Remove this material from personal protective equipment as needed.

Do not eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before food or beverage consumption.

Section 9 - Physical and Chemical Properties

Physical State:	Liquid	**Water Solubility**:	NA
Appearance:	Yellow	Ot**her Solubility:**	NA
Odor Threshold:	Pungent SO2 odor	**Boiling Point:**	205 oF
Vapor Pressure:	NA	**Freezing Point:**	26 oF
Vapor Density (Air=1):	NA	Me**lting Point:**	
Formula Weight:	104	**Evaporation Rate:**	Normal.
Density:	NA	**pH:**	2.9 – 4.9
Specific Gravity (H_2O=1):	1.3 - 1.4	**% Volatile:**	NA

Section 10 - Stability & Reactivity

Stability: Stable under normal conditions.

Polymerization: Hazardous polymerization will not occur.

Chemical Incompatibilities: Sodium Bisulfite Solutions may release toxic and hazardous fumes of sulfur

oxides, including sulfur dioxide. Acute poisoning from sulfur dioxide is rare because the gas is easily detected. It is so irritating that contact cannot be tolerated. Symptoms include coughing, hoarseness, sneezing, tearing, and breathing difficulty. However, workers who cannot escape high accidental exposure may suffer severe pulmonary damage which can be fatal. Contact with powdered potassium, sodium metals, alkali, and oxidizing agents produce violent reactions. Reacts with water and steam to form corrosive sulfurous acid. Reacts with chlorates to form unstable chlorine dioxide.

Conditions to Avoid: Avoid excessive heat, or open flame.

Hazardous Decomposition Products: May release hazardous sulfur dioxide gas

Section 11 - Toxicological Information

Eye Effects (rabbit): Not available. **Acute Inhalation Effects (rat):** Not available.

Skin Effects (rabbit): Not available. **Acute Oral Effects (rat):** LD50 = 2,000 mg/kg

Carcinogenicity: IARC, NTP, and OSHA do not list Sodium Bisulfite as a carcinogen.

Chronic Effects: Prolonged or repeated exposure may cause dermatitis, and sensitization reactions. Exposure to asthmatic, atopic and sulfite sensitive individuals may result in severe bronchioconstriction and reduced levels in forced expiratory volume. Decomposition of sodium bisulfite solutions may release toxic and hazardous fumes of sulfur oxides, including sulfur dioxide, which may cause permanent pulmonary impairments from acute and chronic exposure. The Immediately Dangerous to Life or Health (IDLH) level for SO2 is 100 ppm.

Aquatic Toxicity: The toxicity threshold of Sodium Bisulfite (100 hr. at 23 degrees Celsius) to Daphnia Magna has been reported to be 102 mg/l. In the presence of additional sodium salts, this threshold may be lower. For minnows, exposed for 6 hours to sodium bisulfite solution in distilled water at 19 degrees Celsius it was 60-65 mg/l, and in hard water at 18 degrees Celsius it was 80-85 mg/l.

The 24, 48, and 96 hour LC50 value was 240 mg/l for the mosquito-fish (Gambusia affinis in turbid water at 17 - 22 degree Celsius.

Section 12 - Ecological Information

Ecotoxicity: Sodium Bisulfite is a non hazardous solution commonly used as a waste water dechlorination agent. High concentrations will contribute to elevated chemical oxygen demand in aquatic environments.

Environmental Transport: Soluble in water.

Environmental Degradation: Rapid biological decomposition.

Soil Absorption/Mobility: Slight.

Section 13 - Disposal Considerations

Disposal: Waste determinations typically consider Sodium Bisulfite contaminated materials to be non-hazardous.

Disposal Regulatory Requirements: Follow applicable Federal, state and local regulations.

Container Cleaning and Disposal: Follow applicable Federal, state and local regulations.

Section 14 - Transport Information

Shipping Name: Bisulfites, aqueous solutions, n.o.s.
Technical Name: Sodium Bisulfite
Shipping Symbols: Corrosive
Hazard Class: 8 - Corrosive
Subsidiary Hazard: NA
ID No. (Placard): UN2693
Packing Group: III
Label: Required
Reputable Quantity: (RQ) 5,000 Lbs

Section 15 - Regulatory Information

EPA Regulations:

RCRA Hazardous Waste Classification (40 CFR 261):	Not listed.
RCRA Hazardous Waste Number (40 CFR 261):	Not listed.
CERCLA Hazardous Substance (40 CFR 302.4):	Listed.
CERCLA Reportable Quantity (RQ):	5000 pounds
SARA Title III:	Not listed.
FIFRA:	Not regulated.
TSCA:	Inventory listed chemical; PAIR Reportable; Not listed in Toxic Substances

Chemical Index **OSHA Regulations:**

Air Contaminant (29 CFR 1910.1000): Not listed. OSHA

Specifically Regulated Substance: Not listed.

Other Regulations:

FDA: Regulated when used as a food preservative.

Proposition 65 (California): Not Listed

Section 16 - Other Information

This product is NSF certified to NSF/ANSI Standard 60 and is subject to a maximum use limit (MUL) 0f 46 mg/L for potable water dechlorination applications.

Previous SDS issue date: March, 2015
Current SDS issue date: May, 2015
Reason for current revision: Change in sodium sulfite limit from < 3.5 to < 1.0 % (Section 3).

The information herein is believed to be reliable. However, no warranty, expressed or implied, is made as to its accuracy or completeness and none is made as to the fitness of this material for any purpose. The manufacturer shall not be liable for damages to person or property resulting from its use. Nothing herein shall be construed as a recommendation for use in violation of any patent.

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ATTACHMENT 2
FPM Daily Tailgate Safety Meeting Checklist Form

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Daily Health and Safety Meeting Form

Date: _____ *Time :* _____

Location: _____

Weather Conditions: _____

Meeting Type: _____

Personnel Present:

_____

_____

Visitors Present: _____

Visitor Training: _____

PPE Required: _____

Possible risks, injuries, concerns:

_____

_____

_____

Anticipated Releases to Environment (if so, describe and detail response action/control measures implemented):

_____

_____

Property Damage:

_____

_____

Description (include sequence of events describing step by step how incident happened):

_____

_____

Analysis for, and Implementation of Corrective/Preventative Procedure to Prevent Future Occurrences (to be formulated by SSHO + FOM, approved by PM, and SSHO implemented):

_____

_____

_____

Report made by (Name): _____

SSHP Organization Title: _____

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ATTACHMENT 3
Emergency Contact Information

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Emergency Contact Information

IN CASE OF EMERGENCY, DIAL 911 AS SOON AS POSSIBLE!!!

FPM Project Name: Air Force Plant 59

600 Main Street (Route 17C), Johnson City, NY 13790
Site Address

Site Contact

Phone

Emergency Contacts:

Police: (607)-729-9321

Fire: (607)-729-9321

Ambulance/EMS: (607)-763-6000

Poison Control: 1-800-222-1222

HazMat Response: NYS DEC Environmental Remediation (518) 402-9543

Electric/Gas Utility: Gas= NYSEG, 1-800-572-1121 Electric= Integrys, 312-228-5400

Telephone/Cable Utility: Spectrum, 866-744-1678 (press # to reach operator)

Nearest Hospital with Urgent Care Facility: UHS Wilson Medical Center

Address: 33-57 Harrison Street, Johnson City, NY 13790

General Phone Number: (607)-763-6000

Emergency/Urgent Care Department: N/A

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ATTACHMENT 4
Adult First Aid Guide

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American Red Cross

Adult First Aid/CPR/AED

READY REFERENCE

CHECKING AN INJURED OR ILL ADULT

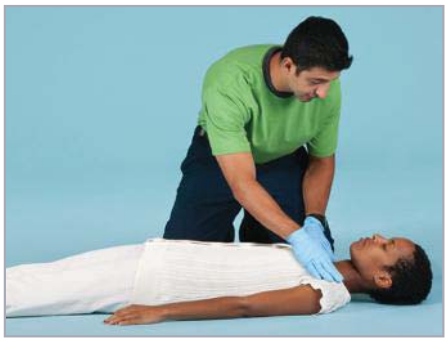
APPEARS TO BE UNCONSCIOUS

TIP: *Use disposable gloves and other personal protective equipment and obtain consent whenever giving care.*

AFTER CHECKING THE SCENE FOR SAFETY, CHECK THE PERSON:

1 CHECK FOR RESPONSIVENESS

Tap the shoulder and shout, "Are you OK?"



2 CALL 9-1-1

If **no** response, **CALL** 9-1-1 or the local emergency number.

- If an unconscious person is face-down, roll face-up, supporting the head, neck and back in a straight line.

If the person responds, obtain consent and **CALL** 9-1-1 or the local emergency number for any life-threatening conditions.

CHECK the person from head to toe and ask questions to find out what happened.

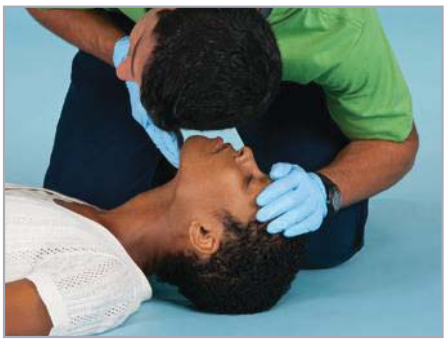
3 OPEN THE AIRWAY

Tilt head, lift chin.

4 CHECK FOR BREATHING

CHECK quickly for breathing for no more than **10** seconds.

- Occasional gasps are not breathing.



5 QUICKLY SCAN FOR SEVERE BLEEDING

WHAT TO DO NEXT

- Give **CARE** based on conditions found.
- IF NO BREATHING—Go to PANEL 6 or PANEL 7 (if an AED is immediately available).
- IF BREATHING—Maintain an open airway and monitor for any changes in condition.

CONSCIOUS CHOKING

CANNOT COUGH, SPEAK OR BREATHE

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON, HAVE SOMEONE CALL 9-1-1 AND GET CONSENT.

1 GIVE 5 BACK BLOWS

Give **5** back blows.

- Bend the person forward at the waist and give **5** back blows between the shoulder blades with the heel of one hand.

2 GIVE 5 ABDOMINAL THRUSTS

- Place a fist with the thumb side against the middle of the person's abdomen, just above the navel.
- Cover your fist with your other hand.
- Give **5** quick, upward abdominal thrusts.

3 CONTINUE CARE

Continue sets of **5** back blows and **5** abdominal thrusts until the:

- Object is forced out.
- Person can cough forcefully or breathe.
- Person becomes unconscious.

WHAT TO DO NEXT

- IF THE PERSON BECOMES UNCONSCIOUS–**CALL** 9-1-1, if not already done, and give care for an unconscious choking adult, beginning with looking for an object (PANEL 5, Step 3).

UNCONSCIOUS CHOKING

CHEST DOES NOT RISE WITH RESCUE BREATHS

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 GIVE RESCUE BREATHS

Retilt the head and give another rescue breath.

2 GIVE 30 CHEST COMPRESSIONS

If the chest still does not rise, give **30** chest compressions.

TIP: *Person must be on firm, flat surface. Remove CPR breathing barrier when giving chest compressions.*

3 LOOK FOR AND REMOVE OBJECT IF SEEN

4 GIVE 2 RESCUE BREATHS

WHAT TO DO NEXT

- IF BREATHS DO NOT MAKE THE CHEST RISE—Repeat steps 2 through 4.
- IF THE CHEST CLEARLY RISES—**CHECK** for breathing. Give **CARE** based on conditions found.

CPR

NO BREATHING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 GIVE 30 CHEST COMPRESSIONS

Push hard, push fast in the middle of the chest at least **2** inches deep and at least **100** compressions per minute

TIP: *Person must be on firm, flat surface.*

2 GIVE 2 RESCUE BREATHS

- Tilt the head back and lift the chin up.
- Pinch the nose shut then make a complete seal over the person's mouth.
- Blow in for about **1** second to make the chest clearly rise.
- Give rescue breaths, one after the other.

Note: *If chest does not rise with rescue breaths, retilt the head and give another rescue breath.*

3 DO NOT STOP

Continue cycles of CPR. Do not stop CPR except in one of these situations:

- You find an obvious sign of life, such as breathing.
- An AED is ready to use.
- Another trained responder or EMS personnel take over.
- You are too exhausted to continue.
- The scene becomes unsafe.

WHAT TO DO NEXT

- IF AN AED BECOMES AVAILABLE—Go to AED, PANEL 7.
- IF BREATHS DO NOT MAKE THE CHEST RISE— AFTER RETILTING HEAD—Go to Unconscious choking, PANEL 5.

TIP: *If at any time you notice an obvious sign of life, stop CPR and monitor breathing and for any changes in condition.*

AED—ADULT OR CHILD OLDER THAN 8 YEARS OR WEIGHING MORE THAN 55 POUNDS

NO BREATHING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

> **TIP:** *Do not use pediatric AED pads or equipment on an adult or child older than 8 years or weighing more than 55 pounds.*

1 TURN ON AED

Follow the voice and/or visual prompts.

2 WIPE BARE CHEST DRY

> **TIP:** *Remove any medication patches with a gloved hand.*

3 ATTACH PADS

4 PLUG IN CONNECTOR, IF NECESSARY

5 STAND CLEAR

Make sure no one, including you, is touching the person.

- **Say, "EVERYONE, STAND CLEAR."**

6 ANALYZE HEART RHYTHM

Push the "analyze" button, if necessary. Let AED analyze the heart rhythm.

7 DELIVER SHOCK

If SHOCK IS ADVISED:

- **Make sure no one, including you, is touching the person.**
- **Say, "EVERYONE, STAND CLEAR."**
- **Push the "shock" button, if necessary.**

8 PERFORM CPR

After delivering the shock, or if no shock is advised:

- **Perform about 2 minutes (or 5 cycles) of CPR.**
- **Continue to follow the prompts of the AED.**

TIPS:

- *If at any time you notice an obvious sign of life, stop CPR and monitor breathing and for any changes in condition.*
- *If two trained responders are present, one should perform CPR while the second responder operates the AED.*

CONTROLLING EXTERNAL BLEEDING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 COVER THE WOUND

Cover the wound with a sterile dressing.

2 APPLY DIRECT PRESSURE UNTIL BLEEDING STOPS

3 COVER THE DRESSING WITH BANDAGE

Check for circulation beyond the injury (check for feeling, warmth and color).

4 APPLY MORE PRESSURE AND CALL 9-1-1

If the bleeding does not stop:

- Apply more dressings and bandages.
- Continue to apply additional pressure.
- Take steps to minimize shock.
- **CALL** 9-1-1 or the local emergency number if not already done.

TIP: *Wash hands with soap and water after giving care.*

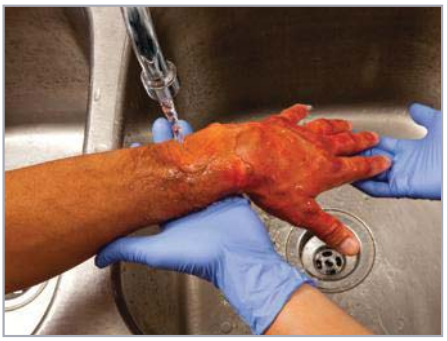
BURNS

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 REMOVE FROM SOURCE OF BURN

2 COOL THE BURN

Cool the burn with cold running water at least until pain is relieved.



3 COVER LOOSELY WITH STERILE DRESSING

4 CALL 9-1-1

CALL 9-1-1 or the local emergency number if the burn is severe or other life-threatening conditions are found.

5 CARE FOR SHOCK

POISONING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 CALL 9-1-1 OR POISON CONTROL HOTLINE

For life-threatening conditions (such as if the person is unconscious or is not breathing, or if a change in the level of consciousness occurs), **CALL** 9-1-1 or the local emergency number.

OR

If the person is conscious and alert, **CALL** the National Poison Control Center (PCC) hotline at **1-800-222-1222** and follow the advice given.

2 PROVIDE CARE

Give **CARE** based on the conditions found.

HEAD, NECK OR SPINAL INJURIES

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 CALL 9-1-1 OR THE LOCAL EMERGENCY NUMBER

2 MINIMIZE MOVEMENT

Minimize movement of the head, neck and spine.

3 STABILIZE HEAD

Manually stabilize the head in the position in which it was found.

- Provide support by placing your hands on both sides of the person's head.
- If head is sharply turned to one side, **DO NOT** move it.

STROKE

FOR A STROKE, THINK F.A.S.T.

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 THINK F.A.S.T.

Face— Ask the person to smile. Does one side of face droop?

Arm— Ask the person to raise both arms. Does one arm drift downward?

Speech— Ask the person to repeat a simple sentence (such as, "The sky is blue."). Is the speech slurred? Can the person repeat the sentence correctly?

Time— **CALL 9-1-1** immediately if you see any signals of a stroke. Try to determine the time when signals first appeared. Note the time of onset of signals and report it to the call taker or EMS personnel when they arrive.

2 PROVIDE CARE

Give **CARE** based on the conditions found.

ATTACHMENT 5
FPM Employee Exposure/Injury Incident Report Form

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FPM *Remediations*	**Health and Safety Program** **INCIDENT / NEAR MISS REPORT FORM**	Revision 1: Dec 2010

ADMINISTRATIVE INFORMATION (To be completed by Supervisor)

Corporate Communications US Site Code:	Project/Order Number:
☐ **FPM Division** RBU:	☐ **Sub Division** SBU:
Region:	SBE Director:
Client Sector:	Program:
Site or Office:	Location/Client Name:
Date/Time of Event:	Time Work Started:
Date/Time Supervisor Notified:	Employee Submitting Report:

Client Notification Completed (if required)? ☐ Yes ☐ No

TYPE OF EVENT (Check all applicable items)

Illness (Check one)
- ☐ Employee
- ☐ Subcontractor
- ☐ Other

Injury (Check one)
- ☐ Employee
- ☐ Subcontractor
- ☐ Other

Near Miss (Check the potential consequences):
- ☐ Injury
- ☐ Equipment Damage
- ☐ Property Damage
- ☐ Environmental release
- ☐ Other (describe)

Property Damage (Check one)
- ☐ Company (owned, leased, rented)
- ☐ Client/Customer
- ☐ Other

Vehicular Accident (Check one)
- ☐ Company (owned, leased, rented)
- ☐ Client/Customer
- ☐ Other

- ☐ Fire
- ☐ Explosion
- ☐ Flash
- ☐ Other (describe):

EVENT DESCRIPTION

Briefly state the facts contributing to the event. Attach additional pages and supporting information, as necessary. Avoid use of employees' names. *If this is an injury or illness, supply additional information as required on Page 2.*

ROOT CAUSE DETERMINATION

Root Cause (State the root or primary cause, then select the most appropriate cause category from Page 4):

CONTRIBUTING FACTORS

Contributing Causes (Describe any contributing causes, then select the applicable cause categories from Page 4):

CORRECTIVE ACTIONS

List methods of preventing/avoiding this type of incident/near miss in the future. There must be one or more corrective action for each root cause.

FPM Remediations	Health and Safety Program **INCIDENT / NEAR MISS REPORT FORM**	Revision 1: Dec 2010

NOTE: If this is a near miss report, no further information is required. Submit only the first page of the form. The preferred method of distribution of near miss reports is by e-mail attachment in either Word or scanned to PDF. Forward FPM near miss reports to your Project Manager.

Additional Distribution: ☐ Office/Site Manager ☐ Regional/SBE/SBU HSE Manager ☐ Office/Site HSE Representative

FOR INJURIES/ILLNESS ONLY

Employee Information (To be completed by affected employee)

Name of Injured/Ill Employee:

Employee Number: Contact Phone Number:

What was your location when the injury/illness occurred?

What were you doing when the injury/illness occurred? Describe the activity as well as the tools, equipment, or material you were using.

What happened? Describe how the injury/illness occurred.

What was the injury or illness? Describe the part of the body that was affected and how it was affected. Use the Body Part pick list on Page 4 to aid in your description.

What level of medical treatment did you receive? ☐ First Aid ☐ Clinic/Physician ☐ Emergency Room ☐ Refused/None

List witnesses and/or other employees involved. Attach statements where applicable.

Do you feel FPM provided you with the proper safety instructions (including PPE usage) for the task you were performing at the time of the incident? ☐ Yes ☐ No (Explain below)

How do you think this type of incident could be prevented or avoided in the future?

Mark all PPE being used when the incident occurred:

☐ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Safety Shoes
☐ Half-face Respirator	☐ Full-face Respirator	☐ Protective Gloves	☐ Chemical Gloves
☐ Hard Hat	☐ Hearing Protection	☐ Other (describe):	

Employee Signature: _____ Date: _____

Additional Sheets Attached? ☐ Yes ☐ No (Include photos, maps, and/or diagrams when possible.)

INCIDENT / NEAR MISS REPORT FORM

Supervisor Information (To be completed by affected employee's supervisor)

Describe any additional/different details other than those provided by employee. Avoid use of employees' names, where possible. Attach additional sheets, drawings, or photos, as needed.

Were the required tools available at the time of the injury? ☐ Yes ☐ No (Explain below)

At the time of the injury, was the employee using the correct tools for the task? ☐ Yes ☐ No (Explain below)

Was the employee sent for substance screening? ☐ Yes ☐ No (Explain below)

How do you think this type of incident could be prevented or avoided in the future?

Supervisor Signature: Date:

Additional Sheets Attached? ☐ Yes ☐ No (Include photos, maps, and/or diagrams when possible.)

HSE Representative Comments

Signature: Date:

Additional Sheets Attached? ☐ Yes ☐ No (Include photos, maps, and/or diagrams when possible.)

Site/Office Manager Comments

Signature: Date:

Additional Sheets Attached? ☐ Yes ☐ No (Include photos, maps, and/or diagrams when possible.)

DISTRIBUTION

NOTE: If this is a near miss report, no further information is required. Submit only the first page of the form. The preferred

FPM Remediations	Health and Safety Program **INCIDENT / NEAR MISS REPORT FORM**	Revision 1: Dec 2010

method of distribution of near miss reports is by e-mail attachment in either Word or scanned to PDF. Forward FPM near miss reports to your Project Manager.

Additional Distribution: ☐ Program Manager ☐ Regional Manager ☐ Office HSE Representative

CAUSE CATEGORIES

Check all cause categories, which apply to the incident/near miss, then choose the root cause (or causes) category from the boxes checked. Enter where indicated on Page 1.

PHYSICAL/ENVIRONMENT
- ☐ Extreme cold/ice
- ☐ Extreme heat
- ☐ Working/walking surface unfavorable
- ☐ Inadequate lighting
- ☐ Excessive noise
- ☐ Chemical exposure
- ☐ Biological hazards (animal/plant)
- ☐ Other weather
- ☐ Other

SYSTEMS
- ☐ Inadequate training/instruction
- ☐ Inadequate management system
- ☐ Missing or incorrect procedures or planning
- ☐ Inadequate management emphasis on safety
- ☐ Corporate/operations procedures not communicated
- ☐ Other

PHYSICAL/EQUIPMENT, TOOLS, and PPE
- ☐ Failure due to improper maintenance
- ☐ Failure due to improper design
- ☐ Other

HUMAN
- ☐ Failure to adequately recognize hazards
- ☐ Failure to follow procedures
- ☐ Failure to recognize condition change
- ☐ Impaired state (drug, alcohol, other)
- ☐ Physical/psychological limitation for task
- ☐ Inadequate communications (i.e., supervisor/employee)
- ☐ Carelessness by affected person(s)
- ☐ Carelessness by other person(s)
- ☐ Improper selection of equipment/tool/PPE
- ☐ Improper use of equipment/tool/PPE
- ☐ Other

BODY PART PICK LIST

ANKLE/FOOT
- ☐ Ankle
- ☐ Foot
- ☐ Great Toe
- ☐ Toe(s)

BACK
- ☐ Back (All Other)
- ☐ Cervical
- ☐ Disc (Back)
- ☐ Disc (Neck)
- ☐ Low Back Area (Incl. Lumbar & Lumbo-Sacral)
- ☐ Lumbar and/or Sacral Vertebrae
- ☐ Multiple Neck Injury
- ☐ Soft Tissue-Neck
- ☐ Spinal Cord
- ☐ Upper Back Area (Thoracic Area)
- ☐ Vertebrae

EYE
- ☐ Eye(s)

HEAD/FACE
- ☐ Brain
- ☐ Ear(s)
- ☐ Face, Multiple Parts
- ☐ Facial Bones
- ☐ Head NEC
- ☐ Jaw
- ☐ Larynx
- ☐ Mouth
- ☐ Multiple Head Injury
- ☐ Nose
- ☐ Other facial soft tissue
- ☐ Scalp
- ☐ Skull
- ☐ Teeth

KNEE/LEG
- ☐ Knee
- ☐ Leg, Multiple
- ☐ Lower Leg
- ☐ Multiple Lower Extremities
- ☐ Upper Leg

MISCELLANEOUS
- ☐ Artificial Appliance (Braces, Etc.)
- ☐ Circulatory System
- ☐ Digestive System
- ☐ Insufficient Info to Identify; Unclassified
- ☐ Nervous System
- ☐ No Physical Injury
- ☐ Stress

MULTIPLE BODY PARTS
- ☐ Body Systems & Multiple Body Systems
- ☐ Multiple Body Parts
- ☐ Muscular-Skeletal System

RESPIRATORY
- ☐ Lung(s)
- ☐ Respiratory System
- ☐ Trachea

TRUNK
- ☐ Abdomen Including Groin
- ☐ Buttocks
- ☐ Chest (Incl. Ribs, Sternum & Soft Tissue)
- ☐ Heart
- ☐ Hip
- ☐ Internal Organs
- ☐ Multiple Trunk
- ☐ Pelvis
- ☐ Sacrum and Coccyx
- ☐ Uro-Genital

UPPER EXTREMITY
- ☐ Arm, Multiple
- ☐ Elbow
- ☐ Finger(s)
- ☐ Forearm
- ☐ Hand
- ☐ Lower Arm
- ☐ Multiple Upper Extremities
- ☐ Shoulder(s)
- ☐ Thumb
- ☐ Upper Arm (Incl.

Clavicle & Scapula)
- ☐ Wrist
- ☐ Wrist(s) and Hand(s)

Appendix C
SW4 and SW7 Boring Logs)

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TEST BORING LOG	ARGONNE NATIONAL LABORATORY	PAGE 1

BORING NO.: SW4	PROJECT: AFP #59 IRP SI	DATE: 12/2/91

PROJECT NO.:	91230	DRILLER:	MARCOR	DRILLING BIT:	8 1/4"
LOCATION:	Johnson City, NY	RIG TYPE:	Canterra CT 350	GROUND ELEVATION:	829.06
INSPECTOR:	Joseph Hau	METHOD:	Hollow Stem Auger	SAMPLING METHOD:	2" Split Spoon
WELL TYPE:	2" PVC	SCREEN LENGTH:	15	PROTOP WIDTH/TYPE:	8" Flush Manhole
WELL LENGTH:	29'	GROUT LENGTH/TYPE:	9.5' / 10:00 Bent:Cemt Mix	PAD ELEVATION:	829.28
SCREEN:	2" Cont. Wound PVC	SEAL LENGTH/TYPE:	2' / Bensonite	TOC ELEVATION:	828.85
SLOT SIZE:	0.010	FILTER LENGTH/TYPE:	17.5' / No. 2 Sand	STICK UP/DOWN:	-0.43'

DEPTH	SAMPLE COLLECTION DATA: SAMPLE NUMBER	HNU (PPM)	STP TEST BLOWS / 6"	REC (in.)	DESCRIPTION	DEPTH
0					Asphalt (Begin 0730 hour)	
2					Yellowish, brown sand and gravel fill	
4		0	5/5/5/9	6"	Brown, fine to coarse sand and gravel, trace silt	
6		0	5/9/10/12	8"	SAB	5
8	CHEM	0	26/24/20/21	16"	SAB	
10		0	8/12/22/24	6"	SAB	10
12		0	16/10/6/7	6"	SAB, moist	
14		0	5/7/7/14	6"	SAB, wet at 13'	
16	CHEM	0	10/19/14/15	12"	14'–15' SAB (3" spoon) 15'–16' Brown, fine sand and silt, little clay	15
18	CHEM	0	17/23/27/31	F	SAB, trace clay (3" spoon)	
21.5					SAB, wet	20
					Gray, fine sand and silt, trace clay (End 1200 hour)	25
30					Boring terminated at 29' (Water at 18.38' bgs.)	30

PROPORTIONS USED: TRACE = 0–10%, LITTLE = 10–20%, SOME 20–35%, AND = 35–50%

TEST BORING LOG	ARGONNE NATIONAL LABORATORY	PAGE 1

BORING NO.: SW7	PROJECT: AFP #59 IRP SI	DATE: 12/6/91

PROJECT NO:	91230	DRILLER:	MARCOR	DRILLING BIT:	8 1/4"
LOCATION:	Johnson City, NY	RIG TYPE:	Centerra CT 350	GROUND ELEVATION:	828.68'
INSPECTOR:	Joseph Hsu	METHOD:	Hollow Stem Auger	SAMPLING METHOD:	24" Split Spoon
WELL TYPE:	2" PVC	SCREEN LENGTH:	15'	PROTOP MOUTH TYPE:	4" St-up Lock Steel
WELL LENGTH:	26.5'	GROUT LENGTH/TYPE:	6.5 / 10:00 Bent:Cemt Mix	PAD ELEVATION:	828.12'
SCREEN:	2" Cont. Wound PVC	SEAL LENGTH/TYPE:	3' / Bentonite	TOC ELEVATION:	831.88'
SLOT SIZE:	0.010	FILTER LENGTH/TYPE:	17' / No. 2 Sand	STICK UP/DOWN:	3.01'

DEPTH	SAMPLE COLLECTION DATA: SAMPLE NUMBER	HNU (PPM)	STP TEST BLOWS / 6"	REC. (in.)	DESCRIPTION	DEPTH
2					Grass and clayey topsoil w/ organics	
7					Brown, fine sand and silt, little clay, trace gravel w/ organics	5
9	CHEM	0	10/11/10/11	5"	Brown, fine to coarse sand and gravel, trace silt (3" spoon)	
11	CHEM	0	9/10/19/19	4"	SAB (3" spoon)	10
14						
16	CHEM	0	5/6/13/9	6"	14'–15' SAB 15'–16' Brown, coarse sand, trace gravel, moist (3" spoon)	15
18	CHEM	0	8/11/16/19	6"	16'–17' SAB 17'–18' Brown, coarse gravel and coarse sand, wet (3" spoon)	
26.5					SAB (End 0840 hours)	20 25
30					Boring terminated at 26.5' (Water at ~ 15.8')	30

PROPORTIONS USED: TRACE = 0–10%, LITTLE = 10–20%, SOME 20–35%, AND = 35–50%