



**Memo**

To **Mr. Michael Schmoller** AMEC # 2-9133-0006  
**Hydrogeologist**  
**Wisconsin DNR**  
**3911 Fish Hatchery Road**  
**Fitchburg, WI 53711**

From **Thomas Kaugher** cc **Mr. James King (NGB – 1HC/1CD)**  
**Mr. Doug Barber (BB&E – 1CD)**  
**Lt Matthew Shaw (115<sup>th</sup> – 1HC/1CD)**

Date **August 31, 2017**

**Subject Final Work Plan - FY16 Phase I Regional Site Inspections for PFCs at Truax Field Air National Guard Base, Madison, Wisconsin**

Mr. Schmoller:

Attached is one electronic copy and one hard copy of the Final Work Plan – FY 16 Phase I Regional Site Inspections for PFCs at Truax Field Air National Guard Base, Madison, Wisconsin. This work plan has been completed as part of Contract No. W9133L-14-D-0002, Task Order 0006. Please review and provide any comments that you may have.

Please contact me at (248) 313-3694 if you have any questions.

Sincerely,

Thomas Kaugher  
Regional Base Lead  
Direct Tel (248) 313-3694  
Direct Fax (248) 926-4009  
E-mail Thomas.kaugher@amec.com

**FINAL WORK PLAN  
FY 16 PHASE 1 REGIONAL SITE INSPECTIONS  
FOR PERFLUORINATED COMPOUNDS**



**TRUAX FIELD AIR NATIONAL GUARD BASE  
MADISON, WISCONSIN**

Contract #: W9133L-14-D-0002  
Delivery Order 0006

Amec Foster Wheeler Project #: 2-9133-0006

August 31, 2017

**THIS PAGE INTENTIONALLY LEFT BLANK**

## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1-1
1.1	Site Location .....	1-2
1.2	Site History .....	1-2
1.3	Project Purpose and Scope .....	1-3
2.0	PROJECT MANAGEMENT APPROACH.....	2-1
3.0	PRELIMINARY ASSESSMENT SITE VISIT AND BACKGROUND INFORMATION .....	3-1
3.1	Areas of Concern.....	3-1
3.2	Operational History .....	3-1
3.2.1	PRL 1: Building 430 (Current Fire Station) .....	3-2
3.2.2	PRL 2: Building 430 Nozzle Test Area 1.....	3-2
3.2.3	PRL 3: Building 430 Nozzle Test Area 2.....	3-2
3.2.4	PRL 4: Former Building 403 (Former Fire Station) .....	3-2
3.2.5	PRL 5: Hangar 400 .....	3-3
3.2.6	PRL 6: Hangar 406 .....	3-3
3.2.7	PRL 7: Hangar 414 .....	3-4
3.2.8	PRL 8: Fuel Spill Ditch .....	3-4
3.2.9	PRL 9: Building 503 Parking Lot.....	3-4
3.3	Pathway Evaluation and Hazard Assessment.....	3-5
3.3.1	Soil.....	3-5
3.3.2	Groundwater .....	3-5
3.3.3	Water Wells.....	3-6
3.3.4	Sediment.....	3-6
3.3.5	Surface Water .....	3-6
4.0	ENVIRONMENTAL SETTING.....	4-1
4.1	Climate .....	4-1
4.2	Topography.....	4-1
4.3	Geology .....	4-1
4.4	Surface Water Hydrology .....	4-2
4.5	Hydrogeology.....	4-2
4.6	Critical Habitat and Threatened/Endangered Species.....	4-3
4.7	City of Madison Water Supply .....	4-3
5.0	PERMITS.....	5-1
6.0	SOIL AND GROUNDWATER STANDARDS.....	6-1
7.0	INVESTIGATIVE APPROACH.....	7-1
7.1	Work Plan Objectives.....	7-1
7.2	General Approach.....	7-1
7.2.1	PRL 1: Building 430 Current Fire Station.....	7-2
7.2.2	PRL 2: Building 430 Nozzle Test Area 1.....	7-3
7.2.3	PRL 3: Building 430 Nozzle Test Area 2.....	7-3
7.2.4	PRL 4: Former Building 403 (Former Fire Station) .....	7-3
7.2.5	PRL 5: Hangar 400 .....	7-4
7.2.6	PRL 6: Hangar 406 .....	7-5
7.2.7	PRL 7: Hangar 414.....	7-5

# NGB/A4OR

---

7.2.8	PRL 8: Fuel Spill Ditch .....	7-6
7.2.9	PRL 9: Building 503 Parking Lot.....	7-6
7.2.10	Base Boundary Wells .....	7-6
8.0	FIELD INVESTIGATION PROCEDURES .....	8-1
8.1	Site Access and Restrictions.....	8-1
8.2	Utility Location and Clearance .....	8-1
8.3	Soil Boring Installation and Soil Sampling .....	8-1
8.3.1	Soil Boring Installation.....	8-1
8.3.2	Soil Sampling .....	8-2
8.3.3	Soil Boring Abandonment.....	8-2
8.4	Temporary Monitoring Well Installation and Groundwater Sampling .....	8-2
8.4.1	Temporary Monitoring Well Installation.....	8-2
8.4.2	Monitoring Well Development.....	8-3
8.4.3	Groundwater Sampling.....	8-4
8.4.4	Temporary Well Boring Abandonment.....	8-4
8.5	Sediment Sampling.....	8-4
8.6	Surface Water Sampling .....	8-4
8.7	Decontamination Procedures.....	8-5
8.8	Site Survey .....	8-5
8.9	Management of IDW .....	8-5
9.0	PROJECT SCHEDULE AND DELIVERABLES.....	9-1
10.0	REFERENCES .....	10-1

## TABLES

Table 1	Preliminary Assessment Summary
Table 2	Federal Health-Based Screening Values
Table 3	Site Inspection Summary
Table 4	Project Schedule and Deliverables Summary

## FIGURES

Figure 1	Site Location Map
Figure 2	Site and Area Features Map
Figure 3	PRL Location Map
Figure 3A	Proposed Sample Locations - PRLs 1, 2, and 3
Figure 3B	Proposed Sample Locations - PRLs 4 and 5
Figure 3C	Proposed Sample Locations - PRL 6
Figure 3D	Proposed Sample Locations - PRLs 7 and 8
Figure 3E	Proposed Sample Locations - PRL 9
Figure 3F	Proposed Sample Locations - Base Boundary

## APPENDICES

APPENDIX A	Quality Assurance Project Plan (On CD)
APPENDIX B	Site Health and Safety Plan
APPENDIX C	Project Schedule
APPENDIX D	Field Sampling Plan

## ACRONYMS

A4OR	Environmental Restoration Branch
AFFF	Aqueous film forming foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
ANG	Air National Guard
PRL	Areas of Concern
BB&E	BB&E, Incorporated
bgs	Below Ground Surface
Bldg.	Building
BRAC	Base Realignment and Closure
COCs	Constituents of Concern
COR	Contracting Officer's Representative
DCRA	Dane County Regional Airport
DO	Delivery Order
DPT	Direct Push Technology
EDR	Environmental Data Resources, Inc.
FD	Fire Department
FSP	Field Sampling Plan
FSS	Fire Suppression System
ft.	Feet/foot

# NGB/A4OR

---

FTA	Fire Training Area
FW	Fighter Wing
Gal	Gallons
HA	Health Advisory
HASP	Health and Safety Plan
HEF	High Expansion Foam
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
µg/L	Micrograms per Liter
µg/kg	Micrograms per Kilogram
NFA	No Further Action
NGB	National Guard Bureau
OWS	Oil Water Separator
PA	Preliminary Assessment
PFASs	Perfluoroalkyl Substances
PFBS	Perfluorobutanesulfonic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
POC	Point of Contact
POL	Petroleum, Oil, and Lubricant
QAPP	Quality Assurance Project Plan
RSL	Regional Screening Level
SI	Site Inspection
SOP	Standard Operation Procedures
UCMR3	Third Unregulated Contaminant Monitoring Rule
USAF	United States Air Force
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
WDNR	Wisconsin Department of Natural Resources
WIANG	Wisconsin Air National Guard Base
WP	Work Plan

# NGB/A4OR

---

## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was contracted by the National Guard Bureau (NGB) under Contract # W9133L-14-D-0002, Delivery Order (DO) 0006 to conduct Phase 1 Regional Site Inspections (SIs) for Perfluorinated Compounds at multiple Air National Guard (ANG) Installations. The scope of the DO includes preparation of this Work Plan (WP) to conduct SIs at potential release locations (PRLs) identified at the Wisconsin Air National Guard (WIANG), in Madison, Wisconsin. This SI WP has been prepared by Amec Foster Wheeler and presents site background information and findings from the Preliminary Assessment (PA) recently conducted by BB&E, Inc. ([BB&E]; BB&E, 2015), and describes the objectives, procedures, and activities to be conducted to execute the SI work. Ten PRLs were identified based on locations where Aqueous Film Forming Foam (AFFF) was potentially discharged or stored. One PRL (PRL 10, Building 510 [Supply]) warranted no further action (NFA) based on the findings of no known AFFF release and is not included in the scope of this SI. A list of the PRLs evaluated during the PA is presented below.

**Table 1**  
**Preliminary Assessment Summary**  
**Truax Field Air National Guard Base, Madison, Wisconsin**

List of PRLs		
PRL	Use	Recommendation
1. Bldg. 430 (Current Fire Station)	Current Fire Station	Soil and Groundwater Inspection
2. Bldg. 430	Nozzle Test Area 1	Soil and Groundwater Inspection
3. Bldg. 430	Nozzle Test Area 2	Soil and Groundwater Inspection
4. Former Bldg. 403	Former Fire Station	Soil and Groundwater Inspection
5. Hangar 400	Hangar with AFFF FSS	Soil and Groundwater Inspection
6. Hangar 406	Hangar with AFFF FSS	Soil and Groundwater Inspection
7. Hangar 414	Hangar with AFFF FSS	Soil and Groundwater Inspection
8. Fuel Spill Ditch	Fuel Emergency Response	Soil and Groundwater Inspection



# NGB/A4OR

---

List of PRLs		
PRL	Use	Recommendation
9. Bldg. 503 Parking Lot	Fuel Emergency Response	Groundwater Inspection
10. Building 510 (Supply)	AFFF Storage Area	NFA

Additionally, groundwater quality at or near the base boundary will be assessed during the SI to evaluate the potential for off-site migration of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutane sulfonate (PFBS).

## 1.1 Site Location

The WIANG is located at Truax Field at the Dane County Regional Airport (DCRA) in south-central Wisconsin approximately 6 miles northeast of the city of Madison (**Figure 1** and **Figure 2**). WIANG is the home of the 115<sup>th</sup> Fighter Wing (FW). The PRLs that will be evaluated during this SI are in the southeast portion of the WIANG (**Figure 3**). The WIANG is zoned for airport district usage. The airport is surrounded by properties zoned for industrial, residential, and business use.

## 1.2 Site History

The installation was originally constructed in 1942 as an Army Air Base, and occupied 2,050 acres. At the end of World War II, the City of Madison assumed control of the facility from the War Assets Administration. Truax Field was reactivated in 1951 and occupied by the United States Air Force (USAF) through 1968, and subsequently by the WIANG. In 1981, the WIANG installation at Truax Field became the 128<sup>th</sup> Tactical Fighter Wing, and later the 128<sup>th</sup> Fighter Wing. In October 1995, the unit at Truax Field was re-designated the 115<sup>th</sup> FW with no change in mission or aircraft. Since its inception in 1942, aircraft housed at Truax Field have varied but have predominantly been fighter/attack aircraft. The WIANG Base has stored petroleum and various types of hazardous materials throughout its history in support of its missions. Although some of the Base's historical operations have resulted in the storage and use of petroleum and hazardous materials, not all of these operations relate to PRL Sites 1 through 9. The Air Force leases the 115<sup>th</sup> FW property from Dane County. The lease expires on October 3, 2050.

# NGB/A4OR

---

## 1.3 Project Purpose and Scope

The SI objective is to determine the presence/absence of constituents of concern (COCs [i.e. PFOA, PFOS, and PFBS]) in soil and groundwater at each of the PRLs and in groundwater at the Base boundary. Samples will be analyzed for the perfluoroalkyl substances (PFAS) listed on the United States Environmental Protection Agency (USEPA's) Third Unregulated Contaminant Monitoring Rule (UCMR3) list (USEPA, 2012); however, the SI will focus on evaluation and discussion of PFOA, PFOS, and PFBS. Data collected during the SI will be used to develop appropriate path(s) forward to either establish an NFA conclusion or to develop data quality objectives for a Remedial Investigation phase.

The SI activities will be conducted in accordance with NGB Environmental Restoration Program Guidance document (USANG 2009), including the following:

- Advance up to 27 soil borings to an approximate depth of 15 feet (ft.) below ground surface (bgs), or first encountered groundwater, at the PRLs using direct-push technology (DPT) methods and collect up to 2 soil samples from each boring;
- Install up to 12 temporary monitoring wells hydraulically downgradient of the PRL areas and at the downgradient base boundary using DPT methods for the installation of temporary monitoring wells to collect a groundwater sample at each location;

The scope is more definitively outlined in the following sections.

# NGB/A4OR

---

## 2.0 PROJECT MANAGEMENT APPROACH

The general parties comprising the management structure of the SI include, WIANG, the Wisconsin Department of Natural Resources (WDNR), BB&E, Amec Foster Wheeler, and Amec Foster Wheeler subcontractors. ANG is the contracting entity through which this project is being executed. Dane county is the current land owner, WIANG is the current lessee. The WDNR is the state's regulatory agency whose role is to enforce the state's environmental regulations.

Amec Foster Wheeler personnel that will be involved with the SI include the following:

- Mr. Jay Mullett, Engineer – Program Manager;
- Mr. Rob Singer, Engineer – Senior Project Manager;
- Mr. Kerry Tull, Geologist, - Co-Project Manager;
- Mr. Thomas Kaugher, Geologist, – Regional Base Lead;
- Ms. Ann Bernhardt, CQM – Quality Assurance/Quality Control;
- Ms. Cynthia Sundquist, CIH, CSP – Health and Safety Manager;
- Mr. Brad Laforest, EAC – Senior Chemist;
- Ms. Shalene Thomas, PMP – Regulatory Specialist;
- Mr. Saamih Bashir, PE, PMP – Technical Lead;
- Mr. Jeremiah Morse, Geologist – Task Manager, Field Operations Manager; and;
- Other supporting staff, as necessary.

Key ANG, WIANG, WDNR, and technical support personnel that will be involved with the SI include the following:

- Mr. James King – NGB/ Environmental Restoration Branch (A4OR) Project Manager
- Mr. Dennis Pinigis – Contracting Officer's Representative (COR)
- Mr. Matthew Shaw – WIANG Environmental Manager;
- Mr. Michael Schmoller – WDNR point of contact (POC); and
- Mr. Doug Barber – BB&E Technical Support Contractor.

Mr. Thomas Kaugher will serve as Amec Foster Wheeler's primary POC. Mr. Kaugher will ensure that objectives are addressed, and will be responsible to meet quality, cost, and schedule performance requirements. Supporting staff, as identified above, will include technical and administrative support personnel involved with the completion of the various SI tasks.

Anticipated subcontractors include a driller for soil borings and temporary monitoring well installation, and a laboratory for sample analysis. The selected laboratory will be Department of Defense Environmental Laboratory Accreditation Program accredited, and maintain a National Environmental Laboratory Accreditation Program. Subcontractors utilized on this project were

# NGB/A4OR

---

pre-qualified by Amec Foster Wheeler. These laboratories will contract directly with and will be monitored by Amec Foster Wheeler to document project performance.

SI activities include, but are not limited to, the following tasks:

- Preparation of a program-wide Quality Assurance Project Plan (QAPP) that includes a program-wide Health and Safety Plan (HASP) (**Appendix A**);
- Preparation of the Draft SI WP that includes a Base specific short-form HASP (**Appendix B**);
- Preparation of the Draft-Final SI WP;
- Preparation of the Final SI WP;
- SI field activities;
- Preparation of the Draft SI Report;
- Preparation of the Draft-Final SI Report; and
- Preparation of Final SI Report.

The site-specific Project Schedule is presented in **Appendix C**.

Following Wisconsin EPA approval, Amec Foster Wheeler will initiate performance of the SI field activities described in the SI Field Sampling Plan (FSP) (**Appendix D**). Amec Foster Wheeler and its subcontractors will mobilize to the site and complete the field activities. The NGB/A4OR Project Manager will be verbally updated by the Amec Foster Wheeler POC, or appointee, of significant observations during the implementation of field activities. Amec Foster Wheeler will document in writing (email, fax, or letter) any significant deviations from the planned activities.

## 3.0 PRELIMINARY ASSESSMENT SITE VISIT AND BACKGROUND INFORMATION

BB&E conducted a PA site visit for the ANG at WIANG during August 10-11, 2015 to identify potential locations of historic environmental releases of PFOA/PFOS/PFBS (i.e. PRLs), specifically from AFFF usage and storage (BB&E, 2015). The PA site visit process included a review of any documented Fire Training Areas (FTAs) in operation since 1970, and any other use or release of AFFF, and the completion of a site reconnaissance. The goal of the PA site visit was to determine if a site poses a potential threat to human health and the environment and requires additional inspection.

Based on past use and storage of AFFF at WIANG, the PA identified nine PRLs where releases of PFASs might have occurred, including hangars, fire stations, storage areas, firefighting equipment testing areas, etc. No former or current FTAs were identified on the Base. The findings of AFFF use and storage at each of the PRLs are documented in BB&E's December 2015, PA Site Visit Report, and summarized below.

### 3.1 Areas of Concern

The following sections summarize the PRLs identified at the 115 FW WIANG based on use and storage of AFFF:

- 1) Building 430 (Current Fire Station)
- 2) Building 430 Nozzle Test Area 1
- 3) Building 430 Nozzle Test Area 2
- 4) Former Building 403 (Former Fire Station)
- 5) Hangar 400
- 6) Hangar 406
- 7) Hangar 414
- 8) Fuel Spill Ditch
- 9) Building 503 Parking Lot

### 3.2 Operational History

The following sections summarize the operational history at each PRL (BB&E, 2015). The PRL and pertinent site features described below are depicted in overview on **Figure 3**, and by each

specific PRL on **Figure 3A** through **Figure 3F** (figures do not include PRLs where NFA was recommended).

### **3.2.1 PRL 1: Building 430 (Current Fire Station)**

AFFF has been used by the WIANG Fire Department (FD) for at least 20 years, and has been stored in Building 430 since it was built, circa 1995. Currently, there are approximately 471 gallons (gal) of AFFF carried in FD trucks and approximately 821 gal of AFFF serving as a backup supply, stored in the fire station. AFFF is transferred to vehicles within the fire station via overhead fill. FD vehicles are washed within the fire station or the outside truck bays when necessary. Trench drains are in the fire station and downgradient of the truck bays; therefore, AFFF releases due to vehicle washing would be captured by the trench drains, which discharge into the sanitary sewer system.

### **3.2.2 PRL 2: Building 430 Nozzle Test Area 1**

The AFFF nozzle systems on FD vehicles have been tested every six months in the grassy areas near Bldg. 430. Nozzle Test Area 1 is located northwest of Building 430. AFFF released in porous green spaces has the potential to seep into the subsurface and groundwater.

### **3.2.3 PRL 3: Building 430 Nozzle Test Area 2**

The AFFF nozzle systems on FD vehicles have been tested every six months in the grassy areas near Building 430. Nozzle Test Area 2 is located southwest of Bldg. 430. AFFF released in porous green spaces has the potential to seep into the subsurface and groundwater.

### **3.2.4 PRL 4: Former Building 403 (Former Fire Station)**

Prior to relocation to Building 430, the FD was stationed in Building 403, which was demolished in 1995/1996. According to Base personnel, AFFF had been in use since at least 1988 and was stored in Former Building 403. There are no records of AFFF nozzle testing from this time period. It is assumed that similar to the current fire station AFFF was transferred into fire trucks through an overhead fill. FD vehicles were likely washed within the fire station or outside when necessary. An oil/water separator (OWS) and associated underground storage tank (UST) were removed during demolition; no contamination was reported during removal (Leidos, 2015).

# NGB/A4OR

---

## 3.2.5 PRL 5: Hangar 400

Hangar 400 was equipped with an AFFF fire suppression system until approximately 2009, when the system was retrofitted for use of high expansion foam (HEF); the installation date of the AFFF fire suppression system is unknown. According to Base personnel, hangar fire suppression systems have been tested annually; foam is discharged every other year during testing. No records of accidental AFFF releases exist. AFFF releases during testing or accidental release within the hangar would have been routed to the trench drains that historically led to an OWS which then discharged into the sanitary sewer system. However, it is possible that AFFF could have been released into the environment during testing through cracks in the floor or through doorways. The OWS was removed in 2009; no contamination was observed during removal (Leidos, 2015).

HEF is currently stored in the mechanical room of Hangar 400. According to Base personnel, AFFF may have been stored in the mechanical room prior to the switch to HEF. Floor drains were present which likely discharge to the sanitary sewer system.

## 3.2.6 PRL 6: Hangar 406

Hangar 406 was equipped with an AFFF fire suppression system until approximately 2006, when the system was retrofitted for use of HEF. According to Base personnel, hangar fire suppression systems have been tested annually; foam is discharged every other year during testing. No records of accidental AFFF releases exist. AFFF releases during testing or accidental release within the hangar would have been routed to the trench drains which then discharged into the sanitary sewer system. However, it is possible that AFFF could have been released into the environment during testing through cracks in the floor or through doorways. There were no records available for AFFF fire suppression system testing at Hangar 406.

HEF is currently stored in the mechanical room of Hangar 406. According to Base personnel, AFFF may have been stored in the mechanical room prior to the switch to HEF. Floor drains were present which likely discharge to the sanitary sewer system.

### **3.2.7 PRL 7: Hangar 414**

Hangar 414 has been equipped with an AFFF fire suppression system since 1994. According to Base personnel, hangar fire suppression systems have been tested annually; foam is discharged every other year during testing. No records of accidental AFFF releases exist. AFFF releases during testing or accidental release within the hangar would have been routed to the trench drains which discharge into the sanitary sewer system. However, it is possible that AFFF could have been released into the environment during testing through cracks in the floor or through doorways.

### **3.2.8 PRL 8: Fuel Spill Ditch**

On March 6, 1981, approximately 2,000 gal of JP-4 jet fuel spilled due to an overflow during refilling at the petroleum, oil, and lubricant (POL) pump house (Building 405). In response to the spill an existing drainage ditch (about 100 ft. long) next to the spill was dammed off (ditch located between Hangars 400 and 414). The fire department foamed the fuel and flushed it toward the ditch, where it soaked into the ground and was covered with straw. By April 9, 1981, as directed by the WDNR, the affected soil in the bottom of the ditch was removed to a depth of approximately 6 ft. and to the limit of odor detection on side slopes (WDNR, 2013).

The type of foam used during the 1981 fuel spill is not specified on the incident report but may have been AFFF based on its historic use. As PFOA/PFOS/PFBS sampling was not conducted during soil excavation, PFOA/PFOS/PFBS from the foam may still be present in this area, particularly the ditch sidewalls, which were excavated based on odor detection.

### **3.2.9 PRL 9: Building 503 Parking Lot**

The soil removed from the 1981 POL spill area, as discussed above, was relocated to what is now the parking lot west of Building 503. The soil was placed on four concrete pads, spread at a depth of 6 to 10 inches, and was turned throughout the summer of 1981 to enhance volatilization. In the summer of 1982, the contaminated soil was removed, the area was excavated to a depth of 3 ft. and the materials were transported off-site for disposal. The area was paved the same year (PEER, 1988).

AFFF runoff from this area could have impacted the soil and may have impacted the groundwater. Although the soil beneath the concrete pads was excavated and disposed off-site, there has not been sampling to confirm the SI COCs are not present.



## 3.3 Pathway Evaluation and Hazard Assessment

A preliminary evaluation of the threats and targets of PFAS was performed during the PA; at the time, testing for COCs (PFOA/PFOS/PFBS) had not been performed at on-base locations. Results of the pathway evaluation and hazard assessment as documented in BB&E's December 2015, PA Site Visit Report, are summarized below.

### 3.3.1 Soil

At the time of the PA site visit, no documentation was available showing that soils at the Base have been tested for COCs; therefore, it is unknown whether COCs are present in the soil. However, based on historical practices, they may be present in the soil due to known or potential AFFF use at the following locations:

- Area surrounding Building 430 (Current Fire Station);
- Grassy areas northwest and southwest of Building 430 where FD vehicles have conducted AFFF system nozzle testing every six months;
- Area surrounding former Building 403 (Former Fire Station);
- Area surrounding Hangars 400, 406, and 414;
- Ditch between Hangar 414 and Hangar 400 where foam was used as a precaution during a fuel spill in 1981; and
- Area surrounding parking lot west of Building 503, where runoff may have occurred from the soil excavated from the 1981 fuel spill.

### 3.3.2 Groundwater

At the time of the PA visit, no documentation was available showing that groundwater at the Base has been tested for COCs; therefore, it is unknown whether COCs are present in the groundwater. Based on historical practices, they may be present in the groundwater due to known or potential AFFF use at the following locations:

- Area surrounding Building 430 (Current Fire Station);
- Grassy areas northwest and southwest of Building 430 where FD vehicles have conducted AFFF system nozzle testing every six months;
- Area surrounding former Building 403 (Former Fire Station);
- Area surrounding Hangars 400, 406, and 414;

# NGB/A4OR

---

- Ditch between Hangar 414 and Hangar 400 where foam was used as a precaution during a fuel spill in 1981; and
- Area surrounding parking lot west of Building 503, where runoff may have occurred from the soil excavated from the 1981 fuel spill.

### 3.3.3 Water Wells

According to the December 2015 PA, a review of the Environmental Data Resources Inc. (EDR) Radius Map™ Report with Geocheck® dated July 21, 2015 (EDR, 2015) shows at least six water wells within a one-mile radius of the Base, located to the west, north and east of the property boundary. The well shown in the center of the Base property is a geothermal system well; there are no water wells on Base.

### 3.3.4 Sediment

At the time of the PA site visit, no documentation was available showing that sediments at the Base have been tested for COCs; therefore, it is unknown whether COCs are present in sediments. Based on historical practices, COCs could be present in sediment in locations that have received drainage from the Base storm sewer system. In general, surface releases at the Base would enter series of man-made ditches and culverts and ultimately discharge to Starkweather Creek. Sediments are not a concern in the area of the 1981 fuel spill, as the soil (and sediment) was excavated and ultimately disposed off-site (BB&E, 2015).

### 3.3.5 Surface Water

At the time of the PA site visit, Surface water at the Base is limited to the man-made surface drainage and storm sewer system. There are no open bodies of water on the Base. Precipitation is generally collected by the stormwater sewer system and discharged to Starkweather Creek, which runs north, west, and south of the Base (BB&E, 2015).

## 4.0 ENVIRONMENTAL SETTING

The following sections provide information on the environmental setting at WIANG. This information is summarized from the Compliance Restoration Program Preliminary Assessment/Site Investigation prepared by Leidos in February 2015 (Leidos; 2015).

### 4.1 Climate

Truax Field has a humid continental climate, which is characterized by variable weather patterns and a large seasonal temperature variance. Winter temperatures can be well below freezing, with moderate to occasionally heavy snowfall and temperatures reaching 0°F (-18°C). High temperatures in summer average in the lower 80s°F (27 to 28°C), often accompanied by high humidity levels. The mean annual rainfall is 34.44 inches (87.48 cm) (USACE 2013).

### 4.2 Topography

Truax Field is located in south-central Wisconsin approximately 6 miles northeast of the city of Madison. The Base is predominantly located on level ground near the western margin of the Great Lakes Section of the Central Lowlands Physiographic Province. This section is characterized by numerous lakes with associated lacustrine plains, prominent end moraines, poorly integrated drainage, and a still-partially exposed cuestaform topography (PEER 1988). Three lakes are located near Truax Field: Lake Mendota to the southwest and Lakes Monona and Waubesa to the south. Truax Field is located at an elevation of approximately 890 ft. (271 m) above mean sea level.

### 4.3 Geology

Truax Field is located in the Central Lowlands Physiographic Province, which is characterized by mostly Paleozoic bedrock with some cretaceous rocks underlying the western boundary. Much of this province also exhibits flat to gently inclined rock strata and widespread topographic effects of glaciation. Structurally, regional dips are controlled by numerous domes and uplifts. With the exception of the southern border, the entire province is bordered by topography that is higher in elevation (PEER 1988). Glacial drift in southern Wisconsin ranges in thickness from only a few ft. to several hundred ft. Truax Field is located directly above a thick (approximately 300-ft) section of glacial drift; thus, several geologic layers encountered elsewhere in the region do not occur

beneath Truax Field. Instead, directly beneath the glacial till lies approximately 350 ft. of Mt. Simon Sandstone bedrock.

## **4.4 Surface Water Hydrology**

Surface water drainage from the Base ultimately drains west into Starkweather Creek, which surrounds the Base on the north, west, and south sides. Starkweather Creek empties into Lake Monona approximately 2 miles to the south. Surface water flow around the Base is directed by man-made ditches and culverts which connect to Starkweather Creek. Because much of the Base is paved, infiltration and evapotranspiration of surface water are negligible.

## **4.5 Hydrogeology**

Regionally, groundwater is found in the unconsolidated glacial deposits and underlying bedrock formations including sandstone of the Trempealeau Group, the deeper Tunnel City Group, and the underlying Elk Mound Group. These bedrock aquifers comprise the principal water supply aquifers in Dane County. The Mt. Simon Sandstone underlying the glacial deposits in the vicinity of the Base is the lowermost formation of the Elk Mound Group.

Based on information collected during investigation activities at the Installation Restoration Program (IRP) sites, monitoring wells within the water table zone indicate shallow groundwater flow is generally toward the south and southeast. The water table at the Base is generally encountered at depths of 5 to 10 ft. bgs. The groundwater flow gradients calculated from IRP investigations indicate groundwater flow velocities of 0.5 to 0.9 ft. per day.

There are currently no known drinking water supply wells at the Base and the shallow groundwater system in the area of the Base is not used as a source of drinking water. The City of Madison obtains its public water supply from the Mt. Simon Sandstone from a network of pumping wells. The Base is provided water via the municipal water distribution system operated by the City of Madison. The nearest municipal water supply wells are located approximately 1.5 miles southwest of the Base. Based on information obtain during the IRP investigations, four private wells may have been located in the immediate vicinity of the Base prior to initial construction activities in 1942. However, in light of the extensive development in the area, the four private wells are believed to be abandoned or not in use.

## 4.6 Critical Habitat and Threatened/Endangered Species

According to the U.S. Fish and Wildlife Service (USFWS), as of December 2013, the following animals and plants are federally endangered, threatened, proposed, and/or listed as candidate species in Dane County, Wisconsin (USFWS 2013):

- *Myotis septentrionalis* (Northern Long-eared Bat) – Proposed Endangered
- *Grus americanus* (Whooping Crane) – Non-essential Experimental Population
- *Lampsilis higginsii* (Higgins eye pearly mussel) – Endangered
- *Plethobasus cyphus* (Sheepnose) – Endangered
- *Bombus affinis* (Rusty patched bumblebee) - Endangered
- *Platanthera leucophaea* (Eastern prairie fringed orchid) – Threatened
- *Asclepias meadii* (Mead's milkweed) – Threatened
- *Lespedeza leptostachya* (Prairie bush-clover) – Threatened

None of these species are known to reside or have been sighted at Truax Field.

## 4.7 City of Madison Water Supply

Drinking water is supplied to the WIANGB and surrounding residential population by the City of Madison. The City of Madison obtains its public water supply from the Mt. Simon Sandstone from a network of pumping wells. The Base is provided water via the municipal water distribution system operated by the City of Madison. The nearest municipal water supply wells are located approximately 1.5 miles southwest of the Base.

## 5.0 PERMITS

Amec Foster Wheeler will obtain Joint Utility Locating Information for Excavators (Diggers Hotline) two weeks prior to initiating SI activities. After the Diggers Hotline request has been fulfilled, Amec Foster Wheeler will work with the WIANG Environmental Manager to obtain work clearance approval (i.e., base dig permits as necessary) for activities to be conducted at each of the PRLs.

## 6.0 SOIL AND GROUNDWATER STANDARDS

A soil or groundwater standard is an environmental and/or public health statute or rule used in identifying site contamination that may pose a risk to human health or the environment. Soil and groundwater standards are federal and state human health- and environment-based regulations and guidelines used to:

- Determine the appropriate levels of site clean-up;
- Define and formulate remedial action alternatives; and,
- Govern implementation and operation of the selected remedial action.

In accordance with *Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations* (USAF, August 2012) and USEPA lifetime drinking water Health Advisory (HA) for PFOS (USEPA, May 2016a) and PFOA (USEPA, May 2016b), a release will be considered confirmed if the following concentrations are exceeded:

### PFOS:

- 0.07 micrograms per liter ( $\mu\text{g/L}$ ) in groundwater/surface water that is used as or contributes to a drinking water source. (PFOS concentration is added to PFOA concentration and total is compared to 0.07  $\mu\text{g/L}$  HA).
- 1,260 micrograms per kilogram ( $\mu\text{g/kg}$ ) in soil (calculated in the absence of Regional Screening Level [RSL] values).
- 1,260  $\mu\text{g/kg}$  in sediment (calculated in the absence of RSL values).

### PFOA:

- 0.07  $\mu\text{g/L}$  in groundwater/surface water. (PFOA concentration is added to PFOS concentration and total is compared to 0.07  $\mu\text{g/L}$  HA).
- 1,260  $\mu\text{g/kg}$  in soil (calculated in the absence of RSL values).
- 1,260  $\mu\text{g/kg}$  in sediment (calculated in the absence of RSL values).

USEPA has also derived RSL values for PFBS, for which there is a Tier 2 toxicity value (Provisional Peer-Reviewed Toxicity Value) (USEPA, May 2016c). The ANG will also consider a release to be confirmed if the following concentrations are exceeded:

# NGB/A4OR

## PFBS:

- 380 µg/L in groundwater/surface water.
- 1,600,000 µg/kg in soil/sediment.

Table 2 has the federal screening values for comparing the analytical results for each compound.

**Table 2**  
**Federal Health-Based Screening Values**  
**115th Fighter Wing, Wisconsin Air National Guard**  
**Truax Field Wisconsin Air National Guard**

Parameter	Chemical Abstract Number	WDNR RR Program Direct Contact RSLs Residential/Industrial (µg/kg)	USEPA Regional Screening Level Table (May 2016) <sup>a</sup>		Air Force Guidance for Soils and Sediments <sup>b</sup> (µg/kg)	USEPA Health Advisory Drinking Water (Surface Water or Groundwater) (µg/L) <sup>c</sup>
			Residential Soil (µg/kg)	Tap Water (µg/L)		
Perfluorobutane sulfonate (PFBS)	375-73-5	1,260/16,400	1,600,000	380	NL	NL
Perfluorooctanoic acid (PFOA)	335-67-1	1,260/16,400	NL	NL	1,260	0.07*
Perfluorooctane sulfonate (PFOS)	1763-23-1	1,260/16,400	NL	NL	1,260	

**Notes:**

<sup>a</sup> USEPA RSLs (May 2016) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016>]

<sup>b</sup> Screening levels calculated using the USEPA RSL calculator [[https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)]. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 mg/kg/day derived by USEPA in their Drinking Water Health Advisories for both PFOS and PFOA (May 2016).

<sup>c</sup> USEPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and USEPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*.

\* Note: The HA is for the total concentration of PFOA and PFOS in drinking water. Only groundwater and surface water will be sampled during the SI, however, analytical results will be compared to drinking water HA level.

USEPA = U.S. Environmental Protection Agency

NL = not listed



# NGB/A4OR

---

## 7.0 INVESTIGATIVE APPROACH

### 7.1 Work Plan Objectives

The objectives of this SI WP are to outline activities necessary to perform the SI. Field activities will be performed at the 9 on-Base PRL s recommended for further inspection and for groundwater along the Base boundary. The overall objective of the SI is to assess for the presence/absence of PFOA, PFOS, and PFBS by performing the following activities:

- Advance up to 27 soil borings to a maximum depth of 15 ft. bgs and collect a minimum of two soil samples from each boring: surface sample (0-2 ft.) and a sample directly above the water table;
- Install up to 12 temporary monitoring wells hydraulically downgradient from the PRL areas and at the downgradient base boundary to allow for groundwater sample collection at locations. Twelve temporary wells will be installed in the soil borings advanced for soil collection and temporary monitoring wells will be installed exclusively for groundwater sample collection.

### 7.2 General Approach

Existing data, site history, and process information have been used, where possible, to design the SI. The work will be conducted in accordance with the QAPP, HASP, and FSP presented in **Appendices A, B, and D**, respectively.

Table 3 summarizes the inspection approach for each of the PRL s, requiring SI, and groundwater at the base boundary:

**Table 3  
Site Inspection Summary  
Truax Field Air National Guard, Madison, Wisconsin**

Potential Release Location	Location type	Confirmed (C) or Suspected (Sus) Release	SB	Wells		No. Samples				Comments
				EW	TW	S	GW	SW	SD	
1. Bldg. 430 (Current Fire Station)	Fire Station	Sus	3	0	1	6	1	0	0	FD vehicles filled and washed in fire station. Trench drains go to sanitary sewer
2. Bldg. 430	Fire Truck Equipment Testing	C	3	0	1	6	1	0	0	FD vehicle nozzle tests are performed every six months and discharged to the grassy area to the southwest of the current fire station.
3. Bldg. 430	Fire Truck Equipment Testing	C	3	0	1	6	1	0	0	FD vehicle nozzle tests are performed every six months and discharged to the grassy area to the northwest of the current fire station.
4. Former Bldg. 403	Fire Station	Sus	3	0	1	6	1	0	0	AFFF was stored in Bldg. 403 between 1988-1995
5. Hangar 400	Hangar with AFFF FSS	Sus	3	0	1	6	1	0	0	System was tested annually with AFFF discharged every other year
6. Hangar 406	Hangar with AFFF FSS	Sus	3	0	1	6	1	0	0	System was tested annually with AFFF discharged every other year
7. Hangar 414	Hangar with AFFF FSS	Sus	3	0	1	6	1	0	0	System was tested annually with AFFF discharged every other year
8. Fuel Spill Ditch	Fuel Emergency Response	C	3	0	1	6	1	0	0	FD foamed the fuel spill and flushed it toward the ditch. Soil was removed to 6 ft. bgs.
9. Bldg. 503 Parking Lot	Fuel Emergency Response	Sus	3	0	1	6	1	0	0	POL spill which could have been foamed, was relocated in piles to the Bldg. 503 parking lot
Base Boundary Wells			3	0	3	0	3	0	0	To determine if PFAA-contaminated groundwater has reached the base boundary.
<b>TOTAL</b>			<b>27</b>	<b>0</b>	<b>12</b>	<b>54</b>	<b>12</b>	<b>0</b>	<b>0</b>	

**Notes**

- AFFF – Aqueous Film Forming Foam
- Bldg. Building
- EW – Existing Well
- FSS – Fire Suppression System
- GW – Groundwater Sample
- PFAA- Perfluoroalkyl Acids
- S – Soil Sample
- SB – Soil Boring
- SD – Sediment
- Sus - Suspected
- SW-Surface Water
- TW – Temporary Monitoring Well

### 7.2.1 PRL 1: Building 430 Current Fire Station

There were documented releases of AFFF at the Current Fire Station. According to facility personnel, AFFF has been used by the WIANG FD for at least 20 years, and has been stored in Building 430 since it was built, circa 1995. Currently, there are approximately 471 gallons (gal) of AFFF carried in FD trucks and approximately 821 gal of AFFF serving as a backup supply, stored in the fire station. FD vehicles are washed within the fire station or the outside truck bays

when necessary. To assess whether soil and groundwater were impacted from training exercises, up to three soil borings will be advanced around the building in the grass, and one temporary monitoring well will be installed within one of the downgradient borings. The borings will be advanced to a maximum depth of 15 ft. The temporary monitoring well will be installed at the water table and a groundwater sample will be collected to assess groundwater quality at the fire station. The locations of soil borings and the temporary monitoring well are shown on **Figure 3A**.

## **7.2.2 PRL 2: Building 430 Nozzle Test Area 1**

There were documented releases of AFFF at Building 430 Nozzle Test Area 1. AFFF was used for nozzle testing every six months in the grassy areas. AFFF may have impacted the soil around the training area and leached into groundwater. To assess whether soil and groundwater were impacted from training exercises, up to three soil borings will be advanced in the area around the nozzle test area 1 and one temporary monitoring well will be installed within one of the downgradient borings. The soil borings will be advanced to a maximum depth of 15 ft. The temporary monitoring well will be installed at the water table and a groundwater sample will be collected to assess groundwater quality in the nozzle test area 1. The locations of soil borings and the temporary monitoring well are shown on **Figure 3A**.

## **7.2.3 PRL 3: Building 430 Nozzle Test Area 2**

There were documented releases of AFFF at Building 430 Nozzle Test Area 2. AFFF was used for nozzle testing every six months in the grassy area to the southwest of the current fire station. AFFF may have impacted the soil around the training area and leached into groundwater. To assess whether soil and groundwater were impacted from training exercises, up to three soil borings will be advanced in the area around the nozzle test area 2 and one temporary monitoring well will be installed within one of the downgradient borings. The soil borings will be advanced to a maximum depth of 15 ft. The temporary monitoring well will be installed at the water table and a groundwater sample will be collected to assess groundwater quality in the nozzle test area 2. The locations of soil borings and the temporary monitoring well are shown on **Figure 3A**.

## **7.2.4 PRL 4: Former Building 403 (Former Fire Station)**

There were no documented releases of AFFF around former Building 403, the former fire station, which was demolished in 1995/1996 (grassy area to the northwest of the current fire station). It

is assumed that similar to the current fire station AFFF was stored at the former fire station and was transferred into fire trucks by an overhead fill. FD vehicles were likely washed within the fire station or outside when necessary. An OWS and associated UST were removed during demolition; no contamination was reported during removal. If AFFF was discharged it likely entered the sanitary sewer, however, releases to the environment may have occurred when washing the fire trucks.

To assess whether soil and groundwater were impacted from releases, up to three soil borings will be advanced, and one temporary monitoring well will be installed within one of the downgradient borings. The soil borings will be advanced to a maximum depth of 15 ft. bgs; one boring will be advanced south of the building, adjacent to the former OWS, one soil boring will be advanced northwest, in the grassy area if possible and one boring/temporary well will be installed southeast of the former building. The temporary monitoring well will be installed at the water table and a groundwater sample will be collected to assess groundwater quality downgradient from former Bldg. 403. The locations of soil borings and the temporary monitoring well are shown on **Figure 3B**.

## 7.2.5 PRL 5: Hangar 400

There is no record of AFFF release at Hangar 400. However, this hangar was equipped with an AFFF fire suppression system until approximately 2009, when the system was retrofitted for use of HEF. According to Base personnel, hangar fire suppression systems have been tested annually; foam is discharged every other year during testing. No records of accidental AFFF releases exist, however, releases to the environment may have occurred through cracks in the floor or through doorways. To assess whether soil and groundwater were impacted from this release, up to three soil borings will be advanced, and one temporary monitoring well will be installed downgradient within one of the borings. The soil borings will be advanced to a maximum depth of 15 ft. bgs. At one of the soil boring locations, a temporary monitoring well will be installed at the water table and a groundwater sample collected to assess groundwater quality downgradient from the Hangar. The locations of soil borings and the temporary monitoring well are shown on **Figure 3B**.

## 7.2.6 PRL 6: Hangar 406

Hangar 406 was equipped with an AFFF fire suppression system until approximately 2006, when the system was retrofitted for use of HEF. According to Base personnel, hangar fire suppression systems have been tested annually; foam is discharged every other year during testing. AFFF releases during testing or accidental release within the hangar would have been routed to the trench drains which then discharged into the sanitary sewer system. However, it is possible that AFFF could have been released into the environment during testing through cracks in the floor or through doorways. Although no AFFF release has been documented it is possible that AFFF might have been released outside on the concrete apron. To assess whether soil and groundwater were impacted from a potential release, up to three soil borings will be advanced, and one temporary monitoring well will be installed downgradient within one of the borings. The soil borings will be advanced to a maximum depth of 15 ft. bgs. The temporary monitoring well will be installed at the water table and a groundwater sample will be collected to assess groundwater quality downgradient from Hangar 406. The locations of soil borings and the temporary monitoring well are shown on **Figure 3C**.

## 7.2.7 PRL 7: Hangar 414

Hangar 414 has been equipped with an AFFF fire suppression system since 1994. According to Base personnel, hangar fire suppression systems have been tested annually; foam is discharged every other year during testing. No records of accidental AFFF releases exist. AFFF releases during testing or accidental release within the hangar would have been routed to the trench drains which discharge into the sanitary sewer system. However, it is possible that AFFF could have been released into the environment during testing through cracks in the floor or through doorways. To assess whether soil and groundwater were impacted from the releases, up to three soil borings will be advanced, and one temporary monitoring well will be installed downgradient within one of the borings. The soil borings will be advanced to a maximum depth of 15 ft. bgs around the hangar. The temporary monitoring well will be installed at the water table and a groundwater sample collected to assess groundwater quality downgradient from hangar 414. The locations of soil borings and the temporary monitoring well are shown on **Figure 3D**.

## 7.2.8 PRL 8: Fuel Spill Ditch

There are no documented releases of AFFF at PRL 8. However, during the 1981 fuel spill of JP-4, a fire suppression foam was used which may have contained AFFF. Subsequently a soil removal action was conducted in the fuel spill ditch, however, the remedial goals were based on fuels and did not consider the potential presence of PFAS. To assess whether soil and groundwater were impacted from the fuel cleanup, up to three soil borings will be advanced, and one temporary monitoring well will be installed within one of the borings. The soil borings will be advanced to a maximum depth of 15 ft. bgs. The temporary monitoring well will be installed at the water table and a groundwater sample will be collected to assess groundwater quality in the fuel spill ditch. The locations of soil borings and the temporary monitoring well are shown on **Figure 3D**.

## 7.2.9 PRL 9: Building 503 Parking Lot

There are no documented releases of AFFF at PRL 9; however, soil from PRL 8 was placed in the area of PRL 9 the Building 503 parking lot. The relocated soil and may have impacted the soil and/or groundwater. Although the soil beneath the concrete pads was excavated and disposed off-site, there has been no sampling for COCs in this area to confirm if they are present. To assess the soil and groundwater have been affected, three soil borings will be advanced to a maximum depth of 15 ft. bgs, and one temporary monitoring well will be installed downgradient within one of the borings. The temporary monitoring well will be installed at the water table and a groundwater sample collected to assess groundwater quality in the testing area. The locations of soil borings and the temporary monitoring well are shown on **Figure 3E**.

## 7.2.10 Base Boundary Wells

This SI includes a component to assess groundwater quality at the base boundary to determine if COCs are present in groundwater which may result in off-site migration. This assessment includes collecting groundwater samples from three temporary monitoring wells that will be installed at the south/southwest base boundary. The locations of the temporary monitoring wells are shown on **Figure 3F**.

## 8.0 FIELD INVESTIGATION PROCEDURES

Field investigation procedures to be utilized are presented in the following sections.

### 8.1 Site Access and Restrictions

Prior to mobilization to the Site, a list of field personnel and vehicles will be provided to WIANG to coordinate access. Upon arriving at the installation each morning, field personnel will check in with the WIANG POC. Field personnel and vehicles will access the installation using the main drive and gate. Anticipated work hours are from 7:00 AM to 5:00 PM local time on weekdays.

### 8.2 Utility Location and Clearance

Prior to commencement of SI activities, Amec Foster Wheeler will review available site information, such as As-Built drawings, to verify locations of subsurface utilities. In addition, Amec Foster Wheeler will schedule a site walk to mark out proposed ground disturbance locations with assistance from the WIANG POC. The WIANG POC will review and approve the locations with respect to avoidance of subsurface utilities and structures. After the locations have been pre-marked, Amec Foster Wheeler will contact Digger Hotline, the Wisconsin One-Call utility clearance hotline. Next, Amec Foster Wheeler will coordinate with the WIANG POC to complete a base dig permit and/or utility clearance checklist, as required. Finally, non-destructive excavation methods (“soft-dig” or hand auger methods) will be used to clear site utilities at the specified sampling locations down to a depth of 4 to 5 ft. bgs.

### 8.3 Soil Boring Installation and Soil Sampling

Soil boring installation and soil sampling activities will be completed as summarized in the following sections. Soil boring locations are illustrated on **Figures 3A** through **3E**.

#### 8.3.1 Soil Boring Installation

Soil boring locations are based on site use and physical characteristics to target the most probable release areas. Up to 27 soil borings will be advanced in and around the PRL areas using DPT drilling methods. The soil borings will be advanced from the ground surface to an approximate depth of 15 ft. bgs (first 4 to 5 ft. to be completed with a hand auger), unless groundwater or refusal is encountered at a shallower depth. Soil cores will be collected continuously for field screening at 4 to 5 ft. intervals in new, acetate liners. Drilling rods/tools will be decontaminated

between borings in accordance with **Section 8.7**. If DPT drilling methods cannot be used due to site conditions, a hand auger will be used to complete the soil boring. Investigation-derived waste (IDW) generated during drilling activities will be containerized in 55-gallon steel drums and labeled for disposal in accordance with **Section 8.9**.

### 8.3.2 Soil Sampling

Soil samples will be collected in accordance with **Section 2.1** of the FSP (**Appendix D**). Samples will be analyzed to determine if COCs congeners are present in soil at each PRL as outlined in **Table 2** of the FSP.

### 8.3.3 Soil Boring Abandonment

Following completion of drilling activities, each boring will be backfilled with cuttings (and hydrated bentonite chips as necessary), and the surface will be repaired with like materials (i.e., asphalt, concrete, or topsoil/seed) in accordance with WIANG specifications.

## 8.4 Temporary Monitoring Well Installation and Groundwater Sampling

Temporary monitoring well installation, and groundwater sampling activities, will be completed as summarized in the following sections. Temporary monitoring well locations are illustrated on **Figures 3A** through **3F**.

### 8.4.1 Temporary Monitoring Well Installation

Up to 12 temporary monitoring wells will be advanced using DPT drilling methods or hand auger (if necessary). One temporary well will be installed at each PRL and three temporary wells will be installed at the Base boundary as described in **Section 7.2.10**. The primary purpose of installing the temporary monitoring wells is to assess groundwater quality hydraulically downgradient or in the area of the PRLs and at the Base boundary. Soil cores will be collected at regular intervals (i.e. every 5 ft.) to verify soil lithology within the screened interval and depth of the water table, which is anticipated to be between three and 12 ft. bgs. Soil cores will be logged and field screened in accordance with **Section 2.1.1** of the FSP. The temporary monitoring wells will be installed in accordance with Amec Foster Wheeler's PFAS-specific Standard Operating Procedure (SOP) for installation of monitoring wells (AFW-04), which is included in Attachment E



of the QAPP (**Appendix A**). Because the monitoring wells will be temporary, the SOP will be supplemented with the following installation-specific requirements:

- Each temporary monitoring well will be constructed using 1 inch diameter PVC pipe with a 5 ft. long, 0.010-inch slotted screened interval and will be installed to straddle the water table.
- The annulus surrounding the well screen and riser will be backfilled with No.1 filter sand, which will be placed from the bottom of the borehole to the ground surface. No annular seal will be installed. Alternatively, a pre-packed screen assembly may be utilized.
- A concrete pad and road box will not be installed.
- If the well is left unattended, an expandable cap will be placed within the riser, and a steel plate or traffic cone will be placed over the well to protect it.

Following temporary monitoring well completion, static water levels will be collected with an electronic water level indicator and recorded on a field data sheet. Well development will be conducted as described below and in accordance with Amec Foster Wheeler's Well Development SOP (AFW-05) included as Attachment E of the QAPP (**Appendix A**).

## 8.4.2 Monitoring Well Development

The temporary monitoring wells will be developed using a pump and tubing to develop the entire screened interval and remove fine particles that have accumulated (1.0 inch temp wells do not allow for use of a surge block). Water quality parameters will be monitored and recorded at periodic intervals. Monitoring wells will be considered adequately developed when water quality parameters have stabilized (see **Section 2.2.1** of the FSP) and turbidity is low (i.e., <50 Nephelometric Turbidity Units).

Well development water will be containerized in steel 55-gallon drums and managed in accordance with **Section 8.9**. A well development log will be prepared for each well and contain the following information:

- Project name and number
- Date
- Well number
- Sampler's name and title

- Depth to water prior to development (ft. below top of riser)
- Depth to bottom of well prior to development (ft. below top of riser)
- Type of pump
- Pumping rate
- Purge volumes (containerized for disposal)
- Characteristics of purge water (color, particulates, clarity, and odor)
- Field measurements (temperature, pH, dissolved oxygen [DO], specific conductance, redox potential, turbidity)
- Estimated recharge rate
- Development time
- Depth to water following development
- Depth to bottom of well following development
- General remarks

### **8.4.3 Groundwater Sampling**

Groundwater samples will be collected from up to 12 temporary monitoring wells in accordance with **Section 2.2** and **Section 2.7.1** of the FSP. Disposable sampling equipment, including tubing, will be changed between temporary well locations. Non-disposable equipment will be decontaminated in accordance with **Section 8.7**. Samples will be analyzed for COCs congeners at each PRL area, as outlined in **Table 2** of the FSP.

### **8.4.4 Temporary Well Boring Abandonment**

After sample collection, the temporary well risers and screens will be removed and the borings properly abandoned in accordance with **Section 8.3.3**. Temporary well riser and screens will be disposed of with general refuse.

## **8.5 Sediment Sampling**

There is no sediment sampling scheduled.

## **8.6 Surface Water Sampling**

There is no surface water sampling scheduled.

## 8.7 Decontamination Procedures

Decontamination procedures will be conducted in accordance with **Section 2.7.5** of the FSP. Equipment (including sampling probes, rods, and tools) will be cleaned prior to initiating and following the completion of field activities. Non-disposable sampling equipment will be decontaminated after each use during field activities. Decontamination fluids will be containerized in steel 55-gallon drums and managed in accordance with **Section 8.9**.

## 8.8 Site Survey

The horizontal position of soil borings and temporary monitoring wells will be located with a hand-held Global Positioning System unit capable of achieving 1-meter horizontal accuracy.

## 8.9 Management of IDW

IDW (purge water, development water, decontamination fluids, and soil cuttings) will be collected and contained in labeled, secured, steel 55-gallon drums. Drums will remain on-site in an area designated by the WIANG POC, pending the results of laboratory testing. Waste characterization sampling is detailed in **Section 2.5** of the FSP. Appropriate disposal methods for these drums will be determined after reviewing the waste characterization analytical results. Drum disposal will be completed in a timely manner and in accordance with ANG policy for IDW.

## 9.0 PROJECT SCHEDULE AND DELIVERABLES

The anticipated project schedule is presented in **Appendix C**. It is estimated that the deliverables and field efforts presented in the schedule will occur as noted. However, these dates are tentative and may be revised based upon agreements reached among parties during the project execution. The schedule and estimated due dates for deliverables are presented in the **Table 4**:

**Table 4**  
**PROJECT SCHEDULE AND DELIVERABLES SUMMARY**

Deliverable	Scheduled Due Date	Distribution
Draft SI WP	25 May, 2017	COR, ANG
Draft-Final SI WP	13 July, 2017	COR, ANG and Regulatory Stakeholders
Final SI WP	31 August, 2017	COR, ANG and Regulatory Stakeholders
Draft SI Report	24 November, 2017	COR, ANG
Draft-Final SI Report	29 December, 2017	COR, ANG and Regulatory Stakeholders
Final SI Report	31 January, 2018	COR, ANG and Regulatory Stakeholders

**Notes:**

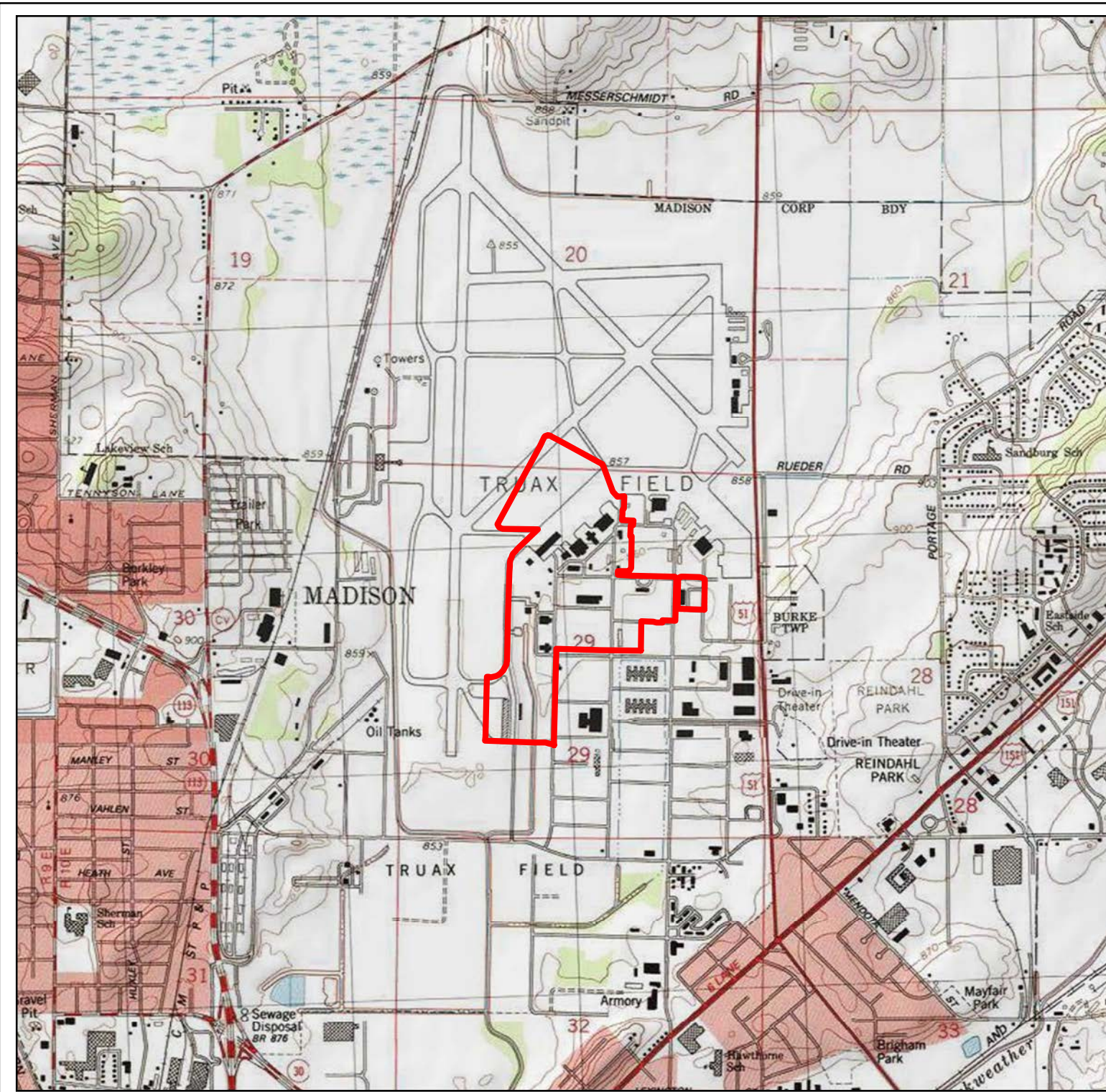
ANG – Air National Guard

COR - Contracting Officer's Representative

## 10.0 REFERENCES

- Amec Foster Wheeler, 2017. *Draft Quality Assurance Project Plan - FY 16 Phase 1 Regional Site Inspections for Per-fluorinated Compounds, Multiple Air National Guard Installations*. March, 2017.
- BB&E, 2015. Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Wisconsin Air National Guard Truax Field Dane County Regional Airport, December 2015.
- Leidos, 2015. *Final Preliminary Assessment/Site Investigation, Dane County Regional Airport Truax Field, Compliance Restoration Program*. February 2015
- USANG, 2009. *Environmental Restoration Program Air National Guard Guidance*. September 2009
- USEPA, 2012. *Federal Register, Volume 77, No. 85, Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 3) for Public Water Systems; Final Rule*. May 2, 2012.
- USEPA, 2016a. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), EPA 822-R-16-004*. United States Environmental Protection Agency. May 2016.
- USEPA, 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA), EPA 822-R-16-005*. United States Environmental Protection Agency. May 2016.
- USEPA, 2016c. *Regional Screening Levels (RSLs) – Generic Tables (May 2016), Composite Table*. 2016

**FIGURES**



### SITE LOCATION MAP

Truax Field Air National Guard Base  
Madison, Wisconsin

### Legend

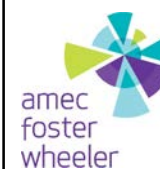
Installation Area (approximate)

### Location of Site



### Notes & Sources

Service Layer Credits: Copyright © 2013 National Geographic Society, i-cubed



Amec Foster Wheeler  
Environment & Infrastructure  
46850 Magellan Dr #190  
Novi, MI 48377  
248 926 4008



FIGURE




1



## SITE AND AREA FEATURES

Truax Field Air National Guard Base  
Madison, Wisconsin

### Legend

-  Rivers and Streams
-  Lakes and Ponds
-  Installation Area (approximate)

### Location of Site



### Notes & Sources

Notes: AFFF - aqueous film forming foam. PFC - perfluorinated compounds.  
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community  
Hydrogeography data courtesy of Wisconsin Department of Natural Resources.



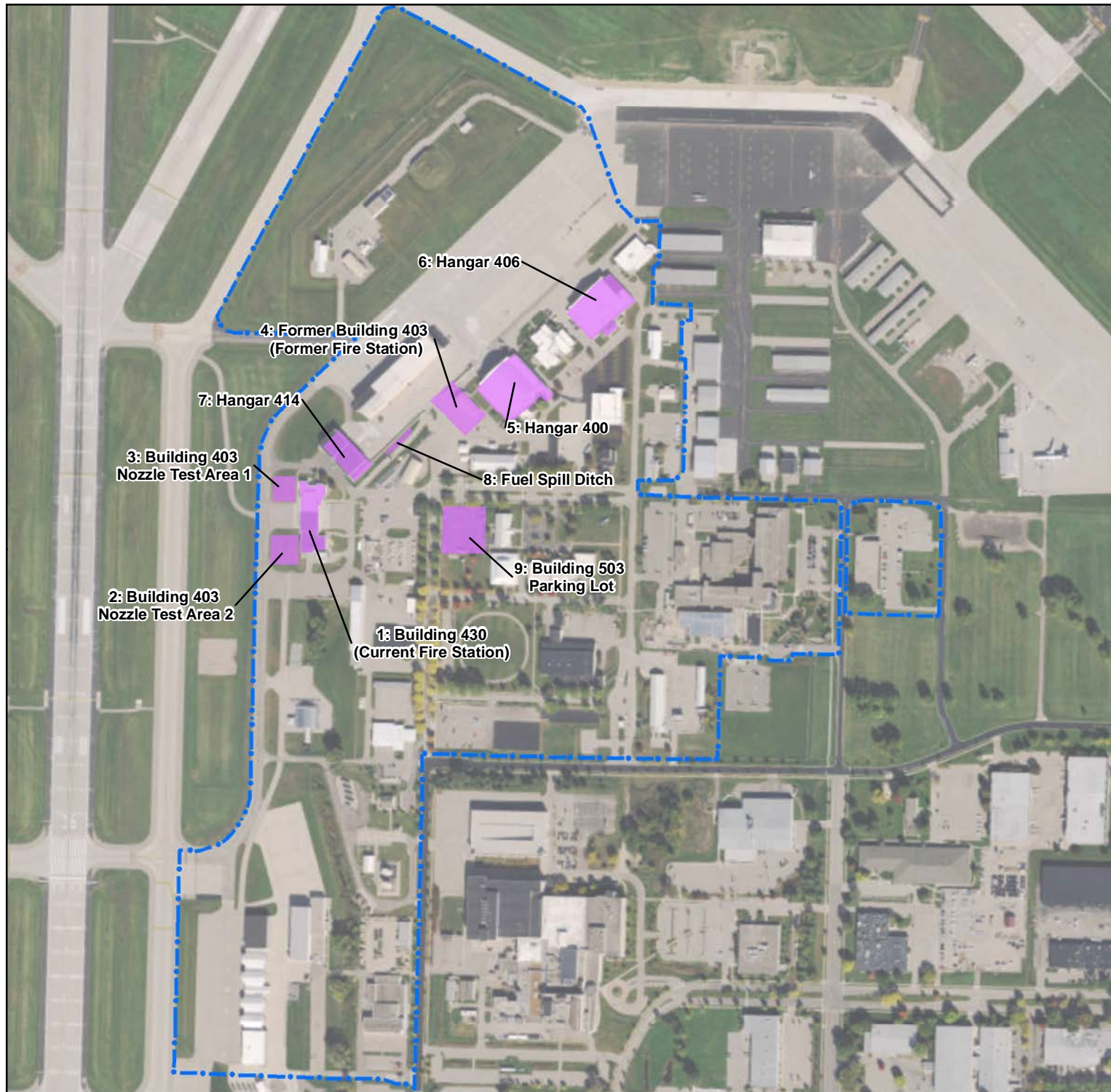
Amec Foster Wheeler  
Environment & Infrastructure  
46850 Magellan Dr #190  
Novi, MI 48377  
248 926 4008



FIGURE

2





## PRL LOCATION MAP

Truax Field Air National Guard Base  
Madison, Wisconsin

### Legend

- Potential AFFF PFOS/PFOA PRL (approximate)
- Installation Area (approximate)

### Location of Site



### Notes & Sources

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Amec Foster Wheeler  
Environment & Infrastructure  
46850 Magellan Dr #190  
Novi, MI 48377  
248 926 4008



FIGURE






3



**PROPOSED  
SAMPLE LOCATIONS  
PRLs 1, 2, and 3**

Truax Field Air National Guard Base  
Madison, Wisconsin

**Legend**

-  Soil Sample
-  Soil Boring and Temporary Well
-  Assumed Groundwater Flow
-  Potential AFFF PFOS/PFOA PRL (approximate)
-  Installation Area (approximate)

**Location of Site**



**Notes & Sources**

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

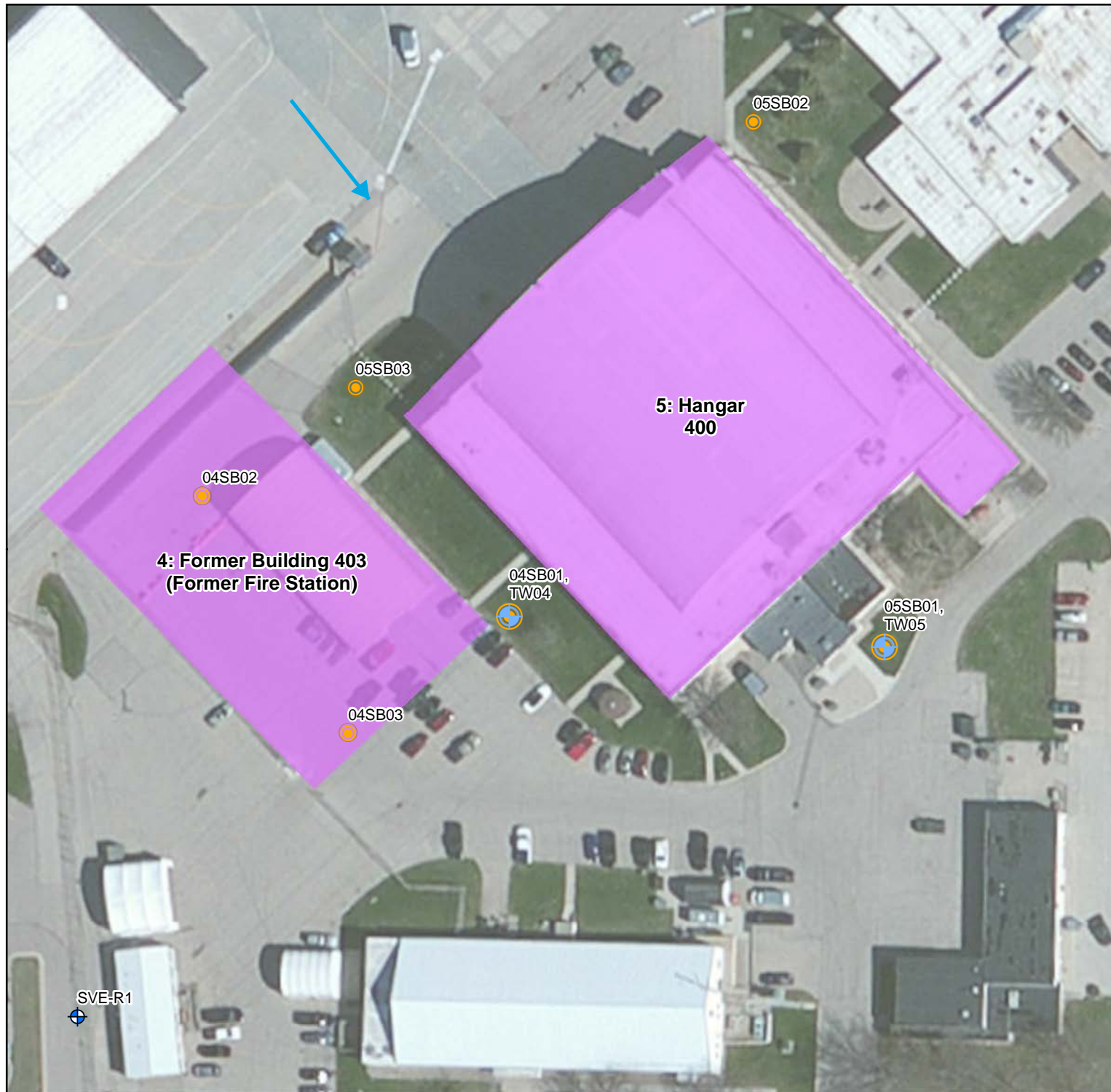


Amec Foster Wheeler  
Environment & Infrastructure  
46850 Magellan Dr #190  
Novi, MI 48377  
248 926 4008



**FIGURE**






**3A**



**PROPOSED  
SAMPLE LOCATIONS  
PRLs 4 and 5**

Truax Field Air National Guard Base  
Madison, Wisconsin

**Legend**

-  Soil Sample
-  Soil Boring and Temporary Well
-  Permanent Monitoring Well
-  Assumed Groundwater Flow
-  Potential AFFF PFOS/PFOA PRL (approximate)

**Location of Site**



**Notes & Sources**

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
 Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

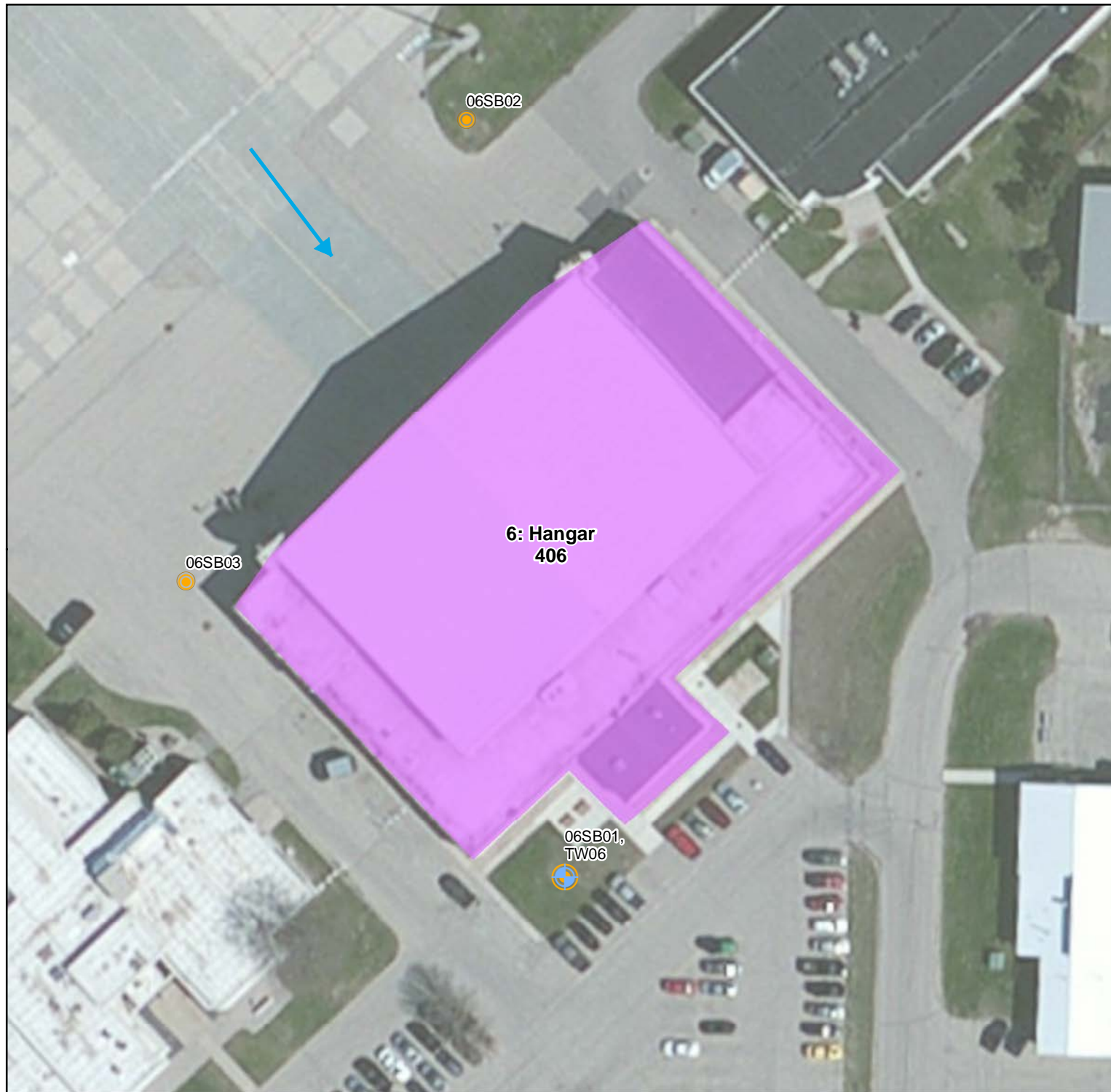


Amec Foster Wheeler  
 Environment & Infrastructure  
 46850 Magellan Dr #190  
 Novi, MI 48377  
 248 926 4008



**FIGURE**





**3B**



**PROPOSED  
SAMPLE LOCATIONS  
PRL 6**

Truax Field Air National Guard Base  
Madison, Wisconsin

**Legend**

-  Soil Sample
-  Soil Boring and Temporary Well
-  Assumed Groundwater Flow
-  Potential AFFF PFOS/PFOA PRL (approximate)

**Location of Site**



**Notes & Sources**

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
 Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

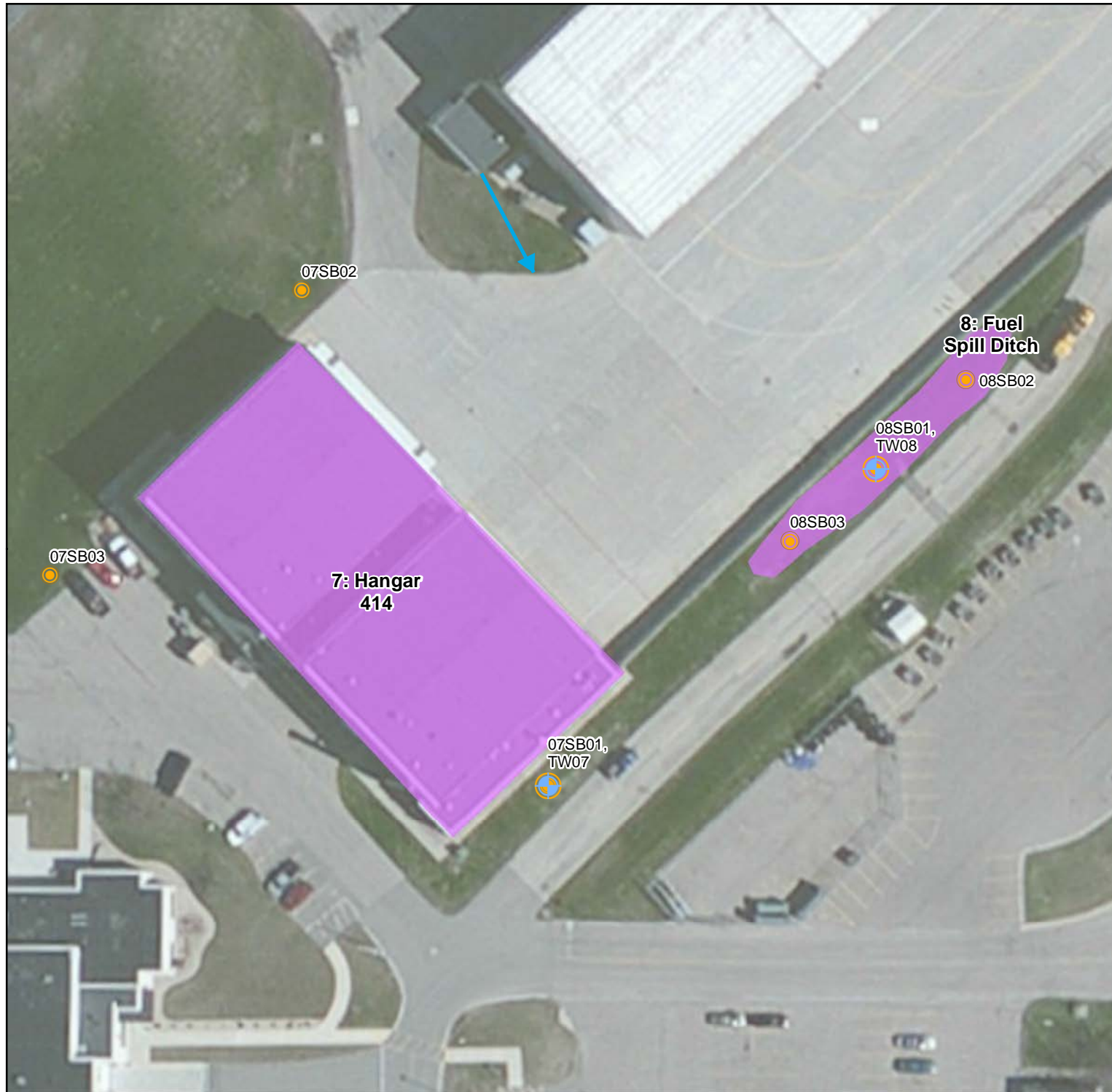


Amec Foster Wheeler  
 Environment & Infrastructure  
 46850 Magellan Dr #190  
 Novi, MI 48377  
 248 926 4008



**FIGURE**





**3C**



**PROPOSED  
SAMPLE LOCATIONS  
PRLs 7 and 8**

Truax Field Air National Guard Base  
Madison, Wisconsin

**Legend**

-  Soil Sample
-  Soil Boring and Temporary Well
-  Assumed Groundwater Flow
-  Potential AFFF PFOS/PFOA PRL (approximate)

**Location of Site**



**Notes & Sources**

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Amec Foster Wheeler  
Environment & Infrastructure  
46850 Magellan Dr #190  
Novi, MI 48377  
248 926 4008



FIGURE





3D



**PROPOSED  
SAMPLE LOCATIONS  
PRL 9**

Truax Field Air National Guard Base  
Madison, Wisconsin

**Legend**

-  Soil Sample
-  Soil Boring and Temporary Well
-  Assumed Groundwater Flow
-  Potential AFFF PFOS/PFOA PRL (approximate)

**Location of Site**



**Notes & Sources**

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

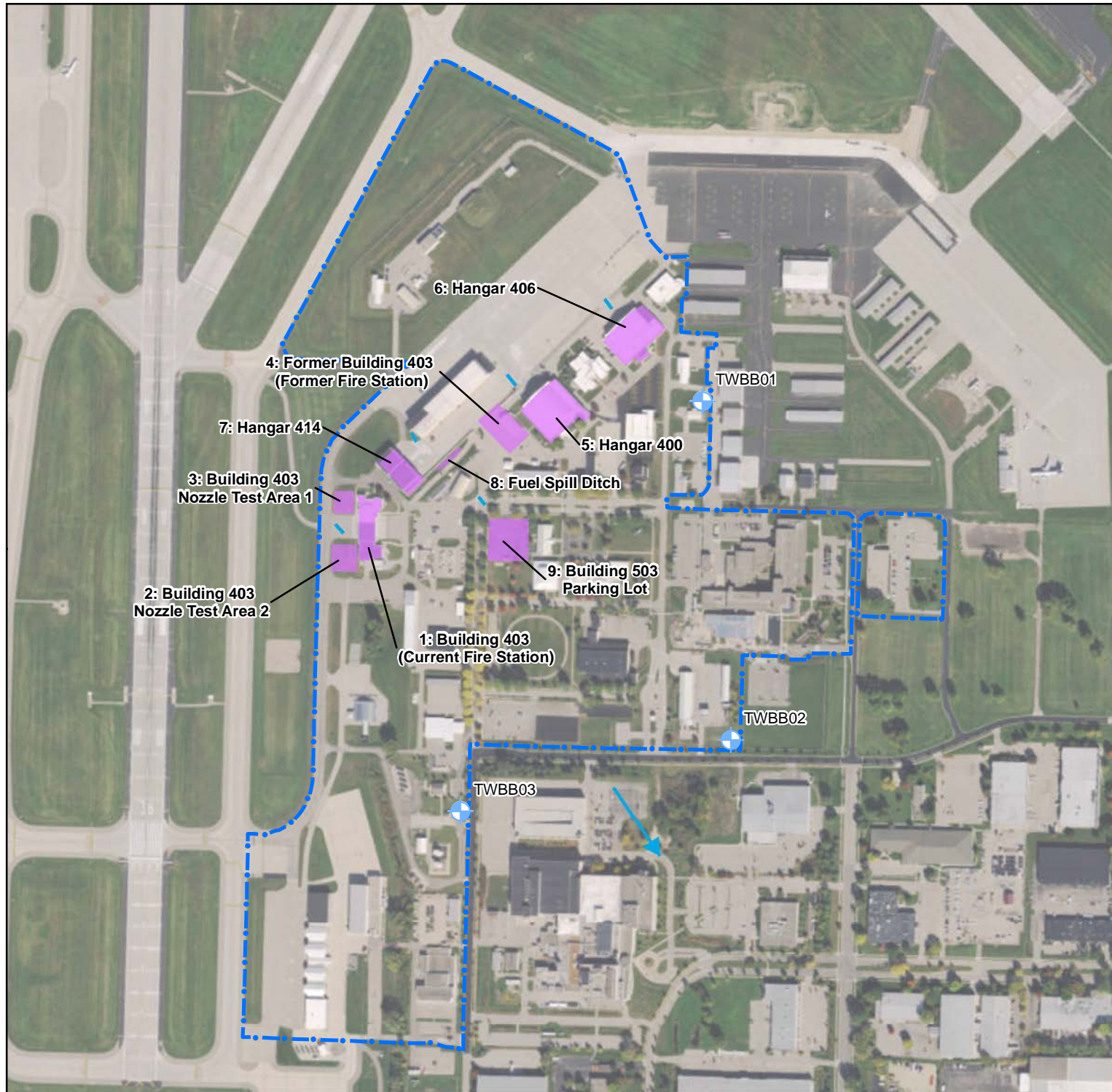


Amec Foster Wheeler  
Environment & Infrastructure  
46850 Magellan Dr #190  
Novi, MI 48377  
248 926 4008



**FIGURE**


**3E**



### PROPOSED SAMPLE LOCATIONS BASE BOUNDARY

Truax Field Air National Guard Base  
Madison, Wisconsin

#### Legend

-  Temporary Monitoring Well
-  Assumed Groundwater Flow
-  Installation Area (approximate)
-  Potential AFFF PFOS/PFOA PRL (approximate)

#### Location of Site



#### Notes & Sources

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds  
 Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Amec Foster Wheeler  
 Environment & Infrastructure  
 46850 Magellan Dr #190  
 Novi, MI 48377  
 248 926 4008



FIGURE  
 3F

**APPENDIX A**

**QUALITY ASSURANCE PROJECT PLAN  
(On CD)**



**FINAL  
QUALITY ASSURANCE PROJECT PLAN**



**FY16 PHASE 1 REGIONAL SITE INSPECTIONS  
FOR PER-FLUORINATED COMPOUNDS**

**MULTIPLE AIR NATIONAL GUARD  
INSTALLATIONS**

Contract #: W9133L-14-D-0002

Delivery Order 0006

Amec Foster Wheeler Project #: 2-9133-0006

May 2017

**THIS PAGE INTENTIONALLY LEFT BLANK.**



## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1
1.1	Development of the Quality Assurance Project Plan .....	2
1.2	Project Setting .....	2
1.3	Applicability of the Quality Assurance Project Plan .....	2
1.4	Laboratory Analysis .....	3
2.0	DOCUMENT OVERVIEW .....	4
3.0	REFERENCES .....	5

## WORKSHEETS

Worksheet #1	Title and Approval Page .....	7
Worksheet #2	QAPP Identifying Information .....	9
Worksheet #3 and #4	Distribution List Project Personnel Sign-Off .....	17
Worksheet #5	Project Organization Chart .....	20
Worksheet #6	Communication Pathways .....	21
Worksheet #7	Personnel Responsibilities and Qualifications .....	23
Worksheet #8	Special Personnel Training Requirements.....	27
Worksheet #9	Project Team Planning Sessions Participants Sheet .....	28
Worksheet #10	Conceptual Site Model .....	31
Worksheet #11	Project Quality Objectives/Systematic Planning Process Statements.....	33
Worksheet #12	Measurement Performance Criteria.....	41
Worksheet #13	Secondary Data Criteria and Limitations .....	44
Worksheet #14	Summary of Project Tasks .....	51
Worksheet #15	Action Limits and Laboratory-Specific Detection/Quantitation Limits .....	57
Worksheet #16	Project Schedule/Timeline .....	63
Worksheet #17	Sampling Design and Rationale .....	73
Worksheet #18	Sampling Locations and Methods/SOP Requirements .....	74
Worksheets #19 and #30	Sample Containers, Preservation, and Hold Times .....	76
Worksheet #20	Sample Quantities and Control Frequencies .....	79
Worksheet #21	Field Sampling SOP References .....	80
Worksheet #22	Field Equipment Calibration, Maintenance, Testing, and Inspection .....	82
Worksheet #23	Analytical SOP References .....	83
Worksheet #24	Analytical Instrument Calibration .....	86
Worksheet #25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection....	90
Worksheets #26 and 27	Sample Handling, Custody, and Disposal .....	93
Worksheet #28	Analytical QC and Corrective Action.....	96
Worksheet #29	Project Documents and Records .....	103
Worksheet #31	Planned Project Assessments .....	104
Worksheet #32	Assessment Findings and Corrective Action Responses .....	105
Worksheet #33	QA Management Reports.....	106
Worksheet #34	Verification (Step I) Process .....	107
Worksheet #35	Validation (Steps IIa and IIb) Process.....	108
Worksheet #36	Validation (Steps IIa and IIb) Summary .....	110
Worksheet #37	Usability Assessment .....	112

## **ATTACHMENTS**

- Attachment A Chain-of-Custody Form
- Attachment B Laboratory Certifications
- Attachment C Laboratory Quality Assurance Manuals
- Attachment D Laboratory Standard Operating Procedures
- Attachment E Amec Foster Wheeler Standard Operating Procedures
- Attachment F Amec Foster Wheeler Field Forms
- Attachment G Health and Safety Plan

## ACRONYMS

A	Analytical
A70R	Operations Restoration Branch
AFFF	Aqueous Film Forming Foam
AFI	Air Force Instruction
AGS	Air Guard Station
AFRC	Air Force Reserve Command
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
amu	atomic mass unit
ANG	Air National Guard
ARW	Air Refueling Wing
AW	Airlift Wing
BRAC	Base Realignment and Closure
C	Concentration
°C	degrees Celsius
CAM	Compliance Assurance Monitoring
CAS	Chemical Abstract Service
CCC	Continuing Calibration Check
CCV	Continuing Calibration Verification
COC	chain of custody
COR	Contract Officer Representative
CTDEEP	Connecticut Department of Energy and Environmental Protection
DL	Detection Limits
DO	Delivery Order
DoD	Department of Defense
DNREC	Delaware Department of Natural Resources and Environmental Control
DQO	Data Quality Objective
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EWVRA	East West Virginia Regional Airport
FDOH	Florida Department of Health
Freq.	Frequency
FSP	Field Sampling Plan
FSP/SIWP	Field Sampling Plan/Site Inspection Work Plan
FW	Fighter Wing
HA	Health Advisory
HIA	Harrisburg International Airport
HDPE	high-density polyethylene
HPLC/MS/MS	High-Performance Liquid Chromatography with Tandem Mass Spectrometry
IAP	International Airport
ICAL	initial calibration
ICV	Initial Calibration Verification
ID	identification

IEPA	Illinois Environmental Protection Agency
IS	Internal Standards
ISO	International Organization for Standardization
KDHE	Kansas Department of Health & Environment
LC	Liquid Chromatography
LC/MS/MS	Liquid Chromatography and Tandem Mass Spectrometry
LCS	laboratory control sample
LOQ	limit of quantitation
MAP	Municipal Airport
MassDEP	Massachusetts Department of Environmental Protection
Maxxam	Maxxam Analytics International
MB	Method Blank
MDE	Maryland Department of the Environment
MDOH	Minnesota Department of Health
MECDC	Maine Center for Disease Control and Prevention
MEDEP	Maine Department of Environmental Protection
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mL	milliliters
MPCA	Minnesota Pollution Control Agency
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSPIA	Minneapolis/St. Paul International Airport
N	no
NA	Not Available
NalCs	Sodium iodide cesium solution
NCDEQ	North Carolina Department of Environmental Quality
NCCA	New Castle County Airport
NFA	No Further Action
NGB	National Guard Bureau
No.	Number
NYSDEC	New York State Department of Environmental Conservation
OPR	Ongoing Precision and Recovery
PADEP	Pennsylvania Department of Environmental Protection
%	Percent
%D	Percent Difference
PFBS	Perfluorobutanesulfonic Acid
PFC	Perfluorinated Compound
PFHpA	Perfluoroheptanoic Acid
PFHxA	Perfluorohexanoic Acid
PFOA	Perfluooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFNA	Perfluorononanoic Acid
PM	Project Manager
PRL	Potential Release Location
QA	quality assurance

QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RDL	Reportable Detection Level
Rev.	Revision
RIDEM	Rhode Island Department of Environmental Management
RPD	Relative Percent Difference
RT	Retention Time
S	Sampling
SDDENR	South Dakota Department of Environment & Natural Resources
SGS Accutest	SGS Accutest Laboratory
SI	Site Inspection
S/N	Signal to noise
S&O	Support and Oversight
SOO	Statement of Objectives
SOP	Standard Operating Procedure
TBD	To Be Determined
TNI	The NELAC Institute
UCMR3	Unregulated Containment Monitoring Rule 3
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UHPLC	Ultra High Performance Liquid Chromatography
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
Vista	Vista Analytical Laboratories, LLC
WP	Work Plan
WVDEP	West Virginia Department of Environmental Protection
Y	yes



**THIS PAGE INTENTIONALLY LEFT BLANK.**

## 1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) was prepared by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) on behalf of the National Guard Bureau (NGB) to support Site Inspection (SI) activities that provide defensible data to determine No Further Action (NFA) or data quality objectives (DQO) for follow-on remedial investigation activities for multiple Air National Guard (ANG) Installations (Project No. ANGH20167150). SI activities will be conducted at a total of 20 ANG bases including:

- 1) Stewart International Airport (IAP), New Windsor, New York;
- 2) New Castle County Airport (NCCA), Wilmington, Delaware;
- 3) Joe Foss Field, South Dakota;
- 4) Harrisburg IAP (HIA), Harrisburg, Pennsylvania;
- 5) Stanly County Air Guard Station (AGS), Stanly County, North Carolina;
- 6) Pittsburgh IAP (Air Force Reserve Command [AFRC] and ANG), Pittsburgh, Pennsylvania;
- 7) Richmond IAP Byrd Field, Richmond, Virginia;
- 8) Martin State Airport, Maryland;
- 9) Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia;
- 10) Barnes Municipal Airport (MAP), Massachusetts;
- 11) Yeager Airport, Charleston, West Virginia;
- 12) Minneapolis-St. Paul MAP (MSPIA) (AFRC and ANG), Minnesota;
- 13) Bradley IAP, East Granby, Connecticut;
- 14) Bangor IAP, Bangor, Maine;
- 15) Quonset State Airport, Rhode Island;
- 16) Greater Peoria Airport, Peoria, Illinois;
- 17) General Mitchell IAP, Wisconsin;
- 18) Forbes Field, Topeka, Kansas;
- 19) Truax Field, Wisconsin; and
- 20) Capital MAP, Springfield, Illinois.

The QAPP is intended to be a living document and will be updated as necessary. This QAPP was completed in general accordance with the NGB Request for Proposal W9133L-16-R-0068 dated 16 June 2016 and corresponding Statement of Objectives (SOO) dated 18 April 2016. This QAPP has been prepared by Amec Foster Wheeler under ANG Delivery Order (DO) 0006, Contract W9133L-14-D-0002 and describes the procedures and activities to be conducted to execute field sampling during the performance of the DO.

## 1.1 Development of the QAPP

As described on the United States Environmental Protection Agency (USEPA) Quality System Website (<http://www.epa.gov/QUALITY/qapps.html>), the purpose of a QAPP is to document the planning, implementation and assessment procedures for a particular project, as well as any specific quality assurance and quality control (QA/QC) activities. It is to integrate all the technical and quality aspects of the project to provide a "blueprint" for obtaining the type and quality of environmental data and information needed for a specific decision or use.

In March 2005, the Intergovernmental Data Quality Task Force developed a policy and guidance document to fulfill the project-specific requirements of Part B of the American National Standards Institute, American Society for QC standard, Specifications and Guidelines for Environmental Data Collection and Environmental Technology Programs to ensure that federal departments and agencies will produce consistent QAPPs that reflect a systematic planning approach to the collection and use of environmental data. That guidance document, the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) Manual V1, March 2005 (USEPA, 2005), was followed in the development of this QAPP.

This QAPP is intended to be used in conjunction with site-specific Work Plans (WPs) that will be prepared throughout the life of this project.

## 1.2 Project Setting

The project setting for the work encompassing the SI activities at multiple ANG Installations will be presented in the site-specific WPs identified in **Section 1**.

## 1.3 Applicability of the QAPP

This QAPP is intended primarily for use in collection of environmental data for the following purposes:

- SI soil sampling;
- SI groundwater sampling;
- SI surface water sampling; and,
- SI sediment sampling.

Specific requirements for the activities being performed at the multiple ANG Installations will be described in the site-specific WPs at the sites identified in **Section 1**.

#### **1.4 Laboratory Analysis**

Laboratory analysis of all environmental samples will be performed by a Department of Defense (DoD) Environmental Laboratory Accreditation Program accredited laboratory. Samples submitted for laboratory analysis will be placed into laboratory-provided containers, in accordance with the site-specific WPs that will be prepared. Sample containers will be labeled with the sample field identification (ID) number (no.), collection date, and requested analyses. The sample field IDs will be as described in the site-specific WPs but in general should include Installation-Matrix (Soil, Sediment, Groundwater, and Surface Water, etc.)-location #. Dates and depths may also be appended to the ID. The samples will be placed into a cooler with ice immediately following collection and transported to the laboratory by courier or shipped by express carrier.

The chain-of-custody (COC) protocol will be documented and strictly followed. Appropriate QA/QC samples will be collected in accordance with the site-specific WPs. Standard Level IV analytical reporting will be provided by the laboratory.

## 2.0 DOCUMENT OVERVIEW

The UFP-QAPP guidance (USEPA, 2005) includes a series of 37 worksheets that present the critical information required in a QAPP. Because the worksheets were designed to “ensure consistent content and presentation of information in a project-specific QAPP... and streamline the review of QAPPs by regulators and others,” this QAPP has been developed using these worksheets, which provide information associated with four key topics:

- Project Management and Objectives
- Measurement and Data Acquisition
- Assessment and Oversight
- Data Review

A series of attachments is also included with this QAPP. These attachments include the following information:

- COC forms
- Laboratory certifications
- Laboratory QA Manual
- Standard Operating Procedures (SOPs)
- Health and Safety Plan

When elements required by the UFP-QAPP are present in other documents (e.g., SOPs), careful cross-referencing of these other documents can be used in lieu of repeating information. Following this guidance, this QAPP provides certain relevant information by referencing the site-specific WPs which will be prepared through the life of this project. All of these planning documents are companion documents to the QAPP.

### 3.0 REFERENCES

National Institute of Environmental Health Sciences, 2016. Perfluorinated Chemicals (PFCs), July 2016.

United States Air Force, 2012. Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds (PFCs) at Active and BRAC Installations, August 27 2012.

United States Air Force, 2014. Air Force Instruction 32-7020, November 2014.

United States Department of Defense, 2013. Quality Systems Manual Version 5.0.

USEPA, 2005. Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) Manual V1, March 2005.

USEPA, 2011. Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by High-Performance Liquid Chromatography with Tandem Mass Spectrometry (HPLC/MS/MS), December 2011.

USEPA, 2014. Peer Review of Health Effects Documents for Perfluorooctanic Acid and Perfluorooctane Sulfonate. February 2014.

USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA), May 2016.

USEPA, 2016b. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), May 2016.

## **WORKSHEETS**

**QAPP Worksheet #1 Title and Approval Page**

<b>Site Name/Project Name:</b>	FY 16 Phase 1 Regional Site Inspections for Per-Fluorinated Compounds, Multiple ANG Installations
<b>Site Location:</b>	Multiple ANG Installations, Stewart IAP, New Windsor, New York; NCCA, Wilmington, Delaware; Joe Foss Field, South Dakota; HIA, Harrisburg, Pennsylvania; Badin AGS, Stanly County, North Carolina; Pittsburgh IAP (AFRC) and ANG, Pittsburgh, Pennsylvania; Richmond IAP Byrd Field, Richmond, Virginia; Martin State Airport, Maryland; EWVRA Shepherd Field, Martinsburg, West Virginia; Barnes MAP, Massachusetts; Yeager Airport, Charleston, West Virginia; MSPIA (AFRC and ANG), Minnesota; Bradley IAP, East Granby, Connecticut; Bangor IAP, Bangor, Maine; Quonset State Airport, Rhode Island; Greater Peoria Airport, Peoria, Illinois; General Mitchell IAP, Wisconsin; Forbes Field, Topeka, Kansas; Truax Field, Wisconsin; and Capital MAP, Springfield, Illinois.
<b>Document Title:</b>	Final QAPP
<b>Reference Documents:</b>	Please see the site-specific WPs for a full list of reference documents.
<b>Lead Organization and Approval Entity:</b>	NGB
<b>Preparer's Name and Organizational Affiliation:</b>	Lynne Baumgras, Ph.D., PG, Amec Foster Wheeler, Environment & Infrastructure, Inc.
<b>Preparer's Contact Information:</b>	453 Route 146, Suite 201, Clifton Park, NY 12065; 518-372-0905 x 306; lynne.baumgras@amecfw.com
<b>Preparation Date:</b>	March 2017



**QAPP Worksheet #1 Title and Approval Page**

<b>Lead Organization's Program Manager</b>	
	Signature
	Dennis Pinigis, NGB/Contracting Officer's Representative/Project Manager (PM) (NGB/)
<b>Investigative Organization's PM</b>	
	Signature
	Kerry Tull, Amec Foster Wheeler
<b>Investigative Organization's Project QA Manager:</b>	
	Signature
	Ann Bernhardt, Amec Foster Wheeler

**QAPP Worksheet #2 QAPP Identifying Information**

<b>Site Name/Project Name:</b>	FY 16 Phase 1 Regional Site Inspections for Per-Fluorinated Compounds, Multiple ANG Installations
<b>Site Location:</b>	Multiple ANG Installations, Stewart IAP, New Windsor, New York; NCCA, Wilmington, Delaware; Joe Foss Field, South Dakota; HIA, Harrisburg, Pennsylvania; Badin Air Guard Station, Stanly County, North Carolina; Pittsburgh IAP (AFRC) and ANG), Pittsburgh, Pennsylvania; Richmond IAP Byrd Field, Richmond, Virginia; Martin State Airport, Maryland; EWVRA Shepherd Field, Martinsburg, West Virginia; Barnes MAP, Massachusetts; Yeager Airport, Charleston, West Virginia; MSPIA (AFRC and ANG), Minnesota; Bradley IAP, East Granby, Connecticut; Bangor IAP, Bangor, Maine; Quonset State Airport, Rhode Island; Greater Peoria Airport, Peoria, Illinois; General Mitchell IAP, Wisconsin; Forbes Field, Topeka, Kansas; Truax Field, Wisconsin; and Capital MAP, Springfield, Illinois. Potential release locations (PRLs) may be added or removed and will be presented in the Site-specific WPs.
<b>Site No./Code:</b>	NA
<b>Operable Unit:</b>	NA
<b>Contractor Name:</b>	Amec Foster Wheeler
<b>Contract No.:</b>	W9133L-14-D-0002
<b>Contract Title:</b>	National Guard Bureau Contract
<b>DO No.:</b>	0006
<b>Identify guidance used to prepare QAPP:</b>	UFP-QAPPs, Manual VI (2005)
<b>Identify regulatory program:</b>	Connecticut Department of Energy and Environmental Protection (CTDEEP) Site Characterization Guidance Document Delaware Department of Natural Resources and Environmental Control (DNREC) Illinois Environmental Protection Agency (IEPA) Site Remediation Program Kansas Department of Health & Environment (KDHE) Remedial Section

**QAPP Worksheet #2 QAPP Identifying Information**

	Maine Department of Environmental Protection (MEDEP) and Maine Center for Disease Control and Prevention (MECDC) Maryland Department of the Environment (MDE) Massachusetts Department of Environmental Protection (MassDEP) Minnesota Pollution Control Agency (MPCA)/Minnesota Department of Health (MDOH) New York State Department of Environmental Conservation (NYSDEC) North Carolina Department of Environmental Quality (NCDEQ) Federal Remediation Branch Pennsylvania Department of Environmental Protection (PADEP) Rhode Island Department of Environmental Management (RIDEM) Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases South Dakota Department of Environment & Natural Resources (SDDENR) USEPA Office of Water Virginia Department of Environmental Quality (VDEQ) West Virginia Department of Environmental Protection (WVDEP) Wisconsin Department of Natural Resources (WDNR) 720 and Wisconsin Administrative Code 140
<b>Identify approval entity</b>	CTDEEP, DNREC, IEPA, KDHE, MEDEP/MECDC, MDE, MassDEP, MPCA/MDOH, NYSDEC, NCDEQ, PADEP, RIDEM, SDDENR, VDEQ, WDNR, WVDEP
<b>Indicate whether the QAPP is a generic or a project-specific QAPP?</b>	This QAPP is an overarching program. QAPP intended to serve the needs of the individual Installation inspection service activities, to be described in the Site-specific WPs.
<b>List dates of scoping sessions that were held:</b>	Program kickoff meeting was held on 18 October 2016 at Sheppard Hall, 3501 Fetchet Avenue, Joint Base Andrews, Maryland
<b>List dates and titles of QAPP documents written for previous site work, if applicable:</b>	
<b>QAPP</b>	NA

**QAPP Worksheet #2 QAPP Identifying Information**

<p><b>List organizational partners (stakeholders) and connection with lead organization:</b></p>	<p>NGB/ – Technical Lead          CTDEEP, DNREC, IEPA, KDHE, MEDEP/MECDC, MDE, MassDEP, MPCA/MDOH, NYSDEC, NCDEQ, PADEP, RIDEM, SDDENR, VDEQ, WDNR, WVDEP – Regulatory Entities</p> <p>ANGBs/Airports:</p> <ol style="list-style-type: none"> <li>1. 105<sup>th</sup> Airlift Wing (AW) - Stewart IAP, New Windsor, New York;</li> <li>2. 166<sup>th</sup> AW - NCCA, Wilmington, Delaware;</li> <li>3. 114<sup>th</sup> Fighter Wing (FW) - Joe Foss Field, South Dakota;</li> <li>4. 193<sup>rd</sup> Special Operations Wing - HIA, Harrisburg, Pennsylvania;</li> <li>5. 145<sup>th</sup> AW – Stanly County Air Guard Station, Stanly County, North Carolina;</li> <li>6. 171<sup>st</sup> Air Refueling Wing (ARW) - Pittsburgh IAP (AFRC and ANG), Pittsburgh, Pennsylvania;</li> <li>7. 192<sup>nd</sup> FW – Former Site at Richmond IAP Byrd Field, Richmond, Virginia;</li> <li>8. 175<sup>th</sup> Wing Martin State Airport, Maryland;</li> <li>9. 167<sup>th</sup> AW - EWVRA Shepherd Field, Martinsburg, West Virginia;</li> <li>10. 104<sup>th</sup> FW - Barnes MAP, Massachusetts;</li> <li>11. 130<sup>th</sup> AW - Yeager Airport, Charleston, West Virginia;</li> <li>12. 133<sup>rd</sup> AW – MSPIA (AFRC and ANG), Minnesota;</li> <li>13. 103<sup>rd</sup> AW - Bradley IAP, East Granby, Connecticut;</li> <li>14. 101<sup>st</sup> ARW - Bangor IAP, Bangor, Maine;</li> <li>15. 143<sup>rd</sup> AW - Quonset State Airport, Rhode Island;</li> <li>16. 182<sup>nd</sup> AW - Greater Peoria Airport, Peoria, Illinois;</li> <li>17. 128<sup>th</sup> ARW - General Mitchell IAP, Wisconsin;</li> <li>18. 190<sup>th</sup> ARW - Forbes Field, Topeka, Kansas;</li> <li>19. 115<sup>th</sup> FW - Truax Field, Wisconsin; and</li> <li>20. 183<sup>rd</sup> FW - Capital MAP, Springfield, Illinois</li> </ol>
<p><b>List data users:</b></p>	<p>NGB/          CTDEEP, DNREC, IEPA, KDHE, MEDEP/MECDC, MDE, MassDEP, MPCA/MDOH, NYSDEC, NCDEQ, PADEP, RIDEM, SDDENR, VDEQ, WDNR, WVDEP</p>

**QAPP Worksheet #2 QAPP Identifying Information**

<b>Lead Organization's Program Manager:</b>		Dennis Pinigis, NGB/	
<b>Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)</b>		<b>Required Information</b>	<b>Crosswalk to Related Information and Documents</b>
<b>Project Management and Objectives</b>			
2.1	Title and Approval Page	- Title and Approval Page	- Worksheet #1 Title and Approval Page
2.2	Document Format and Table of Contents	- Table of Contents	- The Table of Contents is provided following the QAPP cover page.
2.2.1	Document Control Format	- QAPP Identifying Information	- Worksheet #2 QAPP Identifying Information
2.2.2	Document Control Numbering System		
2.2.3	Table of Contents		
2.2.4	QAPP Identifying Information		
2.3	Distribution List and Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	- Worksheet #3 Distribution List/ Personnel Sign-Off
2.3.1	Distribution List		
2.3.2	Project Personnel Sign-Off Sheet		Note: Worksheet 3 and 4 combined
2.4	Project Organization	- Project Organizational Chart	Worksheet #5 Project Organization Chart
2.4.1	Project Organizational Chart	- Communication Pathways	Worksheet #6 Communication Pathways
2.4.2	Communication Pathways	- Personnel Responsibilities and Qualifications Table	Worksheet #7 Personnel Responsibilities and Qualifications and
2.4.3	Personnel Responsibilities and Qualifications	- Special Personnel Training Requirements Table	- Worksheet #8 Special Personnel Training Requirements
2.4.4	Special Training Requirements and Certification		
2.5	Project Planning/Problem Definition	- Project Planning Session Documentation (including Data Needs tables)	- Worksheet #9 Project Team Planning Sessions Participants' Sheet and
2.5.1	Project Planning (Scoping)	- Project Scoping Session Participants Sheet	- Worksheet #10 Problem Definition for Project DQOs
2.5.2	Problem Definition, Site History and Background	- Problem Definition, Site History and Background	Site history and more detail contributing to the

**QAPP Worksheet #2 QAPP Identifying Information**

	- Site Maps (historical and present)	project DQOs can be found in the Site-specific WPs (Amec Foster Wheeler)
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific Project Quality Objectives - Measurement Performance Criteria Table	- Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements and - Worksheet #12 Measurement Performance Criteria for project analytes
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	- Worksheet #13 Secondary Data Criteria and Limitations
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	- Worksheet #14 Summary of Project Tasks - Worksheet #15 Reference Limits and Evaluation for specific monitoring activities and - Worksheet #16 Project Schedule/Timeline
<b>Measurement/Data Acquisition</b>		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume and Preservation	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/Standard Operating Procedure Requirements Table	- Worksheet #17 Sampling Design and Rationale - Worksheet #18 Sampling Locations and Methods/SOP Requirements for the project - Worksheet #18 Sampling Locations and

**QAPP Worksheet #2 QAPP Identifying Information**

<p>3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures</p> <p>3.1.2.4 Field Equipment Calibration, Maintenance, Testing and Inspection Procedures</p> <p>3.1.2.5 Supply Inspection and Acceptance Procedures</p> <p>3.1.2.6 Field Documentation Procedures</p>	<ul style="list-style-type: none"> <li>- Analytical Methods/SOP Requirements Table</li> <li>- Field QC Sample Summary Table</li> <li>- Sampling SOPs</li> <li>- Field Equipment Calibration, Maintenance, Testing and Inspection Table</li> </ul>	<p>Methods/SOP Requirements for the project</p> <ul style="list-style-type: none"> <li>- Worksheet #19 Analytical SOP Requirements (Sample Containers Preservation and Holding Times)</li> <li>- Worksheet #20 Sample Quantities and Control Frequencies (Freq.)</li> <li>- Worksheet #21 Field Sampling SOP References</li> <li>- Worksheet #22 Field Equipment Calibration, Maintenance, Testing, and Inspection</li> </ul> <p>More details concerning the sampling design, rationale and procedures can be found in the Site-specific WPs (Amec Foster Wheeler)</p>
<p>3.2 Analytical Tasks</p> <p>3.2.1 Analytical SOPs</p> <p>3.2.2 Analytical Instrument Calibration Procedures</p> <p>3.2.3 Analytical Instrument and Equipment Maintenance, Testing and Inspection Procedures</p> <p>3.2.4 Analytical Supply Inspection and Acceptance Procedures</p>	<ul style="list-style-type: none"> <li>- Analytical SOPs</li> <li>- Analytical SOP References Table</li> <li>- Analytical Instrument Calibration Table</li> <li>- Analytical Instrument and Equipment Maintenance, Testing and Inspection Table</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #23 Analytical SOP References</li> <li>- Worksheet #24 Analytical Instrument Calibration</li> <li>- Worksheet #25 Analytical Instrument and Equipment Maintenance, Testing and Inspection</li> </ul> <p>The analytical SOPs can be found in <b>Attachment D</b></p>
<p>3.3 Sample Collection Documentation, Handling, Tracking and Custody Procedures</p>	<ul style="list-style-type: none"> <li>- Sample Collection Documentation Handling, Tracking and Custody SOPs</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #26 Sample Handling System</li> <li>- Worksheet #27 Sample Custody</li> </ul>

**QAPP Worksheet #2 QAPP Identifying Information**

3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	<ul style="list-style-type: none"> <li>- Sample Container ID</li> <li>- Sample Handling Flow Diagram</li> <li>- Example COC Form and Seal</li> </ul>	Requirements <ul style="list-style-type: none"> <li>- An example of the COC form can be found in <b>Attachment A</b></li> </ul> More details concerning the field sampling procedures can be found in the Site-specific WPs (Amec Foster Wheeler)
3.4 QC Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	<ul style="list-style-type: none"> <li>- QC Samples Table</li> <li>- Screening/Confirmatory Analysis Decision Tree</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #28 presents QC sample information for project analytes</li> </ul>
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	<ul style="list-style-type: none"> <li>- Project Documents and Records Table</li> <li>- Analytical Services Table</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #29 Project Documents and Records</li> <li>- Worksheet #30 Analytical Services</li> </ul>
<b>Assessment/Oversight</b>		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	<ul style="list-style-type: none"> <li>- Assessments and Response Actions</li> <li>- Planned Project Assessments Table</li> <li>- Audit Checklists</li> <li>- Assessment Findings and Corrective Action Responses Table</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #31 Planned Project Assessments</li> <li>- Worksheet #32 Assessment Findings and Corrective Action Responses</li> </ul> Laboratory Certifications can be found in <b>Attachment B</b>
4.2 QA Management Reports	<ul style="list-style-type: none"> <li>- Conformance of project activities to QAPP requirements and procedures</li> <li>- Status of project and schedule delays</li> <li>- Deviations from the approved QAPP and approved amendments to the QAPP</li> <li>- Results of data review activities</li> <li>- Required corrective actions and</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #33 QA Management Reports</li> </ul>



**QAPP Worksheet #2 QAPP Identifying Information**

	<p>effectiveness of corrective action implementation</p> <ul style="list-style-type: none"> <li>- Data usability assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity</li> </ul>	
4.3 Final Project Report	<ul style="list-style-type: none"> <li>- All QA Management Reports attached</li> <li>- Additional data quality concerns and resolution documentation</li> </ul>	- Worksheet #33 QA Management Reports
<b>Data Review</b>		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	<ul style="list-style-type: none"> <li>- Verification (Step I) Process Table</li> <li>- Validation (Steps IIa and IIb) Process Table</li> <li>- Validation (Steps IIa and IIb) Summary Table</li> <li>- Usability Assessment</li> </ul>	<ul style="list-style-type: none"> <li>- Worksheet #34 Verification (Step I) Process</li> <li>- Worksheet #35 Validation (Steps IIa and IIb) Process</li> <li>- Worksheet #36 Validation (Steps IIa and IIb) Summary</li> <li>- Worksheet #37 Usability Assessment</li> </ul>
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	None	NA

**QAPP Worksheet #3 and #4 Distribution List Project Personnel Sign-Off**

QAPP Recipients	Title	Organization	Telephone No.	Fax No.	E-mail Address	Signature/Date QAPP Read
Dennis Pinigis	Contracting Officer's Representative/ Project Manger	NGB/	240-612-8149		<a href="mailto:dennis.j.pinigis.civ@mail.mil">dennis.j.pinigis.civ@mail.mil</a>	
Frances Saunders	Restoration Program Manager	NGB/	240-612-9511		<a href="mailto:frances.d.saunders.civ@mail.mil">frances.d.saunders.civ@mail.mil</a>	
Gregory Wills	Restoration Program Manager	NGB/	240-612-8366		Gregory.k.wills.civ@mail.mil	
Brant Crumbling	Restoration Program Manager	NGB/	240-612-8144		<a href="mailto:Brant.m.crumbling.civ@mail.mil">Brant.m.crumbling.civ@mail.mil</a>	
Keith Freihofer	Restoration Program Manager	NGB/	240-612-8762		<a href="mailto:Keith.e.freihofer.civ@mail.mil">Keith.e.freihofer.civ@mail.mil</a>	
Jody Ann Murata	Restoration Program Manager	NGB/	240-612-8120		<a href="mailto:Jody.a.murata.civ@mail.mil">Jody.a.murata.civ@mail.mil</a>	
Mark Dickerson	Restoration Program Manager	NGB/	240-612-8445		Mark.dickerson2.civ@mail.mil	
Winston Crow	Restoration Program Manager	NGB/	240-612-8155		Winston.k.crow.civ@mail.mil	
Stan Moore	Restoration Program Manager	NGB/	703-730-7215		Stanley.j.moore6.civ@mail.mil	

**QAPP Worksheet #3 and #4 Distribution List Project Personnel Sign-Off**

<b>QAPP Recipients</b>	<b>Title</b>	<b>Organization</b>	<b>Telephone No.</b>	<b>Fax No.</b>	<b>E-mail Address</b>	<b>Signature/Date QAPP Read</b>
Jay Mullett	Program Manager	Amec Foster Wheeler	248-313-3669	248-926-4009	<a href="mailto:jay.mullett@amecfw.com">jay.mullett@amecfw.com</a>	
Rob Singer	PM	Amec Foster Wheeler	207-828-2643	207-772-4762	<a href="mailto:rob.singer@amecfw.com">rob.singer@amecfw.com</a>	
Kerry Tull	Co-PM	Amec Foster Wheeler	207-828-3514	207-772-4762	<a href="mailto:kerry.tull@amecfw.com">kerry.tull@amecfw.com</a>	
Ann Bernhardt	QA/QC Manager	Amec Foster Wheeler	503-639-3400	503-620-7892	<a href="mailto:Ann.bernhardt@amecfw.com">Ann.bernhardt@amecfw.com</a>	
Denise King	Senior Chemist	Amec Foster Wheeler	978-392-5339	978-692-6633	<a href="mailto:denise.king@amecfw.com">denise.king@amecfw.com</a>	
Steve Posten	Regional Base Lead	Amec Foster Wheeler	732-302-9500	709-896-9006	<a href="mailto:Stephen.Posten@amecfw.com">Stephen.Posten@amecfw.com</a>	
Kerri Doyle	Assistant Regional Base Lead	Amec Foster Wheeler	732-302-9500	709-896-9006	<a href="mailto:kerri.doyle@amecfw.com">kerri.doyle@amecfw.com</a>	
Joe Renier	Regional Base Lead	Amec Foster Wheeler	320-963-5742	612-332-2423	<a href="mailto:Joe.Renier@amecfw.com">Joe.Renier@amecfw.com</a>	
Thomas Kaugher	Regional Base Lead	Amec Foster Wheeler	248-313-3694	248-926-4009	<a href="mailto:thomas.kaugher@amecfw.com">thomas.kaugher@amecfw.com</a>	
Todd Coffin	Regional Base Lead	Amec Foster Wheeler	207-828-2624	207-772-4762	<a href="mailto:todd.coffin@amecfw.com">todd.coffin@amecfw.com</a>	

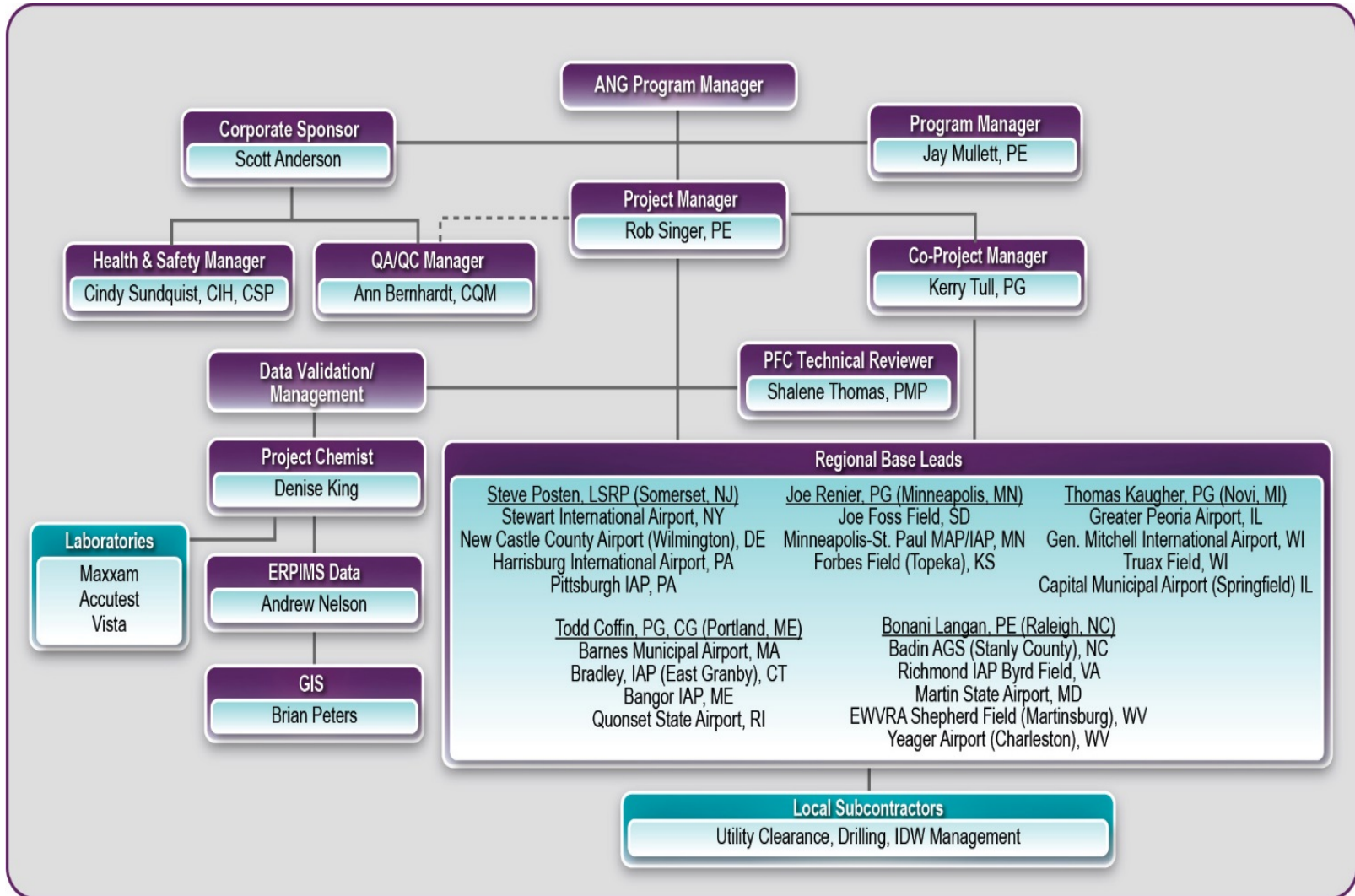
**QAPP Worksheet #3 and #4 Distribution List Project Personnel Sign-Off**

QAPP Recipients	Title	Organization	Telephone No.	Fax No.	E-mail Address	Signature/Date QAPP Read
Bonani Langan	Regional Base Lead	Amec Foster Wheeler	919-765-9977	919-381-9901	<a href="mailto:Bonani.Langan@amecfw.com">Bonani.Langan@amecfw.com</a>	
Andrea Colby	SGS Accutest PM	SGS Accutest Laboratories (SGS Accutest)	407-425-6700	407-425-0707	<a href="mailto:Andrea.colby@sgs.com">Andrea.colby@sgs.com</a>	
Svetlana Izosimova	SGS Accutest QA Manager	SGS Accutest s	407-425-6700	407-425-0707	<a href="mailto:Svetlana.Izosimova@sgs.com">Svetlana.Izosimova@sgs.com</a>	
Melissa DiGrazia	PM	Maxxam Analytics International (Maxxam)	905 817-5784	905-817-5777	<a href="mailto:MDiGrazia@maxxam.ca">MDiGrazia@maxxam.ca</a>	
Salima Haniff	QA Officer	Maxxam	800-563-6266	905-817-5777	<a href="mailto:shaniff@maxxam.ca">shaniff@maxxam.ca</a>	
Martha Maier	Laboratory Director	Vista Analytical Laboratory, Inc.	916-673-1520	916-673-0106	<a href="mailto:mmaier@vista-analytical.com">mmaier@vista-analytical.com</a>	
Bahar Amiri	QA Manager	Vista	916-673-1520	916-673-0106	<a href="mailto:bamiri@vista-analytical.com">bamiri@vista-analytical.com</a>	

**Note:** Copies of the QAPP will be distributed to the individuals above. The copies will consist of the following documents: QAPP and any subsequent QAPP revisions (rev.) and addendums.

**Worksheets #3 and #4** have been combined. The project personnel sign-off table above documents key project personnel who have read the applicable sections of the QAPP and will perform the tasks as described in the QAPP.

**QAPP Worksheet #5 Project Organization Chart**



**QAPP Worksheet #6 Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone No.	Procedure (e.g., Timing, Pathways)
ANG Point of Contact	Program Manager and Contract Officer Representative (COR)	Dennis Pinigis	240-612-8149	Project planning documents will be provided to Dennis Pinigis, NGB/.
Amec Foster Wheeler Point of Contact	Program Manager	Jay Mullett	248-313-3669	Program Manager will be notified of field-related questions or problems by the PM.
Manage Site Activities	PM	Rob Singer	207-828-2643	PM will be notified of field-related questions or problems by phone, e-mail, or fax by close of business the next business day.
QAPP changes in the field	Field Manager	Varies	Varies	The Amec Foster Wheeler PM and Field Manager will be notified of any changes to the QAPP and reasons for the changes immediately. Any minor changes to the QAPP made in the field will be documented in an email from the ANG Program Manager within two business days of the change. Any major changes to the QAPP must be approved by the Amec Foster Wheeler QA/QC Manager, Senior Chemist, and PM, and will be communicated in writing to the ANG Program Manager prior to implementation.
Reporting Lab Data Quality Issues	Laboratory QA Managers	Salima Haniff (Maxxam)	800-563-6266	All QA/QC issues with project field samples will be reported by the Laboratory QA Officers to the QA/QC Manager within two business days. Any significant laboratory data quality issues (i.e., potentially rejected data) will be documented in an email from the Amec Foster Wheeler PM to the ANG Program Manager within two business days of identifying the issue during data review or validation.
		Svetlana Izosimova (SGS Accutest)	407-425-6700	
		Bahar Amiri (Vista)	916-673-1520	
Field and Analytical Corrective Actions	QA/QC Manager and Senior Chemist	Ann Bernhardt	503-639-3400	The need for corrective action for field and analytical issues will be determined by the QA/QC Manager and Senior Chemist in conjunction with the PM, the Field Manager or the Laboratory QA Manager, as appropriate.

**QAPP Worksheet #6 Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone No.	Procedure (e.g., Timing, Pathways)
Release of Analytical Data	Senior Chemist	Denise King	978-392-5339	No final analytical data can be released until verification or validation is completed and the QA/QC Manager has approved the release via the Senior Chemist.
QAPP Amendments	Senior Chemist	Denise King	978-392-5339	Any major changes to the QAPP must be approved by the QA/QC Manager, Senior Chemist, and PM, and communicated to the ANG Program Manager in writing before any change can be implemented.

**QAPP Worksheet #7 Personnel Responsibilities and Qualifications**

<b>Name</b>	<b>Title</b>	<b>Organizational Affiliation</b>	<b>Education and Experience Qualifications</b>
Dennis Pinigis	COR/Program Manager	NGB/	
Jay Mullett	Program Manager	Amec Foster Wheeler	M.S. Engineering Management; B.S. Civil Engineering; Professional Engineer; 21 years
Rob Singer	PM	Amec Foster Wheeler	B.S. Civil Engineering; Professional Engineer; 18 years
Kerry Tull	Co-PM	Amec Foster Wheeler	B.S. Geology; 25 years
Ann Bernhardt	QA/QC Manager	Amec Foster Wheeler	B.S. Environmental Science; Certified Manager of Quality/Organizational Excellence; 24 years
Denise King	Senior Chemist	Amec Foster Wheeler	B.A. Environmental Science; 16 years
Melissa Di Grazia	PM	Maxxam	B.S. Hons Forensic Biology; 7 years
Salima Haniff	QA Manager	Maxxam	B.S Chemistry; 13 years
Andrea Colby	PM	SGS Accutest	B.A. Biology; 26 years
Svetlana Izosimova	QA Manager	SGS Accutest	Ph.D. Colloid Chemistry, 23 years
Martha Maier	Laboratory Director	Vista	B.S. Chemistry; 30 years



**QAPP Worksheet #7 Personnel Responsibilities and Qualifications**

Name	Title	Organizational Affiliation	Education and Experience Qualifications
Bahar Amiri	QA Manager	Vista	B.S. Nutrition Science with emphasis in Biochemistry; 17 years

**Notes:**

The responsibilities of the various team members are summarized below by organization.

***NGB/:***

***ANG Restoration Program Manager***

Responsibilities and duties include the following:

- Provide the ANG's review, comment and concurrence with submitted documents.
- Coordinate with other stakeholders.
- Monitor progress of project activities.
- Review and comment on the QAPP.
- Review of the QA/QC portion of any submitted report.

**Amec Foster Wheeler**

***Program Manager***

Responsibilities and duties include the following:

- Communicate with ANG and other stakeholders.
- Direct Amec Foster Wheeler project team.

### ***PM***

Responsibilities and duties include the following:

- Oversee Amec Foster Wheeler work products.
- Provide Amec Foster Wheeler approval for major project deliverables.

### ***Field Manager***

Responsibilities and duties include the following:

- Coordinate field and laboratory schedules pertaining to relevant site activities.
- Request sample bottles from laboratory.
- Instruct personnel working on relevant site activities.
- Review field instrumentation, maintenance, and calibration to meet quality objectives.
- Review relevant field records and logs.
- Maintain field and laboratory files of notebooks/logs, data reductions and calculations; provide complete copies to the Project Coordinator.
- Develop, establish, and maintain files on relevant site activities.
- Perform data review of field data reductions and reports on relevant site activities.
- Verify that corrective actions are taken for deficiencies cited during audits of relevant site activities.
- Perform overall QA/QC of the relevant portions of the site activities.

### ***QA/QC Manager/Chemist***

Responsibilities and duties include the following:

- Review laboratory data packages.
- Oversee and interface with the analytical laboratory.
- Coordinate field QA/QC procedures with Task Managers (including audits of field activities), concentrating on field analytical measurements and practices to meet DQOs.
- Review field reports.
- Perform and review audit reports.
- Prepare interim QA/QC compliance reports.
- Prepare a QA/QC report in accordance with USEPA guidelines, including an evaluation of field and laboratory data and data usability reports.

### ***Additional Support Staff***

Responsibilities and duties include the following:

- Perform field procedures associated with the investigations as set forth in the Field Sampling Plan /Site Inspection Work Plan (FSP/SIWP).
- Perform field analyses and collect QA samples.
- Calibrate, operate, and maintain field equipment.
- Reduce field data.
- Maintain sample custody.
- Prepare field records and logs.

### **ANALYTICAL LABORATORY**

General responsibilities and duties of the analytical laboratories include the following:

- Perform sample analyses and associated laboratory QA/QC procedures.
- Supply sampling containers and shipping cartons.
- Maintain laboratory custody of sample.
- Adhere to all protocols in the QAPP.

### ***PM***

Responsibilities and duties include the following:

- Serve as primary communication link between project coordinator and laboratory technical staff.
- Monitor workloads and maintain availability of resources.
- Oversee preparation of analytical reports.
- Supervise in-house COC.

### ***Laboratory QA Manager***

Responsibilities and duties include the following:

- Supervise personnel reviewing and inspecting all project-related laboratory activities.
- Conduct audits of all laboratory activities.

**QAPP Worksheet #8 Special Personnel Training Requirements**

<b>Project Function</b>	<b>Specialized Training</b>	<b>Training Provider</b>	<b>Training Date</b>	<b>Personnel/Groups Receiving Training</b>	<b>Personnel Titles/ Organizational Affiliation</b>	<b>Location of Training Records/Certificates</b>
Field Activities	40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER)	Certified Trained Professionals	Not Applicable	Field operations personnel	Consultant Field Staff and Subcontractors	Amec Foster Wheeler project offices and Site Safety and Health Plan

**Note:** Current HAZWOPER training certificates for consultant field staff and subcontractors will be maintained in the Amec Foster Wheeler, Portland, ME office location for each employee performing work at the Site where 40-hour training is required for the position assignment.

**QAPP Worksheet #9 Project Team Planning Sessions Participants Sheet**

Project Name: Phase I Regional Site Inspections for PFCs		Site Name: Multiple ANG Installations			
Projected Date(s) of Sampling: Sampling to begin Spring of 2017.		Site Location: Multiple ANG Installations, Stewart IAP, New Windsor, New York; NCCA, Wilmington, Delaware; Joe Foss Field, South Dakota; HIA, Harrisburg, Pennsylvania; Stanly Count AGS Stanly County, North Carolina; Pittsburgh IAP (AFRC) and ANG), Pittsburgh, Pennsylvania; Richmond IAP Byrd Field, Richmond, Virginia; Martin State Airport, Maryland; EWWRA Shepherd Field, Martinsburg, West Virginia; Barnes MAP, Massachusetts; Yeager Airport, Charleston, West Virginia; MSPIA (AFRC and ANG), Minnesota; Bradley IAP, East Granby, Connecticut; Bangor IAP, Bangor, Maine; Quonset State Airport, Rhode Island; Greater Peoria Airport, Peoria, Illinois; General Mitchell IAP, Wisconsin; Forbes Field, Topeka, Kansas; Truax Field, Wisconsin; and Capital MAP, Springfield, Illinois			
PM: Dennis Pinigis					
Date of Session: 18 October 2016 at Sheppard Hall, 3501 Fetchet Avenue, Joint Base Andrews, Maryland. Attendees are listed below.					
Scoping Session Purpose: Program Kickoff Meeting and review of project scope requirements.					
Name	Title	Affiliation	Phone	E-mail Address	Project Role
Richard McCoy	Branch Chief	NGB/	240-612-8541	Richard.p.mccoy4.civ@mail.mil	NGB/ Branch Chief
Dennis Pinigis	Contracting Officer's Representative	NGB/	240-612-8149	<a href="mailto:Dennis.j.pinigis.civ@mail.mil">Dennis.j.pinigis.civ@mail.mil</a>	Technical Advisor/COR
Stacy MacKay	Contracting Officer	NGB/AQ	703-607-1661	<a href="mailto:Stephanie.a.mackay.civ@mail.mil">Stephanie.a.mackay.civ@mail.mil</a>	Contracting Officer
Susan Klypchak	Contracting Specialist	NGB/AQ	703-607-1220	susan.l.klypchak.civ@mail.mil	Contracting Specialist
Fred Kimble	Restoration Program Manager	NGB/	240-612-8763	Frederick.a.kimble.civ@mail.mil	NGB/ Restoration Program Manager
Frances Saunders	Restoration Program Manager	NGB/	240-612-9511	<a href="mailto:Frances.d.saunders.civ@mail.mil">Frances.d.saunders.civ@mail.mil</a>	NGB/ Restoration Program Manager

**QAPP Worksheet #9 Project Team Planning Sessions Participants Sheet**

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Phone</b>	<b>E-mail Address</b>	<b>Project Role</b>
Gregory Wills	Restoration Program Manager	NGB/	240-612-8366	Gregory.k.wills.civ@mail.mil	NGB/ Restoration Program Manager
Brant Crumbling	Restoration Program Manager	NGB/	240-612-8144	<a href="mailto:Brant.m.crumbling.civ@mail.mil">Brant.m.crumbling.civ@mail.mil</a>	NGB/ Restoration Program Manager
Keith Freihofer	Restoration Program Manager	NGB/	240-612-8762	<a href="mailto:Keith.e.freihofer.civ@mail.mil">Keith.e.freihofer.civ@mail.mil</a>	NGB/ Restoration Program Manager
Jody Ann Murata	Restoration Program Manager	NGB/	240-612-8120	<a href="mailto:Jody.a.murata.civ@mail.mil">Jody.a.murata.civ@mail.mil</a>	NGB/ Restoration Program Manager
Aaron Entyre	Support and Oversight (S&O)	BB & E	248-489-9636	<a href="mailto:aentyre@bbande.com">aentyre@bbande.com</a>	Technical Oversight Contractor
Jim Colmer	S&O	BB & E	248-877-6324	<a href="mailto:jcolmer@bbande.com">jcolmer@bbande.com</a>	Technical Oversight Contractor
Doug Barber	S&O	BB & E	248-705-6749	<a href="mailto:dbarber@bbdande.com">dbarber@bbdande.com</a>	Technical Oversight Contractor
Jay Mullett	Program Manager	Amec Foster Wheeler	248-313-3669	<a href="mailto:Jay.mullett@amecfw.com">Jay.mullett@amecfw.com</a>	Amec Foster Wheeler Program Manager
John Ralston	Senior PM	Amec Foster Wheeler	248-313-3699	<a href="mailto:John.ralston@amecfw.com">John.ralston@amecfw.com</a>	Amec Foster Wheeler Program Manager
Rob Singer	PM	Amec Foster Wheeler	207-828-2643	<a href="mailto:Rob.singer@amecfw.com">Rob.singer@amecfw.com</a>	Amec Foster Wheeler PM
Kerry Tull	Co-PM	Amec Foster Wheeler	207-828-3514	<a href="mailto:Kerry.tull@amecfw.com">Kerry.tull@amecfw.com</a>	Amec Foster Wheeler Co-PM

**QAPP Worksheet #9 Project Team Planning Sessions Participants Sheet**

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Phone</b>	<b>E-mail Address</b>	<b>Project Role</b>
Todd Coffin (via phone)	Regional Base Lead	Amec Foster Wheeler	207-828-2624	<a href="mailto:todd.coffin@amecfw.com">todd.coffin@amecfw.com</a>	Amec Foster Wheeler Regional Base Lead
Steve Posten (via phone)	Regional Base Lead	Amec Foster Wheeler	732-302-9500	<a href="mailto:Stephen.Posten@amecfw.com">Stephen.Posten@amecfw.com</a>	Amec Foster Wheeler Regional Base Lead
Joe Renier (via phone)	Regional Base Lead	Amec Foster Wheeler	320-963-5742	<a href="mailto:Joe.Renier@amecfw.com">Joe.Renier@amecfw.com</a>	Amec Foster Wheeler Regional Base Lead
Shalene Thomas (via phone)	PFC Technical Advisor	Amec Foster Wheeler	612-252-3697	<a href="mailto:Shalene.Thomas@amecfw.com">Shalene.Thomas@amecfw.com</a>	Amec Foster Wheeler PFC Technical Advisor
Tom Kaugher (via phone)	Regional Base Lead	Amec Foster Wheeler	248-313-3694	<a href="mailto:thomas.kaugher@amecfw.com">thomas.kaugher@amecfw.com</a>	Amec Foster Wheeler Regional Base Lead
Bonani Langan (via phone)	Regional Base Lead	Amec Foster Wheeler	919-765-9977	<a href="mailto:Bonani.Langan@amecfw.com">Bonani.Langan@amecfw.com</a>	Amec Foster Wheeler Regional Base Lead
Meeting Discussions/Comments: Discussions are summarized in the Final Kickoff Meeting Minutes, October 26, 2016.					

**QAPP Worksheet #10 Conceptual Site Model**

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
<p><b>Installation Description:</b></p> <ul style="list-style-type: none"> <li>Years of operation</li> <li>Total area occupied by base (acres)</li> <li>Investigation area (acres)</li> <li>Description of historical activities on base</li> <li>Installation mission</li> </ul> <p><b>Site History:</b></p> <ul style="list-style-type: none"> <li>Location(s) on base</li> <li>Years of operation</li> <li>Freq. of operation</li> <li>Activities</li> </ul>	<p><b>Site Characteristics:</b></p> <ul style="list-style-type: none"> <li>Total area (acres)</li> </ul> <p><b>Topography:</b></p> <ul style="list-style-type: none"> <li>General topography across base</li> <li>Topography in vicinity of site</li> <li>Approximate elevation</li> </ul> <p><b>Vegetation:</b></p> <ul style="list-style-type: none"> <li>General overview of vegetation at site</li> <li>Stressed vegetation</li> </ul> <p><b>Surface Water:</b></p> <ul style="list-style-type: none"> <li>Presence of streams, lakes, playas, oceans, etc.</li> <li>Drainage pathways</li> </ul> <p><b>Soils:</b></p> <ul style="list-style-type: none"> <li>Primary soil makeup (e.g. sand, silt, clay, etc.)</li> </ul> <p><b>Geology:</b></p> <ul style="list-style-type: none"> <li>Formation information and name</li> <li>Depth intervals</li> </ul> <p><b>Hydrogeology:</b></p> <ul style="list-style-type: none"> <li>Aquifer formation name</li> <li>Depth to groundwater</li> <li>Saturated thickness</li> <li>Confined, unconfined and/or perched aquifer</li> <li>Groundwater flow direction</li> <li>Hydraulic gradient, hydraulic conductivity and seepage velocity (if known)</li> </ul> <p><b>Meteorology:</b></p> <ul style="list-style-type: none"> <li>Average annual precipitation</li> <li>Wet and dry seasons</li> <li>Average temperature / climate</li> </ul>	<p><b>Contaminants of Potential Concern:</b></p> <ul style="list-style-type: none"> <li>Primary concern</li> <li>As determined from previous reports</li> <li>Note historical contaminants (e.g. chlorinated solvents, fuels, etc.) associated with the site</li> </ul> <p><b>Media of Potential Concern:</b></p> <ul style="list-style-type: none"> <li>Soil, groundwater, and sediment</li> </ul> <p><b>Confirmed Releases:</b></p> <ul style="list-style-type: none"> <li>Per records</li> <li>Dates of release / use</li> <li>Quantities used (if known)</li> </ul> <p><b>Primary Releases from Site:</b></p> <ul style="list-style-type: none"> <li>Infiltration into groundwater (unconsolidated material, fracture flow, etc.)</li> <li>Direct discharge into storm water sewer collection system</li> <li>Direct discharge into drains, plumbing infrastructure and outfall locations</li> <li>Adsorption to soil matrix near source</li> </ul> <p><b>Secondary Releases:</b></p> <ul style="list-style-type: none"> <li>Soil excavations and disposal</li> <li>Pump and treat systems discharges</li> </ul>	<p><b>Current Landowners:</b></p> <ul style="list-style-type: none"> <li>Owner</li> <li>Company name</li> <li>Contact information</li> </ul> <p><b>Current Land Use:</b></p> <ul style="list-style-type: none"> <li>Site specific information</li> </ul> <p><b>Future Land Use:</b></p> <ul style="list-style-type: none"> <li>Potential development</li> <li>Land use restrictions</li> </ul> <p><b>Potential Receptors:</b></p> <ul style="list-style-type: none"> <li>Surface water bodies</li> <li>Municipal groundwater wells</li> <li>Private groundwater wells</li> <li>Humans</li> <li>Biota</li> </ul>	<p><b>Potential Ecological Receptors:</b></p> <ul style="list-style-type: none"> <li>High quality rivers, streams, lakes, etc.</li> <li>Inland and marine plant species, fish, birds, insects, soil invertebrates, and mammals that inhabit or migrate through the site</li> <li>Associated threatened and endangered species</li> </ul> <p><b>Threatened and Endangered Species:</b></p> <ul style="list-style-type: none"> <li>Listed threatened and endangered species</li> </ul>

**Note:** Information contributing to the preliminary Conceptual Site Model for each site will be presented in appropriate sections of the Site-specific WPs. This information at a minimum will include the information presented above as applicable.



**THIS PAGE INTENTIONALLY LEFT BLANK.**

### QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements

#### Step 1: State the Problems:

The problems to be addressed are:

- PFCs are a large group of synthetic fluorinated compounds that are widely used to make everyday products more resistant to heat, stains, grease, and water and as components in firefighting foams, such as Aqueous Film Forming Foam (AFFF) (National Institute of Environmental Health Sciences (NIEHS), 2016 and USAF, 2012). AFFF containing Perfluorooctanesulfonic acids (PFOS) and/or Perfluorooctanoic acids (PFOA) were used by the United States military, including the USAF, for firefighting and firefighting training; and PFCs may be present at USAF installations where AFFF was stored, disposed, intentionally discharged, or spilled (USAF, 2012). The chemical structures of PFCs make them very resistant to breakdown in the environment. Due to their persistence, bioaccumulation potential, and toxicity, PFCs may potentially impact human health and the environment (USEPA, 2014). According to DoD and subsequently under Air Force Instruction (AFI) 32-7020, PFCs (including PFOA/PFOS) are an emerging contaminant since they either do not have promulgated regulatory standards based on peer-reviewed science or they have promulgated standards but it is anticipated that such standards may change due to new science, detection capabilities, or pathways. Health Advisories (HAs) have been established for PFOA and PFOS to protect humans from potential exposure risk to these PFCs, which are not legally enforceable federal standards and are subject to change as new information becomes available. Based on AFI 32-7020, the ANG is required to investigate and mitigate human exposure to PFCs as an emerging contaminant since there is a potential for the presence of an unacceptable risk to human health or the environment.

#### Step 2: Identify the Goals of the Study:

- Conduct initial SIs at identified PRLs to determine the presence (detectable concentrations) or absence of PFCs in sampled media. Collect soil, groundwater, surface water, and/or sediment samples to assess for potential environmental impacts by PFCs at the previously identified PRLs at the following installations: Stewart IAP, New Windsor, New York; NCCA, Wilmington, Delaware; Joe Foss Field, South Dakota; HIA, Harrisburg, Pennsylvania; Stanly County AGS, Stanly County, North Carolina; Pittsburgh IAP (AFRC and ANG), Pittsburgh, Pennsylvania; Richmond IAP Byrd Field, Richmond, Virginia; Martin State Airport, Maryland; EWVRA Shepherd Field, Martinsburg, West Virginia; Barnes MAP, Massachusetts; Yeager Airport, Charleston, West Virginia; MSPIA(AFRC and ANG), Minnesota; Bradley IAP, East Granby, Connecticut; Bangor IAP, Bangor, Maine; Quonset State Airport, Rhode Island; Greater Peoria Airport, Peoria, Illinois; General Mitchell IAP, Wisconsin; Forbes Field, Topeka, Kansas; Truax Field, Wisconsin; and Capital MAP, Springfield, Illinois.

### QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements

#### Step 3: Identify Information Inputs:

Develop an approach to the SIs based on the understanding of Installation conditions obtained through document review and Installation visits and develop a consensus on the inspection approach.

The following new data will be collected to achieve the goals of the study:

- **Stewart IAP**
  - Complete installation of approximately 32 soil borings and the collection of 64 soil samples;
  - Complete the installation of approximately 13 temporary monitoring wells;
  - Collection of groundwater samples from 6 existing monitoring wells and 13 temporary monitoring wells;
  - Collection of 5 surface water and 5 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the ANG SOO for this Task Order.
- **NCCA**
  - Complete installation of approximately 12 soil borings and the collection of 24 soil samples;
  - Complete the installation of approximately 5 temporary monitoring wells;
  - Collection of groundwater samples from 5 existing monitoring wells and 5 temporary monitoring wells;
  - Collection of 3 surface water and 6 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Joe Foss Field**
  - Complete installation of approximately 36 soil borings and the collection of 72 soil samples;
  - Complete the installation of approximately 17 temporary monitoring wells;
  - Collection of groundwater samples from 17 temporary monitoring wells;
  - Collection of 3 surface water and 3 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **HIA**
  - Complete installation of approximately 8 soil borings and the collection of 16 soil samples;
  - Complete the installation of approximately 3 temporary monitoring wells;
  - Collection of groundwater samples from 3 temporary monitoring wells; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Badin AGS**
  - Complete installation of approximately 4 soil borings and the collection of 7 soil samples;
  - Complete the installation of approximately 3 temporary monitoring wells;

**QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements**

- Collection of groundwater samples from 3 temporary monitoring wells;
- Collection of 1 surface water and 1 sediment sample; and
- Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Pittsburgh IAP**
  - Complete installation of approximately 59 soil borings and the collection of 118 soil samples;
  - Complete the installation of approximately 36 temporary monitoring wells;
  - Collection of groundwater samples from 36 temporary monitoring wells;
  - Collection of 16 surface water and 16 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Richmond IAP**
  - Complete installation of approximately 20 soil borings and the collection of 40 soil samples;
  - Complete the installation of approximately 8 temporary monitoring wells;
  - Collection of groundwater samples from 8 temporary monitoring wells;
  - Collection of 5 surface water and 2 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Martin State Airport**
  - Complete installation of approximately 35 soil borings and the collection of 67 soil samples;
  - Complete the installation of approximately 15 temporary monitoring wells;
  - Collection of groundwater samples from 15 temporary monitoring wells;
  - Collection of 5 surface water and 5 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **EWVRA Shepherd Field**
  - Complete installation of approximately 30 soil borings and the collection of 60 soil samples;
  - Complete the installation of approximately 16 temporary monitoring wells;
  - Collection of groundwater samples from 16 temporary monitoring wells;
  - Collection of 1 surface water and 1 sediment sample; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Barnes MAP**
  - Complete installation of approximately 12 soil borings and the collection of 24 soil samples;
  - Complete the installation of approximately 5 temporary monitoring wells;

**QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements**

- Collection of groundwater samples from 5 temporary monitoring wells;
- Collection of 3 sediment samples; and
- Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Yeager Airport**
  - Complete installation of approximately 21 soil borings and the collection of 42 soil samples;
  - Complete the installation of approximately 9 temporary monitoring wells;
  - Collection of groundwater samples from 9 temporary monitoring wells;
  - Collection of 2 surface water and 2 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **MSPIA**
  - Complete installation of approximately 27 soil borings and the collection of 54 soil samples;
  - Complete the installation of approximately 19 temporary monitoring wells;
  - Collection of groundwater samples from 19 temporary monitoring wells;
  - Collection of 3 surface water and 3 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Bradley IAP**
  - Complete installation of approximately 15 soil borings and the collection of 30 soil samples;
  - Complete the installation of approximately 6 temporary monitoring wells;
  - Collection of groundwater samples from 6 temporary monitoring wells; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Bangor IAP**
  - Complete installation of approximately 26 soil borings and the collection of 52 soil samples;
  - Complete the installation of approximately 9 temporary monitoring wells;
  - Collection of groundwater samples from 9 temporary monitoring wells;
  - Collection of 2 surface water and 2 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Quonset State Airport**
  - Complete installation of approximately 6 soil borings and the collection of 14 soil samples;
  - Complete the installation of approximately 4 temporary monitoring wells;
  - Collection of groundwater samples from 4 temporary monitoring wells;

**QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements**

- Collection of 1 surface water and 1 sediment sample; and
- Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Greater Peoria Airport**
  - Complete installation of approximately 27 soil borings and the collection of 54 soil samples;
  - Complete the installation of approximately 15 temporary monitoring wells;
  - Collection of groundwater samples from 15 temporary monitoring wells;
  - Collection of 4 surface water and 4 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **General Mitchell IAP**
  - Complete installation of approximately 47 soil borings and the collection of 94 soil samples;
  - Complete the installation of approximately 19 temporary monitoring wells;
  - Collection of groundwater samples from 3 existing permanent monitoring wells and 19 temporary monitoring wells;
  - Collection of 4 surface water and 4 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Forbes Field**
  - Complete installation of approximately 27 soil borings and the collection of 54 soil samples;
  - Complete the installation of approximately 12 temporary monitoring wells;
  - Collection of groundwater samples from 12 temporary monitoring wells;
  - Collection of 2 surface water and 2 sediment samples; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Truax Field**
  - Complete installation of approximately 27 soil borings and the collection of 54 soil samples;
  - Complete the installation of approximately 12 temporary monitoring wells;
  - Collection of groundwater samples from 12 temporary monitoring wells; and
  - Completion of an SI Report that addresses each PRL addressed in the SOO.
- **Capital MAP**
  - Complete installation of approximately 12 soil borings and the collection of 24 soil samples;
  - Complete the installation of approximately 7 temporary monitoring wells;
  - Collection of groundwater samples from 1 existing permanent monitoring well and 7 temporary monitoring wells;
  - Collection of 2 surface water and 2 sediment samples; and

**QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements**

- Completion of an SI Report that addresses each PRL addressed in the SOO.

**Step 4: Define the Boundaries of the Sampling:**

As the activities in Step 3 progress, the data will be continually reviewed to determine if additional sampling locations are necessary to confirm presence or absence of PFCs. Proposed sampling locations are described in Site-specific WPs. Generally, the inspection will not extend beyond the accepted boundaries of the ANG Installations.

**Step 5: Develop the Analytical Approach:**

Soil, sediment, surface water, and groundwater samples will be collected to determine the presence or absence of PFCs in sampled media. For this SI program, PFC concentrations will be compared against USEPA HAs and/or state-specific regulations, as applicable. For all of the installations, it is expected that samples will be analyzed for the 6 PFCs (included in **Worksheet #15**) on the Unregulated Contaminant Monitoring Rule 3 (UCMR3) list by Method 537.1 Modified. Liquid Chromatography and Tandem Mass Spectrometry (LC/MS/MS) methods will be used to analyze the samples. If PFCs are detected at concentrations exceeding USEPA HAs and/or concentrations established by state regulations, then the PRL will require further investigation. In the absence of local standards and in accordance with the *Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations* dated 27 Aug 2012 (USAF, 2012), further evaluation will be performed if the following HA levels are exceeded in groundwater and or surface water samples collected as part of SI programs at the 20 installations:

- PFOS: 0.07 micrograms per liter (µg/L)
- PFOA: 0.07 µg/L
- PFOS + PFOA : 0.07 µg/L

**Worksheet #15** identifies the laboratory reporting limits for the various media that will be sampled to determine the presence of PFCs. If concentrations of PFCs are above the method reporting limits, the PFC constituent will be considered to be present at the specific PRL.

**Step 6: Specify Performance or Acceptance Criteria:**

The following performance and acceptance criteria will be used during SI activities:

- Daily standardized PFC personal protective equipment and field equipment checklist (provided in the PFC protocol SOP AFW-01 included in **Attachment E**) will be completed by the Amec Foster Wheeler Field Manager for each installation. The QA Manager will review and accept the final checklist.
- The Amec Foster Wheeler Field Manager will verify that field procedures described in the QPP and WP are followed on a daily basis during field work. Deviations from QPP procedures will be promptly addressed and documented by the Amec Foster Wheeler Field Manager.
- Laboratories analyzing SI samples will be accredited under the DoD Environmental Laboratory Accreditation Program (ELAP) for PFC analysis and will adhere to analytical method performance/acceptance criteria as specified in the DoD Quality Systems Manual (QSM) V5.0 (or latest version) and defined on **Worksheets #12**.

**QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements**

- The LC/MS/MS method will provide acceptable detection limits (DLs) to confirm the exceedance of the USEPA HAs, or state-specific criteria at concentrations defined in Step 2 and **Worksheet #15**.
- USEPA Stage 2B data verification will be conducted on 100 percent (%) of the data, and USEPA Stage IV data validation will be conducted on 10 % of the analytical data by an experienced chemist to assess data usability. The data usability will then be evaluated by NGB for final approval. Data completeness of 90 % usable data will be required for this SI program.
- All documents, including WPs and SI Reports will be reviewed and accepted by NGB.

Sampling and laboratory analysis of PFOA and PFOS using the LC/MS/MS methodology will be used to verify that mitigation systems are reducing PFOA and PFOS concentrations to below USEPA HAs, and/or state-specific standards in drinking water.

**Step 7: Develop the Plan for Obtaining Data:**

The overall QA objective is to develop and implement procedures for field sampling — COC, laboratory analysis and reporting — that will provide results to support the evaluation of site data consistent with requirements. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, data reporting, internal QC, audits, preventive maintenance of field equipment and corrective action are described in other sections of this QAPP.

The Site-specific WPs will involve a phased approach to sampling and analysis, including field evaluation of the soil, groundwater, sediment, and surface samples as well as the collection of samples for laboratory analysis. This will provide the opportunity to evaluate and focus each data collection step to optimize the sampling process and maximize the amount of information gained from this inspection.

**Who will use the data?**

Project team, their subcontractors, and overseeing agencies will use the data to assess the efficacy of the project activities and to confirm adherence to the performance standards.

**What will the data be used for?**

The data will be used to produce defensible data for use in determining if NFA is appropriate at each installation and, if not, to develop DQOs for follow-on remedial investigation activities.

**What type of data are needed?**

Data include investigative soil, groundwater, surface water, and sediment samples. Standard protocols for sample collection and handling, sample preparation, and analytical methods will be followed. SOPs are included in this document (**Appendix E**) and in the Site-specific WPs.

**How “good” does the data need to be in order to support the environmental decision?**

The data obtained must be of sufficient quality to support decision making processes for the future of the sites. Definitive data (Level IV) will be required for this project. Data completeness of 90 % usable data will be required for this SI program.



**QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements**

<b>How much data is needed? (No. of samples for each analytical group, matrix and concentration)</b>
The estimated no. of samples and analyses for each media are summarized in <b>Worksheet #20</b> and will be described in the Site-specific WPs.
<b>Where, when, and how should the data be collected/generated?</b>
<p>In general, soil sampling activities will consist of collecting samples for laboratory analysis using direct-push methods and groundwater sampling activities will consist of collecting samples for laboratory analysis using low-flow methods.</p> <p>The specific sampling programs will be described in the Site-specific WPs. Standard protocols for sample collection and handling, sample preparation, and analytical methods will be followed. SOPs for field sampling are referenced in this document (<b>Attachment E</b>) and will be provided in the Site-specific WPs.</p> <p>Field forms are to be completed by the field team either manually or digitally and have been included in <b>Attachment F</b>.</p>
<b>Who will collect and generate the data?</b>
Samples will be collected by Amec Foster Wheeler and submitted to Vista as the primary lab. Both SGS Accutest and Maxxam are backup laboratories.
<b>How will the data be reported?</b>
The analytical data will be provided by the laboratories in PDF. The PDFs will be Level IV data packages which include all necessary information for the recalculation of analytical results. The laboratories will also provide an Environmental Resources Program Information Management System (ERPIMS) compliant electronic data deliverable (EDD). The results of the Installation-specific sampling activities will be provided in the Installation-specific SI Reports.
<b>How will the data be archived?</b>
All data will be archived by NGB in their Joint Base Andrews, Prince George's County, Maryland office. Data will also be retained and stored by Amec Foster Wheeler for a minimum of 7 years.

**QAPP Worksheet #12-1 Measurement Performance Criteria – PFCs at Vista**

Matrix	Water and Soil				
Analytical Group	PFCs – 537.1 Modified				
Concentration Level	Low				
Sampling Procedure <sup>1</sup>	Analytical Method/SOPs <sup>2</sup>	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
WP (Amec Foster Wheeler, To Be Determined [TBD])	537.1 Modified/SOP 49, Rev 8	Precision — Overall	Relative Percent Difference (RPD) < 30 %	Field duplicate	S&A
		Accuracy/Bias Contamination	No analytes detected > 1/2 the limit of quantitation (LOQ) or 1/3 the regulatory limit, whichever is greater.	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	More conservative of laboratory-specified limits or areas within 50-150% of the average areas measured during initial calibration (ICAL)	Internal standards	A
		Accuracy/Bias/Precision	Perfluorobutanesulfonic Acid (PFBS) = 60-130% Perfluoroheptanoic acid (PFHpA), Perfluorohexanoic acid (PFHxA), PFOA, and PFOS = 70-130% Perfluorononanoic Acid (PFNA) = 50-130%, RPD ≤30%	(Matrix Spike [MS]/Matrix Spike Duplicate [MSD])	A
		Accuracy	PFBS = 60-130% PFHpA, PFHxA, PFOA, and PFOS = 70-130% PFNA = 50-130%	Ongoing Precision & Recovery (OPR) Sample	A

**Notes:**

1. Reference no. from QAPP Worksheet #21.
2. Reference no. from QAPP Worksheet #23.

**QAPP Worksheet #12-2 Measurement Performance Criteria – SGS Accutest**

Matrix	Water and Soil				
Analytical Group	PFCs – 537.1 Modified				
Concentration Level	Low				
Sampling Procedure <sup>1</sup>	Analytical Method/SOP <sup>2</sup>	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or S&A
WP (Amec Foster Wheeler, TBD)	MS014.2, OP058.4, and OP063.1	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias Contamination	< ½ LOQ, <1/10 the concentration detected in an associated sample, or <1/10 the regulatory limit, whichever is highest	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	More conservative of laboratory-specified limits or areas within 50-150% of the average areas measured during ICAL	Internal standards	A
		Accuracy/Bias/Precision	70-130%, RPD ≤30%	MS/MSD	A
		Accuracy/Bias	70-130%	Laboratory Control Sample (LCS)	A
		Accuracy/Bias	Perfluoro-n-[1,2-13C2] hexanoic acid (13C2-PFHxA) and Perfluoro-n-[1,213C2] decanoic acid (13C2-PFDA) 70-130% recovery	Surrogates	A

**Notes:**

1. Reference no. from QAPP Worksheet #21.
2. Reference no. from QAPP Worksheet #23.

**QAPP Worksheet #12-3 Measurement Performance Criteria – PFCs at Maxxam**

Matrix	Water and Soil				
Analytical Group	PFCs – 537.1 Modified				
Concentration Level	Low				
Sampling Procedure <sup>1</sup>	Analytical Method/SOPs <sup>2</sup>	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or S&A
WP (Amec Foster Wheeler, TBD)	537.1 Modified/ Compliance Assurance Monitoring (CAM) SOP-00894/10	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias Contamination	No analytes detected > 1/2 the LOQ or the regulatory limit, whichever is greater.	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	50-150% of the average areas measured during ICAL	Internal standards	A
		Accuracy/Bias/Precision	70-130% recovery, RPD ≤30%	MS/MSD	A
		Accuracy/Bias	70-130% recovery	LCS	A
		Accuracy/Bias	Water - 70-130% recovery Soil - 50-130% recovery	Surrogates	A

**Notes:**

1. Reference no. from QAPP Worksheet #21.
2. Reference no. from QAPP Worksheet #23.

**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
Stewart IAP				
Preliminary Assessments	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, New York Air National Guard, Stewart Air National Guard Base	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
NCCA				
Preliminary Assessments	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Delaware Air National Guard Base, New Castle, Delaware	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Joe Foss Field				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, South Dakota Air National Guard, 114th Fighter Wing, Sioux Falls, South Dakota	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.

**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
HIA				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Harrisburg Air National Guard Base, Harrisburg International Airport, Middletown, Pennsylvania.	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Stanly County AGS				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Stanly County Air National Guard Base, New London, North Carolina.	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Pittsburgh IAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Pittsburgh Air National Guard Base, Coraopolis, Pennsylvania	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.

**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
Richmond IAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Former Richmond Air National Guard Base, Richmond, Virginia.	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Martin State Airport				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Martin State Air National Guard Base, Baltimore, Maryland.	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
E WVRA				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, West Virginia Air National Guard Base, Martinsburg, West Virginia	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.

**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
Barnes MAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Barnes Air National Guard Base, Westfield, Massachusetts.	BB&E, 2016	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Yeager Airport				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, McLaughlin Air National Guard Base, Charleston, West Virginia.	BB&E, 2015	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
MSPIA				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Minnesota Air National Guard Base, Minneapolis, Minnesota.	BB&E, 2016	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.



**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
Bradley IAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Bradley Air National Guard Base, East Granby, Connecticut.	BB&E, 2016	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Bangor IAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Bangor Air National Guard Site, Bangor, Maine.	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Quonset State Airport				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Quonset Air National Guard Base, North Kingstown, Rhode Island.	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.

**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
Greater Peoria Airport				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Peoria Air National Guard Base, Peoria, Illinois.	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
General Mitchell IAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Wisconsin Air National Guard Base, General Mitchell International Airport, Milwaukee, Wisconsin.	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Forbes Field				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Forbes Field Air National Guard Base, Topeka, Kansas.	BB&E, 2016.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.

**QAPP Worksheet #13 Secondary Data Criteria and Limitations**

Data Type	Data Source (Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
Truax Field				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Wisconsin Air National Guard Base, Truax Field, Dane County Regional Airport, Madison, Wisconsin	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.
Capital MAP				
Preliminary Assessment	Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Illinois Air National Guard, Abraham Lincoln Capital Airport, Springfield, Illinois.	BB&E, 2015.	ID of potential PFC release areas as well as historical use and dates of operation.	Assessments were developed based upon reporting of others and/or interviews of former Base personnel.

### QAPP Worksheet #14 Summary of Project Tasks

#### Sampling Tasks

To meet the project goals defined in **Worksheet #11**, SIs will be initiated at 20 installations. The SIs will include site reconnaissance (as needed to refine the scope of sampling activities) as well as collection of soil, sediment, surface water, and groundwater samples to determine the presence of PFCs at identified AFFF areas. The specific sampling and analytical procedures for implementing the SIs will be described in 20 WPs. Based on the scope of work the SIs will include the activities identified in **Worksheet #14/16** and described below. It is expected the scope of work identified in **Worksheet #14/16** of this QPP will be modified based on the scoping visits and review of pertinent background documentation for each installation. The final SI scope will be described in detail in WPs that will be reviewed by ANG and the appropriate regulatory agency, as applicable, for review and approval prior to the commencement of field activities. Fieldwork will be conducted in accordance with the SOPs provided in **Attachment E**.

SOPs (**Attachment E**) applicable to each installation/PRL will be reviewed prior to implementation of field activities; the SOPs consist of:

- SOP AFW-01: *Field Sampling Protocols to Avoid Cross-Contamination of PFCs;*
- SOP AFW-02: *Soil Sampling;*
- SOP AFW-03: *Groundwater Sampling;*
- SOP AFW-04: *Monitoring Well Installation;*
- SOP AFW-05: *Monitoring Well Development;*
- SOP AFW-06: *Borehole Abandonment;*
- SOP AFW-07: *Sediment Sampling;*
- SOP AFW-08: *Surface Water Sampling;*
- SOP AFW-09: *Influent and Effluent Water Sampling;*
- SOP AFW-10: *Drilling, Development, and Heavy Equipment Decontamination;*
- SOP AFW-11: *Sampling Handling and Custody;*
- SOP AFW-12: *Protocol to Provide Water Free of Perfluorinated Compounds for Collection of Field Blanks and Equipment Blanks;*
- SOP AFW-13: *Electronic Field Forms.*

Field sampling forms which will be completed manually or digitally are included in **Attachment F**.

#### PFC Sampling Considerations

Given the low DLs associated with PFC analysis and the many potential sources of trace levels of PFCs, field personnel are advised to strictly follow protocols to help mitigate the potential for false detections of PFCs. A list of prohibited and acceptable clothing/equipment for sampling at PFC sites is

**QAPP Worksheet #14 Summary of Project Tasks**

provided in **SOP AFW-01 Table 1**. In addition, a *Protocol to Provide Water Free of Perfluorinated Compounds for Collection of Field Blanks and Equipment Blanks* has also been included as **SOP AFW-12**.

**QC Samples**

One duplicate sample will be collected at a rate of 10 % (one for each 10 samples) for each media sampled. In addition, duplicate sample volume will be collected at a rate of 5 % (one for each 20 samples) for MS/MSD analysis. In addition, one rinsate sample will be collected for each day that samples are collected unless dedicated equipment is used. One field blank per lot of laboratory-provided “PFC-free” deionized water will be collected and analyzed for PFCs.

**Analysis Tasks**

Samples will be processed, prepared, and analyzed by Maxxam, SGS Accutest, or Vista as described in this QAPP (Amec Foster Wheeler, 2016).

**QC Tasks**

The samples will be collected and processed and the waste disposed as documented in field SOPs to be provided in Site-specific WPs. The QC samples are described in **Worksheet #28**.

**Secondary Data**

See **Worksheet #13**.

**Data Management Tasks**

The purpose of data management is to ensure that all of the necessary data are accurate and readily accessible to meet the analytical and reporting objectives of the project. The analytical results will be provided by the laboratory in the ERPIMS lab submittal EDD format. Laboratory EDDs will be loaded to the ERPToolsX software where it will be checked and supplemented with field-derived data. Final ERPIMS submittal will be complete after all data in ERPToolsX have been loaded, checked, and final review performed by Amec Foster Wheeler ERPIMS staff.

**Documentation and Records**

**Field sample ID** — to be described in the site-specific WPs

- **Field documentation** — Field personnel will provide comprehensive documentation covering various aspects of field sampling, field analysis, and sample COC. This documentation consists of a record that allows reconstruction of field events and sample handling to aid in the data review and interpretation process. Documents, records, and information relating to the performance of the field work will be retained in the project file for a minimum of seven years.
- **Laboratory project files** — The laboratory will establish a file for pertinent data. The file will include correspondence, faxed information, phone logs, and COC forms. The laboratory will retain project files and data packages for a period not less than 5 years. The NGB and/or its designated representative will retain copies of the analytical data reports.

### QAPP Worksheet #14 Summary of Project Tasks

- **Laboratory logbooks** — Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and to document important aspects of the work, including the associated QCs. As such, logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory. Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with one stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages of logbooks that are not used will be completed by lining out unused portions. Information regarding the sample, analytical procedures performed, and results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated and will also identify the analyst; instrument used, and instrument conditions. Laboratory notebooks will be periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance with this QAPP. All entries and calculations will be verified by the laboratory group leader. If all entries on the pages are correct, the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.
- **Computer and hard copy storage** — All electronic files and deliverables will be retained by the laboratory for not less than 5 years; hard copy data packages (or electronic copies) will also be retained for not less than 5 years. The NGB and/or its designated representative will retain copies of the analytical data reports.
- **Field data reporting** — Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets and/or on forms. Such data will be reviewed by the appropriate Field Manager for adherence to the Installation-specific FSP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and (as necessary) incorporated into the data evaluation process. If applicable, field data forms and calculations will be processed and included in appendices to the appropriate reports (when generated). The original field logs, documents, and data reductions will be kept in the project file at the Amec Foster Wheeler office in Portland, Maine.
- **Laboratory data reporting** — Data reports for all parameters will include, at a minimum, the following items:

**Narrative:** Summary of activities that took place during sample analysis, including the following information:

- Laboratory name and address
- Date of sample receipt
- Cross reference of laboratory ID no. to contractor sample ID
- Analytical methods used
- Deviations from specified protocol
- Corrective actions taken

### QAPP Worksheet #14 Summary of Project Tasks

Included with the narrative will be any sample handling documents, including field and internal COC forms, air bills, and shipping tags.

**Analytical Results:** These will be reported according to analysis type and include the following information, as applicable:

- Sample ID
- Laboratory ID
- Date of collection
- Date of receipt
- Date of extraction
- Date of analysis
- DL

Sample results on the report forms will be corrected for dilutions. Soil data will be reported on a dry-weight basis. Unless otherwise specified, all results will be reported uncorrected for blank contamination.

The data associated with Contract Laboratory Program-equivalent reporting will be expanded to include supporting documentation necessary to provide a Contract Laboratory Program-equivalent package. This additional documentation will include, but not be limited to, raw data required to recalculate any result, including instrument printouts and quantitation reports. The report also will include standards used in calibration and calculation of analytical results; sample extraction, digestion, and other preparation logs; standard preparation logs; instrument run logs; and moisture content calculations.

- **Data reporting levels are as follows:**

- **Level 4 — Full Reporting:** Full Contract Laboratory Program or Contract Laboratory Program-type reporting is used for those analyses that, based on the intended data use, require full documentation. Laboratory analysis of all SI samples will be performed with full Level IV reporting, including raw data.

#### Assessment/Audit Tasks

Performance and systems audits will be completed in the field and laboratory during the SIs, as described below and in **Worksheets #31 and #32**.

1. **Field Audits** — The following field performance and systems audits will be completed during this project.

The Field Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field activities to verify that the activities are performed according to established procedures. Field performance audits may be performed by the PM (or his designee). The auditor(s) will review field reports and communicate concerns to the PM and/or Field Manager, as appropriate.

The no. and freq. of field performance audits conducted will be determined independently by the PM or Field Manager. The PM (or his/her designee) will conduct field performance audits at a freq. of approximately one per month during field activities. The observations made during

## QAPP Worksheet #14 Summary of Project Tasks

field performance audits and any recommended changes/deviations to the field procedures will be recorded and documented.

### 2. Laboratory Audits

Periodic internal laboratory audits are conducted by the Laboratory QA Manager. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the laboratory QA manual and SOPs. Results of the audits are summarized and issued to each department supervisor, Laboratory Manager, and Laboratory Director. A systems audit of each laboratory may also be performed by the QA/QC Manager to determine whether the procedures implemented by each laboratory comply with the QA manual and SOPs. As a participant in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification, in addition to the laboratory's internal audits. Audits are usually conducted every one or two years and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sample handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are formally documented and submitted to the laboratory for corrective action, if necessary.

The NGB reserves the right to conduct an on-site audit of the laboratory prior to the start of analyses for the project; however none are scoped at this time. Additional audits may be performed during the course of the project, as deemed necessary.

### 3. Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the actions are described below.

#### a. Field Procedures

If, during fieldwork, a condition is noted by the field crew that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition ID, cause, and corrective action implemented by the Field Program Coordinator or a designee will be documented on a Corrective Action Form and reported to the appropriate Field Manager, QA/QC Manager, and PM.

Examples of situations that would require corrective actions are provided below:

- Protocols as defined by the QAPP and/or site-specific FSPs have not been followed.
- Equipment is not in proper working order or is not properly calibrated.
- QC requirements have not been met.
- Issues resulting from performance or systems audits have not been resolved.

Project personnel will continuously monitor ongoing work performance as part of daily responsibilities.

#### b. Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this



### QAPP Worksheet #14 Summary of Project Tasks

condition. Condition ID, cause, and corrective action taken will be documented and reported to the PM and QA/QC Manager.

Corrective action may be initiated, at a minimum, under the following conditions:

- Protocols as defined by this QAPP have not been followed.
- Predetermined data acceptance standards are not obtained.
- Equipment is not in proper working order or calibrated.
- Sample and test results are not completely traceable.
- QC requirements have not been met.
- Issues resulting from performance or systems audits have not been resolved.

Laboratory personnel will continuously monitor ongoing work performance as part of daily responsibilities. Corrective action is initiated at the point where the problem has been identified. At whatever level this occurs (analyst, supervisor, data review, or QC); it is brought to the attention of the Laboratory QA Manager and, ultimately, the Laboratory Director. Final approval of any action deemed necessary is subject to the approval of the Laboratory Director.

Any corrective action deemed necessary based on system or performance audits, the analytical results of split samples, or the results of data review will be implemented. The corrective action may include sample re-extraction, re-preparation, reanalysis, cleanup, dilution, matrix modification, or other activities.

#### Data Review Tasks

See **Worksheets #34 through #37**. Data validation will be conducted in accordance with QAPP **Worksheet #36**: Data Validation Procedures. The results of data validation will be presented in a Data Validation Report that will be included as an appendix in the SI Report.

**QAPP Worksheet #15-1 Action Limits and Laboratory-Specific Detection/Quantitation Limits - Vista**

<b>Matrix: Aqueous</b>							
<b>Analytical Method: USEPA Method 537.1 Modified (PFCs by LC/MS/MS)</b>							
<b>Analyte<sup>1</sup></b>	<b>Acronym</b>	<b>Chemical Abstract Service (CAS) No.</b>	<b>Project Action Limit<sup>2</sup> (µg/L)</b>	<b>Project Quantitation Limit Goal (µg/L)</b>	<b>Achievable Laboratory Limits</b>		
					<b>LOQ (µg/L)</b>	<b>Limit of Detection (LOD) (µg/L)</b>	<b>DL (µg/L)</b>
Perfluorobutanesulfonic acid	PFBS	375-73-5	NA	NA	0.00800	0.00500	0.00218
Perfluoroheptanoic acid	PFHpA	375-85-9	NA	NA	0.00800	0.00500	0.00218
Perfluorohexane sulfonic acid	PFHxS	355-46-4	NA	NA	0.00800	0.00500	0.00218
Perfluorononanoic acid	PFNA	375-95-1	NA	NA	0.00800	0.00500	0.00218
Perfluorooctanoic acid	PFOA	335-67-1	0.07	0.007	0.00800	0.00500	0.00218
Perfluorooctanesulfonic acid	PFOS	1763-23-1	0.07	0.007	0.00800	0.00500	0.00218
Perfluorooctanesulfonic acid <i>and</i> Perfluorooctanoic acid	PFOS <i>and</i> PFOA	1763-23-1 335-67-1	0.07	0.007	0.00800	0.00500	0.00218

**Notes:**

<sup>1</sup> This analyte list represents the PFCs that are included on UCMR3 which will be used at each Installation.

<sup>2</sup> USEPA Drinking Water HAs for PFOA (USEPA, May 2016b) and PFOS (USEPA, May 2016a). The HAs will be used as the action criteria unless state-specific regulations are applicable.

DL - The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the detection limit, the false positive rate (Type I error) is 1 %.

LOD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1 %.

LOQ - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest ICAL standard.

LODs and DLs are subject to change based on the results of the most current DL and LOD studies.

HA – Concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over specific exposure durations. Potential for human health and environmental risk will be evaluated.

Project Quantitation Limit Goal - The lowest concentration of a target analyte the laboratory must be able to achieve, as determined by the project DQO.

**QAPP Worksheet #15-2 Action Limits and Laboratory-Specific Detection/Quantitation Limits - Vista**

<b>Matrix: Soil</b>							
<b>Analytical Method: USEPA Method 537.1 Modified (PFCs by LC/MS/MS)</b>							
<b>Analyte<sup>1</sup></b>	<b>Acronym</b>	<b>CAS No.</b>	<b>Project Action Limit<sup>2</sup> micrograms per kilogram (µg/kg)</b>	<b>Project Quantitation Limit Goal (µg/kg)</b>	<b>Achievable Laboratory Limits</b>		
					<b>LOQ (µg/kg)</b>	<b>LOD (µg/kg)</b>	<b>DL (µg/kg)</b>
Perfluorobutanesulfonic acid	PFBS	375-73-5	NA	NA	2.00	1.00	0.285
Perfluorobutanoic acid	PFBA	375-22-4	NA	NA	2.00	1.00	0.285
Perfluoroheptanoic acid	PFHpA	375-85-9	NA	NA	2.00	1.00	0.285
Perfluorohexane sulfonic acid	PFHxS	355-46-4	NA	NA	2.00	1.00	0.285
Perfluorononanoic acid	PFNA	375-95-1	NA	NA	2.00	1.00	0.285
Perfluorooctanoic acid	PFOA	335-67-1	12,000	1,200	2.00	1.00	0.285
Perfluorooctanesulfonic acid	PFOS	1763-23-1	5,000	500	2.00	1.00	0.285

**Notes:**

<sup>1</sup> This analyte list represents the PFCs) that are included on UCMR3 which will be used at each Installation.

<sup>2</sup> Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations (USAF, 2012).

DL – The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the detection limit, the false positive rate (Type I error) is 1 %.

LOD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1 %.

LOQ - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest ICAL standard.

LODs and DLs are subject to change based on the results of the most current DL and LOD studies.

Project Quantitation Limit Goal - The lowest concentration of a target analyte the laboratory must be able to achieve, as determined by the project DQO.

**QAPP Worksheet #15-3 Action Limits and Laboratory-Specific Detection/Quantitation Limits – SGS Accutest**

<b>Matrix: Aqueous</b>							
<b>Analytical Method: USEPA Method 537.1 Modified (PFCs by LC/MS/MS)</b>							
<b>Analyte<sup>1</sup></b>	<b>Acronym</b>	<b>CAS No.</b>	<b>Project Action Limit<sup>2</sup> (µg/L)</b>	<b>Project Quantitation Limit Goal (µg/L)</b>	<b>Achievable Laboratory Limits</b>		
					<b>LOQ (µg/L)</b>	<b>LOD (µg/L)</b>	<b>DL (µg/L)</b>
Perfluorobutanesulfonic acid	PFBS	375-73-5	NA	NA	0.020	0.0128	0.008
Perfluoroheptanoic acid	PFHpA	375-85-9	NA	NA	0.020	0.0128	0.008
Perfluorohexane sulfonic acid	PFHxS	355-46-4	NA	NA	0.020	0.0128	0.008
Perfluorononanoic acid	PFNA	375-95-1	NA	NA	0.020	0.0064	0.004
Perfluorooctanoic acid	PFOA	335-67-1	0.07	0.007	0.020	0.0064	0.004
Perfluorooctanesulfonic acid	PFOS	1763-23-1	0.07	0.007	0.020	0.0064	0.004
Perfluorooctanesulfonic acid <i>and</i> Perfluorooctanoic acid	PFOS <i>and</i> PFOA	1763-23-1 335-67-1	0.07	0.007	0.04	0.0128	0.008

**Notes:**

<sup>1</sup> This analyte list represents the PFCs that are included on UCMR3 which will be used at each Installation.

<sup>2</sup> USEPA Drinking Water HAs for PFOA (USEPA, May 2016b) and PFOS (USEPA, May 2016a). The HAs will be used as the action criteria unless state-specific regulations are applicable.

DL - The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the detection limit, the false positive rate (Type I error) is 1 %.

LOD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the limit of detection, the false negative rate (Type II error) is 1 %.

LOQ - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest ICAL standard.

LODs and DLs are subject to change based on the results of the most current DL and LOD studies.

HA – Concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over specific exposure durations. Potential for human health and environmental risk will be evaluated.

Project Quantitation Limit Goal - The lowest concentration of a target analyte the laboratory must be able to achieve, as determined by the project DQO.

**QAPP Worksheet #15-4 Action Limits and Laboratory-Specific Detection/Quantitation Limits – SGS Accutest**

<b>Matrix: Soil</b>							
<b>Analytical Method: USEPA Method 537.1 Modified (PFCs by LC/MS/MS)</b>							
<b>Analyte<sup>1</sup></b>	<b>Acronym</b>	<b>CAS No.</b>	<b>Project Action Limit<sup>2</sup> (µg/kg)</b>	<b>Project Quantitation Limit Goal (µg/kg)</b>	<b>Achievable Laboratory Limits</b>		
					<b>LOQ (µg/kg)</b>	<b>LOD (µg/kg)</b>	<b>DL (µg/kg)</b>
Perfluorobutanesulfonic acid	PFBS	375-73-5	NA	NA	12.5	10	5.0
Perfluoroheptanoic acid	PFHpA	375-85-9	NA	NA	12.5	10	5.0
Perfluorohexane sulfonic acid	PFHxS	355-46-4	NA	NA	12.5	10	5.0
Perfluorononanoic acid	PFNA	375-95-1	NA	NA	12.5	10	5.0
Perfluorooctanoic acid	PFOA	335-67-1	12,000	1,200	12.5	10	5.0
Perfluorooctanesulfonic acid	PFOS	1763-23-1	5,000	500	12.5	10	5.0

**Notes:**

<sup>1</sup> This analyte list represents the PFCs that are included on UCMR3 which will be used at each Installation.

<sup>2</sup> Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations (USAF, 2012).

DL - The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the detection limit, the false positive rate (Type I error) is 1 %.

LOD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the limit of detection, the false negative rate (Type II error) is 1 %.

LOQ - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

LODs and DLs are subject to change based on the results of the most current DL and LOD studies.

Project Quantitation Limit Goal - The lowest concentration of a target analyte the laboratory must be able to achieve, as determined by the project DQO.

**QAPP Worksheet #15-5 Action Limits and Laboratory-Specific Detection/Quantitation Limits – Maxxam**

<b>Matrix: Aqueous</b>							
<b>Analytical Method: USEPA Method 537.1 Modified (PFCs by LC/MS/MS)</b>							
<b>Analyte<sup>1</sup></b>	<b>Acronym</b>	<b>CAS No.</b>	<b>Project Action Limit<sup>2</sup> (µg/L)</b>	<b>Project Quantitation Limit Goal (µg/L)</b>	<b>Achievable Laboratory Limits</b>		
					<b>LOQ (µg/L)</b>	<b>LOD (µg/L)</b>	<b>DL (µg/L)</b>
Perfluoroheptanoic acid	PFHpA	375-85-9	NA	NA	0.02	0.010	0.0047
Perfluorooctanoic acid	PFOA	335-67-1	0.07	0.007	0.02	0.014	0.0053
Perfluorononanoic acid	PFNA	375-95-1	NA	NA	0.02	0.010	0.0046
Perfluorobutanesulfonic acid	PFBS	375-73-5	NA	NA	0.02	0.007	0.0019
Perfluorohexane sulfonic acid	PFHxS	355-46-4	NA	NA	0.02	0.010	0.0040
Perfluorooctanesulfonic acid	PFOS	1763-23-1	0.07	0.007	0.02	0.010	0.0033
Perfluorooctanesulfonic acid <i>and</i> Perfluorooctanoic acid	PFOS <i>and</i> PFOA	1763-23-1 335-67-1	0.07	0.007	0.02	0.014	0.0053

**Notes:**

<sup>1</sup> This analyte list represents the PFCs that are included on UCMR3 which will be used at each Installation.

<sup>2</sup> USEPA Drinking Water HAs for PFOA (USEPA, May 2016b) and PFOS (USEPA, May 2016a). The HAs will be used as the action criteria unless state-specific regulations are applicable.

Maxxam is unable to report DLs, LODs, and LOQs due to limits with its data system. Maxxam's LOQ is listed as a reportable detection level (RDL) on the analytical report. Instead of reporting nondetected results to the LOD per QSM 5.0 reporting conventions, nondetected results are reported at the DL and for the purposes of data validation the LOD is considered to be the same no. as the DL.

DL - The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the detection limit, the false positive rate (Type I error) is 1 %.

LOD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the limit of detection, the false negative rate (Type II error) is 1 %.

LOQ - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest ICAL standard.

LODs and DLs are subject to change based on the results of the most current DL and LOD studies.

HA – Concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over specific exposure durations. Potential for human health and environmental risk will be evaluated.

Project Quantitation Limit Goal - The lowest concentration of a target analyte the laboratory must be able to achieve, as determined by the project DQO.

**QAPP Worksheet #15-6 Action Limits and Laboratory-Specific Detection/Quantitation Limits - Maxxam**

<b>Matrix: Soil</b>							
<b>Analytical Method: USEPA Method 537.1 Modified (PFCs by LC/MS/MS)</b>							
<b>Analyte<sup>1</sup></b>	<b>Acronym</b>	<b>CAS No.</b>	<b>Project Action Limit<sup>2</sup> (µg/kg)</b>	<b>Project Quantitation Limit Goal (µg/kg)</b>	<b>Achievable Laboratory Limits</b>		
					<b>LOQ (µg/kg)</b>	<b>LOD (µg/kg)</b>	<b>DL (µg/kg)</b>
Perfluoroheptanoic acid	PFHpA	375-85-9	NA	NA	1.0	0.4	0.14
Perfluorooctanoic acid	PFOA	335-67-1	12,000	1,200	1.0	0.2	0.060
Perfluorononanoic acid	PFNA	375-95-1	NA	NA	1.0	0.2	0.084
Perfluorobutanesulfonic acid	PFBS	375-73-5	NA	NA	1.0	0.4	0.17
Perfluorohexane sulfonic acid	PFHxS	355-46-4	NA	NA	1.0	0.4	0.13
Perfluorooctanesulfonic acid	PFOS	1763-23-1	5,000	500	1.0	0.4	0.12

**Notes:**

<sup>1</sup> This analyte list represents the PFCs that are included on UCMR3 which will be used at each Installation.

<sup>2</sup> Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations (USAF, 2012). Maxxam is unable to report DLs, LODs, and LOQs due to limits with its data system. Maxxam's LOQ is listed as a RDL on the analytical report. Instead of reporting nondetected results to the LOD per QSM 5.0 reporting conventions, nondetected results are reported at the DL and for the purposes of data validation the LOD is considered to be the same no. as the DL.

DL - The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the detection limit, the false positive rate (Type I error) is 1 %.

LOD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the limit of detection, the false negative rate (Type II error) is 1 %.

LOQ - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest ICAL standard.

LODs and DLs are subject to change based on the results of the most current DL and LOD studies.

Project Quantitation Limit Goal - The lowest concentration of a target analyte the laboratory must be able to achieve, as determined by the project DQO.

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Stewart IAP, New Windsor, New York</b>					
Kickoff Meeting	Amec Foster Wheeler	December 1, 2016	December 1, 2016	Meeting Minutes	December 15, 2016
WP	Amec Foster Wheeler	November 17, 2016	April 28, 2017	SI WP	April 28, 2017
Field Work	Amec Foster Wheeler	May 5, 2017	May 25, 2017	None	
SI Report	Amec Foster Wheeler	June 2, 2017	December 1, 2017	SI Report	December 1, 2017
<b>NCCA, Wilmington, Delaware</b>					
Kickoff Meeting	Amec Foster Wheeler	March 23, 2017	March 23, 2017	Meeting Minutes	April 6, 2017
WP	Amec Foster Wheeler	March 10, 2017	August 18, 2017	SI WP	August 18, 2017
Field Work	Amec Foster Wheeler	August 24, 2017	August 31, 2017	None	
SI Report	Amec Foster Wheeler	September 8, 2017	March 9, 2018	SI Report	March 9, 2018



**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Joe Foss Field, Sioux Falls, South Dakota</b>					
Kickoff Meeting	Amec Foster Wheeler	March 15, 2017	March 15, 2017	Meeting Minutes	March 29, 2017
WP	Amec Foster Wheeler	March 2, 2017	August 8, 2017	SI WP	August 8, 2017
Field Work	Amec Foster Wheeler	August 14, 2017	August 30, 2017	None	
SI Report	Amec Foster Wheeler	September 7, 2017	March 6, 2018	SI Report	March 6, 2018
<b>HIA, Harrisburg, Pennsylvania</b>					
Kickoff Meeting	Amec Foster Wheeler	December 22, 2016	December 22, 2016	Meeting Minutes	January 6, 2017
WP	Amec Foster Wheeler	December 9, 2016	May 19, 2017	SI WP	May 19, 2017
Field Work	Amec Foster Wheeler	May 26, 2017	May 30, 2017	None	
SI Report	Amec Foster Wheeler	June 7, 2017	December 5, 2017	SI Report	December 5, 2017

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Stanly County AGS, Stanly County, North Carolina</b>					
Kickoff Meeting	Amec Foster Wheeler	March 29, 2017	March 29, 2017	Meeting Minutes	April 12, 2017
WP	Amec Foster Wheeler	March 16, 2017	August 22, 2017	SI WP	August 22, 2017
Field Work	Amec Foster Wheeler	August 28, 2017	August 30, 2017	None	
SI Report	Amec Foster Wheeler	September 7, 2017	March 6, 2018	SI Report	March 6, 2018
<b>Pittsburgh IAP, Pittsburgh, Pennsylvania</b>					
Kickoff Meeting	Amec Foster Wheeler	December 22, 2016	December 22, 2016	Meeting Minutes	January 6, 2017
WP	Amec Foster Wheeler	December 9, 2016	May 19, 2017	SI WP	May 19, 2017
Field Work	Amec Foster Wheeler	May 26, 2017	July 7, 2017	None	
SI Report	Amec Foster Wheeler	July 17, 2017	January 16, 2018	SI Report	January 16, 2018

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Richmond IAP Byrd Field, Richmond, Virginia</b>					
Kickoff Meeting	Amec Foster Wheeler	January 23, 2017	January 23, 2017	Meeting Minutes	February 6, 2017
WP	Amec Foster Wheeler	January 10, 2017	June 20, 2017	SI WP	June 20, 2017
Field Work	Amec Foster Wheeler	June 26, 2017	July 13, 2017	None	
SI Report	Amec Foster Wheeler	July 20, 2017	January 19, 2018	SI Report	January 19, 2018
<b>Martin State Airport, Middle River, Maryland</b>					
Kickoff Meeting	Amec Foster Wheeler	January 23, 2017	January 23, 2017	Meeting Minutes	February 6, 2017
WP	Amec Foster Wheeler	January 10, 2017	June 20, 2017	SI WP	June 20, 2017
Field Work	Amec Foster Wheeler	June 26, 2017	July 18, 2017	None	
SI Report	Amec Foster Wheeler	July 25, 2017	January 23, 2018	SI Report	January 23, 2018

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>EWVRA Shepherd Field, Martinsburg, West Virginia</b>					
Kickoff Meeting	Amec Foster Wheeler	December 13, 2016	December 13, 2016	Meeting Minutes	December 28, 2016
WP	Amec Foster Wheeler	November 30, 2016	May 9, 2017	SI WP	May 9, 2017
Field Work	Amec Foster Wheeler	May 15, 2017	June 27, 2017	None	
SI Report	Amec Foster Wheeler	July 5, 2017	January 2, 2018	SI Report	January 2, 2018
<b>Barnes MAP, Westfield, Massachusetts</b>					
Kickoff Meeting	Amec Foster Wheeler	November 15, 2016	November 15, 2016	Meeting Minutes	November 30, 2016
WP	Amec Foster Wheeler	November 2, 2016	April 11, 2017	SI WP	April 11, 2017
Field Work	Amec Foster Wheeler	April 17, 2017	April 21, 2017	None	
SI Report	Amec Foster Wheeler	April 28, 2017	October 27, 2017	SI Report	October 27, 2017

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Yeager Airport, Charleston, West Virginia</b>					
Kickoff Meeting	Amec Foster Wheeler	December 12, 2016	December 12, 2016	Meeting Minutes	December 27, 2016
WP	Amec Foster Wheeler	November 29, 2016	May 9, 2017	SI WP	May 9, 2017
Field Work	Amec Foster Wheeler	May 15, 2017	June 5, 2017	None	
SI Report	Amec Foster Wheeler	June 12, 2017	December 12, 2017	SI Report	December 12, 2017
<b>MSPIA (AFRC and ANG), Hennepin County, Minnesota</b>					
Kickoff Meeting	Amec Foster Wheeler	March 15, 2017	March 15, 2017	Meeting Minutes	May 29, 2017
WP	Amec Foster Wheeler	March 2, 2017	August 8, 2017	SI WP	August 8, 2017
Field Work	Amec Foster Wheeler	August 14, 2017	August 31, 2017	None	
SI Report	Amec Foster Wheeler	September 8, 2017	March 9, 2018	SI Report	March 9, 2018

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Bradley IAP, East Granby, Connecticut</b>					
Kickoff Meeting	Amec Foster Wheeler	February 20, 2017	February 20, 2017	Meeting Minutes	March 6, 2017
WP	Amec Foster Wheeler	February 7, 2017	July 27, 2017	SI WP	July 27, 2017
Field Work	Amec Foster Wheeler	August 3, 2017	August 23, 2017	None	
SI Report	Amec Foster Wheeler	August 31, 2017	March 9, 2018	SI Report	March 9, 2018
<b>Bangor IAP, Bangor, Maine</b>					
Kickoff Meeting	Amec Foster Wheeler	November 14, 2016	November 14, 2016	Meeting Minutes	November 29, 2016
WP	Amec Foster Wheeler	November 1, 2016	April 20, 2017	SI WP	April 20, 2017
Field Work	Amec Foster Wheeler	July 24, 2017	August 25, 2017	None	
SI Report	Amec Foster Wheeler	August 28, 2017	December 13, 2017	SI Report	December 13, 2017

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Quonset State Airport, North Kingstown, Rhode Island</b>					
Kickoff Meeting	Amec Foster Wheeler	November 16, 2016	November 16, 2016	Meeting Minutes	December 1, 2016
WP	Amec Foster Wheeler	November 3, 2016	April 21, 2017	SI WP	April 21, 2017
Field Work	Amec Foster Wheeler	April 28, 2017	April 28, 2017	None	
SI Report	Amec Foster Wheeler	May 8, 2017	November 10, 2017	SI Report	November 10, 2017
<b>Greater Peoria Airport, Peoria, Illinois</b>					
Kickoff Meeting	Amec Foster Wheeler	February 1, 2017	February 1, 2017	Meeting Minutes	February 15, 2017
WP	Amec Foster Wheeler	January 19, 2017	July 10, 2017	SI WP	July 10, 2017
Field Work	Amec Foster Wheeler	July 17, 2017	July 26, 2017	None	
SI Report	Amec Foster Wheeler	August 3, 2017	February 9, 2018	SI Report	February 9, 2018

**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>General Mitchell IAP, Milwaukee, Wisconsin</b>					
Kickoff Meeting	Amec Foster Wheeler	February 1, 2017	February 1, 2017	Meeting Minutes	February 15, 2017
WP	Amec Foster Wheeler	January 19, 2017	July 10, 2017	SI WP	July 10, 2017
Field Work	Amec Foster Wheeler	July 13, 2017	August 17, 2017	None	
SI Report	Amec Foster Wheeler	August 25, 2017	March 2, 2018	SI Report	March 2, 2018
<b>Forbes Field, Topeka, Kansas</b>					
Kickoff Meeting	Amec Foster Wheeler	February 22, 2017	February 22, 2017	Meeting Minutes	March 8, 2017
WP	Amec Foster Wheeler	February 9, 2017	July 31, 2017	SI WP	July 31, 2017
Field Work	Amec Foster Wheeler	August 3, 2017	August 21, 2017	None	
SI Report	Amec Foster Wheeler	August 29, 2017	March 9, 2018	SI Report	March 9, 2018



**QAPP Worksheet #16 Project Schedule/Timeline**

<b>Activities</b>	<b>Organization</b>	<b>Anticipated Date(s) of Initiation</b>	<b>Anticipated Date of Completion</b>	<b>Deliverable</b>	<b>Deliverable Due Date (or Anticipated Delivery)</b>
<b>Truax Field, Madison, Wisconsin</b>					
Kickoff Meeting	Amec Foster Wheeler	February 1, 2017	February 1, 2017	Meeting Minutes	February 15, 2017
WP	Amec Foster Wheeler	January 19, 2017	July 10, 2017	SI WP	July 10, 2017
Field Work	Amec Foster Wheeler	July 17, 2017	August 11, 2017	None	
SI Report	Amec Foster Wheeler	August 2, 2017	March 1, 2018	SI Report	March 1, 2018
<b>Capital MAP, Springfield, Illinois</b>					
Kickoff Meeting	Amec Foster Wheeler	January 24, 2017	January 24, 2017	Meeting Minutes	February 7, 2017
WP	Amec Foster Wheeler	January 11, 2017	June 29, 2017	SI WP	June 29, 2017
Field Work	Amec Foster Wheeler	July 7, 2017	July 18, 2017	None	
SI Report	Amec Foster Wheeler	July 26, 2017	February 2, 2018	SI Report	February 2, 2018

### QAPP Worksheet #17 Sampling Design and Rationale

<b>Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):</b>
Details of the PRL sampling programs are provided in the Site-specific WPs.
<b>Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the no. of samples to be taken, and the sampling freq. (including seasonal considerations) [May refer to map or Worksheet #18 for details]:</b>
PFCs in soil and groundwater will be sampled at all installations. Sediment and surface water samples will be collected at selected installations.  The objectives of the soil, groundwater, surface water, and sediment sampling are explained in <b>Worksheet #10</b> .  The estimated no. of samples, including type and freq. of QC samples, is provided in <b>Worksheet #18</b> and will be provided in the Site-specific WPs where additional details of the sampling program are described. Seasonal considerations are not expected to affect site evaluation sampling.

### QAPP Worksheet #18 Sampling Locations and Methods/SOP Requirements

Soil, sediment, surface water, and groundwater samples will be collected, as applicable, at identified PRLs at each of the 20 installations to determine the presence or absence of PFCs in environmental media. The sampling approach, no. of samples to be collected, and freq. of sampling will be determined during each installation-specific scoping session and will be described in the Site-specific WP. As discussed on **Worksheet #14** sample methodologies will strictly follow the protocols in SOP AMEC-01 (**Appendix E**) to help mitigate the potential for false detections of PFCs. The anticipated sampling is summarized below.

ANGBs	Exploration Type					Analytical Samples by Media			
	No. of Sites	Soil Borings	Downgradient Wells	Existing Wells	<sup>1</sup> Base Boundary Wells	Soil Samples	Groundwater Samples	Sediment Samples	Surface Water Samples
Stewart	13	32	11	6	10	64	19	5	5
New Castle	8	12	5	5	8	24	10	6	3
Joe Foss	12	36	12	0	5	72	17	3	3
Harrisburg	3	8	3	0	2	16	3	0	0
Stanly County	2	4	2	0	1	7	2	1	1
Pittsburgh	28	59	36	0	6	118	36	16	16
Richmond	5	20	8	0	3	40	8	2	5
Martin	11	35	11	0	4	67	15	5	5
Martinsburg	10	30	10	0	6	60	16	1	1
Barnes	5	12	5	0	5	24	5	3	0
Yeager	8	21	7	0	2	42	9	2	2
Minneapolis	11	27	13	0	9	54	21	3	3
Bradley	5	15	5	0	2	30	6	0	0
Bangor	9	26	9	0	5	52	9	2	2
Quonset	4	6	3	0	2	14	4	1	1
Peoria	10	27	10	0	7	54	15	4	4
General Mitchell	14	47	18	3	12	94	23	4	4
Forbes	9	27	9	0	5	54	12	2	2
Truax	9	27	9	0	8	54	12	0	0

**QAPP Worksheet #18 Sampling Locations and Methods/SOP Requirements**

Soil, sediment, surface water, and groundwater samples will be collected, as applicable, at identified PRLs at each of the 20 installations to determine the presence or absence of PFCs in environmental media. The sampling approach, no. of samples to be collected, and freq. of sampling will be determined during each installation-specific scoping session and will be described in the Site-specific WP. As discussed on **Worksheet #14** sample methodologies will strictly follow the protocols in SOP AMEC-01 (**Appendix E**) to help mitigate the potential for false detections of PFCs. The anticipated sampling is summarized below.

ANGBs	Exploration Type					Analytical Samples by Media			
	No. of Sites	Soil Borings	Downgradient Wells	Existing Wells	<sup>1</sup> Base Boundary Wells	Soil Samples	Groundwater Samples	Sediment Samples	Surface Water Samples
Capital	5	12	5	1	5	24	8	2	2
Contingency	0	0	0	0	20	0	20	0	0
<b>SUBTOTAL</b>	<b>181</b>	<b>490</b>	<b>190</b>	<b>15</b>	<b>108</b>	<b>978</b>	<b>265</b>	<b>54</b>	<b>57</b>
<b>QC</b>									
Duplicates						97	26	6	6
Equipment Rinsates*						30	10	6	6
MS/MSD						49	13	3	3
Field Blanks**						0	20	0	0
<b>IDW</b>									
Investigation Derived Wastes – RCRA Characteristics						20	20		
<b>TOTAL</b>						<b>1,174</b>	<b>354</b>	<b>69</b>	<b>72</b>

**Notes:**  
1 – Base Boundary Wells include existing wells, base boundary only wells and dual purpose wells (serve as both PRL downgradient and base boundary well)  
\*Using dedicated sampling equipment for soil and groundwater to minimize rinsates

**QAPP Worksheets #19-1 and #30-1 Sample Containers, Preservation, and Hold Times - Vista**

**Laboratory for PFC Analysis:** Vista, 1104 Windfield Way, El Dorado Hills, CA 95762, Martha Maier, [mmaier@vista-analytical.com](mailto:mmaier@vista-analytical.com), (916) 673-1520

**List any required accreditations/certifications:** DoD ELAP; International Organization for Standardization (ISO) 17025; Florida Department of Health (FDOH)  
The NELAC Institute (TNI)

**Back-up Laboratory for PFC Analysis:** SGS Accutest, Maxxam

**Sample Delivery Method:** EDDs (analytical data packages, electronic data)

Analyte/ Analyte Group	Matrix	Method/ SOP	Accreditation Expiration Date	Container(s) (no., size & type per sample)	Preservation	Extraction Holding Time	Analytical Holding Time	Data Package Turnaround
PFCs	Solid (Soil, Sediment)	PFC by LC/MS/MS, SOP 49, rev8 <sup>1</sup>	30 Sept. 2017	125 milliliter (mL) HDPE (high- density polyethylene) bottles and jars	≤10°C for up to 48 hours after sampling, then ≤6 degrees Celsius (°C)	60 days <sup>2</sup>	30 days <sup>2</sup> from extraction	15 business days
PFCs	Aqueous (Groundwater, Surface Water)	PFC by LC/MS/MS, SOP 49, rev8 <sup>1</sup>	30 Sept. 2017	2 x 125 mL HDPE bottles and jars	≤10°C for up to 48 hours after sampling, then ≤6°C	14 days	28 days from extraction	15 business days

**Notes:**

<sup>1</sup> SOP 49 is titled *Preparation and Analysis for the Determination of Per and Poly-fluorinated Compounds*.

<sup>2</sup> Holding time taken from *Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS* (December 2011).

**QAPP Worksheets #19-2 and #30-2 Sample Containers, Preservation, and Hold Times – SGS Accutest**

**Laboratory for PFC Analysis:** SGS Accutest, 4405 Vineland Rd, Ste C-15, Orlando, FL 32811, 407-425-6700

**List any required accreditations/certifications:** DoD ELAP; ISO 17025; FDOH (TNI)

**Back-up Laboratory for PFC Analysis:** Vista, Maxxam

**Sample Delivery Method:** EDDs (analytical data packages, electronic data)

Analyte/ Analyte Group	Matrix	Method/ SOP	Accreditation Expiration Date	Container(s) (no., size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Perfluorinated Alkyl Acids	Soil	PFC by LC/MS/MS, SOP# MS014.2 <sup>1</sup> ; OP063.1 <sup>3</sup>	15 December 2018	125 mL polyethylene wide mouth bottle with unlined cap	<10°C during the first 48 hours after collection. <6°C from the time of receipt until extraction	60 days <sup>4</sup>	30 days <sup>4</sup>	15 days
Perfluorinated Alkyl Acids	Water	PFC by LC/MS/MS, SOP# MS014.2 <sup>1</sup> ; OP058.4 <sup>2</sup>	15 December 2018	2- 125 mL polyethylene bottles with polyethylene screw top.	<10°C during the first 48 hours after collection. <6°C from the time of receipt until extraction	14 days	28 days	15 days

**Notes:**

<sup>1</sup> SOPs# MS014.2 is titled *Analysis of Perfluorinated Alkyl Acids by LC/MS/MS*.

<sup>2</sup> SOP# OP058.4 is titled *Extraction of Perfluorinated Alkyl Acids from Water Samples for LC/MS/MS Analysis*.

<sup>3</sup> SOP# OP063.1 is titled *Extraction of Perfluorinated Alkyl Acids from Soil Samples for LC/MS/MS Analysis*.

<sup>4</sup> Holding time taken from *Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS* (December 2011).

**QAPP Worksheets #19-3 and #30-3 Sample Containers, Preservation, and Hold Times – Maxxam**

**Laboratory for PFC Analysis:** Maxxam, 6740 Campobello Road, Mississauga, ON L5N 2L8, Canada, 905-817-5712

**List any required accreditations/certifications:** DoD ELAP, ISO 17025; Louisiana Department of Environmental Quality (TNI)

**Back-up Laboratory for PFC Analysis:** Vista, SGS Accutest

**Sample Delivery Method:** EDDs (analytical data packages, electronic data)

Analyte/ Analyte Group	Matrix	Method/ SOP	Accreditation Expiration Date	Container(s) (no., size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Perfluorinated Alkyl Acids	Solid (Soil, Sediment)	CAM SOP- 00894 <sup>1</sup>	31 May 2017	(1) 250 mL polyethylene bottle unlined plastic cap <sup>2</sup>	≤10°C for up to 48 hours after sampling, then ≤6°C	60 days <sup>3</sup>	30 days <sup>3</sup>	15 days
Perfluorinated Alkyl Acids	Aqueous (Groundwater, Surface Water)	CAM SOP- 00894 <sup>1</sup>	31 May 2017	(1) 250 mL polyethylene bottle unlined plastic cap <sup>2</sup>	≤10°C for up to 48 hours after sampling, then ≤6°C	14 days	28 days	15 days

**Notes:**

<sup>1</sup> CAM SOP-00894 is titled Determination of Perfluorinated Compounds in Water and Soil by LC/MS/MS.

<sup>2</sup> Size and no. of sample containers may change at the discretion of the laboratory. However, Amec Foster Wheeler approval is needed to implement a change to the container size.

<sup>3</sup> Holding time taken from *Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS* (December 2011).

**QAPP Worksheet #20 Sample Quantities and Control Frequencies**

	Laboratory <sup>4</sup>	Analytical and Preparation SOP <sup>1</sup>	Estimated Environmental Sample Quality <sup>2</sup>	Field QC Analyses						Laboratory QC Sample						Total
				Field Blank	Rinsate Blank <sup>3</sup>		Field Duplicate		MS		MSD		Laboratory Duplicate			
				Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
<b>Soil</b>																
PFCs	Vista	PFC by LC/MS/MS - SOP 49, rev8	964	NA	--	1/day	30	1/10	96	1/20	48	1/20	48	NA	--	1156
<b>Groundwater</b>																
PFCs	Vista	PFC by LC/MS/MS - SOP 49, rev8	270	NA	20	1/day	10	1/10	27	1/20	14	1/20	14	NA	--	355
<b>Sediments</b>																
PFCs	Vista	PFC by LC/MS/MS - SOP 49, rev8	62	NA	--	1/day	6	1/10	6	1/20	3	1/20	3	NA	--	80
<b>Surface Water</b>																
PFCs	Vista	PFC by LC/MS/MS - SOP 49, rev8	59	NA	--	1/day	6	1/10	6	1/20	3	1/20	3	NA	--	77

**Notes:**

1. See Worksheet #23 for SOP title, Rev no., date details.
2. No. of samples is estimated. No. of Field Duplicates and MS/MSDs may vary, as a result.
3. Rinsate blanks not required when dedicated sampling equipment is used.
4. Vista is the primary lab for all project samples. SGS Accutest and Maxxam are included as backup options.



**QAPP Worksheet #21 Field Sampling SOP References**

<b>SOP # or reference<sup>1</sup></b>	<b>Title, Rev, Date, and Website Address (if available)</b>	<b>Originating Organization</b>	<b>SOP option or Equipment Type (if SOP provides different options)</b>	<b>Modified for Project Work? Yes (Y)/No (N)</b>	<b>Comments</b>
AFW-01	Field Sampling Protocols to Avoid Cross-Contamination of PFCs	Amec Foster Wheeler	n/a	N	NA
AFW-02	Soil Sampling	Amec Foster Wheeler	Core sampler, split-spoon sampler, Shelby Tube sampler	Y	Incorporates PFC protocols
AFW-03	Groundwater Sampling	Amec Foster Wheeler	Bladder Pump, Peristaltic Pump, Electric Submersible Pump, Bailer	Y	Incorporates PFC protocols
AFW-04	Monitoring Well Installation	Amec Foster Wheeler	Direct push technology, Hollow stem auger, rotary, dual-tube percussion	Y	Incorporates PFC protocols
AFW-05	Monitoring Well Development	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-06	Borehole Abandonment	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-07	Sediment Sampling	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-08	Surface Water Sampling	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-09	Influent and Effluent Sampling	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-10	Drilling, Development, and Heavy Equipment Decontamination	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols

**QAPP Worksheet #21 Field Sampling SOP References**

<b>SOP # or reference<sup>1</sup></b>	<b>Title, Rev, Date, and Website Address (if available)</b>	<b>Originating Organization</b>	<b>SOP option or Equipment Type (if SOP provides different options)</b>	<b>Modified for Project Work? Yes (Y)/No (N)</b>	<b>Comments</b>
AFW-11	Sample Handling and Custody	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-12	Protocol to Provide Water Free of Perfluorinated Compounds for Collection of Field Blanks and Equipment Blanks	Amec Foster Wheeler	NA	Y	Incorporates PFC protocols
AFW-13	Electronic Field Forms	Amec Foster Wheeler	NA	N	

**Notes:**

<sup>1</sup> Amec Foster Wheeler SOPs included as Appendix E.

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

Field Equipment	Calibration Activity/ Freq.	Maintenance Activity	Testing Activity	Inspection Activity	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference <sup>1</sup>
Water Quality Meter	Daily	As required by manufacturer specification	Groundwater and surface water sampling	Battery charge, various meter calibrations	Manufacturer Specifications	Manufacturer Specifications	Field Team	Site-specific WPs (to be prepared)
Water Level Meter	Not calibrated	As required by manufacturer specification	Groundwater and surface water sampling	Mechanical components	Manufacturer Specifications	Manufacturer Specifications	Field Operations Support (FOS)	Not applicable
Sampling Pump	Not calibrated	As required by manufacturer specification	Groundwater and surface water sampling	Mechanical components	Manufacturer Specifications	Manufacturer Specifications	FOS	Not applicable
Photoionization Detector	Daily	As required by manufacturer specification	Soil, groundwater, surface water, and sediment sampling	Isobutylene standard reading	Manufacturer Specifications	Manufacturer Specifications	Field Team	Site-specific WPs (to be prepared)

**Notes:**

1 SOPs will be found in the Site-specific WPs.

**QAPP Worksheet #23-1 Analytical SOP References - Vista**

SOP Reference No.	Title, Rev Date, and/or No.	Definitive or Screening Data	Matrix/Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SOP 49	Preparation and Analysis for the Determination of Per and PFCs, July 27, 2016, Rev 8	Definitive	Aqueous/Solid/ PFCs	LC/MS/MS	Vista	N

**QAPP Worksheet #23-2 Analytical SOP References – SGS Accutest**

SOP Reference No.	Title, Rev Date, and/or No.	Definitive or Screening Data	Matrix/Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
MS014.2	Analysis of Perfluorinated Alkyl Acids by LC/MS/MS, Rev. Date: 09/2015	Definitive	Aqueous/Solid/ PFCs	LC/MS/MS	SGS Accutest	N
OP058.4	Extraction of Perfluorinated Alkyl Acids from Water Samples for LC/MS/MS Analysis, Rev. Date: 01/2016	Definitive	Aqueous/PFCs	Solid-Phase Extraction Cartridges	SGS Accutest	N
OP063.1	Extraction of Perfluorinated Alkyl Acids for analysis from Soil Samples by LC/MS/MS Analysis, Rev. Date: 09/2016	Definitive	Solid/ PFCs	Vortexer/Centrifuge	SGS Accutest	N

**QAPP Worksheet #23-3 Analytical SOP References - Maxxam**

SOP Reference No.	Title, Rev Date, and/or No.	Definitive or Screening Data	Matrix/Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
CAM SOP-00894/10	Determination of PFCs in Water and Soil by LC/MS/MS, October 20, 2016	Definitive	Aqueous/Solid/ PFCs	LC/MS/MS	Maxxam	N

**QAPP Worksheet #24-1 Analytical Instrument Calibration - Vista**

Instrument	Calibration Procedure	Calibration Range	Freq.	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Quattro Premier XE	Sodium iodide cesium solution (NaICs) Calibration	22 – 1,500 atomic mass unit (amu)	Annually or after major repairs	Internal (instrument) software acceptance	Clean sample/gas cones and repeat	Technical Director	SOP 49, rev8
	Compound tuning	Within 22 – 1,500 amu	Before analysis of ICAL	+/- 0.3 amu from theoretical	Recalibrate with NaICs	Analyst	SOP 49, rev8
	ICAL	NA	After prep. of standards	Quadratic; must contain at least 6 points;	Clean sample/gas cones and repeat	Analyst	SOP 49, rev8
				Coefficient of Determination $\geq 0.96$ for native compounds;			
				Relative Standard Deviation $\leq 35\%$ for internal standards;			
	Each calibration point for each analyte must calculate 75-125%, except lowest cal. point which must be 70-130%						
Continuing Calibration Check (CCC)	NA	Before and after analytical sequence and every 10 samples	Liquid chromatography (LC) peak representing each native and labeled compound must be present with a S/N $\geq 10$ ;	Clean sample/gas cones and repeat	Analyst	SOP 49, rev8	
			70 to 130% for target analytes;				

**QAPP Worksheet #24-1 Analytical Instrument Calibration - Vista**

Instrument	Calibration Procedure	Calibration Range	Freq.	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
				Retention Time (RT) for internal compounds must be within $\pm 15$ seconds of the respective RTs in the most recent CCC.			

**Notes:**

Data will be evaluated using the more stringent of QSM 5.0 (or latest version) or laboratory-specified criteria.



**QAPP Worksheet #24-2 Analytical Instrument Calibration – SGS Accutest**

Instrument	Calibration Procedure	Calibration Range	Freq.	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Agilent 1200 series LC/MS/MS (Electrospray detector)	Instrument Tuning	NA	Before analysis of ICAL	± 0.5 mass to charge from theoretical	Recalibrate	Analyst	MS014
	5 points minimum, 6 points preferred to maximize calibration range	1 – 25 Parts per billion on-column	Major maintenance (per method) or second consecutive failure of opening CCV warrants recalibration	Correlation coefficient ≥0.995. Individual calibration points drift <25%, low standard <30%.	Instrument maintenance, standard inspection, recalibration		
	Initial Calibration Verification (ICV)	Mid-Range	After ICAL	≤25 percent difference (%D)	Rerun once if still a failure then recalibrate		
	Continuing Calibration Verification (CCV)	Mid-Range	Beginning and end of each run and after every 10 samples	≤25%D	Rerun once if still a failure then recalibrate		

**QAPP Worksheet #24-3 Analytical Instrument Calibration - Maxxam**

Instrument	Calibration Procedure	Calibration Range	Freq.	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
LC/MS/MS	5 points minimum	low	5 pt. daily	Unlabeled analytes <25% from target (lowest standard $\leq$ 30%) Analyte RT is $\leq$ 2% from internal Signal to noise 5	Instrument Maintenance  Instrument parameters adjusted (re-optimization)  Standards reanalyzed	Instrument Operator	CAM SOP-00894
	ICV	Mid-Range	After ICAL	$\leq$ 25%D	Rerun once if still a failure then recalibrate		
	CCV	Mid-Range	Beginning and end of each run and after every 10 samples	$\leq$ 25%D	Rerun once if still a failure then recalibrate		

**Notes:**

Data will be evaluated using the more stringent of QSM 5.0 (or latest version) or laboratory-specified criteria.

**QAPP Worksheet #25-1 Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Vista**

<b>Instrument/ Equipment</b>	<b>Maintenance Activity</b>	<b>Testing Activity</b>	<b>Inspection Activity</b>	<b>Freq.</b>	<b>Acceptance Criteria</b>	<b>Corrective Action</b>	<b>Title/position responsible for corrective action</b>	<b>SOP Reference</b>
Quattro Premier XE	Source cleaning	Sample/gas cone cleaning	Visual	As needed	NA	NA	Analyst	SOP 49, rev 8
Aquity Ultra Performance Liquid Chromatography (UPLC) System	Needle replacement	Contamination Bent needle	Visual	As needed	Leak test in software	Repeat if leak test fails	Analyst	SOP 54, rev 8
Quattro Premier XE	Source heater	Source not at 150 degrees	Low readback	As needed	Source maintains 150 degrees	Repeat with new heater if source does not heat	Analyst	SOP 54, rev 8

**QAPP Worksheet #25-2 Analytical Instrument and Equipment Maintenance, Testing, and Inspection – SGS Accutest**

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Freq.	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
Agilent 1200 series LC/MS/MS	Spray chamber, Clean capillary	Perfluorinated Alkyl Acids and Sulfonates	Check Tune Leak checks Pressure check Mobile phase filters Needle inspection	Need for maintenance determined by passing calibration– see MS014	Passing calibration	Check LC column Run Autotune Check calculations Re-run affected samples	Laboratory Analyst	MS014

**QAPP Worksheet #25-3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Maxxam**

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Freq.	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
LC/MS/MS	Ion source Injector Column UHPLC (Ultra High Performance Liquid Chromatography) Pump	USEPA 537.1 (modified)	Leaks LC column performance Mass spectrum Sensitivity / Selectivity	Daily	Passing ICAL	Recalibrate Re-inject affected samples Reanalyze affected samples	Laboratory Analyst	CAM SOP-00894
	Planned Maintenance (PM)		Tuning Mass Calibration/ Resolution Replace Consumables	Mass Spectrometer (Bi-annually) UHPLC Pump (Annually)	Meets original manufacturers performance specifications	NA	Contracted third party service provider	

**QAPP Worksheets #26-1 and 27-1 Sample Handling, Custody, and Disposal – Vista**

**Sampling Organization:** Amec Foster Wheeler

**Method of sample delivery (shipper/carrier):** FedEx

**No. of days from reporting until sample disposal:** 60 days from receipt

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	Amec Foster Wheeler – Field Manager	AFW-11
COC form completion	Amec Foster Wheeler – Field Manager	AFW-11
Packaging	Amec Foster Wheeler – Field Manager	AFW-11
Shipping coordination	Amec Foster Wheeler – Field Manager	AFW-11
Shipping coordination	Vista/Sample Custodian	SOP 12, rev 12
Sample receipt, inspection, & log-in	Vista/Sample Custodian	SOP 12, rev 12
Sample custody and storage	Vista/Sample Custodian	SOP 12, rev 12
Sample disposal	Vista/Sample Custodian	SOP 12, rev 12

**QAPP Worksheets #26-2 and 27-2 Sample Handling, Custody, and Disposal – SGS Accutest**

**Sampling Organization:** Amec Foster Wheeler

**Method of sample delivery (shipper/carrier):** FedEx

**No. of days from reporting until sample disposal:** 60 days from receipt

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	Amec Foster Wheeler – Field Manager	AFW-11
COC form completion	Amec Foster Wheeler – Field Manager	AFW-11
Packaging	Amec Foster Wheeler – Field Manager	AFW-11
Shipping coordination	Amec Foster Wheeler – Field Manager	AFW-11
Shipping coordination	SGS Accutest PM and Amec Foster Wheeler Field Manager	SAM102.09
Sample receipt, inspection, & log-in	SGS Accutest Sample Management	SAM101.18
Sample custody and storage	SGS Accutest Sample Management	SAM101.18, QA048.02
Sample disposal	SGS Accutest Sample Management	SAM101.18

**QAPP Worksheets #26-3 and 27-3 Sample Handling, Custody, and Disposal – Maxxam**

**Sampling Organization:** Amec Foster Wheeler

**Method of sample delivery (shipper/carrier):** FedEx

**No. of days from reporting until sample disposal:** 60 days from receipt

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	Amec Foster Wheeler – Field Manager	AFW-11
COC form completion	Amec Foster Wheeler – Field Manager	AFW-11
Packaging	Amec Foster Wheeler – Field Manager	AFW-11
Shipping coordination	Amec Foster Wheeler – Field Manager	AFW-11
Shipping coordination	Maxxam PM and Amec Foster Wheeler Field Manager	None
Sample receipt, inspection, & log-in	Maxxam Sample Management	CAM-WI-00405/17
Sample custody and storage	Maxxam Sample Management	CAM-WI-00405/17
Sample disposal	Maxxam Sample Management	CAM SOP-00105/9



**QAPP Worksheet #28-1 - Analytical QC and Corrective Action – Vista**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by LC/MS/MS

QC Sample	No./ Freq.	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank (MB)	1 per prep. batch of up to 20 samples.	No analytes detected > 1/2 the LOQ or 1/3 the regulatory limit, whichever is greater.	Reprep and reanalyze the MB and all samples processed with the contaminated blank. If problem persists, call PM (PM).	Analyst / Laboratory QA Officer	All analytes in the MB must be less than ½ the LOQ or 1/5 of the HA's on <b>Worksheet #15</b> , whichever is greater
OPR Sample containing all analytes	One per preparatory batch of up to 20 samples.	PFBS = 60-130% PFHpA, PFHxA, PFOA, and PFOS = 70-130% PFNA = 50-130%	Correct problem, reprep and reanalyze LCS and all samples in associated batch for failed analytes. If problem persists, call PM.	Analyst / Laboratory QA Officer	If PFOA and/or PFOS are detected in the associated samples at concentrations within 20% of the HAs, PFOA and PFOS must pass method/SOP criteria.
MS	One per preparatory batch of up to 20 samples.	Use OPR control limits	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. When appropriate, re- prep if sufficient sample is available.	Bench Analyst	Use OPR control limits
MSD	One per preparatory batch of up to 20 samples.	Use OPR control limits; Relative Percent RPD ≤30%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. When appropriate, re- prep if sufficient sample is available.	Bench Analyst	Use OPR control limits; RPD ≤30%
Internal	Every	More conservative of	Evaluate the data to determine if the	Bench Analyst	More conservative of

**QAPP Worksheet #28-1 - Analytical QC and Corrective Action – Vista**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by LC/MS/MS

<b>QC Sample</b>	<b>No./ Freq.</b>	<b>Method/SOP Acceptance Criteria</b>	<b>Corrective Action</b>	<b>Title/position of person responsible for corrective action</b>	<b>Project-Specific Measurement Performance Criteria</b>
Standards (IS)	standard and sample	laboratory-specified limits or areas within 50-150% of the average areas measured during ICAL	failed criteria are due to sample matrix or laboratory error. Failed QC samples must be reanalyzed with all associated failed field samples		laboratory-specified limits or areas within 50-150% of the average areas measured during ICAL
Surrogate Spike	NA	NA	NA	NA	NA

**QAPP Worksheet #28-2 - Analytical QC and Corrective Action – SGS Accutest**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by 537.1 LC/MS/MS

QC Sample	No./ Freq.	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
MB	1 per prep. batch of up to 20 samples.	< ½ LOQ, <1/10 the concentration detected in an associated sample, or <1/10 the regulatory limit, whichever is highest	Reprep and reanalyze the MB and all samples processed with the contaminated blank. If problem persists, call PM.	Bench Analyst	All analytes in the MB must be less than ½ the LOQ or 1/5 of the HAs on WS#15, whichever is greater
LCS containing all analytes	One per preparatory batch of up to 20 samples.	70% to 130% for mid-to high-concentration spikes or 50% to 150% for low-level spikes	Correct problem, reprep and reanalyze LCS and all samples in associated batch for failed analytes. If problem persists, call PM.	Bench Analyst	If PFOA and/or PFOS are detected in the associated samples at concentrations within 20% of the HAs, PFOA and PFOS must pass method/SOP criteria.
MS	One per preparatory batch of up to 20 samples.	70% to 130%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. When appropriate, re-prep if sufficient sample is available.	Bench Analyst	70% to 130%
MSD	One per preparatory batch of up to 20 samples.	70% to 130%; RPD<30	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. When appropriate, re-prep if sufficient sample is available.	Bench Analyst	70% to 130%; %RPD <30

**QAPP Worksheet #28-2 - Analytical QC and Corrective Action – SGS Accutest**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by 537.1 LC/MS/MS

QC Sample	No./ Freq.	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
IS	Every standard and sample	70% to 130% and area must be within 50% of the average areas measured during ICAL	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Failed QC samples must be reanalyzed with all associated failed field samples.	Bench Analyst	70% to 130% and area must be within 50% of the average areas measured during ICAL
Surrogate Spike	Every sample	13C2-PFHxA and 13C2-PFDA 70-130% recovery	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Failed QC sample – correct analytical problem and reanalyze all failed samples.	Bench Analyst	70% to 130%

**QAPP Worksheet #28-3 - Analytical QC and Corrective Action – Maxxam**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by 537.1 - LC/MS/MS

QC Sample	No./ Freq.	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
MB	1 per prep. batch of up to 20 samples.	No analytes detected > 1/2 the LOQ or the regulatory limit, whichever is greater.	The source of the contamination is investigated and eliminated before proceeding with further analysis. If required, re-prep and re-analyze MB and all samples processed with contaminated blank.	Analyst/Prep Analyst	All analytes in the MB must be less than ½ the LOQ or 1/5 of the HA's on <b>Worksheet #15</b> , whichever is greater
LCS containing all analytes	One per preparatory batch of up to 20 samples.	Native analyte recoveries 70-130%	Source of poor recovery is investigated and eliminated before proceeding with further analysis. If necessary, re-prep and re-analyze the LCS and all samples in the associated preparatory batch for failed analytes.	Analyst/Prep Analyst	If PFOA and/or PFOS are detected in the associated samples at concentrations within 20% of the HAs, PFOA and PFOS must pass method/SOP criteria.

**QAPP Worksheet #28-3 - Analytical QC and Corrective Action – Maxxam**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by 537.1 - LC/MS/MS

QC Sample	No./ Freq.	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
MS	One per preparatory batch of up to 20 samples.	70-130% recovery	If the recoveries indicate that the problem is procedure related, re-extraction and re-analysis is required. If the recoveries indicate that the failures are matrix-related, refer to Blank Spike as measure of method performance in clean matrix. The project Chemist will be contacted and a decision will be made to either report the data as is with a notation in the analytical narrative or if the samples should be re-extract and re-analyzed.	Analyst/Prep Analyst	70-130% recovery
MSD	One per preparatory batch of up to 20 samples.	70-130% recovery; %RPD <30	Source of poor RPD is investigated and eliminated before proceeding with further analysis. Check for heterogeneity in samples.	Bench Analyst	70-130% recovery; RPD <30
IS	Every standard and sample	50-150% of the average areas measured during ICAL	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Failed QC samples must be reanalyzed with all associated failed field samples	Bench Analyst	50-150% of the average areas measured during ICAL

**QAPP Worksheet #28-3 - Analytical QC and Corrective Action – Maxxam**

**Matrix:** Soil/Aqueous

**Analytical Group:** PFCs

**Analytical Method/SOP:** PFC by 537.1 - LC/MS/MS

QC Sample	No./ Freq.	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Surrogate Spike	Every standard and sample	Aqueous - 70-130% recovery  Soil - 50-130% recovery	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Failed QC samples must be reanalyzed with all associated failed field samples	Bench Analyst	Aqueous - 70-130% recovery  Soil - 50-130% recovery

**QAPP Worksheet #29 Project Documents and Records**

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
<ul style="list-style-type: none"> <li>- Field Notes</li> <li>- Sampling Logs</li> <li>- COC Records</li> <li>- Air Bills</li> <li>- Custody Seals</li> </ul>	<ul style="list-style-type: none"> <li>- Equipment Calibration Logs</li> <li>- Field Data Records</li> <li>- Field Instrument Maintenance Logs</li> </ul>	<ul style="list-style-type: none"> <li>- Sample Receipt, Custody and Tracking Records</li> <li>- Standard Traceability Logs</li> <li>- Equipment Calibration Logs</li> <li>- Sample Prep Logs</li> <li>- Run Logs</li> <li>- Equipment Maintenance, Testing, and Inspection Logs</li> <li>- Corrective Action Forms</li> <li>- Reported Field Sample Results</li> <li>- Reported Results for Standards, QC Checks and QC Samples</li> <li>- Instrument Printouts (raw data) for Field Samples, Standards, QC Checks and QC Samples</li> <li>- Data Package Completeness Checklists</li> <li>- Sample Disposal Records</li> <li>- Extraction/Cleanup Records</li> <li>- Raw Data (stored on disk or CD-R)</li> <li>- Analytical Reports</li> </ul>	<ul style="list-style-type: none"> <li>- Data Validation Checklists</li> <li>- Data Quality Assessments</li> </ul>	<ul style="list-style-type: none"> <li>- Site Safety and Health Plan</li> <li>- QAPP</li> <li>- WP</li> </ul>



**QAPP Worksheet #31 Planned Project Assessments**

<b>Assessment Type</b>	<b>Freq.</b>	<b>Internal or External</b>	<b>Organization Performing Assessment</b>	<b>Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)</b>	<b>Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)</b>	<b>Person(s) Responsible for Identifying and Implementing Corrective Actions (title and organizational affiliation)</b>	<b>Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (title and organizational affiliation)</b>
Field Audit	One time per field event	Internal	Amec Foster Wheeler	Field Team Leader, Amec Foster Wheeler	Field Manager, Amec Foster Wheeler	Field Manager, Amec Foster Wheeler	PM, Amec Foster Wheeler
Laboratory Audit	Per Laboratory QA Program	External	DoD ELAP Accreditation Body	Laboratory QA Manager(s), DoD ELAP Accreditation.	Laboratory QA Manager(s), Vista/Maxxam/SGS Accutest	Laboratory PM(s), Vista/Maxxam/SGS Accutest	QA/QC Manager, Amec Foster Wheeler
Field Inspections	One time per field event	Internal	Amec Foster Wheeler	Field Team Leader, Amec Foster Wheeler	Field Manager, Amec Foster Wheeler	Field Manager, Amec Foster Wheeler	PM, Amec Foster Wheeler
Safety Audits	One time per field event	Internal	Amec Foster Wheeler	Field Team Leader, Amec Foster Wheeler	Field Manager, Amec Foster Wheeler	Field Manager, Amec Foster Wheeler	PM, Amec Foster Wheeler

**QAPP Worksheet #32 Assessment Findings and Corrective Action Responses**

<b>Assessment Type</b>	<b>Nature of Deficiencies Documentation</b>	<b>Individual(s) Notified of Findings (name, title, organization)</b>	<b>Time Frame of Notification</b>	<b>Nature of Corrective Action Response Documentation</b>	<b>Individual(s) Receiving Corrective Action Response (name, title, organization)</b>	<b>Time Frame for Response</b>
Field Sampling Technical Systems Audit	Written Audit Report	PM, Amec Foster Wheeler	72 hours after audit	Letter	Field Manager, Amec Foster Wheeler	48 hours after notification
Field Inspection	Memorandum	PM, Amec Foster Wheeler	Two days	Memorandum	Field Manager, Amec Foster Wheeler	48 hours after notification
Contract Laboratory Technical Audit (internal)	Memorandum	Laboratory PM, Vista/Maxxam/ SGS Accutest	Two days	Memorandum	Laboratory QA Manager(s), Vista/Maxxam/ SGS Accutest	48 hours after notification

**QAPP Worksheet #33 QA Management Reports**

<b>Type of Report</b>	<b>Freq. (e.g., daily, weekly monthly, quarterly, annually)</b>	<b>Projected Delivery Date(s)</b>	<b>Person(s) Responsible for Report Preparation (title and organizational affiliation)</b>	<b>Report Recipient(s) (title and organizational affiliation)</b>
Field Sampling Technical Systems Audit Report	Once per year	NA	Field Manager, Amec Foster Wheeler	PM, Amec Foster Wheeler
Contract Laboratory Technical Audit Report	As necessary during project	NA	Senior Chemist, Amec Foster Wheeler	PM, Amec Foster Wheeler
Data Validation Reports	As specified in the Data Assessment section based on intended use of the data and required percentage to meet project DQOs. Data Validation Reports will be documented in various project reports, as appropriate.	As generated throughout project	Senior Chemist, Amec Foster Wheeler	PM, Amec Foster Wheeler

**QAPP Worksheet #34 Verification (Step I) Process**

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
COC and Shipping Forms	COC forms and shipping documentation will be reviewed by laboratory upon receipt of samples for verification against the sample coolers they represent. The COC form will be signed by all parties that had custody of samples, with the exception of commercial carriers.	External	Martha Maier, Vista; Andrea Colby, SGS Accutest; Melissa Di Grazia, Maxxam
Field Notes and Sampling Logs	All field notes and sampling logs will be reviewed internally and placed in the project file.	Internal	Field Manager, Amec Foster Wheeler
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	External	Martha Maier, Vista; Andrea Colby, SGS Accutest; Melissa Di Grazia, Maxxam
Laboratory Data	All final data packages will be verified for content upon receipt.	Internal	Denise King, or designee, Amec Foster Wheeler

**QAPP Worksheet #35 Validation (Steps IIa and IIb) Process**

<b>Step IIa/IIb</b>	<b>Validation Input</b>	<b>Description</b>	<b>Responsible for Validation (Name, Organization)</b>
Step IIa	Sampling methods and procedures	Establish that required sampling methods were used and that any deviations were noted. Provide that the sampling procedures and field measurements met performance criteria and that any deviations were documented.	Field Manager, Amec Foster Wheeler
Step IIa	Analytical method and procedures	Establish that required analytical methods were used and that any deviations were noted. The laboratory will provide that QC samples met performance criteria and that any deviations were documented in the report narrative.	Martha Maier, Vista; Andrea Colby, SGS Accutest; Melissa Di Grazia, Maxxam; and Denise King, or designee, Amec Foster Wheeler
Step IIa Modified	Analytical method and procedures	Review of associated blanks for potential contamination and verify that all preparations and analyses have been performed within applicable holding times.	Denise King, or designee, Amec Foster Wheeler
Step IIb	Documentation of QAPP QC sample results	Establish that all QAPP-required QC samples were collected and analyzed.	Denise King, or designee, Amec Foster Wheeler

**QAPP Worksheet #35 Validation (Steps IIa and IIb) Process**

<b>Step IIa/IIb</b>	<b>Validation Input</b>	<b>Description</b>	<b>Responsible for Validation (Name, Organization)</b>
Step IIb	Project quantitation limits	Determine that the project quantitation limits were achieved, as outlined in the QAPP.	Denise King, or designee, Amec Foster Wheeler
Step IIb	Performance criteria	Evaluate QC data for all samples against project-specific performance criteria in the QAPP, laboratory QA manual, and control criteria.	Denise King, or designee Amec Foster Wheeler
Step IIb	Validation Report	<p>Summarize data verification and validation components included in the Performance Review. Include qualified data and explanation of all qualifiers.</p> <p>Note: Data will be validated 90% Stage 2B and 10% Stage 4</p>	Denise King, or designee, Amec Foster Wheeler

**QAPP Worksheet #36 Validation (Steps IIa and IIb) Summary**

Step IIa/IIb	Matrix	Analytical Group	Data Purpose	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
Steps IIa and IIb	All	All	Contaminant delineation	All	Department of Defense <i>Quality Systems Manual for Environmental laboratories, Version 5.0</i> , July 2013; laboratory control limits; method criteria; QAPP criteria; and professional judgment	Denise King, or designee, Amec Foster Wheeler

Amec Foster Wheeler chemists will perform validation. With the exception of investigation-derived waste samples, data will be validated 90% Stage 2B, and 10% Stage 4. Data validation will be performed in accordance with the DoD QSM and QC criteria specified in this document.

Stage 2B and Stage 4 data validation follow Amec Foster Wheeler data validation protocols. These protocols apply to full data packages that include raw data (e.g., instrument spectra and chromatograms), backup documentation for calibration standards, analysis run logs, and dilution factors. Data and QC summary forms are reviewed for compliance with method-specified QC criteria. For data that undergo Stage 4 validation, analyte ID and reported concentrations are also checked. To assure that DL and data values meet project requirements; instrument performance, methods of calibration, and calibration standards are evaluated.

Analytical data may be qualified based on findings from data validation review. Qualifiers will provide data users with an estimate of the level of uncertainty associated with the qualified results.

Data validation results will be evaluated with respect to the qualifiers listed below to assess the usability of the data:

- B – analyte was detected in the associated blank at a concentrations greater than 1/10 the concentration detected in the sample
- J – estimated concentration
- Q – analyte was both B and J qualified
- UJ – not detected and sample detection limit is estimated
- R – rejected

The following data validation guidelines will be followed for sample reporting and blank detections:

- The general reporting convention will be to report non-detected results at the LOD, with detections reported down to the DL. All detections less than the LOQ will be reported by the laboratory with J qualifiers.
- If the sample concentration is between the DL and LOQ and less than ten times the concentration detected in the blank or rinsate sample, then the qualifier will be changed from the laboratory's J qualifier to B during data validation.
- If the sample concentration is greater than the LOQ and less than five times the concentration detected in the blank or rinsate sample, then the sample concentration will be B-flagged during data validation.

The data validation criteria will be based on method-specific criteria for preservation, holding times, instrument tuning, calibration, instrument performance checks, internal standard responses, serial dilutions, and target compound ID; laboratory-specified criteria for surrogate, LCSs, laboratory duplicates, and MSs; and the validator's professional judgment.



### QAPP Worksheet #37 Usability Assessment

The Data Usability Assessment will be performed by Amec Foster Wheeler for data associated with determination of NFA or for follow-on remedial investigations. Documentation generated during the usability assessment will consist of data validation checklists with a brief summary of overall data usability.

The Data Usability Assessment process involves data verification and data validation. Data verification is the process by which laboratory results are checked to provide that the proper QC steps were performed, and key items have met QC objectives (both analytical and contractual). The key items checked in a data verification include the following:

- Sample collection, handling, and analysis procedures;
- Field sampling, handling, and analysis activities documented (e.g., QC signatures in field logs, QC checklist);
- Sampling, handling, on-site analytical and off-site laboratory data verified internally at the data generator level;
- Laboratory data (e.g., laboratory-qualified data);
- Sampling, on-site analytical, and off-site laboratory data;
- Data package deliverable completeness;
- Review of case narrative;
- All analytical results presented;
- QC sample data summaries;
- Applicable raw data;

All required data deliverables must be present in the data package in order to proceed to the next step of data validation.

Data validation entails a review of the sample collection, handling, field analysis, and QC data, and the raw data to verify that the laboratory was operating within required limits; analytical results were correctly transcribed from the instrument readouts; and which (if any) environmental samples were related to out-of-control QC samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

The data quality indicators used to evaluate conformance with the project DQOs are presented below.

Data quality indicators are generally defined in terms of six parameters:

1. Representativeness
2. Comparability

### QAPP Worksheet #37 Usability Assessment

3. Completeness
4. Precision
5. Accuracy
6. Sensitivity

Each parameter is defined below. Specific objectives for the Site actions are presented in other sections of this QAPP, as referenced below.

#### **Representativeness**

Representativeness is the degree to which sampling data accurately and precisely represent site conditions and depends on sampling and analytical variability and the variability of environmental media at the site. Actions have been designed to assess the presence of chemical constituents at the time of sampling. The QAPP presents the rationale for sample quantities and location. This QAPP presents field sampling and laboratory analytical methodologies. Use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements is intended to provide representative data.

#### **Comparability**

Comparability is the degree of confidence with which one data set can be compared to another. Comparability among phases of the actions (if additional phases are required) will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP, established QA/QC procedures, and use of appropriately trained personnel.

#### **Completeness**

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results. Completeness of a field or laboratory data set will be calculated by comparing the no. of valid sample results generated to the total no. of results generated.

$$\text{Completeness} = \frac{\text{No. valid results}}{\text{Total no. of anticipated results}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90 %. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

### QAPP Worksheet #37 Usability Assessment

#### Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the site actions will adhere to established protocols presented in the QAPP. Checks for analytical precision will include the analysis of MS/MSD, laboratory duplicates, and field duplicates. Checks for field measurement precision will include duplicate field measurements.

The precision of data will be measured by calculating the RPD by the following equation:

$$\text{RPD} = \frac{|(A-B)|}{|(A+B)|/2} \times 100$$

Where:

A = Analytical result from one of two duplicate measurements

B = Analytical result from the second measurement

#### Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, MSs, blank spikes, and surrogate standards will be used to assess the accuracy of the analytical data.

Accuracy will be calculated in terms of % recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:

A = Value measured in spiked sample or standard

X = Value measured in original sample

B = True value of amount added to sample or true value of standard

#### Sensitivity

Sensitivity is a quantitative measurement to determine if the analytical laboratory's procedures/methodologies and their associated method DL can

### QAPP Worksheet #37 Usability Assessment

satisfy the project requirements as they relate to the project action limits. Method DL are updated annually by the laboratory. The current method DL for the analytical laboratories are presented in **Worksheet #15**.

#### **Data Validation and Usability**

Validation will be performed on all data generated for SI purposes referencing the most recent versions of the Department of Defense Quality Systems Manual Version 5.0 (DOD 2013), and this QAPP. These procedures and criteria may be modified, as necessary, to address project-specific and method-specific criteria, control limits, and procedures. Data validation will consist of data screening, checking, reviewing, editing, and interpretation to document analytical data quality and to determine whether the quality is sufficient to meet the DQOs. USEPA Stage 2b data validation will be performed on 90% of the data and Stage 4 on the remaining 10%.

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP. Any deviations from the analytical method or any special reporting requirements apart from those specified in this QAPP will be detailed on COC forms.

Upon receipt of laboratory data, the following procedures will be executed by the data validator:

- Evaluate completeness of data package.
- Verify that field COC forms were completed and that samples were handled properly.
- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis.
- Verify that parameters were analyzed according to the methods specified.
- Review QA/QC data (i.e., confirm that duplicates, blanks, and spikes were analyzed on the required no. of samples, as specified in the method and verify that duplicate and MS recoveries are acceptable).
- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the PM and/or Laboratory Manager, as appropriate.
- If data appear suspect, investigate the specific data of concern. Calculations will be traced back to raw data. If calculations do not agree, the cause will be determined and corrected.

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report addressing the following topics, as applicable to each method:

### QAPP Worksheet #37 Usability Assessment

- Assessment of the data package
- Description of any protocol deviations
- Failures to reconcile reported and/or raw data
- Assessment of any compromised data
- Overall appraisal of the analytical data
- Table of site name, sample quantities, matrix, and fractions analyzed

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean that data must be produced without QC qualifiers. Qualified data can provide useful information.

During the review process, laboratory-qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results will be qualified with the following codes:

Concentration (C) qualifiers:

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

Validation qualifiers:

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

B The analyte was positively identified in an associated blank sample.

Q The result was both B qualified because of a detection in an associated blank and J qualified because of another QC exceedance.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual LOQ necessary to accurately and precisely measure the analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.

The "R" flag means that the associated value is unusable. In other words, due to significant QC problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values cannot be relied upon.

### QAPP Worksheet #37 Usability Assessment

No compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the data validator. Suggestions for reanalysis may be made by the QA/QC Manager.

#### **Validation Reports**

The data validation reports will identify all deficiencies and the potential impact on the results. The Validation and Data Management Team will apply qualifiers generated during the validation process to the analytical data tables, with an explanation of how and why the data were qualified. The validation reports and the data tables will be the primary location of all applicable data qualifiers. Qualifiers will not be applied to the original hard copy analytical reports.

#### **Field Data Review**

Field data are generated from in-field measurement, which may include global positioning system or physical survey data, x-ray fluorescence measurement data, groundwater quality field parameters, and qualitative soil characterization or site description results. The quality objective for the in-field measurement activities is to obtain accurate measurements using appropriate equipment. Data are recorded in field logbooks or on field sampling sheets and calibration logs. Calibration logs will be reviewed with other field documentation to identify any potential impacts to data quality and usability. Field logbooks are reviewed as part of the QC inspections.

#### **Reconciliation with Data Usability Requirements**

The data results will be examined to determine the performance that was achieved for each data usability criterion. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action relating to incomplete information, questionable results, or inconsistent data may include any or all of the following:

- Retrieval of missing information
- Request for additional explanation or clarification
- Reanalysis of sample from extract (when appropriate)
- Recalculation or reinterpretation of results by the laboratory

### QAPP Worksheet #37 Usability Assessment

These actions may improve the data quality, reduce uncertainty and eliminate the need to qualify or reject data.

If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- Extrapolation of missing data from existing data points
- Use of historical data
- Evaluation of the critical/noncritical nature of the sample

If the data gap cannot be resolved by these actions, the data bias and potential for false negatives and positives can be evaluated. If the resultant uncertainty level is unacceptable, the following action must be taken:

- Additional sample collection and analysis

## **ATTACHMENTS**



**ATTACHMENT A**  
**CHAIN-OF-CUSTODY FORM**



Amec Foster Wheeler Environment & Infrastructure  
 511 Congress Street  
 Portland, ME 04101  
 (207) 775-5401

SHIP TO:  
 Vista Analytical  
 1104 Windfield Way  
 El Dorado Hills, CA 95762  
 Atten: Martha Maier  
 Lab Phone# 916-673-1520

# CHAIN OF CUSTODY

DATE: 11/18/2016  
 COC #: \_\_\_\_\_  
 PAGE: 1 OF 1

Project Name:	Phase I Site Inspections	Project Contact:	Bill To:	Amec Foster Wheeler Env. & Infrastructure	Disposal Instructions:	LAB
Project Number:	291330006	Phone Number:	Quorum Office Park, 271 Mill Road		Shipment Method:	FEDEX
Project Manager:	Rob Singer/Kerry Tull	Project Phase:	Chelmsford, MA 01824		Waybill Number:	N/A

Sample Information					Methods for Analysis																RUSH																
No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	PFCs - EPA 537.1 Modified*																								24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses		
1						X																															
2																																					
3																																					
4																																					
5																																					
6																																					
7																																					
8																																					
9																																					
10																																					
11																																					
12																																					

Sampler's Signature:	Date:	Time:	For Lab Use		Comments: <b>X=Analyze H=Hold Analysis Request</b>  Contract # - W9133L-14-D-0002 *UCMR 3 Analyte List 15 DAY TAT  NUMBER OF COOLERS SENT: 1
Relinquished By/Affiliation:	Date:	Time:	Does COC match samples:	Y or N	
Received By:	Date:	Time:	Broken Container:	Y or N	
Relinquished By/Affiliation:	Date:	Time:	COC seal intact:	Y or N	
Received By:	Date:	Time:	Other problems:	Y or N	
Relinquished By/Affiliation:	Date:	Time:	WSDOT contacted:	Y or N	
Received By (LAB):	Date:	Time:	Date contacted:	_____	
			Cooler Temperature at receipt:	_____ °C	

**ATTACHMENT B**  
**LABORATORY CERTIFICATIONS**



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

VISTA ANALYTICAL LABORATORY  
 1104 Windfield Way  
 El Dorado Hills, CA 95762  
 Martha Maier Phone: 916-673-1520  
 mmaier@vista-analytical.com

ENVIRONMENTAL

Valid To: September 30, 2017

Certificate Number: 3091.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2009 NELAC Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.0 of the DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the

following testing technologies and in the analyte categories identified below:

Testing Technologies

High Resolution Gas Chromatography / Mass Spectrometry

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
<b><u>Dioxins/Furans</u></b>				
2,3,7,8-Tetrachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
2,3,7,8-Tetrachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,7,8-Pentachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
2,3,4,7,8-Pentachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,7,8-Hexachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,6,7,8-Hexachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
2,3,4,6,7,8-Hexachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,7,8,9-Hexachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,7,8,9-Heptachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
Total Tetrachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
Total Pentachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
Total Hexachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
<b><u>Dioxins/Furans</u></b>				
Total Heptachlorodibenzo-p-dioxin	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
Total Tetrachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
Total Pentachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
Total Hexachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
Total Heptachlorodibenzofuran	-----	EPA 1613B/8290	EPA 1613B/8290	EPA 1613B/8290
<b><u>PCBs</u></b>				
2-Chlorobiphenyl (1)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3-Chlorobiphenyl (2)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
4-Chlorobiphenyl (3)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2'-Dichlorobiphenyl (4)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3-Dichlorobiphenyl (5)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3'-Dichlorobiphenyl (6)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4-Dichlorobiphenyl (7)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4'-Dichlorobiphenyl (8)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,5-Dichlorobiphenyl (9)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,6-Dichlorobiphenyl (10)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3'-Dichlorobiphenyl (11)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,4-Dichlorobiphenyl (12)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,4'-Dichlorobiphenyl (13)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,5-Dichlorobiphenyl (14)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
4,4'-Dichlorobiphenyl (15)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3-Trichlorobiphenyl (16)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4-Trichlorobiphenyl (17)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',5-Trichlorobiphenyl (18)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',6-Trichlorobiphenyl (19)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3'-Trichlorobiphenyl (20)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,3,4-Trichlorobiphenyl (21)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4'-Trichlorobiphenyl (22)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,5-Trichlorobiphenyl (23)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,6-Trichlorobiphenyl (24)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4-Trichlorobiphenyl (25)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',5-Trichlorobiphenyl (26)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',6-Trichlorobiphenyl (27)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4,4'-Trichlorobiphenyl (28)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4,5-Trichlorobiphenyl (29)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4,6-Trichlorobiphenyl (30)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4',5-Trichlorobiphenyl (31)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4',6-Trichlorobiphenyl (32)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,4-Trichlorobiphenyl (33)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,5-Trichlorobiphenyl (34)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4-Trichlorobiphenyl (35)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',5-Trichlorobiphenyl (36)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,4,4'-Trichlorobiphenyl (37)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,4,5-Trichlorobiphenyl (38)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,4',5-Trichlorobiphenyl (39)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3'-Tetrachlorobiphenyl (40)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4-Tetrachlorobiphenyl (41)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4'-Tetrachlorobiphenyl (42)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5-Tetrachlorobiphenyl (43)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5'-Tetrachlorobiphenyl (44)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,6-Tetrachlorobiphenyl (45)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,2',3,6'-Tetrachlorobiphenyl (46)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,4'-Tetrachlorobiphenyl (47)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,5'-Tetrachlorobiphenyl (48)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,5'-Tetrachlorobiphenyl (49)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,6'-Tetrachlorobiphenyl (50)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,6'-Tetrachlorobiphenyl (51)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',5,5'-Tetrachlorobiphenyl (52)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',5,6'-Tetrachlorobiphenyl (53)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',6,6'-Tetrachlorobiphenyl (54)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4'-Tetrachlorobiphenyl (55)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4'-Tetrachlorobiphenyl (56)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',5'-Tetrachlorobiphenyl (57)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',5'-Tetrachlorobiphenyl (58)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',6'-Tetrachlorobiphenyl (59)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,4'-Tetrachlorobiphenyl (60)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,5'-Tetrachlorobiphenyl (61)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,6'-Tetrachlorobiphenyl (62)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,5'-Tetrachlorobiphenyl (63)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,6'-Tetrachlorobiphenyl (64)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,5,6'-Tetrachlorobiphenyl (65)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,4'-Tetrachlorobiphenyl (66)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,5'-Tetrachlorobiphenyl (67)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,5'-Tetrachlorobiphenyl (68)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,6'-Tetrachlorobiphenyl (69)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4',5'-Tetrachlorobiphenyl (70)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,3',4',6-Tetrachlorobiphenyl (71)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',5,5'-Tetrachlorobiphenyl (72)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',5',6-Tetrachlorobiphenyl (73)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4,4',5-Tetrachlorobiphenyl (74)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,4,4',6-Tetrachlorobiphenyl (75)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,4,5-Tetrachlorobiphenyl (76)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4,4'-Tetrachlorobiphenyl (77)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4,5-Tetrachlorobiphenyl (78)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4,5'-Tetrachlorobiphenyl (79)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',5,5'-Tetrachlorobiphenyl (80)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,4,4',5-Tetrachlorobiphenyl (81)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4-Pentachlorobiphenyl (82)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5-Pentachlorobiphenyl (83)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',6-Pentachlorobiphenyl (84)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4'-Pentachlorobiphenyl (85)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5-Pentachlorobiphenyl (86)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5'-Pentachlorobiphenyl (87)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,6-Pentachlorobiphenyl (88)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,6'-Pentachlorobiphenyl (89)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',5-Pentachlorobiphenyl (90)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',6-Pentachlorobiphenyl (91)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5,5'-Pentachlorobiphenyl (92)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5,6-Pentachlorobiphenyl (93)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5,6'-Pentachlorobiphenyl (94)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5',6-Pentachlorobiphenyl (95)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C



Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,2',3,6,6'-Pentachlorobiphenyl (96)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3',4,5-Pentachlorobiphenyl (97)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3',4,6-Pentachlorobiphenyl (98)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,4',5-Pentachlorobiphenyl (99)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,4',6-Pentachlorobiphenyl (100)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,5,5'-Pentachlorobiphenyl (101)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,5,6'-Pentachlorobiphenyl (102)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,5,6-Pentachlorobiphenyl (103)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,6,6'-Pentachlorobiphenyl (104)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4'-Pentachlorobiphenyl (105)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,5-Pentachlorobiphenyl (106)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4',5-Pentachlorobiphenyl (107)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,5'-Pentachlorobiphenyl (108)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,6-Pentachlorobiphenyl (109)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4',6-Pentachlorobiphenyl (110)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',5,5'-Pentachlorobiphenyl (111)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',5,6-Pentachlorobiphenyl (112)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',5',6-Pentachlorobiphenyl (113)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,4',5-Pentachlorobiphenyl (114)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,4',6-Pentachlorobiphenyl (115)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,5,6-Pentachlorobiphenyl (116)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4',5,6-Pentachlorobiphenyl (117)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,4',5-Pentachlorobiphenyl (118)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,4',6-Pentachlorobiphenyl (119)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,5,5'-Pentachlorobiphenyl (120)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,3',4,5,'6-Pentachlorobiphenyl (121)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,3',4,5-Pentachlorobiphenyl (122)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,4,4',5-Pentachlorobiphenyl (123)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,4,5,5'-Pentachlorobiphenyl (124)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2',3,4,5,6'-Pentachlorobiphenyl (125)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4,4',5-Pentachlorobiphenyl (126)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4,5,5'-Pentachlorobiphenyl (127)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4'-Hexachlorobiphenyl (128)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5-Hexachlorobiphenyl (129)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5'-Hexachlorobiphenyl (130)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,6-Hexachlorobiphenyl (131)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,6'-Hexachlorobiphenyl (132)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5,5'-Hexachlorobiphenyl (133)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5,6-Hexachlorobiphenyl (134)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5,6'-Hexachlorobiphenyl (135)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',6,6'-Hexachlorobiphenyl (136)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5-Hexachlorobiphenyl (137)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',6-Hexachlorobiphenyl (139)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',6'-Hexachlorobiphenyl (140)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5,5'-Hexachlorobiphenyl (141)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5,6-Hexachlorobiphenyl (142)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5,6'-Hexachlorobiphenyl (143)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5',6-Hexachlorobiphenyl (144)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,6,6'-Hexachlorobiphenyl (145)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,2',3,4',5,5'-Hexachlorobiphenyl (146)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',5,6-Hexachlorobiphenyl (147)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',5,6'-Hexachlorobiphenyl (148)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',5',6-Hexachlorobiphenyl (149)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',6,6'-Hexachlorobiphenyl (150)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5,5',6-Hexachlorobiphenyl (151)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,5,6,6'-Hexachlorobiphenyl (152)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,4',5',6-Hexachlorobiphenyl (154)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',4,4',6,6'-Hexachlorobiphenyl (155)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',5-Hexachlorobiphenyl (156)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',5'-Hexachlorobiphenyl (157)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',6-Hexachlorobiphenyl (158)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,5,5'-Hexachlorobiphenyl (159)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,5,6-Hexachlorobiphenyl (160)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,5',6-Hexachlorobiphenyl (161)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4',5,5'-Hexachlorobiphenyl (162)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4',5,6-Hexachlorobiphenyl (163)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4',5',6-Hexachlorobiphenyl (164)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',5,5',6-Hexachlorobiphenyl (165)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,4,4',5,6-Hexachlorobiphenyl (166)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,4',5,5'-Hexachlorobiphenyl (167)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3',4,4',5',6-Hexachlorobiphenyl (168)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
3,3',4,4',5,5'-Hexachlorobiphenyl (169)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,2',3,3',4,4',6-Heptachlorobiphenyl (171)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,5'-Heptachlorobiphenyl (172)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,6-Heptachlorobiphenyl (173)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,6'-Heptachlorobiphenyl (174)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5',6-Heptachlorobiphenyl (175)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,6,6'-Heptachlorobiphenyl (176)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4',5,6-Heptachlorobiphenyl (177)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5,5',6-Heptachlorobiphenyl (178)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5,6,6'-Heptachlorobiphenyl (179)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5,6-Heptachlorobiphenyl (181)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5,6'-Heptachlorobiphenyl (182)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5',6-Heptachlorobiphenyl (183)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5,5',6-Heptachlorobiphenyl (185)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,5,6,6'-Heptachlorobiphenyl (186)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4',5,6,6'-Heptachlorobiphenyl (188)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',5,6-Heptachlorobiphenyl (190)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',5',6-Heptachlorobiphenyl (191)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,5,5',6-Heptachlorobiphenyl (192)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4',5,5',6-Heptachlorobiphenyl (193)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (194)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (196)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (197)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,5',6-Octachlorobiphenyl (198)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (199)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (200)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (201)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (202)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5,5',6-Octachlorobiphenyl (203)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (204)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,3,3',4,4',5,5',6-Octachlorobiphenyl (205)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (207)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (208)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Decachlorobiphenyl (209)	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Monochlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Dichlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Trichlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Tetrachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Pentachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Hexachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Heptachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Octachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Nonachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
Decachlorobiphenyl, Total	-----	EPA 1668A/1668C	EPA 1668A/1668C	EPA 1668A/1668C
<b>Per- and Poly-fluorinated compounds</b>				
Perfluorobutanesulfonic acid (PFBS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
Perfluoroheptanoic acid (PFHpA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorohexanesulfonic acid (PFHxS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorooctanesulfonic acid (PFOS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorooctanoic acid (PFOA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorononaic acid (PFNA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluoroheptanesulfonate (PFHpS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorodecanesulfonate (PFDS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluoropentanoic acid (PFPeA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluoroundecanoic acid (PFUdA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorodecanoic acid (PFDA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorododecanoic acid (PFDoA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorotridecanoic acid (PFTrDA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorotetradecanoic acid (PFTeDA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorohexadecanoic acid (PFHxDA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorobutanoic acid (PFBA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorohexanoic acid (PFHxA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
6:2 Fluorotelomer sulfanate (6:2 FTS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
8:2 Fluorotelomer sulfanate (8:2 FTS)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
N-methylperfluoro-1-octanesulfonamide (N-MeFOSA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
N-ethylperfluoro-1-octanesulfonamide (N-EtFOSA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
Perfluorooctane sulfonamide (PFOSA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
N-methylperfluoro-1-octanesulfonamido ethanol (N-MeFOSE)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
N-ethylperfluoro-1-octanesulfonamido ethanol (N-EtFOSE)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	EPA 537 mod	EPA 537 mod	EPA 537 mod (VAL-PFAS)	EPA 537 mod (VAL-PFAS)

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Tissue
<b>1,4-Dioxane</b>				
1,4-Dioxane	-----	EPA 522 mod	-----	-----



**LABORATORY  
ACCREDITATION  
BUREAU** a division of A-5-B



# Certificate of Accreditation

ISO/IEC 17025:2005

Certificate Number L2229

**SGS Accutest - Orlando**

4405 Vineland Road, Suite C-15

Orlando FL 32811

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).\*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation valid through: December 15, 2018

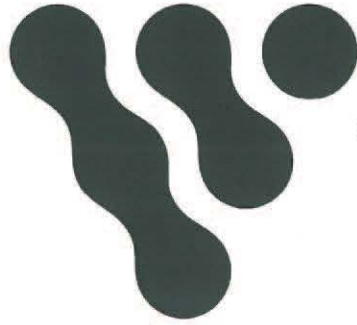
**R. Douglas Leonard, Jr., President, COO**  
**Laboratory Accreditation Bureau**  
**Presented the 14<sup>th</sup> of January 2016**

\*See the laboratory's Scope of Accreditation for details of accredited parameters

\*\*Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).  
Form 403.14 - Rev 1 7/3/13



**ATTACHMENT C**  
**LABORATORY QUALITY ASSURANCE MANUALS**



# Vista

## Analytical Laboratory

---

# QUALITY MANUAL

REVISION 23

EFFECTIVE DATE: DECEMBER 15, 2015

Andrew Patterson  
Technical Director

Date

Martha M. Maier  
Acting Quality Assurance Manager

Date

Martha M. Maier  
President / Laboratory Director

Date

Melanee Schuld  
Director of HRMS

Date

## TABLE OF CONTENTS

<b>1. INTRODUCTION.....</b>	<b>6</b>
1.1. POLICY.....	6
<b>2. ORGANIZATION AND FACILITIES.....</b>	<b>8</b>
2.1. MANAGEMENT RESPONSIBILITIES.....	8
2.2. QUALITY ASSURANCE MANAGER.....	9
2.3. LIMS ADMINISTRATOR.....	5
2.4. APPROVED SIGNATORIES.....	6
2.5. FACILITIES.....	11
<b>3. QUALITY SYSTEM.....</b>	<b>13</b>
3.1. QUALITY DOCUMENTS.....	13
3.2. USE OF QUALITY DOCUMENTS.....	13
3.3. DOCUMENT CONTROL.....	14
3.4. QUALITY ASSURANCE OBJECTIVES AND QUALITY CONTROL PROCEDURES.....	17
<b>4. PURCHASING.....</b>	<b>26</b>
4.1. QUALITY MATERIALS AND SERVICES.....	26
4.2. CONTROL OF QUALITY MATERIALS AND SERVICES.....	26
4.3. PROCUREMENT DOCUMENTS.....	26
<b>5. SAMPLE CONTROL.....</b>	<b>27</b>
5.1. RECEIPT OF MATERIALS.....	27
5.2. STORAGE, HANDLING, AND DISPOSAL.....	27
5.3. NOTIFICATION OF PROBLEMS.....	28
5.4. RECORDS.....	28
<b>6. TRACEABILITY OF MATERIALS.....</b>	<b>32</b>
6.1. VERIFICATION OF ITEMS DEVELOPED IN-HOUSE.....	32
6.2. CONTROL OF LABORATORY SAMPLES.....	32
6.3. STANDARDS AND REAGENTS TRACEABILITY.....	32
6.4. QUALITY CONTROL RECORDS.....	32
6.5. CERTIFICATES OF ANALYSIS.....	33
6.6. INSTRUMENTS AND EQUIPMENT.....	33
<b>7. PROCESS CONTROL.....</b>	<b>34</b>

7.1. INSTRUMENTS AND FACILITIES.....	34
7.2. PERFORMANCE AUDITS .....	34
<b>8. LABORATORY INSTRUMENTATION .....</b>	<b>35</b>
8.1. CALIBRATION STANDARDS AND INSTRUMENTS .....	35
8.2. CALIBRATION RECORDS.....	35
<b>9. QUALITY RECORDS.....</b>	<b>37</b>
9.1. DOCUMENTATION OF QUALITY RECORDS .....	37
9.2. QUALITY AND TECHNICAL RECORDS .....	37
9.3. RECORDS MANAGEMENT AND STORAGE.....	38
<b>10. CORRECTIVE ACTION.....</b>	<b>39</b>
10.1. CAUSES OF NONCONFORMANCE.....	39
10.2. CORRECTIVE ACTION .....	39
10.3. DOCUMENTATION.....	39
<b>11. REPORTS.....</b>	<b>40</b>
11.1. HANDLING AND STORAGE OF REPORTS.....	40
11.2. PACKAGING AND DELIVERY OF REPORTS .....	40
11.3. LABORATORY REPORT FORMAT AND CONTENT .....	41
<b>12. PERFORMANCE AND SYSTEM AUDITS.....</b>	<b>44</b>
12.1. SYSTEM AUDITS.....	44
12.2. MANAGEMENT REVIEWS .....	45
12.3. PERFORMANCE TESTING SAMPLES.....	45
12.4. EXTERNAL AUDITS.....	46
12.5. DATA AUDITS.....	46
<b>13. TRAINING.....</b>	<b>48</b>
13.1. INITIAL ON-SITE TRAINING.....	48
13.2. TRAINING PROGRAMS .....	48
13.3. TRAINING DOCUMENTATION .....	48
<b>14. CLIENT SERVICES.....</b>	<b>50</b>
14.1. ROUTINE SERVICES.....	50
14.2. CONTRACT REVIEW.....	50
14.3. RESPONSES TO CLIENT AUDITS, INQUIRIES, AND COMPLAINTS.....	51

<b>15. STATISTICAL TECHNIQUES.....</b>	<b>52</b>
15.1. STATISTICAL PROCESS CONTROL PROCEDURES.....	52
<b>16. SUBCONTRACTING .....</b>	<b>53</b>
<b>17. DATA INTEGRITY AND ETHICS .....</b>	<b>54</b>

**APPENDIX**

Vista Organization Chart

Key Resumes

List of Certifications

Quality Manual Revision Log

## **FOREWORD**

The Quality Manual (QM) describes the Quality System implemented at Vista Analytical Laboratory in El Dorado Hills, California. The policies and procedures outlined in this QM are designed and developed to comply with the established NELAP Standards. It is the intent of Vista to meet or exceed the Quality Assurance/Quality Control (QA/QC) requirements set by ISO 17025, NELAP, the USEPA or other appropriate governmental or private entities to assure that all analytical data generated are scientifically valid, defensible, comparable, and of known acceptable precision and accuracy.

The QM shall be amended to reflect any changes to Vista's capability, location or Quality System. The Quality Assurance Manager is responsible for the maintenance and annual review of the QM.

## 1. INTRODUCTION

Vista Analytical Laboratory in El Dorado Hills, CA was established in 1990 and is a privately owned California corporation. Vista provides state-of-the-art mass spectrometry services to chemical manufacturers, environmental engineering firms, and the pulp and paper industry as well other industrial and governmental clients. Vista operates with the intent of providing data of the highest quality with responsive service in a short turnaround time.

Vista has an expanding national and international client base attributable to its reliable reputation in performing difficult trace level analyses. Vista's expertise lies in the analysis of semivolatile organic compounds such as Polychlorinated Dioxin/Furans (PCDD/PCDF), Perfluorinated compounds, Polynuclear Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), Polychlorinated Naphthalenes (PCNs), Hexachlorobenzene (HCB), Polybrominated Diphenyl Ethers (PBDEs), and Pesticides.

### 1.1. Policy

It is the policy and commitment of Vista to meet the specific quality requirements and to satisfy the needs of the client, the regulatory authorities or organizations providing recognition, such as the EPA, TNI Standards, ISO/IEC 17025, and/or the Department of Defense (DoD) Quality Systems Manual (QSM), throughout data generation and process operations. A Quality System has been established to achieve this policy. The system encompasses all of the applicable elements of the established TNI Standard. It is Vista's intent to provide full compliance with this Quality System throughout all phases of client services and to ensure that only an acceptable final product is presented to the client.

1.1.1. It is Management's responsibility to instill a commitment to continuously improve the quality standards throughout the company, and to ensure each employee has a clear understanding of the Quality System.

- Quality is the responsibility of all Vista employees.
- All Vista employees must comply with all QA/QC procedures as it pertains to their function.
- All employees shall be accountable for the quality of their individual assignments and functional responsibilities.
- Employees shall be responsible for reporting any non-conformance to Management or the QA Manager.

- The laboratory shall have sufficient personnel with necessary education training, technical knowledge and experience for the assigned positions.
- 1.1.2. Management is responsible to ensure personnel are free from any commercial, financial, and other undue pressures, which might affect the quality of work.
- 1.1.3. All Vista employees shall be confident in their independence of judgment and maintain integrity at all times.



## 2. ORGANIZATION AND FACILITIES

The management staff of Vista consists of a President/Laboratory Director, Technical Director, and QA Manager.

The relationships between technical operations, quality management, and support services of Vista Analytical Laboratory are shown in the organizational chart presented in the Appendix.

### 2.1. Management Responsibilities

#### 2.1.1. President / Laboratory Director

The President manages the production scheduling and client management for the laboratory, is responsible for final review and interpretation of analytical data and final reports, and also serves as Laboratory Director. Should the Laboratory Director be absent for more than 15 consecutive calendar days, the Quality Assurance Manager or the Technical Director shall be designated acting Laboratory Director. In the absence of the Laboratory Director for more than 65 calendar days, all laboratory Accrediting Bodies shall be notified in writing by the QA Manager or Technical director. The Laboratory Director has the authority and is responsible for:

- Ensuring that the laboratory is current with all regulations that affect operations and the information be communicated to all laboratory personnel by the Technical Director and/or QA Manager;
- Overseeing the develop and implementation of the QA program which assures that all data generated will be scientifically sound, legally defensible and of known quality;
- Maintaining sufficient personnel, equipment and supplies to achieve production goals;
- Ensuring that personnel are free from commercial, financial, and other undue pressures which might affect the quality of their works;
- Being responsible for certifying the qualifications and training of the analysts;

- Reviewing all laboratory SOPs and training materials prior to their implementation and ensures that all approved SOPs are implemented and adhered to; and
- Being responsible for the review and negotiation of client contracts.

#### 2.1.2. Technical Director

The Technical Director is responsible for implementing the scientific procedures and best practices needed for the optimal performance of the laboratory. The Technical Director reports directly to the Laboratory Director. Should the Technical Director be absent for more than 15 consecutive calendar days, the Laboratory Director shall be designated acting Technical Director. The Technical Director has the authority and is responsible for:

- Identifying, resolving, and documents analytical problems encountered in the laboratory;
- Overseeing all method development work ;
- Being involved in the hiring and training of chemists and analysts;
- Providing technical expertise in evaluating potential work prior to bid submittal;
- Supporting QA and Operations with revisions of laboratory SOPs; and
- Providing support to QA for internal and external audit responses.

#### 2.2. Quality Assurance Manager

The QA Manager is responsible for managing the QA activities of the entire laboratory. The QA Manager reports directly to the Laboratory Director and is also the Deputy Laboratory Director. The QA Manager serves as the focal point for QA/QC and is responsible for the oversight and/or review of quality control data. When QA oversight is necessary, the QA Manager functions must be independent from the laboratory operations. Should the QA Manager be absent for more than 15 consecutive calendar days,

Technical Director shall be designated acting QA Manager. The QA Manager has the authority and is responsible for:

- Implementing, maintaining, and improving the quality system;
- Ensuring that all personnel understand their contributions to the quality system;
- Ensuring communication takes place at all levels within the laboratory regarding the effectiveness of the quality system;
- Evaluating the effectiveness of training;
- Review and update the Quality Manual as needed to remain current, at least annually;
- Using available tools, such as internal and external audits and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system; and
- Notifying management of deficiencies in the quality system and monitors corrective actions.

The QA Manager works with management to ensure that the Vista QM and associated SOPs are followed as written and maintains a position that is free from outside influence in order to evaluate the data and perform all other QA Manager responsibilities objectively.

### 2.3. LIMS Administrator

A key support staff position is the Laboratory Information Management System (LIMS) Administrator. The LIMS Administrator is responsible for assisting in developing and maintaining all LIMS-related programming and assists with other IT development and maintenance needs. The LIMS Administrator reports directly to the Laboratory Director. Should the LIMS Administrator be absent, internal laboratory support can be provided by the Principal or the Premium Help Desk shall be contacted for assistance. The LIMS Administrator has the authority and is responsible for:

- Implementing and maintaining the LIMS system;

- Providing LIMS system support, technical assistance and training to all laboratory personnel;
- Setting-up and managing LIMS system user accounts and security privileges;
- Managing and documenting change control for the LIMS system;
- Investigating and resolving LIMS system errors, correct user errors;
- Creating documentation of SOPs and training materials;
- Communicating changes, enhancements and modifications to the LIMS system to appropriate laboratory personnel;
- Developing data backup and recovery processes related to the LIMS system; and
- Communicating with IT vendors to resolve issues.

2.4. Approved signatories

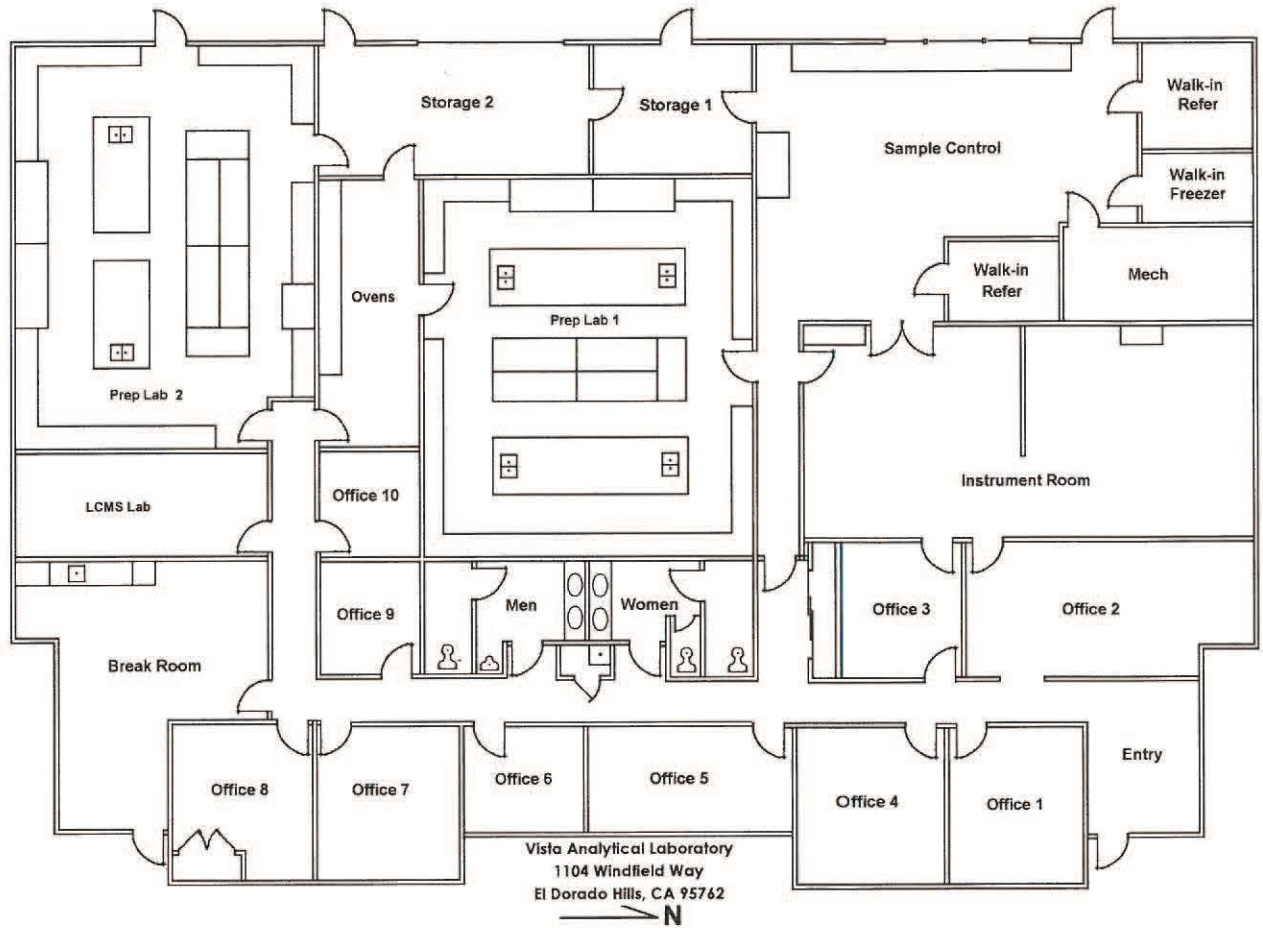
2.4.1. Approved signatories include the Laboratory Director, the Technical Director, the QA Manager, the Principal and the Director of HRMS.

2.5. Facilities

2.5.1. Vista Analytical Laboratory operates from El Dorado Hills, CA. The facility consists of 9,000 square feet.

2.5.2. The facility has been constructed and maintained to ensure that results are not invalidated or do not adversely affect the required accuracy of measurement.

2.5.3. Layout – 1104 Windfield Way, El Dorado Hills, CA



### 3. QUALITY SYSTEM

The Quality System applies to Vista Analytical Laboratory.

The company's Quality System is designed to comply with the applicable requirements of NELAP Standard and to satisfy the needs of the client or organization providing recognition. All policies, systems, and procedures are documented to assure quality of the data. Personnel shall familiarize themselves with quality documentation and implement the policies and procedures in their work.

Senior Management will review the effectiveness and suitability of the Quality System at least annually. The reviews shall address issues that impact quality. The results of the reviews shall be used to design and implement improvements to the system. The reviews include reports from management and supervisory personnel, recent internal audits, external audits, proficiency testing, client feedback, and corrective action reports. The QA Manager will maintain records of the review meeting, findings, and corrective actions.

#### 3.1. Quality Documents

- 3.1.1. The Quality System is outlined and documented in the Quality Manual and supporting quality documents. The documented quality system assures that services provided to clients comply with specified quality criteria.
- 3.1.2. The Quality Manual contains Quality Policies covering the applicable requirements of the NELAP quality standard.
- 3.1.3. Program specific quality criteria are specified in the Quality Assurance Program Plan (QAPP).
- 3.1.4. Procedural activities that affect quality are described in more detail in the Standard Operating Procedures (SOPs).

#### 3.2. Use of Quality Documents

- 3.2.1. Management will review and approve all quality documents prior to issuance. All quality documentation shall be communicated to, understood by, available to, and implemented by the appropriate personnel.
- 3.2.2. A QAPP or other project-specific requirements submitted by the client will be reviewed to determine whether they are within the scope of the Analytical Procedures. Any discrepancies will be

discussed with the client and documented prior to commencement of the project.

- 3.2.3. The Quality Manual will be understood and implemented throughout the company. The QAPP and SOPs will be understood and implemented throughout applicable operations.
- 3.2.4. Quality documents shall be periodically reviewed to ensure continuing suitability and compliance with applicable requirements. The Quality System will be reviewed on an ongoing basis and revised as needed to ensure that it effectively encompasses the company's quality criteria. The QA Manager will maintain the Quality Manual. Revisions to the Quality Manual may be made by replacing individual policies or the entire manual.
- 3.2.5. Any departures from policies or planned activities that affect quality will be approved by management prior to occurrence.
- 3.2.6. The QAPP will be maintained by the designated responsible manager, or the QA Manager. Revision may be made to individual sections of the entire plan.
- 3.2.7. Standard Operating Procedures will be maintained as designated in the specific SOP with revisions being made on an as needed basis.

### 3.3. Document Control

Standard Operating Procedures (SOPs) or any documents that specify quality requirements or otherwise affect quality are Controlled Documents. All controlled documents will be prepared, issued and revised in accordance with the applicable SOPs. The SOPs are presented in Table 3.1.

- 3.3.1. Procedures are established to control and maintain the issue, distribution, and revisions of all controlled documentation. The Standard Operating Procedures SOP is SOP 3.
- 3.3.2. Appropriate documents shall be made available at all locations where operations essential to the effective functioning of the laboratory are performed.
- 3.3.3. Complete and current copies of the controlled documents shall be made available upon issuance, and obsolete copies will be removed from all points of issue or use. The controlled document copies will be stamped, in red, as an "Official QA Copy".

- 3.3.4. All original controlled documents are archived by QA Manager.
- 3.3.5. A master list will be used to ensure that the correct revision of each SOP is available for use, and that obsolete revisions are removed from service. Each controlled document has an associated revision number and effective date to enable tracking of current revisions.
- 3.3.6. Document changes are reviewed and approved by the appropriate personnel.
- 3.3.7. Documents are periodically reviewed and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements. The Quality Manual will be revised as needed and reviewed annually.
- 3.3.8. QA Manager will maintain records of revisions for Controlled Documents and the QAPP.

<b>Table 3.1 List of Standard Operating Procedures</b>	
<b>SOP #</b>	<b>Title</b>
1	Laboratory Security
2	Laboratory Audits
3	Standard Operating Procedures
5	Data Collection, Reporting, and Archival
6	Corrective Actions
7	Control Charts
8	Method Detection Limits
9	Manual Integrations
10	Instrument Maintenance Logbooks and Schedule
11	Laboratory Support Instrument Calibration
12	Sample Receiving and Sample Control Procedures
13	Consignment Tracking
14	Bottle Order Preparation
15	Reagents and Standards – Preparation, Handling, and Documentation
16	Sample Preparation and Analysis of PUF Samples for PCDD/PCDFs/PCBs by EPA Method TO-9A
17	Preparation and Shipping of Air Sampling Media for in Field Use
18	Sample Preparation of MM5 Train for Analysis of PAHs by Method CARB 429
19	Sample Preparation of MM5 Train for Analysis of PCDD/PCDFs by Methods CARB 428 and Method 23 or Method 0023A
20	Sample Preparation and Analysis of Sampling Trains and PUFs and PUF/XAD2 for Analysis of PCBs by Modified Method 1668



<b>Table 3.1 List of Standard Operating Procedures</b>	
<b>SOP #</b>	<b>Title</b>
21	Sample Preparation and Analysis of Sampling Trains and PUFs and PUF/XAD for Analysis of PBDEs by Modified Method 1614 (Draft)
22	Preparation of Surface Wipes
23	Polychlorinated Dibenzo Dioxin/Furans by USEPA Method 8280A
24	Polychlorinated Dibenzo Dioxin/Furans by USEPA Method 8290
25	Tetrachlorodibenzodioxin in Aqueous Samples by Modified USEPA Method 613
26	Polychlorinated Dibenzo Dioxin/Furans by Method 1613B
28	Sample Analysis of Pentachlorobenzene/Hexachlorobenzene/Hexachlorobutadiene by Modified Method 1625B
30	Preparation and Analysis of Polybrominated Dibenzo-Dioxin/Furans by Modified EPA Method 8290
31	Analysis of Polychlorinated Biphenyls (PCBs) by Method 1668A/C
32	Preparation and Analysis of Various Matrices for Polybrominated Diphenyl Ethers (PBDE) by EPA Method 1614
33	Preparation and Analysis of Polychlorinated Naphthalenes (PCN) by Modified EPA Method 1668A
34	Preparation and Analysis Using Modified Method 8290 for PCDD/PCDFs and Modified Method 1668A For Coplanar/Mono-Ortho PCBs
35	Glassware Preparation
36	Sample Preparation of MM5 Train for Analysis of PCDDs/PCDFs/PCBs/PAHs by Methods 0023A/1668/CARB 429
37	NCASI 551: Procedures for the Preparation and Isomer Specific Analysis of Pulp and Paper Industry Samples for 2,3,7,8-TCDD And 2,3,7,8-TCDF
38	Computer Systems
39	Preparation and Analysis of Pesticides by Method 1699
40	Preparation and Analysis of Water Using Modified Method 1694 for Pharmaceuticals and Personal Care Products
41	Extraction and Analysis of Hexachloroxanthene by HRMS
42	Computer Software Validation
44	Incremental Subsampling
45	EPA Method 1668 Contract/Government Sites
46	Sample Preparation and Analysis of PUF Samples For PAH By Modified Method TO-13
47	Sample Preparation and Analysis of PAHs Based On A Modified EPA 8270 / 1625 Method
49	Preparation and Analysis for the Determination of Perfluorinated Compounds
50	Preparation and Analysis of Aqueous and Solid Matrices for the Determination of Hexachlorophene
51	Client Custom SOP - Confidential
52	Sample Preparation – DRAFT

Table 3.1 List of Standard Operating Procedures	
SOP #	Title
53	Preparation and Analysis Solid Matrices for the Determination of 2,4,6,8-Tetrachlorodibenzothiophene
58	1-4 Dioxane by Modified EPA Method 522
59	Bligh and Dyer Extraction of Lipids
60	Fish Sample Preparation

### 3.4. Quality Assurance Objectives and Quality Control Procedures

Quality assurance objectives employed at Vista provide routine mechanisms of ongoing control and evaluation of measurement data quality. The quality control (QC) procedures routinely followed evaluate method performance in terms of accuracy and criteria specified by the method or protocol.

#### 3.4.1. Accuracy and precision

Accuracy and precision objectives for HRMS analyses are listed in Table 3.2. Vista's internal quality control procedures include the analysis of method blanks, duplicate samples, laboratory control samples, and matrix spikes.

#### 3.4.2. Definitions

3.4.2.1. **Accuracy:** Accuracy is the nearness of a measurement to the true or theoretical value. Accuracy is assessed by determining recoveries from laboratory control samples, matrix spikes or by comparing values obtained from reference samples.

3.4.2.2. **Analytical Batch:** An analytical batch is a maximum set of 20 samples of the same matrix that are analyzed together using the same method, reagents, and standards. QC results associated with individual analytical batches such as ongoing precision and recovery samples, laboratory control samples, method blanks, matrix spike samples, and duplicate samples are evaluated together to assess data quality. Each batch will be assigned a unique batch number, which will be used to associate sample results with quality control data. All samples associated with a particular batch must be extracted on the same day.

- 3.4.2.3. **Clean-up Recovery Standard:** A clean-up recovery standard is a reference substance that is an isotopically labeled analyte that is added to the sample extract prior to any clean-up procedures. This standard is used to quantitatively assess losses occurring throughout the clean-up process.
- 3.4.2.4. **Control/Warning Limits:** Warning and control limits are limits used in laboratory control charts tracking average recovery and relative percent difference. For a Means Chart, typical warning and control levels are  $\pm 2$  and  $\pm 3$  standard deviations (s) from the central line (i.e., average mean recovery), respectively. Similarly, the warning and control limits for a RPD Chart are usually set at + 2s and + 3s above the mean RPD, respectively.
- 3.4.2.5. **Detection Limit (DL):** The lowest concentration of an analyte within an environmental matrix that a method or equipment can detect.
- 3.4.2.6. **Duplicate Sample (DS):** Duplicate samples are two separate aliquots taken from the same source. Duplicate samples are analyzed independently to assess laboratory precision.
- 3.4.2.7. **Estimated Maximum Possible Concentration (EMPC):** The EMPC is calculated when the response has a S/N in excess of 2.5, but the ion abundance criteria are not met.
- 3.4.2.8. **Internal Standards (IS):** An internal standard is a reference substance that is an isotopically labeled analyte which is added to the sample prior to extraction and used in the quantitation and identification of native analytes.
- 3.4.2.9. **Laboratory Control Sample (LCS):** A laboratory control sample is prepared by adding a known quantity of native standards to an interferent free matrix.
- 3.4.2.10. **Limit of Detection (LOD):** An estimate of the minimum amount of an analyte that can be reliably detected. An LOD is analyte, matrix specific and laboratory
- 3.4.2.11. **Limit of Quantitation (LOQ):** The minimum concentration of an analyte that can be reported. The LOQ shall be set at or

above the concentration of the lowest initial calibration standard.

- 3.4.2.12. **Method Blank (MB):** A method blank is a sand, XAD or deionized water preparation that is free of native analyte or interferences that has been prepared and analyzed using the same procedures followed for the rest of the analytical batch. The method blank is used to determine the level of background laboratory contamination, if present.
- 3.4.2.13. **Method Detection Limit (MDL):** The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero in the matrix tested. MDLs follow 40 CFR Part 136, Appendix B.
- 3.4.2.14. **Method Quantitation Limit (MQL):** The method quantitation limit is defined as the quantity of native analyte that corresponds to the lowest concentration of the calibration curve. The Method Quantitation Limit is also known as the Reporting Limit.
- 3.4.2.15. **Matrix Spike (MS/MSD):** A matrix spike sample is prepared by adding a known quantity of native standards to a sample matrix prior to extraction. Matrix spike concentration levels will vary according to the matrix encountered and study objectives.
- 3.4.2.16. **Native Standard:** A native standard is a reference substance that is a non-isotopically labeled analyte. Native standards are used in conjunction with internal standards to determine response factors and quantitatively assess accuracy.
- 3.4.2.17. **Ongoing Precision and Recovery (OPR):** A laboratory blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the specified limits.
- 3.4.2.18. **Precision:** Precision is the agreement between a set of replicate measurements. Relative Percent Difference (RPD) is used as the principal measure of precision and is based on the analysis of duplicate quality control samples.

- 3.4.2.19. **Pre-Spike Standards:** A pre-spike standard is an isotopically labeled analyte that is spiked into an MM5 resin cartridge or PUF prior to sampling. The recoveries of pre-spike standards provide a measure of the air sampling efficiency for native analytes.
  - 3.4.2.20. **Quality Control Sample:** Quality control samples are analyzed to assess the various aspects of the analytical process in order to monitor quality within the laboratory. The most frequently used QC samples are method blanks, duplicates, matrix spikes, matrix spike duplicates and LCS pairs.
  - 3.4.2.21. **Recovery Standard:** A recovery standard is a reference substance that is an isotopically labeled analyte which is added to the sample extract after clean-up and prior to injection. This standard is used to quantitatively assess the absolute recoveries of the internal and clean-up recovery standards.
  - 3.4.2.22. **Resin QC:** A resin QC is an XAD-2 preparation that is analyzed to assess possible background contamination originating from the resin.
  - 3.4.2.23. **Reporting Limit:** See Method Quantitation Limit.
  - 3.4.2.24. **Signal-to-Noise Ratio:** Dimensionless measure of the relative strength of an analytic signal to the average strength of background instrument noise.
- 3.4.3. Calculations

- 3.4.3.1. Percent Recovery (%R): Percent recovery is a measure of accuracy and is calculated according to the following expression:

$$\%R = \frac{(Amount\ Found)}{(Amount\ Spiked)} \times 100$$

- 3.4.3.2. Relative Percent Difference (RPD): Percent Recovery (%R) from duplicate LCS or matrix spike analyses are used to calculate RPD using the following expression:

$$RPD = \frac{|\% R_1 - \% R_2|}{\left(\frac{(\% R_1 + \% R_2)}{2}\right)} \times 100$$

- 3.4.3.3. Similarly, the RPD for duplicate sample analyses, is calculated using the sample concentration (C), as follows:

$$RPD_{DS} = \frac{|C_1 - C_2|}{\frac{(C_1 + C_2)}{2}} \times 100$$

- 3.4.3.4. Relative Standard Deviation (RSD): Also known as the coefficient of variation.

$$RSD = \frac{SD}{Mean} \times 100$$

#### 3.4.4. Quality Control Procedures

##### 3.4.4.1. Method Blanks:

A method blank is run with each analytical batch or 20 samples (whichever is less) per method and matrix type.

For any method involving the determination of native 2,3,7,8-substituted isomers, the levels measured in the method blank must be less than the MQL, or ten times lower than the concentration found in samples within the analytical batch, unless otherwise mandated by project or client requirements.

All samples within an analytical batch are re-extracted and analyzed if the method blank associated with that batch does not meet internal standard recovery criteria or contamination limits specified above. Otherwise, the data is qualified appropriately.

##### 3.4.4.2. Ongoing Precision and Recovery/Laboratory Control Samples

A single OPR or a pair of LCS is analyzed with every batch of clients' samples.

If the recoveries of the OPR/LCS do not fall within the acceptable control range for accuracy or if the RPD falls outside the specified precision limit established by the method, then all samples within the analytical batch are re-extracted and analyzed. If the OPR/LCS recoveries are not within the acceptable control range and the analytes are not detected in the samples, then the Analyst, Project Manager

and/or QA Manager will use professional judgment to assess the effect on the sample data. A decision will be made to re-extract the affected batch or qualify the data that is reported.

#### 3.4.4.3. Matrix Spike and Duplicate Sample Analyses

An MS, MS/MSD, or duplicates are analyzed upon client request, method requirements, or at the discretion of the Project Manager.

If the RPD from duplicate samples or MS/MSD exceeds criteria in Table 3.2, corrective action will be taken as directed in the method, unless there is demonstrated matrix effect.

#### 3.4.5. Quality Control Charts

Quality control data are calculated as needed by the QA Manager and distributed to the Laboratory Director for review if necessary. A set of current QC control charts is maintained in QA Manager. Original copies of the QC charts and any associated tabular data are stored in QA Manager. QC control charts are available upon written request of clients or regulatory agencies or may be reviewed during facility audits.

**Table 3.2 Accuracy and Precision Objectives**

<b>DATA ACCEPTANCE/REJECTION CRITERIA</b>					
<b>Precision/Accuracy and QC Requirements</b>					
<b>METHOD</b>	<b>Method Blank</b>	<b>Internal Standard Recovery Limits</b>	<b>OPR Recovery Limits</b>	<b>Duplicate Sample Analysis</b>	<b>MS/MSD</b>
<b>EPA 8280/8280A</b>	One/extraction batch ≤ML, report in ng/g or ng/L ≤5% regulatory limit or amount in sample	25-150%	70-130%	By client request RPD ≤50%	By client request RPD ≤50%
<b>EPA 8290/0023A</b>	One/extraction batch Run between calibration std and 1st sample	40-135%	70-130%	By client request RPD ≤25%	By client request RPD ≤20%
<b>EPA 23</b>	One/extraction batch Run between calibration std and 1st sample	Surrogate 70-130% IS Tetra-Hexa 40-130% Hepta-Octa 25-130%	70-130%	Not applicable	Not applicable
<b>T0-9A</b>	One/extraction batch Run between calibration std and 1st sample	Surrogate 70-130% IS Tetra-Hexa 50-120% Hepta-Octa 40-120%	70-130%	Not applicable	Not applicable
<b>EPA 613</b>	One/extraction batch	25-150%	70-130%	By client request RPD ≤25%	10% of samples or 1/month RPD ≤20%



**Table 3.2 Accuracy and Precision Objectives**

<b>DATA ACCEPTANCE/REJECTION CRITERIA</b>					
<b>Precision/Accuracy and QC Requirements</b>					
<b>METHOD</b>	<b>Method Blank</b>	<b>Internal Standard Recovery Limits</b>	<b>OPR Recovery Limits</b>	<b>Duplicate Sample Analysis</b>	<b>MS/MSD</b>
<b>EPA 1613A EPA 1613B</b>	One/extraction batch after OPR Must be $\leq 1/3$ of minimum level (10 pg/L or regulatory compliance level whichever is greater).	Method Tables 7 and Table 7A	Method Tables 6 and 6A	By client request RPD $\leq 25\%$	By client request RPD $\leq 20\%$
<b>EPA 1614</b>	Method Blank $\leq ML$ ; $\leq 1/3$ regulatory limit or amount in sample	Tetra-Hepta: 30-140% Tetra-Hepta: 25-150% Samples Deca: 20-200%	Tetra-Hepta: 50-150% Deca: 40-200%	By client request RPD $\leq 50\%$	By client request RPD $\leq 50\%$
<b>EPA Method 1625</b>	One/extraction batch	Method Table 8	Method Table 8	By client request RPD $\leq 25\%$	By client request RPD $\leq 20\%$
<b>EPA 1668A/C PCBs</b>	One/extraction batch $\leq 10X$ amount in sample	Samples 25-150% OPR Recovery per SOP 31	OPR Recovery per SOP 31	By client request RPD $\leq 50\%$	By client request RPD $\leq 20\%$
<b>Modified 1668A (PCN)</b>	One/extraction batch	30-140% 25-150% Samples	50-150%	By client request RPD $\leq 25\%$	By client request RPD $\leq 20\%$
<b>EPA Method 1699</b>	One/extraction batch	Method Table 5	Method Table 5	By client request RPD $\leq 25\%$	By client request RPD $\leq 20\%$
<b>NCASI 551</b>	Method Blank IS & RS Recovery $> 40\%$	40-120% or S/N $> 10:1$ , if %R is $> 20\%$ "H" Qualifier	70-130%	By client request RPD $\leq 25\%$	By client request RPD $\leq 20\%$

**Table 3.2 Accuracy and Precision Objectives**

<b>DATA ACCEPTANCE/REJECTION CRITERIA</b>					
<b>Precision/Accuracy and QC Requirements</b>					
<b>METHOD</b>	<b>Method Blank</b>	<b>Internal Standard Recovery Limits</b>	<b>OPR Recovery Limits</b>	<b>Duplicate Sample Analysis</b>	<b>MS/MSD</b>
<b>CARB 428 PCB's</b>	One/extraction batch ≤ 10X amount in sample	40-120% or S/N >10:1	60-140%	Not applicable	Not applicable
<b>CARB 428 Dioxin/Furan</b>	One/extraction batch Must be ≤ ML	Surrogates= 60-140% IS= 40-120% or S/N >10:1	60-140%	Not applicable	Not applicable
<b>CARB 429</b>	One/extraction batch ≤ 5% amount in sample	50-150% or S/N >10:1 "H" Qualifier	Field Spikes 50-150%	By client request RPD ≤25%	Not applicable
<b>Modified Method 1694</b>	One/extraction batch	Method Table 12	Method Table 12	By client request RPD ≤25%	By client request RPD ≤20%
<b>EPA Method 537</b>	One/extraction batch	Samples: 5-153% OPR: 5-168%	50-120%	By client request RPD ≤50%	By client request RPD ≤20%

## 4. PURCHASING

### 4.1. Quality Materials and Services

Materials and services that affect the quality of the company's services will be designated as quality material and services. Purchases shall be made only from approved suppliers (based on historical experience or quality certifications).

### 4.2. Control of Quality Materials and Services

Quality Materials and Services and, where appropriate, potential suppliers' Quality Systems, shall be evaluated to ensure that specified quality requirements are met. Any purchased equipment and consumable materials, whenever possible, shall be inspected, calibrated, or otherwise verified as complying with any standard specifications relevant to the calibrations or tests concerned prior to use. Records of actions taken to check compliance shall be maintained.

### 4.3. Procurement Documents

Procurement documents will clearly specify all information and requirements necessary to ensure that the correct materials and services are purchased and received. Any discrepancies between request and contracts shall be resolved before any work commences. Request and contracts shall be reviewed to determine the effect of financial, legal and time schedule aspects. Any amendments to the request or contract after work has commenced shall require another review process.

## 5. SAMPLE CONTROL

Samples and other material received from clients shall be handled and maintained in accordance with laboratory SOPs.

### 5.1. Receipt of Materials

5.1.1. Samples and materials received from clients, and any other materials received from an outside source in the regular course of business, will be inspected upon receipt to insure that they meet specified quality requirements. All conditions, including any abnormalities or departures from standard conditions, shall be recorded according to SOPs.

5.1.2. Immediately after inspection samples will be logged into the laboratory computer system. A unique laboratory identification number is assigned to each sample at the time of login. This unique laboratory identification allows the sample to be controlled and tracked during storage, handling, and disposal.

5.1.3. Other materials will be properly identified upon verification that they meet specified quality requirements.

### 5.2. Storage, Handling, and Disposal

5.2.1. Samples and materials received from clients will be stored and handled in a manner that ensures the integrity and quality characteristics are maintained.

5.2.1.1. All samples are stored away from all standards; reagents, food, or any other potentially contaminating sources in such a manner as to prevent cross contamination.

5.2.2. Samples, sample extracts, and any other sample preparation fractions are stored according to the conditions specified by preservation protocols or according to the appropriate test method.

5.2.3. Samples are stored for a minimum of 90 days. If the client provides any relevant instructions regarding sample storage, then the samples are stored according to the client's request.

5.2.4. Samples will be disposed of in a manner that:

- Protects the environment

- Complies with applicable regulatory requirements
  - Complies with any project specific requirements
- 5.2.5. Excess materials will either be returned to the client, or disposed of in accordance with the applicable SOPs.
- 5.2.6. Access to laboratories and sample storage facilities will be restricted to authorized personnel to further ensure that sample integrity is maintained.
- 5.2.7. Ambient conditions will be monitored in storage facilities and laboratories where control of those conditions is necessary to maintain the integrity of the sample.
- 5.3. Notification of Problems
- Clients or suppliers will be notified if the integrity of their samples or materials is jeopardized either upon receipt or while in the possession of the company.
- 5.4. Records
- Records of all procedures to which a sample is subjected to while in the laboratory shall be maintained. Chain of custody records shall establish an intact, continuous record of the physical possession, storage, and disposal of all samples.

**Table 5 Sample Containers, Preservatives and Maximum Holding Times**

Method	Sample Type	Maximum Holding Times	Container Type	Preservation
<b>EPA Method 8280</b>	Aqueous	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(2)</sup>	Amber Glass	< 6 °C
	Solid	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(2)</sup>	Glass Container	≤ 6 °C
<b>EPA Method 8290</b>	Aqueous	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(2)</sup>	Amber Glass	< 6 °C dark
	Solid	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(2)</sup>	Glass Container	< 6 °C dark
	Fish/Tissue	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(1)</sup>	Glass Container	< -10 °C dark
<b>EPA Method 1613B</b>	Aqueous	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGB	0 – 6 °C <sup>(3)</sup> dark
	Solid Fish/Tissue	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGJ	< 6 °C dark <sup>(6)</sup> < -10 °C dark <sup>(7)</sup>
<b>EPA Method 1614</b>	Aqueous <sup>(3)</sup>	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGB	0 – 6 °C <sup>(3)</sup> dark
	Solid Fish/Tissue	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGJ	< 6 °C dark < -10 °C dark <sup>(7)</sup>
<b>Modified EPA Method 1625</b>	All samples	Extraction: 7 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup>	Amber Glass Containers	0 – 6 °C <sup>(3)</sup> dark
<b>EPA Method 1668A/C</b>	Aqueous	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGB	0 – 6 °C <sup>(3)</sup> dark
	Solid Fish/Tissue	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGJ	< 6 °C dark <sup>(6)</sup> < -10 °C dark <sup>(7)</sup>
<b>EPA Method 1694</b>	Aqueous	Extraction: 7 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup>	Amber Glass Containers	< 6 °C dark

**Table 5 Sample Containers, Preservatives and Maximum Holding Times**

Method	Sample Type	Maximum Holding Times	Container Type	Preservation
<b>EPA Method 1694</b>	Solid	Extraction: 7 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup>	Amber Glass Containers	< 6 °C dark < -10 °C dark <sup>(7)</sup>
<b>EPA Method 1699</b>	Aqueous <sup>(3)</sup>	Extraction: 7 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup>	AGB	< 6 °C dark
	Solid Fish/Tissue	Extract/Analyze: 1 year	AGJ	< 6 °C dark < -10 °C dark <sup>(7)</sup>
<b>Modified EPA Method 537</b>	Aqueous Solid	Extraction: 14 days <sup>(1)</sup> Analysis: 28 days <sup>(2)</sup>	Polypropylene or HDPE	≤ 10 °C Receipt <sup>(8)</sup> < 6 °C dark <sup>(8)</sup>
<b>EPA Method 613</b>	Aqueous	Extraction: 7 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup>	AGB	6 °C <sup>(3)</sup> dark
<b>EPA Method 23</b>	MM5 Train	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(2)</sup> Trap Prep: 30 days	Train and/or AGB	Adsorbents on ice <sup>(6)</sup>
<b>EPA Method T0-9A</b> <sup>(4)</sup>	PUF	Extraction: 7 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup> PUF Prep: 30 days	PUF	< 6 °C
<b>CARB Method 428</b> <sup>(4)</sup>	MM5 Train	Extraction: 30 days <sup>(1)</sup> Analysis: 45 days <sup>(2)</sup> Trap Prep: 30 days	Train and/or AGB	0 – 6 °C dark <sup>(5)</sup>
<b>CARB Method 429</b>	MM5 Train	Extraction: 21 days <sup>(1)</sup> Analysis: 40 days <sup>(2)</sup> Resin QC Date: 21 days	Train and/or AGB	< 6 °C dark
<b>NCASI 551</b> <sup>(4)</sup>	All Samples	NA	NA	< 6 °C
<b>PCN</b>	Aqueous	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGB	0 – 6 °C <sup>(3)</sup> dark < -10 °C dark <sup>(7)</sup>
	Solid Fish/Tissue	Extraction: 1 year <sup>(1)</sup> Analysis: 1 year <sup>(2)</sup>	AGJ	< -10 °C dark <sup>(7)</sup>

(1) From collection

(2) From extraction

(3) If residual chlorine is present sodium thiosulfate is added as per the method

(4) Holding times set by Vista Analytical Laboratory

- (5) Recommended by Vista Analytical Laboratory
- (6) From collection until laboratory receipt
- (7) Solid matrices not extracted within 21 days will be stored  $<-10^{\circ}\text{C}$
- (8) Preserved in the field with Trizma



## 6. TRACEABILITY OF MATERIALS

Procedures for identifying, controlling, and tracking items purchased from vendors, items developed in-house, samples received from clients, and client reports are detailed in SOPs.

Purchased materials and supplies will be checked to confirm that they meet quality specifications.

### 6.1. Verification of Items Developed In-house

6.1.1. Items developed in-house such as computer programs, equipment, and procedures, will be tested to verify that they meet the intended objectives. Test records will be maintained so that client reports can be traced to specific items.

### 6.2. Control of Laboratory Samples

6.2.1. Each sample will be assigned a unique laboratory ID number that will be used to track the sample as it is processed through the laboratory. This unique ID number is also used to associate the analytical results with the sample.

6.2.2. Samples will be batched for analysis. Each batch will be assigned a unique batch number that will be used to associate sample results with quality control data.

### 6.3. Standards and Reagents Traceability

6.3.1. Documented procedures shall exist for the purchase, reception, and storage of consumable materials used for the technical operations within the laboratory. Certificate of Analysis records for all standards shall be retained by QA Manager. Reagent and standard preparation documentation shall indicate traceability to purchased stock or neat compounds, reference to method of preparation, date of preparation, expiration date, and preparer's initials.

### 6.4. Quality Control Records

Records will be maintained to trace calibration standards and instrument calibration data to NIST or USEPA standards as appropriate. If NIST or USEPA standards are not available other standards will be used which are acceptable to specific project requirements. In compliance to A2LA, external calibrations

and verifications, these must be recorded in a calibration certificate or report and must include an endorsement by the recognized Accreditation Body's symbol (or otherwise makes reference to accredited status by a specific, recognized accreditation body); and an indication of the type of entity that is accredited (e.g., via an accreditation certificate number, inclusion of "calibration laboratory" with the symbol, etc.); and the measurement uncertainty.

In-house calibrations must be performed as per SOP 11.

6.4.1. Each instrument will be assigned a unique ID number. Records will be maintained to document the performance and maintenance of each instrument.

6.4.2. Records will be maintained to identify the individuals responsible for preparing calibration standards, analyzing samples, and reviewing analytical data.

6.4.3. Quality control records will be maintained to demonstrate that individual test procedures have been verified. Individual analytical results will be traceable to these quality control records.

#### 6.5. Certificates of Analysis

6.5.1. All client reports and certificate of Analysis will be uniquely identified. Where appropriate, contract or purchase order numbers will be referenced on client reports. When requested, test procedures will be referenced on Certificates of Analysis.

#### 6.6. Instruments and Equipment

6.6.1. All measuring operations and testing equipment effecting accuracy or validity of tests shall be calibrated and verified before being put into service and on a continuing basis.

## 7. PROCESS CONTROL

Analytical procedures and other processes that directly affect the quality of services will be conducted under controlled conditions using SOPs that are written at a level of detail appropriate to the complexity of the process.

Personnel will be properly trained before being given responsibility for an analytical procedure or other process that directly affects the quality of a service.

### 7.1. Instruments and Facilities

7.1.1. Analytical instruments will be maintained in a condition, which will ensure that they are able to meet specified operating conditions.

7.1.2. Laboratory facilities will be designed to meet specific operating conditions, and maintained in a condition, which will ensure that the operating conditions are consistently met.

7.1.3. Results of quality control checks will be recorded.

### 7.2. Performance Audits

7.2.1. The laboratory shall ensure the quality of results provided to clients by implementing checks to monitor the quality of the laboratories analytical activities.

7.2.1.1. Internal QC procedures.

7.2.1.2. Participation in proficiency testing or other interlaboratory comparisons.

7.2.1.3. Use of certified reference materials.

## 8. LABORATORY INSTRUMENTATION

All laboratory instrumentation and testing equipment used by the company will be maintained and calibrated in accordance with SOPs to verify proper operation. Table 8 details a list of current laboratory instrumentation for analysis.

Instrumentation will be placed into service dependent upon the capability of achieving the accuracy required and shall comply with relevant specifications to the instrument.

Authorized personnel shall operate laboratory instrumentation and testing equipment.

Instrumentation and equipment will be used in a manner that ensures that measurement uncertainty is known and consistent with specified quality requirements.

Methods and intervals of calibration specified for each instrument will be based on the individual operating characteristics of the instrument and the quality requirements of the analytical procedure.

### 8.1. Calibration Standards and Instruments

8.1.1. Calibration and verification procedures will use standards and instruments, whenever applicable, that are traceable to recognized national or international standards. Where traceability to national standards does not exist, the basis for the calibration will be documented.

8.1.2. Prior to use, laboratory instrumentation and testing equipment shall be calibrated or calibration verified and checked to establish that it meets the laboratory's specification requirements and complies with the relevant standard specifications.

8.1.3. Where applicable, reference standards and instrumentation will be checked periodically between calibration and verification procedures.

### 8.2. Calibration Records

8.2.1. Except for procedures requiring reanalysis, calibration prior to each analysis and previous calibration data will be reviewed when an instrument is out of calibration to determine whether or not the analytical results are acceptable.

8.2.2. Instruments that are unable to maintain calibration or not operating properly will be taken out of service. Instruments will

not be placed back into service until they have been repaired and verified to be operating properly.

- 8.2.3. The records for each test or calibration shall contain sufficient information to indicate whether specified quality or process parameters are achieved. Each instrument will be assigned a unique ID number. Records will be maintained to document the performance and maintenance of each instrument.

**Table 8 Instrument List**

Name	ID	Acquired
Waters Autospec Ultima High Resolution Mass Spectrometer	VG-7	2001
Waters Autospec Ultima High Resolution Mass Spectrometer	VG-8	2001
Waters Autospec Ultima High Resolution Mass Spectrometer	VG-9	2004
Waters Autospec Premier High Resolution Mass Spectrometer	VG-10	2008
Waters Autospec Ultima High Resolution Mass Spectrometer	VG-11	2015
Waters Micromass Quattro Premier XE Tandem Quadrupole Mass Spectrometer (QT™Q) MS/MS	Q-1	2008
AB SCIEX API 4000 Triple Quadrupole Mass Spectrometer	Q-2	2015

## 9. QUALITY RECORDS

Procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records shall be in accordance with SOPs. Quality records shall include internal audits and management reviews as well as records of corrective actions and preventative actions. Technical records include original observations, calculations and derived data, calibration records and a copy of final report.

### 9.1. Documentation of Quality Records

9.1.1. Quality records will be generated in accordance with the specification of applicable procedures, programs, and contracts. These records will be maintained to demonstrate that specified quality requirements are met, and that the Quality System is functioning successfully.

9.1.2. Quality records of subcontractor services which affect the quality of the company's services will be required to meet the conditions of this section.

9.1.3. Documents will be clean and legible, and will reference back to the specific activities or procedures to which they apply.

### 9.2. Quality and Technical Records

9.2.1. Quality and technical records shall be conducted in accordance with SOPs.

9.2.2. History of all samples must be traceable and readily understood through the documentation.

9.2.3. Instruments may not be used in analytical procedures unless maintenance and calibration records indicate that specified quality requirements are achieved. The results of instrument maintenance and calibration inspections will be clearly identified either on the instrument or in maintenance and calibration documents

9.2.4. Work must pass specified quality requirements before it will be released to the succeeding step in the process or, finally, to the clients. The results of quality control checks on work processes will be documented in a manner that clearly indicates the status of the work to the responsible personnel.

9.2.5. Individuals authorized to conduct instrument maintenance and calibration procedures and quality control checks will be identified in the documentation.

### 9.3. Records Management and Storage

9.3.1. The laboratory shall retain on record all original observations, calculations and derived data, calibration records and a copy of report for a minimum of five years. This applies to both manual and electronic data.

- Individual records will be reviewed and noted if storage requirements longer than five years are required based on client, project or state specific regulations.

9.3.2. Records must provide sufficient information for an adequate audit trail that produces the same results for the sample analytical data. The sample from receipt to analysis must be readily understood through documentation.

9.3.3. All records shall be safely stored, held secure and in confidence to the clients. NELAP related records shall be available to the accrediting authority

9.3.4. All records shall be archived and protected from fire, theft, loss, and environmental deterioration. Any access to archived information shall be documented in the Archive Access Log

9.3.5. Quality documents will be stored in a manner that protects them from loss, damage, unauthorized alterations, and held in confidence to the client.

9.3.6. Documents will be indexed and filed in a manner that allows them to be readily retrieved. Clients will be provided access to records that document the quality of work done for them.

9.3.7. If the laboratory were to transfer ownership, the procedures on handling documents would remain the same. The transfer would ensure that the procedures in place prior to transfer show little significant change for client ease into transition.

9.3.8. If the laboratory were to go out of business, the laboratory would contact the client with the option of how they would like to proceed with their data. All data would be handled according to client or Vista approval for proper destruction or safekeeping.

## 10. CORRECTIVE ACTION

Nonconforming conditions are when any aspect of the quality system or technical operations does not conform to procedures or to client requirements. Nonconforming conditions have an adverse effect to the quality specifications and are handled in accordance with SOPs. If a nonconformance occurs, where necessary, the client shall be notified.

The applicable SOPs provide instructions for determining the root cause of nonconforming conditions, designing and implementing corrective action, and evaluating the effectiveness of the corrective action.

### 10.1. Causes of Nonconformance

Procedures will be implemented to determine the root cause of nonconformance conditions, and the corrective action will be designed to eliminate the root cause and prevent reoccurrence.

### 10.2. Corrective Action

10.2.1. Corrective actions are taken immediately, together with any decision about the acceptability of the nonconforming work. When nonconforming work is identified, the Laboratory Director and Quality Assurance Manager work together to investigate the source of the nonconformance. Either manager may halt work and withholding test reports, as necessary. Work shall not resume until the Laboratory Director has authorized the resumption of work.

10.2.2. Procedures that result in or allow nonconformance conditions will be revised. If necessary, new procedures will be written.

10.2.3. The revised or new procedures will be implemented and evaluated to ensure that the corrective action steps taken effectively eliminate the nonconformance conditions.

### 10.3. Documentation

10.3.1. Results of root cause analyses and corrective action steps implemented to eliminate nonconformance conditions will be documented and reported to appropriate levels of management in accordance with laboratory SOPs. Records of corrective actions are maintained by QA Manager.



## 11. REPORTS

Handling, storage, packaging, and, when applicable, delivery of client reports will be conducted in accordance with SOPs to ensure that specified quality requirements and confidentiality of the reports are maintained. The reports shall include all the information requested by the client or required by the method used. Reports may also include electronic data. Electronic data will follow the same criteria as reports. Any information not reported to the client shall be readily available in the laboratory.

### 11.1. Handling and Storage of Reports

- 11.1.1. Reports and files will be handled in a manner that ensures that client confidentiality is maintained, and that the reports are protected from loss, damage, or unauthorized alterations.
- 11.1.2. All reports and files will be coded for ease of identification and retrieval.
- 11.1.3. File cabinets and storage rooms will be designed to protect filed copies of reports from loss, damage, or unauthorized alterations.
- 11.1.4. Computer files will be backed up to electronic storage media and stored in a manner that protects them from loss, damage, or unauthorized personnel.
- 11.1.5. The condition of reports and files in storage will be periodically evaluated to ensure that there is no deterioration, and that the reports remain readily accessible to authorized personnel.
- 11.1.6. NELAP related records shall be made available to the accrediting authority, and shall be maintained for a minimum of five years.
  - Individual records will be reviewed and noted if storage requirements longer than five years are required based on client, project or state specific regulations.

### 11.2. Packaging and Delivery of Reports

- 11.2.1. Client reports will be inspected prior to delivery to ensure that they meet specified quality requirements. Then the reports will be packaged for delivery to the client in a manner that ensures protection while in transit.

11.2.2. When required by specific contractual stipulations, the company will assume responsibility for protection of client reports while en route to the client.

### 11.3. Laboratory Report Format and Content

All laboratory reports shall include, at least, the following information:

- 11.3.1. A title, indicating the nature of the document (i.e. Test Report, Laboratory Results);
- 11.3.2. Name and address of the laboratory, location analysis was conducted if different from the address of the laboratory, and a phone number with name of a contact person;
- 11.3.3. Unique identification of the report and of each page, and the total number of pages. It must be clear that discrete pages are associated with a specific report, and that the report contains a specified number of pages;
- 11.3.4. NELAP accredited logo and a statement certifying that the report meets all requirements of NELAP and cannot be reproduced;
- 11.3.5. Name and address of client, where appropriate and project name if applicable;
- 11.3.6. Description and unambiguous identification of the tested sample including the client identification code;
- 11.3.7. Identification of test results derived from any sample that did not meet NELAP sample acceptance requirements such as improper container, holding time, or temperature;
- 11.3.8. Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;
- 11.3.9. Identification of the test method used, or unambiguous description of any non-standard method used;
- 11.3.10. If the laboratory collected the sample, reference to sampling procedure;
- 11.3.11. Any deviations from, additions to or exclusions from the test method, and any non-standard conditions that may have affected

the quality of results, and including the use and definitions of data qualifiers

- 11.3.12. Measurements, examinations and derived results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis, identify the reporting units
- 11.3.13. A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the report, and date of issue;
- 11.3.14. Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.
  - The original report from subcontracted laboratories should be included in the client laboratory report.
- 11.3.15. Reports shall, when required, include a statement of compliance/non-compliance with requirements and/or specifications, including identification or test results derived from any sample that did not meet NELAP sample acceptance requirements such as improper container, holding time, or temperature.
- 11.3.16. Additional information, which may be required by specific methods, clients or groups of clients.
- 11.3.17. After issuance of the report, the report remains unchanged.
- 11.3.18. Any report that requires amending must clearly state that the report has been revised. The amended report must also meet the requirements set forth within the most recent TNI standard.

## DATA QUALIFIERS & ABBREVIATIONS

B	This compound was also detected in the method blank.
D	Dilution
E	The associated compound concentration exceeded the calibration range of the instrument.
H	Recovery was outside laboratory acceptance limits.
I	Chemical Interference
J	The amount detected is below the Lower Calibration Limit of the instrument.
P	The amount reported is the maximum possible concentration due to possible chlorinated diphenylether interference.
*	See Case Narrative
Conc.	Concentration
DL	Sample-specific estimated detection limit
MDL	Method Detection Limit as determined by 40 CFR 136, Appendix B
EMPC	Estimated Maximum Possible Concentration
M	Estimated Maximum Possible Concentration (CA Region 2)
NA	Not applicable
RL	Reporting Limit – concentrations that correspond to low calibration point
ND	Not Detected
TEQ	Toxic Equivalency

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

## 12. PERFORMANCE AND SYSTEM AUDITS

Performance, System, and External audits are conducted to verify conformance with Vista's quality assurance program, to determine the effectiveness of the QA program, and to continually improve Vista's data quality.

### 12.1. System Audits

- 12.1.1. Internal audits (facility audits) of activities affecting the quality of the company's services will be conducted by the QA Department on a regular schedule in accordance with laboratory SOPs. Internal audits are performed periodically and at least annually. The QA Manager is trained and qualified as an auditor who, wherever possible, is independent of the activities being audited. Other QA department members are trained prior to conducting internal audits. Internal audits verify that operations continue to comply with the requirements of the quality system and NELAP standards.
- 12.1.2. It is the responsibility of the QA Manager to plan and organize audits based on a predetermined schedule or as requested by management.
- 12.1.3. SOPs and checklists will be used to focus the internal audit on specific activities of the area to be audited.
- 12.1.4. Personnel will not be allowed to audit activities for which they are responsible or in which they are directly involved, unless it is demonstrated that an effective, nonbiased, audit can be performed.
- 12.1.5. Results of internal audits will be documented by the audit team and submitted to the manager(s) in charge of the audited area and the management of the QA Manager.
- 12.1.6. Appropriate corrective action steps will be promptly taken to address any deficiencies or areas for improvement identified by the internal audit. Laboratory management shall ensure that these actions are within the agreed time frame.
- 12.1.7. If client work was affected by any found deficiencies, laboratory management will notify the client, in writing, within five business days.

- 12.1.8. All records of internal facility inspections and responses will be maintained by the QA Manager.
- 12.2. Management Reviews
  - 12.2.1. Management shall review the quality system annually to evaluate its continuing suitability and effectiveness, make any necessary changes or improvements, and follow up on previous recommendations.
  - 12.2.2. The review includes reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of interlaboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, corrective and preventative actions, in-depth monitoring of data integrity, and other relevant factors.
  - 12.2.3. The management review procedure including scheduling is available on the Laboratory network.
- 12.3. Performance Testing Samples
  - 12.3.1. Performance testing samples are conducted as single blind assay samples. A performance testing sample (PT), purchased from an independent contractor, and is analyzed twice a year. The acceptable result for the PT sample is unknown until after the experimental result is reported to the contractor. Other externally originated PTs are analyzed when supplied by the client as either a single blind or as a double blind sample and are scheduled through the laboratory as routine samples. All performance testing samples are handled in the same manner as real environmental samples including staff, method, procedures, equipment, facilities, and frequency.
  - 12.3.2. The samples shall be analyzed and the results returned to the PT Provider no later than 45 calendar days from the opening of the study.
  - 12.3.3. When analyzing a PT sample, the same calibration, laboratory quality control and acceptance criteria, sequence of analytical steps, number of replicates and other procedures are employed as used when analyzing routine samples.

- 12.3.4. No PT sample, or a portion of a PT sample, shall be sent to another laboratory for any analysis
  - 12.3.5. No PT sample or portion of a PT sample shall be received from another laboratory for any analysis
  - 12.3.6. Vista Analytical Laboratory management or staff shall not communicate with any individual at another laboratory concerning the PT sample or attempt to obtain the assigned value of any PT sample from their PT Provider.
  - 12.3.7. Vista shall maintain copies of all written, printed, and electronic records, resulting from the analysis of any PT sample for five years or for as long as is required by the applicable regulatory program, whichever is greater. All of these laboratory records shall be made available to the assessors during on-site audits of the laboratory.
  - 12.3.8. In the event that the laboratory receives test results that are "unacceptable", the likely cause is investigated, identified, and resolved. A Corrective Action PT sample, for which the laboratory shall report only the analytes for which corrective action was required, will then be analyzed. Documentation of the corrective action as well as the corrective action PT scores will then be submitted to the applicable accrediting authorities. The laboratory will provide A2LA the results of the Proficiency Testing and any related corrective action(s) within 14 days of receipt. Follow up results (if required) will be provided within 45 days. Form F104 will accompany all correspondence.
- 12.4. External Audits
- 12.4.1. External audits are performed on an on-going basis by clients, regulating agencies (State and Federal), or other third party auditors. These audits are pre-scheduled with the client and QA Manager to ensure that the appropriate laboratory personnel are available to address all audit inquiries. All deviations or deficiencies noted during the audit are to be addressed in the time frame provided by the auditor.
- 12.5. Data Audits
- 12.5.1. Data audits at Vista utilize a three tier data review system involving the Laboratory Director, Project Managers and the QA Manager.

- 12.5.2. Tier 1. In the initial phase, the analyst, defined as the instrument operator, reviews the raw data for correct analyte identification and integration, completes final data calculations, enters the data, signs and dates the raw data, and submits the package to a Director or Project Manager for review. In the case of anomalies, the analyst may be required to prepare a corrective action / preventative action report (CAPA) discussing the potential causes for the problems encountered as well as the recommended corrective action. The analyst will make any necessary corrections and/or reanalyze the sample, review, sign and date the raw data and any CAPAs (if applicable). The Project Manager after review of the data will approve all final datasheets.
- 12.5.3. Tier 2. The second tier review requires the Project Manager, signing the cover letter of the final report, to review and approve the data package. The Project Manager examines the chain of custody request, sample receipt information, analytical data for completeness and assesses whether the package as a whole meets the data quality objectives set by the client. The Project Manager is required to discuss or explain any data anomalies in the text of the case narrative.
- 12.5.4. Tier 3. The third tier review is performed by the QA Manager. The QA Manager will audit a minimum of 10% of the data packages and review all aspects of the data package covered during the first and second tier reviews. The QA Manager review may result in a request to the Laboratory Director for additional information regarding the data set and if necessary, re-analysis of selected samples.



## 13. TRAINING

Training assessments and all related training documentation shall be conducted in accordance with SOPs.

### 13.1. Initial On-Site Training

13.1.1. The training requirement of each employee will be assessed periodically to ensure the competency of their job responsibilities that career development objectives are being met, and that general-purpose educational opportunities are being utilized. The training program shall be relevant to the present and anticipated tasks of the laboratory.

13.1.2. Previous training, education, and experience will be considered when evaluating the training needs of each employee.

13.1.3. Manuals, texts, SOPs, journals, analytical methods and in-house Analytical Procedures are available for all new trainees, with on the job training performed by senior staff.

### 13.2. Training Programs

13.2.1. Job related training will be provided through regularly scheduled in-house seminars and courses, university courses, conferences and seminars, and one-on-one on the job tutorials.

13.2.2. Specified performance criteria must be successfully met while under supervision before personnel will be made responsible for activities that affect the quality objectives of the company.

### 13.3. Training Documentation

13.3.1. Training records will be maintained in each individual's training file. These records will be readily available to supervisors to ensure that employees have demonstrated capability prior to performing activities for which they are responsible. Employees are responsible for keeping their training file up-to-date. The training files shall maintain records of competence, education and professional qualifications, training, skills and experience of all technical personnel, including contracted personnel.

- 13.3.2. Evidence on file demonstrating each employee has read and understood the current version of in-house quality documents (QM, QAPP, SOPs).
- 13.3.3. Documentation of training courses.
- 13.3.4. Documentation of continued proficiency at least once per year.

## 14. CLIENT SERVICES

Routine client service as well as responses to client inquiries, audit reports, recommendations, and complaints will be handled in accordance with SOPs.

### 14.1. Routine Services

- 14.1.1. Each client will be assigned a Project Manager who will be responsible for ensuring that the needs of the client are clearly understood and communicated to the appropriate areas of the company.
- 14.1.2. The Project Manager reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work. Once the Project Manager accepts the new work, an acknowledgement letter is sent to the client for confirmation.
- 14.1.3. Clients will be given the opportunity to verify that the company's services conform to specified requirements. Regardless of whether or not client verifications are conducted, the Quality System will be responsible for ensuring that all services conform to specified requirements.
- 14.1.4. As the client's representative, the Project Manager will be responsible for ensuring that the client's needs are met. The Project Manager will maintain good communication, advice and guidance in technical matters, and opinions and interpretations based on results.
- 14.1.5. All client data are managed and maintained with the utmost care and diligence to ensure that the protection of clients' confidential information and proprietary rights are a primary concern.

### 14.2. Contract Review

- 14.2.1. For all analytical services to be provided, contract review is performed by the Contract Administrator and Project Manager. Sales and client services personnel are responsible for implementing and documenting contract review. Client requirements are defined and documented in the written quote or contract.

- 14.2.2. For routine projects, a review by Technical Sales is considered as adequate. Technical Sales confirms that the laboratory can meet the client's data quality objectives, turn-around time, reporting requirements and required certification for the work.
- 14.2.3. For large or new projects, the proposal is given to the Laboratory Director for review. The Laboratory Director will, if required, request input from the Technical Director, Quality Assurance Manager, and Technical Sales in preparing a response to the proposal.
- 14.3. Responses to Client Audits, Inquiries, and Complaints
  - 14.3.1. The QA Manager will be responsible for coordinating responses to client audits.
  - 14.3.2. Complaints received from clients or other parties regarding data or laboratory activities will be directed to the appropriate project manager and reported to the Technical Director or Laboratory Director.
  - 14.3.3. If a corrective action(s), which may require completion of a CAPA (corrective action / preventative action report), is taken, this will be documented and archived with the appropriate project data.
  - 14.3.4. All complaints will be documented and records of actions in response to any complaints will be maintained.
  - 14.3.5. If a complaint raises doubt regarding the laboratory's policies or compliance with NELAP or other standards, those areas shall be promptly reviewed or audited by the laboratory QA Manager.

## 15. STATISTICAL TECHNIQUES

Statistical techniques used to monitor the performance of activities that directly affect quality objectives will be conducted in accordance with SOPs.

### 15.1. Statistical Process Control Procedures

15.1.1. Statistical Process Control (SPC) will be used to monitor analytical procedure performance indicators such as accuracy and precision, and process performance indicators such as turnaround time and Nonconformance reports.

15.1.2. Results of SPC analyses will be used to improve processes that affect quality objectives.

## 16. SUBCONTRACTING

- 16.1. Vista Analytical may subcontract services, or may refer a client directly to another lab, for a particular analysis. Subcontracted laboratories are held responsible for the implementation of their own QM and meeting their data quality objectives.
- 16.2. Clients shall be notified prior to subcontracting any portion of their testing to another laboratory.
- 16.3. Services requiring NELAP accreditation will only be subcontracted to a laboratory with NELAP accreditation.
- 16.4. For DoD clients, subcontractor laboratories must have records to demonstrate their compliance with ISO/IEC 17025 for the subcontracted work in question, documented compliance with DoD QSM requirements, must be approved by the specific DoD laboratory approval process, must demonstrate the ability to generate acceptable results through the analysis of proficiency testing samples, and must receive project-specific approval from the DoD client before any samples are analyzed.
- 16.5. For services associated with projects outside of California, individual state accreditations may need to be met.
- 16.6. Vista Analytical shall retain records demonstrating that the above requirements have been met. Original reports received from a subcontracted laboratory will be included with the clients test report.

## 17. DATA INTEGRITY AND ETHICS

Vista Analytical Laboratory expects employee compliance with all laboratory SOPs and applicable regulatory guidelines and standards. Vista encourages participation in cooperative and educational efforts designed to promote and inform laboratory personnel of the necessity of active compliance.

17.1. Vista does not condone and will not tolerate the fraudulent manipulation or falsification of data, intentional non-compliance, gross negligence, or any other unethical conduct. Employees who are aware of, or reasonably suspicious of, any case fraudulent or unethical conduct shall notify the Technical Director, Laboratory Director, or QA Manager. Allegations of unethical conduct may be reported anonymously and will be fully investigated under the direction of the QA Manager. The investigation will be performed in a confidential manner until a full investigation or other appropriate actions have been completed and the issues clarified.

17.2. Any employee who knowingly manipulates and/or falsifies data or documents or engages in any unethical conduct is subject to immediate release from employment and other serious consequences.

17.3. Vista Analytical Laboratory provides mandatory initial and annual or as needed, Laboratory Ethics and Data Integrity refresher training to all employees. Topics covered are approved by management, documented in writing, and provided to all trainees.

17.3.1. Training topics include:

- Quality System requirements
- Personnel training requirements
- Vista Analytical Laboratory Ethics policy
- Examples of actions that are strictly prohibited
- Other breaches of data integrity
- Pertinent SOPs and other quality documents
- Potential consequences of misconduct
- Confidential mechanism for reporting allegations
- Investigation procedures and documentation
- “No-fault” policy to encourage personnel to come forward and report any fraudulent activities.

- 17.3.2. All employees sign an ethics statement and documentation of training attendance that demonstrates they have participated and understand their obligations related to data integrity. This sheet is maintained in individual training records.
- 17.4. Upon hire, new employees are required to read and sign a confidentiality statement. This signed statement is maintained in personnel files.



## **APPENDIX**

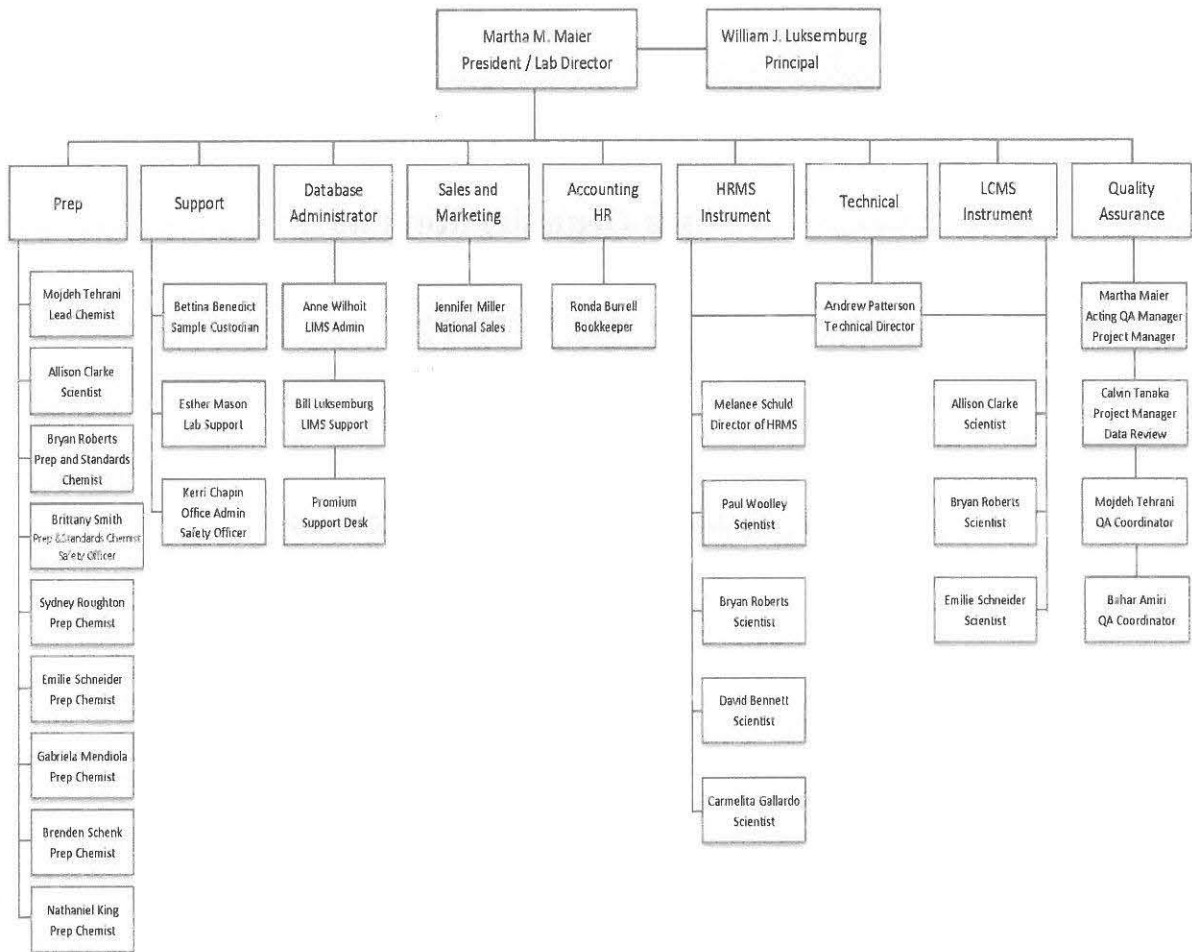
**Vista Organization Chart**

**Key Resumes**

**Certifications**

**Quality Manual Revision Log**

# Vista Organization Chart



Vista Organization 10/28/2015

**Martha M. Maier**  
**Laboratory Director/Acting Quality Assurance Manager**

**EDUCATION**

B.S. Chemistry, University of Wisconsin, Madison, WI (1983)  
B.S. Philosophy, University of Wisconsin, Madison, WI (1983)

**EXPERIENCE**

Present **Laboratory Director/Acting Quality Assurance Manager, Vista Analytical Laboratory, Inc.**  
The Laboratory Director for Vista Analytical Laboratory, formerly Alta Analytical, oversees the routine operations of the laboratory. Performs the interpretation and final review of analytical data, and issues final reports. As the Quality Assurance Manager of Vista Analytical Laboratory, ensures compliance to the laboratory Quality System according to the National Environmental Laboratory Accreditation Program (NELAP) standards.

1999-2001 **Director, Ultra-Trace Analyses Group, Paradigm Analytical Laboratories Inc.**  
Responsible for extractions, analyses, final review and processing of all data generated by the group. Served as project manager. Oversaw the development of analytical procedures for the analysis for PCBs by HRMS (Method 1668A), as well as the implementation of NELAP certification.

1998-1999 **Bioanalytical Project Manager, Alta Analytical Laboratory**  
Liaison between pharmaceutical clients and the Liquid Chromatography Mass Spectrometry (LCMS) Services group, ensuring efficient study management and timely reporting of laboratory results. Directed all phases of study conduct, including: review of study protocols and sponsor Standard Operating Procedures; initiation, maintenance and review of study and raw data files; scheduling of sample analyses; and preparation of final reports.

1992-1998 **Associate Scientist, Alta Analytical Laboratory**  
Involved in sales and project management. Directed sample analysis, reviewed data and prepared reports. Presented papers and gave educational seminars and presentations on dioxin/furan analysis. Arranged exhibit schedule and represented the laboratory at technical meetings and industry conferences. From 1992-1997, acted as laboratory representative for the Eastern U.S., both in sales and project management capacities.

1990-1992 **Technical Sales, Enseco-Cal Lab**

Coordinated the dioxin/furan marketing program. Prepared bids, organized exhibits, and oversaw the production of marketing materials. Acted as a liaison between the salespeople and the dioxin/furan laboratory.

- 1988-1990      **HR GC/MS Operator, Enseco-Cal Lab**  
Dioxin/furan analysis of pulp, food, and low-level environmental samples using high resolution GC/MS. Promoted to scientist position in December 1989. Involved in data review and project management.
- 1987-1988      **GC/MS Operator, Enseco-Cal Lab**  
Dioxin/furan analysis using low-resolution GC/MS systems. Promoted to lead person in May 1988.
- 1986-1987      **GC/MS BNA Operations Supervisor, Radian Corporation**  
Responsible for the scheduling and completion of all semi volatile analyses. Trained other operators in BNA analysis and routine instrument maintenance.
- 1984-1986      **GC/MS Operator, Radian Corporation**  
Analyzed environmental samples for volatile and semi volatile organic pollutants using EPA Methods 624, 625, SW-8240, SW-8270, and by EPA Contract Lab Protocol. Performed routine maintenance on all systems. Responsible for interfacing the GC/MS lab with the laboratory database management system.
- 1984-1984      **Analytical Chemist, Wisconsin Department of Agriculture**  
Assayed pesticide formulations using HPLC, GC, and TLC.  
Researched, developed and modified methods.

## QUALIFICATIONS

Ms. Maier has over 22 years of experience in the environmental laboratory, including 19 years of specialization in dioxin/furan analysis.

## AFFILIATIONS

Air & Waste Management Association  
American Chemical Society  
Technical Association of the Pulp & Paper Industry

**Andrew N. Patterson**  
**Technical Director**

**EDUCATION**

B.S. Microbiology, California Polytechnic State University  
San Luis Obispo (2001)  
Concentration in Biochemistry

**EXPERIENCE**

Present

**Technical Director**

Mr. Patterson is responsible for implementing the scientific procedures and best practices needed for the optimal performance of the laboratory. The technical director identifies, resolves, and documents analytical problems encountered in the laboratory, and oversees all method development work. The technical director is also involved in the hiring and training of chemists and analysts.

2010-2012

**Director of LC/MS Instrumentation, Vista Analytical Laboratory**

Mr. Patterson performs routine analysis and maintains instrumentation in the Liquid Chromatography Mass Spectrometry Division of Vista Analytical. He also is responsible for the research and development of new and client specific methods. He designs and implements analytical standard solutions for use in ESI-UPLC/MS/MS instruments. Mr. Patterson is responsible for reviewing and interpreting data, method validation, overseeing sample extraction and purification, along with training new staff.

2005-2010

**Scientist, Vista Analytical Laboratory**

Responsible for sample extraction and purification for dioxin/furan, Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyl (PCBs), Polybrominated Diphenyl Ethers (PBDEs), and Organochlorine Pesticide analyses in a variety of matrices. Mr. Patterson interviewed and trained new staff as well as helped author SOPs. He designed suites of analytical standards for both HRMS and LCMS instrumentation as well as prepared formulations of existing standards. His duties also included refining and designing new procedures for column chromatography.

2001-2005

**Associate Scientist, Alta Analytical Laboratory**

Responsible for sample extraction and purification for dioxin/furan, Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyl (PCBs) analyses in a variety of matrices. Preparation of solid and liquid reagents and formulation of analytical standards.

**QUALIFICATIONS**

Mr. Patterson has over ten years experience in production analytical laboratories. His focus has been on the analysis of emerging contaminants such as PBDEs and, more recently, pharmaceuticals and personal care products in the environment. This work has led to Vista Analytical's implementation of EPA method 1694. His research for custom client methods includes the trace analysis of Bisphenol-A, Triclosan & Triclocarbon, Diclazuril, and Nirtofuran metabolites.

## **AFFILIATIONS**

Association for Environmental Health & Sciences  
Association of Analytical Communities

## **RECENT PUBLICATIONS AND PRESENTATIONS**

Polybrominated diphenyl ethers (PBDEs) and polychlorinated dibenzo-p-dioxins (PCDD/F) and biphenyls (PCB) in fish, beef and fowl purchased in food markets in Northern California USA  
Luksemburg, W., Wenning, R., Maier, M., Patterson, A., Braithwaite, S.,  
*Organohalogen Compd.* 2004, 66, 3932–3937.

Levels of PCDD/PCDF, PCBs and PBDEs in Wild and Farm Raised Fish, Luksemburg, W., Maier, M., Patterson, A., USEPA National Forum on Contaminants in Fish, San Diego, CA USA (2004).

Pharmaceuticals and Endocrine Disrupting Compounds in Reclaimed Wastewater,  
Luksemburg W., Maier M., Patterson A.,  
Presented at WEF Microconstituants and Industrial Water Quality, Baltimore, MD (2009)

**Melanee A. Schuld**  
**Director of HRMS**

## **EDUCATION**

B.S. Biology, California State University, Sacramento, CA (1991)  
Minor in Chemistry

## **EXPERIENCE**

- Present **Director of HRMS Laboratory, Vista Analytical Laboratory**  
Ms. Schuld performs routine analysis and method development work in the High Resolution Mass Spectrometry department at Vista Analytical Laboratory. She is responsible for routine maintenance of HR/MS instruments, aids in the training of new staff, reviews and interprets data, and interfaces with clients.
- 1992 – 2010 **Scientist, Vista Analytical Laboratory**  
Ms. Schuld performs the duties of scientist under the direction of the Laboratory Director. As a scientist, she is competent in basic laboratory techniques and selected analytical procedures according to her assigned service area. Basic job duties include understanding all laboratory SOPs including safety procedures and policies, preparing reagents and standards, completing all data entry and calculations, and reviewing analytical data for accuracy and completeness. Ms. Schuld also performs analysis of dioxin/furan, Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyl (PCBs) in a variety of matrices.
- 1991 – 1992 **Extraction Chemist, Enseco-Cal Lab**  
Responsible for sample extraction for semivolatile analysis and preparing standards for semivolatile analysis. Performed GC screenings on a Varian Gas Chromatograph, calculated and maintained pH and percent moisture data. Also maintained QA/QC records.

## **QUALIFICATIONS**

Ms. Schuld has over 20 years experience in production analytical laboratories and environmental mass spectrometry. Most of this experience has involved PCDD/PCDF analysis of environmental samples and High Resolution Mass Spectrometry analysis of PCDD's/PCDFs in a variety of matrices. Ms. Schuld's experience also extends into Wet Chemistry, bacteriological techniques, UV-visible spectrophotometry, column chromatography as well as gas chromatography, HPLC, IR and NMR spectroscopy.

**Bahar Amiri**  
**Quality Assurance Coordinator**

**Education:**

June, 1998    BS in Nutrition Science with emphasis in Biochemistry, UC Davis, Davis, CA

**Experience:**

10/2015-present    Quality Assurance Coordinator, Vista Analytical Laboratory, El Dorado Hills, CA

- Oversee all QA activities in the laboratory including, audits, Corrective Action procedures, and SOP generation.

2/2012-4/2015    QA Manager, Eurofins Air Toxics, Inc. Folsom, CA

- Perform QA Reviews
- SOP/LQAP generation and updates
- Direct Corrective Action procedures
- Certify Initial and On-going Demonstration of Capabilities
- Monitoring and leading the Laboratory Certifications for states and agencies
- Conduct both internal and external audits
- Document and train staff against new procedures and systems
- Performing LODs, LOQs, and Control Charts on a quarterly basis or as needed
- Oversee QC activities including various independent checks of lab systems

2005-2012    QA Scientist/Project Chemist, Air Toxics Ltd., Folsom, CA (2008-present)

- Perform QA Reviews
- Lead Monthly Spot Audits
- Certify Initial and On-going Demonstration of Capabilities
- Apply for Laboratory Certifications for states and agencies
- Conduct both internal and external audits
- Create Variance Tables for client specific SOWS/QAPPs
- Evaluate project and regulatory requirements against Air Toxics' QA/QC protocols

Laboratory Scientist (2005-2008)

- Scheduled production of SVOC samples
- Performed data reduction
- Performed peer review for all SVOC methods

2003-2005    Analyst IV/Chemist, Severn Trent Laboratories, Inc., Sacramento, CA

- Performed hands-on lab and production chemistry process tasks on a daily basis by GCMS instrumentation for water and soil samples to support production



activities for a variety of clients including Department of Defense and Department of Energy.

- Prepared and analyzed liquid and solid samples, complying with various regulatory requirements and methods
- Worked with staff members to ensure promised turn-around time and quality data
- Performed scheduling and data reduction for the volatiles laboratory
- Lead the installation, calibration, optimization, qualification, and validation of processes and equipment

1999-2003 Laboratory Analyst/EDD specialist, Air Toxics Ltd., Folsom, CA

- Performed environmental analysis of air samples by GC and GC/MS
- Pressurized canisters
- Performed screening tasks and standard preparation
- Completed data write-up and review
- Completed CVP (Comprehensive Validation Packages) which met the Level IV EPA requirements including all data associated with a sample set
- Completed EDDs (Electronic Data Deliverables) in a variety of formats including ERPIMS and Coelt
- Used Chemstation software to run instruments and Target software for data reduction

#### **Qualifications:**

- Ms. Amiri has over 15 years of Laboratory experience in environmental laboratory, including 10 years of quality assurance experience.

## CERTIFICATIONS

Accrediting Authority	Certificate Number
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2014022
Nevada Division of Environmental Protection	CA004132016-1
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-004
Pennsylvania Department of Environmental Protection	012
South Carolina Department of Health	87002001
Tennessee department of Environmental Quality	TN02996
Texas Commission on Environmental Quality	T104704189-15-6
Virginia Department of General Services	7923
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

*Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.*

## Quality Manual Revision Log

Revision	Description of Revision
22	Removed VG-5 and added VG 11 in Table 8. List of certifications and SOPs were updated. Section 12 was updated regarding management review procedures, and section 12.2.3 was added. Organization chart was updated.
23	Added Fish Prep and Bligh-Dyer SOPs to Table 3.1 list. Updated key staff resumes.

# Quality Systems Manual

Volume XVI, Revision I: May 2016

Effective Date: June 10<sup>th</sup>, 2016

Document Control Number: \_\_\_\_\_



\_\_\_\_\_  
Rick Watkins, Laboratory Director, Technical Director



\_\_\_\_\_  
Norman D. Farmer, Corporate Technical Director



\_\_\_\_\_  
Svetlana Izosimova, Ph.D., Quality Assurance Officer

SGS Accutest - Orlando.  
4405 Vineland Road, Suite C-15  
Orlando, Florida 32811  
407.425.6700

This document is the exclusive property of SGS Accutest Inc. Reproduction without the expressed written permission of SGS Accutest Inc. is prohibited

## INTRODUCTION

The SGS Accutest - Orlando, Inc. (SASE) Quality Assurance Program, detailed in this plan, has been designed to meet the quality program requirements of the National Environmental Laboratories Accreditation Conference (TNI), DoD QSM Ver 5.0, 2013 and ISO 17025. The plan establishes the framework for documenting the requirements of the quality processes regularly practiced by the Laboratory. The Quality Assurance Officer is responsible for changes to the Quality Assurance Program, which are appended to the Laboratory Quality Systems Manual (LQSM) as they occur. The plan is reviewed annually for compliance purposes by the Laboratory Director and Technical Director and edited if necessary. Changes that are incorporated into the plan are summarized in the plan introduction. Changes to the plan are communicated to the general staff in a meeting conducted by the Quality Assurance Officer following the plan's approval.

The SASE plan is supported by standard operating procedures (SOPs), which provide specific operational instructions on the execution of each quality element and assure that compliance with the requirements of the plan are achieved. SASE employees are responsible for knowing the requirements of the SOPs and applying them in the daily execution of their duties. These documents are updated as changes occur and the staff is trained to apply the changes.

At SGS Accutest - Orlando, we believe that satisfying client requirements and providing a product that meets or exceeds the standards of the industry is the key to a good business relationship. However, client satisfaction cannot be guaranteed unless there is a system that assures the product consistently meets its design requirements and is adequately documented to assure that all procedural steps are executed and are traceable.

This plan has been designed to assure that this goal is consistently achieved and the SGS Accutest –Orlando product withstands the rigors of scrutiny that are routinely applied to analytical data and the processes that support its generation.

SGS Accutest - Orlando is a permanent location facility and is part of SGS Accutest Inc.

**Summary of Changes**  
**SGS Accutest - Orlando Quality System Manual –March 2016**

<u>Section</u>	<u>Description</u>	<u>Page #</u>
Title Page	new revision number	Title
Title Page	Added “Corporate” to Mr. Farmer’s TD title	Title
OrgChart	Listed Charles Hartke as Corporate QA Director	8
Entire Document	Replaced Accutest Southeast with SGS Accutest – Orlando.	
2.1; 2.2	Replaced Accutest logo with SGS logo	
3.3	Added three laboratories and editorial in second paragraph.	6, 7
6.8	Data integrity agreement replaced with current wording and moved to Appendix VI	14,15
4.3	Discussed SGS Accutest university database	27
10.5	SGS Accutest University database name corrected	20
19.3	Linear range requirement edited	43
App II	Initial Orientation clarification	69
App III	Added EPA 537MOD in NPW and SCM; added 6010D.	Entire section
App IV	Updated instrumentation list	87
App V	Updated USDA permit number	92
	Updated SOP list	94

**Table of Contents**

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.0	Quality Policy .....	5
2.0	Organization .....	6
3.0	Quality Responsibilities of the Management Team .....	9
4.0	Job Descriptions Of Key Staff .....	16
5.0	Signatory Approvals .....	20
6.0	Documentation & Document Control .....	22
7.0	Reference Standard Traceability .....	28
8.0	Test Procedures, Method References, & Regulatory Programs .....	30
9.0	Sample Management, Login, Custody, Storage & Disposal .....	34
10.0	Laboratory Instrumentation and Measurement Standards .....	41
11.0	Instrument Maintenance .....	44
12.0	Quality Control Parameters, Procedures, and Corrective Action .....	45
13.0	Corrective Action System .....	54
14.0	Procedures For Executing Client Specifications .....	57
15.0	Client Complaint Resolution Procedure .....	61
16.0	Control of Non-Conforming Product .....	62
17.0	Confidentiality Protection Procedures .....	63
18.0	Quality Audits And Quality System Reviews .....	65
19.0	Health and Safety .....	67

**Appendices**

I	Glossary of Terms .....	72
II	Analytical Capabilities .....	80
III	Equipment List .....	88
IV	Certification Summary .....	92
V	Standard Operating Procedures (SOP) List .....	95
IV	Data Integrity and Ethics Agreement .....	101

## 1.0 QUALITY POLICY

### 1.1 SGS Accutest - Orlando Mission:

*SGS Accutest - Orlando provides analytical services to commercial and government clients in support of environmental monitoring and remedial activities as requested. The Laboratory's mission is dedicated to providing reliable data that satisfies the client's requirements as explained in the following: "Provide easy access, high quality, analytical support to commercial and government clients which meet or exceeds data quality objectives and provides them with the data needed to satisfy regulatory requirements and/or make confident decisions on the effectiveness of remedial activities."*

These services are provided impartially and are not influenced by undue commercial or financial pressures, which might impact the staff's technical judgment. Coincidentally, SGS Accutest - Orlando does not engage in activities that endanger the trust in our independent judgment and integrity in relation to the testing activities performed.

### 1.2 Policy Statement:

*The management and staff of SGS Accutest - Orlando share the responsibility for product quality and continually strive for its systematic improvement. Accordingly, SGS Accutest's quality assurance program is designed to assure that all processes and procedures, which are components of environmental data production, meet established industry requirements, are adequately documented from a procedural and data traceability perspective, and are consistently executed by the staff. It also assures that analytical data of known quality, meeting the quality objectives of the analytical method in use and the data user's requirements, is consistently produced in the laboratory. This assurance enables the data user to make rational, confident, cost-effective decisions on the assessment and resolution of environmental issues.*

*The laboratory Quality System also provides the management staff with data quality and operational feedback information. This enables them to determine if the laboratory is achieving the established quality and operational standards, which are dictated by the client or established by regulation, such as TNI, ISO 17025 or DoD QSM. The information provided to management, through the QA program, is used to assess operational performance from a quality perspective and to perform corrective action as necessary.*

*All employees of SGS Accutest - Orlando participating in environmental testing receive quality system training and are responsible for knowing and complying with the system requirements. The entire staff shares SGS Accutest's commitment to good professional practice.*



---

Richard A. Watkins  
Laboratory Director



## 2.0 ORGANIZATION

2.1 **Organizational Entity.** SGS Accutest - Orlando, Inc. is a testing laboratory founded in 1956 and registered as a New Jersey Corporation. In 2016 the laboratory has changed ownership to SGS Accutest Inc, while operations, staff and physical locations were not affected by the change. The laboratory network headquarters are located in Dayton, New Jersey where it has conducted business since 1987. Satellite laboratories are maintained in Marlborough, Massachusetts; Syracuse, New York; Wilmington, North Carolina; Anchorage, Alaska; Orlando, Florida; San Jose, California; Denver, Colorado; Lafayette, Louisiana; and Houston, Texas.

Legal designations of the individual facilities follow SGS Accutest – Location convention, i.e. SGS Accutest – Orlando. Legal designation of the laboratory must be used on all certification and licensure documentation. Due to decades of Accutest brand prominence in their respective regions it is acceptable to display former regional designation on documents other than certificates and licenses. Example – data report from Orlando facility may be branded SGS Accutest Southeast. These documents may also use SASE abbreviation.

## 2.2 **Management Responsibilities**

**Requirement.** Each laboratory facility will have an established chain of command. The duties and responsibilities of the management staff are linked to the President/CEO of SGS Accutest Inc. who establishes the agenda for all company activities.

**President/CEO.** Primarily responsible for all operations and business activities. Delegates authority to laboratory directors, laboratory managers, and quality assurance director to conduct day-to-day operations and execute quality assurance duties. Each of the individual operational entities (Massachusetts, New York, North Carolina, Alaska, Florida, California, Colorado, Louisiana, and Texas) reports to the President/CEO.

**Corporate Quality Assurance Director.** Responsible for design, oversight, and facilitation of all quality assurance activities established by the Quality Program. Directly reports to the President/CEO.

**Chief Information Officer:** Maintains and develops LIMS and various EDD formats to suit clients' requests. Maintains cyber security and confidentiality. Delegates daily LIMS operation to local labs.

**Laboratory Director.** A Laboratory Director is assigned to each of the following operational entities: New York, Alaska, North Carolina, New Jersey, Massachusetts Florida, Louisiana, Texas, California, and Colorado. The Laboratory Director executes day-to-day responsibility for laboratory operations including technical aspects of production activities and associated logistical procedures. The Laboratory Director reports directly to the President/CEO.

**Quality Assurance Officer (on location).** Responsible for oversight, implementation and facilitation of all quality assurance activities established by the Quality Program. Directly reports to the Laboratory Director. Also exchanges information with and submits laboratory performance data (PE scores, audit reports, accreditation changes, etc.) to Corporate QA Director. Takes program directions from Corporate QA Director.

**Technical Director.** Responsible for oversight and implementation of all technical aspects of production activities in the environmental testing laboratory, including method development and compliance. Directly reports to the Laboratory Director.

In the event that the technical director, quality assurance officer, or laboratory director is absent for a period of time that exceeds 15 consecutive calendar days, the designated appointees shall temporarily perform the technical director, quality assurance officer's, or laboratory director's job function. If this absence exceeds 65 consecutive calendar days, the Accreditation Body(ies), including DoD ELAP, will be notified in writing. Current list of appointed deputies located in restricted access controlled document directory.

**Project Manager/Customer Service Manager:** primary contact for clients requesting laboratory services. Evaluates and processes client specifications for routine and non-routine analytical services. Identifies, evaluates, and documents the requested specifications to determine if adequate resources are available to perform the analysis. Communicates the specifications to the laboratory staff for execution and verifies that specifications have been executed.

**Purchasing Manager:** Evaluates and vendors of services and supplies following established policies. Procures services and supplies. Maintains purchasing documentation and communicates to technical personnel prior to release into lab.

**Department Supervisors.** Executes day-to-day responsibility for specific laboratory areas including technical aspects of production activities and associated logistical procedures. Directly reports to the Technical Director and Laboratory Manager.

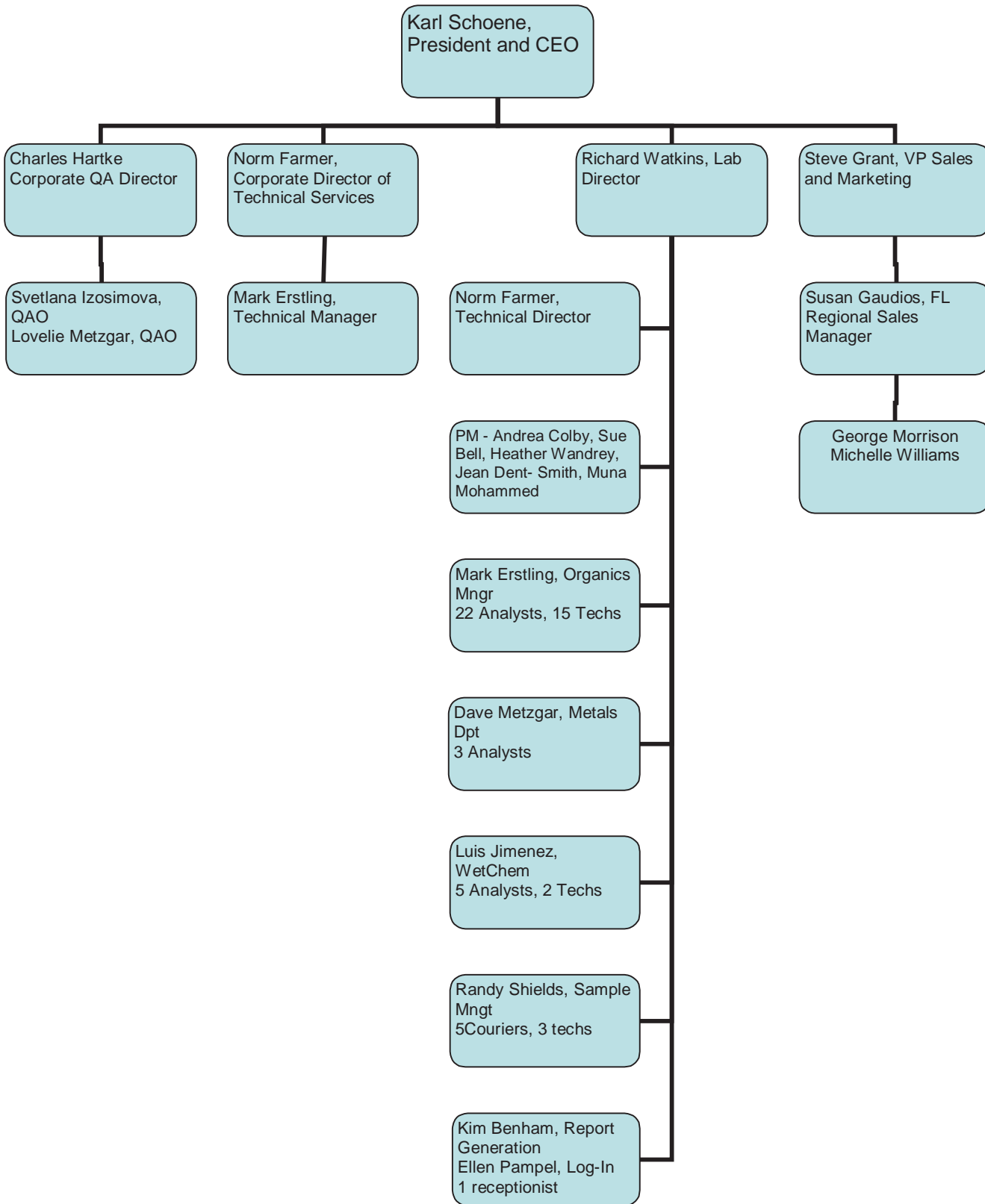
**Section Supervisors.** Executes day-to-day responsibility for specific laboratory units including technical aspects of production activities and associated logistical procedures. Directly report to the Department Supervisor.

## 2.3 Chain of Command

The responsibility for managing all aspects of the Company's operation is delegated to specific individuals, who have been assigned the authority to act in the absence of the senior staff. These individuals are identified in the following Chain of Command:

Rick Watkins, Laboratory Director (Operations)  
Norm Farmer, Corporate Technical Director (Operations and IT)  
Heather Wandrey, Project Manager (Client Services)

**SGS Accutest - Orlando Organizational Chart**



### 3.0 QUALITY RESPONSIBILITIES OF THE MANAGEMENT TEAM

3.1 **Requirement.** Each member of the management team has a defined responsibility for the Quality Program. Program implementation and operation is designated as an operational management responsibility. Program design and implementation is designated as a Quality Assurance Responsibility.

**President/CEO:** Primary responsibility for all quality activities. Delegates program responsibility to the Quality Assurance Director. Serves as the primary alternate in the absence of the Quality Assurance Director. Has the ultimate responsibility for implementation of the Quality Program.

**Laboratory Director.** Responsible for implementing and operating the Quality Program in all laboratory areas. Responsible for the design and implementation of corrective action for defective processes. Has the authority to delegate Quality Program implementation responsibilities.

**Corporate Quality Assurance Director.** Responsible for design, implementation support, training, and monitoring of the quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if warranted by quality problems. Monitors implemented corrective actions for compliance.

**Quality Assurance Officer (on location).** Responsible for design support, implementation support, and monitoring support of the quality system. Training personnel in various aspects of quality system. Conducts audits and product reviews to identify product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if warranted by quality problems. Monitors implemented corrective actions for compliance.

**Technical Director.** Responsible for oversight and implementation of technical aspects of Quality System as they are integrated into method applications and employed to assess analytical controls on daily basis. The Technical Director reviews and acknowledges the technical feasibility of proposed quality system involving technical applications. Empowered with the authority to halt production if warranted by quality problems.

**Laboratory Manager.** Responsible for oversight and implementation of various aspects of Quality System as they are integrated into method applications and employed to assess analytical controls on daily basis. The Laboratory Manager reviews and acknowledges the technical and logistical feasibility of proposed quality system involving technical applications. Empowered with the authority to halt production if warranted by quality problems.

**Department Supervisors.** Responsible for applying the requirements of the Quality Program in their section and assuring subordinate supervisors and staff apply all program requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

**Section Supervisors.** Responsible for applying the requirements of the Quality Program to their operation and assuring the staff applies all program requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

**Bench Analysts.** Responsible for applying the requirements of the Quality Program to the analyses they perform, evaluating QC data and initiating corrective action for quality control deficiencies within their control. Implements global corrective action as directed by superiors.

### 3.2 Program Authority:

Authority for program implementation on corporate level originates with the President/CEO who bears ultimate responsibility for program design, implementation, and enforcement of requirements. This authority and responsibility is delegated to the Director of Quality Assurance who performs quality functions independently without the encumbrances or biases created by operational or production responsibilities to ensure an honest, independent assessment of quality issues.

Laboratory Director and Quality Assurance Officer mirror this authority on location.

### 3.3 Data Integrity Policy:

The SGS Accutest Data Integrity Policy reflects a comprehensive, systematic approach for assuring that data produced by the laboratory accurately reflects the outcome of the tests performed on field samples and has been produced in a bias free environment by ethical professionals. The policy includes a commitment to technical ethics, staff training in ethics and data integrity, an individual attestation to data integrity and procedures for evaluating data integrity. Senior management assumes the responsibility for assuring compliance with all technical ethics elements and operation of all data integrity procedures. The staff is responsible for compliance with the ethical code of conduct and for practicing data integrity procedures.

The SGS Accutest Data Integrity Policy is as follows:

***“SGS Accutest - Orlando is committed to producing data that meets the data integrity requirements of the environmental regulatory community. This commitment is demonstrated through the application of a comprehensive data integrity program that includes ethics and data integrity training, data integrity evaluation procedures, staff participation and management oversight. Adherence to the specifications of the program assures that data provided to our clients is of the highest possible integrity and can be used for decision making processes with high confidence.”***

## Data Integrity Responsibilities

**Management.** Senior management retains oversight responsibility for the data integrity program and retains ultimate responsibility for execution of the data integrity program elements. Senior management is responsible for providing the resources required to conduct ethics training and operate data integrity evaluation procedures. They also include responsibility for creating an environment of trust among the staff and being the lead advocate for promoting the data integrity policy and the importance of technical ethics.

**Staff.** The staff is responsible for adhering to the company ethics policy as they perform their duties and responsibilities associated with sample analysis and reporting. By executing this responsibility, data produced by SGS Accutest retains its high integrity characteristics and withstands the rigors of all data integrity checks.

The staff is also responsible for adhering to all laboratory requirements pertaining to manual data edits, data transcription and data traceability. These include the application of approved manual peak integration and documentation procedures. It also includes establishing traceability for all manual results calculations and data edits.

**Ethics Statement.** The SGS Accutest ethics statement reflects the standards that are expected for businesses that provide environmental services to regulated entities and regulatory agencies on a commercial basis. The Ethics Policy is comprised of key elements that are essential to organizations that perform chemical analysis for a fee. As such, it focuses on elements related to personal, technical and business activities.

SGS Accutest - Orlando provides analytical chemistry services on environmental matters to the regulated community. The data the company produces provides the foundation for determining the risk presented by a chemical pollutant to human health and the environment. The environmental industry is dependent upon the accurate portrayal of environmental chemistry data. This process is reliant upon a high level of scientific and personal ethics.

It is essential to the Company that each employee understands the ethical and quality standards required to work in this industry. Accordingly, SGS Accutest has adopted a code of ethics, which each employee is expected to adhere to as follows:

- Perform chemical and microbiological analysis using accepted scientific practices and principles.
- Perform tasks in an honest, principled and incorruptible manner inspiring peers & subordinates.
- Maintain professional integrity as an individual.
- Provide services in a confidential, honest, and forthright manner.
- Produce results that are accurate and defensible.

- Report data without any considerations of self-interest.
- Comply with all pertinent laws and regulations associated with assigned tasks and responsibilities.

### **Data Integrity Procedures.**

Four key elements comprise the SGS Accutest data integrity system:

- 1) data integrity training,
- 2) signed data integrity documentation for all laboratory employees,
- 3) in-depth, periodic monitoring of data integrity, and
- 4) data integrity procedure documentation.

Procedures have been implemented for conducting data integrity training and for documenting that employees conform to the SGS Accutest Data Integrity and Ethics policy.

The data integrity program consists of routine data integrity evaluation and documentation procedures to periodically monitor and document data integrity. These procedures are documented in SOPs. SOPs are approved and reviewed annually following the procedures employed for all SGS Accutest SOPs. Documentation associated with data integrity evaluations is maintained on file and is available for review.

**Data Integrity Training.** SGS Accutest employees receive technical ethics training during new employee orientation. Employees are also required to attend annual ethics refreshment training and sign an ethical conduct agreement annually, which verifies their understanding of SGS Accutest's technical ethics policy and their ethical responsibilities. The agreement is refreshed annually and appended to each individual's training file.

The training focuses on the reasons for technical ethic training, explains the impact of data fraud on human health and the environment, and illustrates the consequences of criminal fraud on businesses and individual careers. Multiple examples of prohibited practices are reviewed and discussed. SGS Accutest's ethics policy and code of ethics are reviewed and explained for each new employee. Employees receive SGS Accutest's technical ethics brochure for further review.

Training on department-specific data integrity procedures are conducted by individual departments for groups involved in data operations. These include procedures for manual chromatographic peak integration, standards traceability, etc.

**Data Integrity Training Documentation.** Records of all data integrity training are maintained in individual training folders. Attendance at all training sessions is documented and appended to the training file.

**SGS Accutest Data Integrity and Ethical Conduct Agreement.** All employees are required to sign a Data Integrity and Ethical Conduct Agreement annually – See Appendix VI This document is archived in individual training files, which are retained for duration of employment.

**Data Integrity Monitoring.** Several documented procedures are employed for performing data integrity monitoring. These include regular data review procedures by supervisory and management staff (Section 12.7), supervisory review and approval of manual integrations and periodic reviews of data audit trails from the LIMS and all computer controlled analysis.

*Data Review.* All data produced by the laboratory undergoes several levels of review, which includes two levels of management review. Detected data anomalies that appear to be related to data integrity issues are isolated for further investigation. The investigation is conducted following the procedures described in this section.

*Manual Peak Integration Review and Approval.* Routine data review procedures for all chromatographic processes includes a review of all manual chromatographic peak integrations. This review is performed by the management staff and consists of a review of the machine integration compared to the manual integration. Manual integrations, which have been performed in accordance with SGS Accutest's manual peak integration procedures are approved for further processing and release. Manual integrations which are not performed to SGS Accutest's specifications are set aside for corrective action, which may include analyst retraining or further investigation as necessary.

*Data Audit Trail Review.* Data integrity audits are comprehensive data package audits that include a review of raw data, process logbooks, processed data reports and data audit trails from individual instruments and LIMS. Data audit trails, which record all electronic data activities, are available for the majority of computerized methodology and the laboratory information management system (LIMS). These audit trails are periodically reviewed to determine if interventions performed by technical staff constitute an appropriate action. The review is performed on a recently completed job and includes interviews with the staff that performed the analysis. Findings indicative of inappropriate interventions or data integrity issues are investigated to determine the cause and the extent of the anomaly.

**Confidential Reporting Of Data Integrity Issues.** Data integrity concerns may be raised by any individual to their supervisor. Employees with data integrity concerns should always discuss those concerns with their immediate supervisors as a first step unless the employee is concerned with the confidentiality of disclosing data integrity issues or is uncomfortable discussing the issue with their immediate supervisors. The supervisor makes an initial assessment of the situation to determine if the concern is



related to a data integrity violation. Those issues that appear to be violations are documented by the supervisor and referred to the QA Officer (local) for investigation.

Documented procedures for the confidential reporting of data integrity issues in the laboratory are part of the data integrity policy. These procedures assure that laboratory staff can privately discuss ethical issues or report items of ethical concern without fears of repercussions with senior staff.

Employees with data integrity concerns that they consider to be confidential are directed to the Corporate Human Resources Manager in Dayton, New Jersey. The HR Manager acts as a conduit to arrange a private discussion between the employee and the Corporate QA Director or a local QA Officer.

During the employee - QA discussion, the QA representative evaluates the situation presented by the employee to determine if the issue is a data integrity concern or a legitimate practice. If the practice is legitimate, the QA representative clarifies the process for the employee to assure understanding. If the situation appears to be a data integrity concern, the QA representative initiates a Data Integrity Investigation following the procedures specified in SOPs QA038-QA041.

**Data Integrity Investigations.** Follow-up investigations are conducted for all reported instances of ethical concern related to data integrity. Investigations are performed in a confidential manner by senior management according to a documented procedure. The outcome of the investigation is documented and reported to the company president who has the ultimate responsibility for determining the final course of action in the matter. Investigation documentation includes corrective action records, client notification information and disciplinary action outcomes, which is archived for a period of five years.

The investigations are conducted by the senior staff and supervisory personnel from the affected area. The investigation team includes the Laboratory Director and the Quality Assurance Officer. Investigations are conducted in a confidential manner until it is completed and resolved.

The investigation includes a review of the primary information in question by the investigations team. The team performs a review of associated data and similar historical data to determine if patterns exist. Interviews are conducted with key staff to determine the reasons for the observed practices.

Following data compilation, the investigations team reviews all information to formulate a consensus conclusion. The investigation results are documented along with the recommended course of action.

**Corrective Action, Client Notification & Discipline.** Investigations that reveal systematic data integrity issues will go through corrective action for resolution and disposition (Section 13). If the investigation indicates that an impact to data has occurred and the defective data has been released to clients, client notification procedures will be initiated following the steps in Section 17.6.

In all cases of data integrity violations, some level of disciplinary action will be conducted on the responsible individual. The level of discipline will be consistent with the violation and may range from retraining and/or verbal reprimand to termination.

## 4.0 JOB DESCRIPTIONS OF KEY STAFF

4.1 **Requirement:** Descriptions of key positions within the organization must be defined to ensure that clients and staff understand duties and the responsibilities of the management staff and the reporting relationships between positions.

**President/Chief Executive Officer.** Responsible for all laboratory operations and business activities. Establishes the company mission and objectives in response to business needs. Direct supervision of the Vice President of Operations, each laboratory director, client services, management information systems, and quality assurance.

**Laboratory Director.** Reports to the company president. Establishes regional laboratory operations strategy and business development. Authorized to enter into contractual agreements on Company's behalf. Directs the day-to-day operations of entire laboratory, direct supervision of organic chemistry, inorganic chemistry, field services, and sample management. Oversees daily work schedule as developed by respective departments. Supervises method implementation. Responsible for following Quality Program requirements. Maintains laboratory instrumentation in an operable condition.

**Director, Quality Assurance.** Reports to the company president. Establishes the company quality agenda, develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities monitors the quality system and provides quality system feedback to management to be used for process improvement.

**Vice President, Information Technologies** Reports to the company president. Develops the MIS software and hardware agenda. Provides system strategies to compliment company objectives. Maintains all software and hardware used for data handling.

**Client Services, Sales, Account Manager(s).** Reports to the company president. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

**Quality Assurance Officer (on location).** Reports to the Corporate QA Director. Develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities, monitors the quality system, and provides quality system feedback to management to be used for process improvement. In the event of prolonged absence QAO also designated a Deputy Technical Director, unless otherwise specified by internal memo from Laboratory Director.

**Manager Client Services (on location).** Reports to the Laboratory Director. Establishes and maintains communications between clients and the laboratory

pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

**Technical Director (on Location).** Reports to the Laboratory Director. Establishes laboratory operations strategy. Direct supervision of organic chemistry and inorganic chemistry. Directs the operations, preparation and instrumental analysis. Responsible for following Quality Program requirements. Assumes operational responsibilities of Lab Director in his absence.

**Supervisors, Shipping and Receiving Departments.** Reports to the Laboratory Director. Develops, maintains and executes all procedures required for transport and receipt of samples, verification of preservation, and chain of custody documentation. Responsible for maintaining and documenting secure storage, delivery of samples to laboratory units on request, and disposal following completion of all analytical procedures.

**Supervisor, Wet Chemistry.** Reports to the Laboratory Director. Directs the operations of the wet chemistry group. Establishes and executes daily work schedule. Supervises method implementation, application, and data production. Supervises the analysis of samples for wet chemistry parameters using valid, documented methodology. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Responsible for following Quality Program requirements.

**Supervisor, Metals.** Reports to the Laboratory Director. Directs the operations of the metals group. Establishes and executes daily work schedule. Supervises method implementation, application, and data production. Supervises the analysis of samples for metallic elements using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Responsible for following Quality Program requirements

**Supervisor, Organic Preparation.** Reports to the Laboratory Director. Directs the operations of the sample preparation group. Establishes and executes daily work schedule. Supervises method implementation, and application. Supervises the preparation of samples for organic compounds using valid, documented methodology. Documents all procedures and data production activities. Maintains laboratory equipment in an operable condition. Reviews records for compliance to quality and methodological requirements. Responsible for following Quality Program requirements.

**Volatile and Semivolatle Supervisors, Organics.** Reports to the Laboratory Director. Directs the operations of the respective organics group. Establishes and executes daily work schedule. Supervises method implementation, application, and data production. Supervises the analysis of samples for organic compounds using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to

quality and methodological requirements. Responsible for following Quality Program requirements

**Report Generation Supervisor.** Reports to Laboratory Director. Oversees report generation and fulfillment of client specifications as applied to data deliverables. Responsible for data delivery in timely manner.

Detailed Job descriptions of lab personnel are found in training folders

#### 4.2 **Employee Screening, Orientation, and Training.**

All potential laboratory employees are screened and interviewed by human resources and technical staff prior to their hire. The pre-screen process includes a review of their qualifications including education, training and work experience to verify that they have adequate skills to perform the tasks of the job. Minimum qualifications for non-technical personnel require High School diploma (couriers also must possess clean driving record), technical personnel must also demonstrate basic laboratory experience, such as balance and syringe use, aseptic practices, etc. College-level science coursework is favored.

Newly hired employees receive orientation training beginning the first day of employment by the Company. Orientation training consists of initial health and safety training and a detailed review of the personal protection policies, technical ethics and data integrity procedures training (for detailed description refer to Sec. 3.3) and quality assurance program training (including Company's goals, objectives, mission, and vision).

All technical staff receives training to develop and demonstrate proficiency for the methods they perform. New analysts work under supervision until the supervisory staff is satisfied that a thorough understanding of the method is apparent. Organics/Inorganics analysts are required to demonstrate method proficiency through a precision and accuracy study (Demonstration of Capability). Data from the study is reviewed by appropriate technical supervisor and compared to method acceptance limits. If the data is unacceptable, additional training is required. The analyst must also demonstrate the ability to produce acceptable data through the analysis of an independently prepared proficiency sample.

Proficiency is demonstrated annually. Data from initial and continuing proficiency demonstration is archived in the individual's training folder. In the instance where analyte can not be spiked in the clean matrix, such as TSS or pH, the results of an external Performance Evaluation (PE) sample may be used to document analyst's proficiency.

Minimum training required for administrative staff consists of laboratory safety and ethical conduct.

#### 4.3 **Training Documentation.** The QA Officer prepares a training file for every new employee. All information related to qualifications, experience, external training

courses, and education are placed into the file. Verification documentation for orientation, health & safety, quality assurance, and ethics training is also included in the file.

Additional training documentation is added to the file as it occurs. This includes data for initial and continuing demonstrations of proficiency, performance evaluation study data and notes and attendance lists from group training sessions.

The Quality Assurance Department also maintains the employee training database – SGS Accutest University. This database is a comprehensive inventory of training documentation for each individual employee. The database enables supervisors to obtain current status information on training data for individual employees on a job specific basis. It also enables the management staff to identify training documentation in need of completion.

Employee specific database records are created by QA Staff on the date of hire. Reports are produced which summarize the qualifications of individual employees or departments.

## 5.0 SIGNATORY APPROVALS

**Requirement.** Procedures are required for establishing the traceability of data and documents. The procedure consists of a signature hierarchy, indicating levels of authorization for signature approvals of data and information within the organization. Signature authority is granted for approval of specific actions based on positional hierarchy within the organization and knowledge of the operation that requires signature approval. A log of signatures and initials of all employees is maintained for cross-referencing purposes.

### 5.1 Signature Hierarchy.

**President/Chief Executive Officer.** Authorization for contracts and binding agreements with outside parties. Approval of quality assurance policy, SOPs, project specific QAPs. Contract signature authority resides with Company Officers only, which include the President/CEO, CFO and VP Administration.

**Laboratory Director.** Authorization for contracts and binding agreements with outside parties. Approval of final reports and quality assurance policy. Approval of project specific QAPs. Review and approval of technical and quality systems policies (LQSM). In the event of prolonged absence refer to list of approved deputies – sec 2.2.

**Technical Director:** Approval of final reports and quality assurance policy in the absence of the Laboratory Director. Approval of SOPs, project specific QAPs. Review and approval of technical and quality systems policies (LQSM). In the event of prolonged absence refer to list of approved deputies – sec 2.2.

**Director, Quality Assurance.** Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers.

**Quality Assurance Officer (on location).** Approval of final reports and quality assurance policy in the absence of the Laboratory Director. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. In the event of prolonged absence refer to list or appointed deputies – see sec. 2.2.

**Manager, Sample Management.** Initiation of laboratory sample custody and acceptance of all samples. Approval of department policies and procedures. Department specific supplies purchase. Waste manifesting and disposal.

**Project Manager, Client Services.** QAP and sampling and analysis plan approval. Project specific contracts, pricing, and price modification agreements. Approval and acceptance of incoming work, Client services policy.

**Supervisors, Technical Departments.** Methodology and department specific QAPs. Data review and approval, department specific supplies purchase. Technical approval of SOPs.

- 5.2 Signature Requirements.** All laboratory activities related to sample custody and generation or release of data must be approved using either initials or signatures. The individual, who applies his signature or initial to an activity or document, is authorized to do so within the limits assigned to them by their supervisor. All signatures and initials must be applied in a readable format that can be cross-referenced to the signatures and initials log if necessary.
- 5.3 Signature and Initials Log.** The QA Officer maintains a signature and initials log. New Employee signatures and initials are appended to the log on the first day of employment. Signature of individuals no longer employed by the company are retained.



## 6.0 DOCUMENTATION and DOCUMENT CONTROL

**Requirement.** Document control policies have been established which specify that any document used as an information source or for recording analytical or quality control information must be managed using defined document control procedures. Accordingly, policies and procedures required for the control, protection, and storage of any information related to the production of analytical data and the operation of the quality system to assure its integrity and traceability have been established and implemented in the laboratory. The system contains sufficient controls for managing, archiving and reconstructing all process steps, which contributed to the generation of an analytical test result. Using this system, an audit trail for reported data can be produced, establishing complete traceability for the result.

**6.1 Administrative Records.** The Quality Assurance Officer manages Administrative (non-analytical) records. These records consist of electronic documents that are retained in a limited access electronic directory, which are released to the technical staff upon specific request.

**Form Generation & Control.** The Quality Assurance Officer approves all forms used as either stand-alone documents or in logbooks to ensure their traceability. Forms are generated as computer files only and maintained in a limited access master directory. Access to the electronic forms and applications is granted to QA Officer, Laboratory Manager and Technical Director(s) (local and regional). Approved forms must display the date of current revision and initials of person who revised the form. Modifications to existing forms are approved by QA, obsolete forms moved to archive directory and retained for minimum of five years.

New forms must include SGS Accutest - Orlando identification and appropriate spaces for signatures of approvals and dates. Further design specifications are the responsibility of the originating department.

Technical staff is required to complete all forms to the maximum extent possible. If information for a specific item is unavailable, the analyst is required to cross out the information block. The staff is also required to cross out the uncompleted portions of a logbook or logbook form if the day's analysis does not fill the entire page of the form.

**Logbook Control.** All laboratory logbooks are controlled documents that are comprised of approved forms used to document specific processes. Logbook control is maintained by QA staff.

New logs are numbered and issued to a specific individual who is assigned responsibility for the log. Supervisor performs periodical review of the logbooks. Old logs are returned to QA for entry into the document archive system where they are retained for minimum of five (5) years. Laboratory staff may hold a maximum of two consecutively dated logbooks of the same type in the laboratory, not including the most recently issued book to simplify review of recently completed analysis.

**Controlled Documents.** Key laboratory documents are designated for controlled document status to assure that identities of individuals receiving copies and the number of copies that have been distributed are known. Controlled status simplifies document updates and **retrieval** of outdated documents. Control is maintained through a document numbering procedure and document control logbook designating the individual receiving the controlled document. Document control is also maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory.

**Quality Systems Manual (QSM).** All QSMs are assigned a number prior to distribution. The QSMs are distributed as controlled documents i.e. ones that will be collected back and replaced with next version (documents distributed to the SGS Accutest Inc. staff). QSMs distributed to outside entities are considered tracked documents – since there is no possibility of collecting them back and ensuring that current revision is in use. These situations include bid submissions, client requests, etc. These copies are watermarked as “Uncontrolled Documents” The control/tracking number, date of distribution, and identity of the individual receiving the document are recorded in the document control spreadsheet. QA staff maintains tracking spreadsheet. The numbering system is continuous.

**Standard Operating Procedures (SOPs).** SOPs are maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory. Official documents are printed and placed into the appropriate laboratory section as follows:

Sample Management: One copy for the sample receiving file

Bottle preparation area – One copy for shipping area

Organics Laboratories: One for each affected laboratory area. Copy may be electronic.

Inorganics Laboratories: One for each affected laboratory area. Copy may be electronic.

The original, signed copy of the SOP is maintained in the master SOP binder by the QA staff.

Documents are controlled using an “Official Copy” stamp in red ink. Additional copies could be issued to individuals for training purposes. Distribution is documented on SOP cover page. Superseded copies collection is conducted accordingly to cover page distribution list.

SOPs distributed to clients as part of bid submission, pre-audit evaluation, etc. are watermarked as “Proprietary Information”.

**Quick reference cards:** These documents are compiled for lab staff convenience and are based on current SOP revision and/or recent regulatory updates. These one- or two-sided documents are footnoted with reference to SOP/regulatory standard, stamped with “Official Copy” stamp in red ink and laminated for durability. *Use of*

***these quick references does not substitute reading and acknowledging the parent SOP.***

Operators' Manuals are considered controlled documents and stored in appropriate departments.

- 6.2 Technical Records.** All records related to the analysis of samples and the production of analytical results are archived in secure document storage or on electronic media and contain sufficient detail to produce an audit trail, which re-creates the analytical result. These records include information related to the original client request, bottle order, sample login and custody, storage, sample preparation, analysis, data review and data reporting.

Records that can not be maintained on electronic media are considered irretrievable records, segregated into separate secured storage and access controlled with access log maintained by QA Staff. Examples of such records are employee training files, obsolete SOPs and acknowledgement form originals, training files, logbooks, etc.

Each department involved in this process maintains controlled documents, which enable them to maintain records of critical information relevant to their department's process.

- 6.3 Quality Assurance Directory.** All Quality Assurance documentation and quality control limit data is stored in a restricted QA directory on the network server. The directory has been designated as read only. The QA staff, technical director and the laboratory manager have write capability in this directory. Information on this directory is backed-up weekly.

This directory contains all current and archived Quality System Manuals, SOPs, control limits, MDL studies, precision and accuracy data, internal and external audit reports, official forms, Health and Safety materials, PT scores, State Certifications and metrics calibration information.

- 6.4 Analytical Records.** All data related to the analysis of field samples are retained as either paper or electronic records that can be retrieved to compile a traceable audit trail for any reported result. All information is linked to the client job and sample number, which serves as a reference for all sample related information tracking.

Critical times in the life of the sample from collection through analysis to disposal are documented. This includes date and time of collection, receipt by the laboratory, preparation times and dates, analysis times and dates and data reporting information. Analysis times are calculated in hours for methods where holding time is specified in hours ( $\leq 72$  hours).

Sample preparation information is recorded in a separate controlled logbook or on controlled forms in three-ring binder. It includes sample identification numbers, types of analysis, preparation and cleanup methods, sample weights and volumes, reagent

lot numbers and volumes and any other information pertinent to the preparation procedure.

Information related to the identification of the instrument used for analysis is permanently attached to the electronic record. The record includes an electronic data file that indicates all instrument conditions employed for the analysis, including the type of analysis conducted. The analyst's identification is electronically attached to the record. The instrument tuning and calibration data is electronically linked to the sample or linked through paper logs, which were used in the documentation of the analysis. Quality control and performance criteria are permanently linked to the paper archive or electronic file.

Paper records for the identity, receipt, preparation and evaluation of all standards and reagents used in the analysis are documented in prepared records and maintained in controlled documents or files. Lot number information linking these materials to the analysis performed is recorded in the logbooks associated with the samples in which they were used.

Manual calculations or peak integrations that were performed during the data review are retained as paper or electronically generated PDF documents and included as part of the electronic archive. Signatures for data review are retained on paper or as electronic stamps on PDF versions of the paper record for the permanent electronic file.

- 6.5 Confidential Business Information (CBI).** Operational documents including SOPs, Quality Manuals, personnel information, internal operations statistics, and laboratory audit reports are considered confidential business information. Strict controls are placed on the release of this information to outside parties.

Release of CBI to outside parties or organizations may be authorized upon execution of a confidentiality agreement between SGS Accutest and the receiving organization or individual. CBI information release is authorized for third party auditors and commercial clients in electronic mode as Adobe Acrobat .PDF format only.

- 6.6 Software Change Documentation & Control.** Changes to software are documented as text within the code of the program undergoing change. Documentation includes a description of the change, reason for change and the date the change was placed into effect. Documentation indicating the adequacy of the change is prepared following the evaluation by the user who requested the change.

- 6.7 Report and Data Archiving.** SGS Accutest maintains electronic image file copies of original reports in archive for a minimum period of five (5) years. After five years, the files are automatically discarded unless contractual arrangements exist which dictate different requirements. Client specific data retention practices are employed for government organizations such as the Department of Defense Agencies and MA DEP that require a retention period of ten (10) years, as well as commercial clients upon contractual requirements agreement.

Complete date and time stamped client reports are generated from LIMS using the source documents archived on Document server. These source documents are maintained on document server and backed up to removable primary and clone hard drives. SGS Accutest archives the original report (organized by job number) and the organic and inorganic support data. Organic support data is archived according to instrument batch numbers and datafile. All organics data is backed up to an archive drive via Baculla backup software and/or AccuBack backup software. Data from the archive drive is then written to removable hard drives at periodic intervals. Drives are cloned for off site archival.

Wet chemistry support data is archived by analytical batch (GN...). Metals support data is archived by instrument batch (MA...). Metals digestion data is archived as digestion logbooks. Additionally all Wet chemistry and Metals data is scanned to PDF and archived electronically.

The reports generation group electronically scans completed reports and stores them by job number on the document server. The document server is backed up daily to a removable hard drive. Copies of these files remain active on the document server for easy review access. The removable hard drives remain in secure storage for the remainder of the archive period.

- 6.8 Training.** Ongoing training ensures competence of all relevant personnel. At the minimum personnel should possess knowledge of the technology used in the testing, general requirements expressed in legislature and industry standards, and understand the significance of deviations with regard to approved procedures. The company maintains a training record for all employees that documents that they have received instruction on administrative and technical tasks that are required for the job they perform. Training records for individuals employed by the company are retained for a period of five years following their termination of employment.

**Training File Origination.** The Quality Assurance Officer (QAO) initiates training files. Quality Assurance officer retains the responsibility for the maintenance and tracking of all training related documentation in the file. The file is started on the first day of employment. Information required for the file includes a copy of the individual's most current resume, detailing work experience and a copy of any college diplomas or transcript(s), if applicable. Information added on the first day includes documentation of health and safety training and a signed Ethics and Data Integrity agreement. Classroom content is standardized across entire SGS Accutest network and administered using SGS Accutest University database. Safety and Ethics training constitute minimal necessary training for Project Management and Administrative staff. Analyst training documentation, training requirements, analyst proficiency information and other training related support documentation is tracked using a customized database applications. Database extracts provide an itemized listing of specific training requirements by job function. Training status summaries for individual analysts portray dates of completion for job specific training requirements.

**Technical Training.** The supervisor of each new employee is responsible for developing a training plan for each new employee. The supervisor updates the

outline, adding signatures and dates as training elements are completed at regular frequency. Supporting documentation, such as precision and accuracy studies, which demonstrate analyst capability for a specific test, are added as completed. When analyte can not be spiked, such as pH or TSS, external PE sample is purchased and analyzed. Where no external PE sample is available, sample duplicates must be successfully analyzed. Method review records are retained where analysis of duplicates is not possible. Employees and supervisors verify documentation of understanding (DOU) for all assigned standard operating procedures in the training database. Certificates or diplomas for any off-site training are added to the file.

## 7.0 REFERENCE STANDARD TRACEABILITY

**Requirement:** Documented procedures, which establish traceability between any measured value and a national reference standard, must be in place in the laboratory. All metric measurements must be traceable to NIST reference weights or thermometers that are calibrated on a regular schedule. All chemicals used for calibration of a quantitative process must be traceable to an NIST reference that is documented by the vendor using a certificate of traceability. The laboratory maintains a documentation system that establishes the traceability links. The procedures for verifying and documenting traceability must be documented in standard operating procedures.

**7.1 Traceability of Metric Measurements - Thermometers.** SGS Accutest – Orlando uses NIST-traceable thermometers to calibrate commercially purchased working laboratory thermometers prior to their use in the laboratory and annually thereafter for liquid in glass thermometers or quarterly for electronic temperature measuring devices. If necessary, these working thermometers are assigned correction factors that are determined during their calibration using an NIST-traceable thermometer as the standard. The correction factor is documented in a thermometer log and on a tag attached to the working thermometer. Both original observation and corrected measurement are recorded in the temperature log. The NIST-traceable reference thermometer is checked for accuracy by an outside vendor minimum every five (5) years following the specifications for NIST-traceable thermometer calibration verification detailed in the United States Environmental Protection Agency’s “Manual for the Certification of Laboratories Analyzing Drinking Water”, Fifth Edition, January 2005. Currently the NIST thermometer is verified by outside vendor on triennial basis due to contract-specific requirements. Calibration log and Certificate(s) of calibration are maintained on file with QAO.

**7.2 Traceability of Metric Measurements – Calibration Weights.** SGS Accutest – Orlando uses calibrated weights, which are traceable to NIST standard weights to calibrate all balances used in the laboratory. Balances must be calibrated to specific tolerances within the intended use range of the balance. Calibration checks are required on each day of use. If the tolerance criteria are not achieved, corrective action specified in the balance calibration SOP must be applied before the balance can be used for laboratory measurements. All weights are recalibrated by outside vendor every five years following the specifications for weight calibration verification detailed in the United States Environmental Protection Agency’s “Manual for the Certification of Laboratories Analyzing Drinking Water”, Fifth Edition, January 2005. Certificate(s) of calibration are maintained on file with QAO. Balances are inspected and maintained by professional service technicians annually. Certificate(s) of inspection are maintained with QAO.

**7.3 Traceability of Chemical Standards and Reagents.** All chemicals and reagents, purchased as reference standards for use in method calibration must establish traceability to NIST referenced material through a traceability certificate (Certificate of Analysis, CoA). Process links are established that enable a calibration standard

solution to be traced to its NIST reference certificate. Solvents, acids and other supplies are being tested to verify their suitability for the analytical process.

- 7.4 Assignment Of Reagent and Standard Expiration Dates.** Expiration date information for all purchased standards and reagents is provided to SGS Accutest – Orlando with all prepared standard solutions and unstable reagents as a condition of purchase. Neat materials and inorganic reagents are not required to be purchased with expiration dates. Certified prepared solutions are labeled with the expiration date provided by the manufacturer. In-house prepared solutions are assigned expiration dates that are consistent with the method that employs their use unless documented experience indicates that an alternate date can be applied. If alternate expiration dates are employed, their use is documented in the method SOP. Expiration dates for prepared inorganic reagents, which have not exhibited instability, are established at two years from the date of preparation for tracking purposes. All containers shall be labeled with the date of preparation and expiration date clearly indicated.

The earliest expiration date is always the limiting date for assigning expiration dates to prepared solutions. Expiration dates that are later than the expiration date of any derivative solution or material are prohibited.

- 7.5 Documentation of Traceability.** Traceability information is documented in individual logbooks designated for the measurement process in use. The QA Officer maintains calibration documentation for metric references in pertinent folders and logbooks.

Balance calibration verification is documented in logbooks that are assigned to each balance. The individual conducting the verification is required to initial and date all calibration activities. Any defects that occur during verification are also documented along with the corrective action applied and a demonstration of return to control. Annual service and calibration reports and certificates retained on file with QA staff.

Temperature control is documented in logbooks assigned to the equipment being monitored. A verified (see 7.1) thermometer is assigned to each individual item. Measurements are recorded along with date and initials of the individual conducting the measurement on a daily or as used basis. Corrective action, if required, is also documented including the demonstration of return to control.

Initial traceability of chemical standards and reagents is documented via a vendor-supplied certificate (see also 7.3) that includes lot number and expiration date information. Solutions prepared using the vendor supplied chemical standards are documented in logbooks assigned to specific analytical processes. Alternatively, documentation may be entered into the electronic standards and reagent tracking log. The documentation includes links to the vendors lot number, an internal lot number, dates of preparation, and the preparer's initials. Standards received without certificate of analysis can not be used for calibration or calibration verification and are rejected.

Supervisors conduct regular reviews of logbooks, which are verified using a word "rev'd", signature and date. QA Staff monitors the process and documents it in the same manner.



## 8.0 TEST PROCEDURES, METHOD REFERENCES, AND REGULATORY PROGRAMS

**Requirements:** The laboratory must use client specified or regulatory agency approved methods for the analysis of environmental samples. The laboratory maintains a list of active methods, which specifies the type of analysis performed, and cross-references the methods to applicable environmental regulation. Routine procedures used by the laboratory for the execution of a method must be documented in a standard operating procedure. Method performance and sensitivity must be demonstrated annually where required. Defined procedures for the use of method sensitivity for data reporting purposes must be established by the Director of Quality Assurance and used consistently for all data reporting purposes.

8.1 **Method Selection.** SGS Accutest – Orlando employs methods for environmental sample analysis that are consistent with the client's application, which are appropriate and applicable to the project objectives. SGS Accutest – Orlando informs the client if the method proposed is inappropriate or outdated and suggests alternative approaches.

SGS Accutest – Orlando employs documented, validated regulatory methods in the absence of a client specification and informs the client of the method selected. These methods are available to the client and other parties as determined by the client. Documented and validated in-house methods may be applied if they are appropriate to the project. The client is informed of the method selection.

8.2 **Method Validation.** Standard methods from regulatory sources are primarily used for all analysis. Standard methods do not require validation by the laboratory. Non-standard, in-house methods are validated prior to use. Validation is also performed for standard methods applied outside their intended scope of use. Validation is dependent upon the method application and may include analysis of quality control samples to develop precision and accuracy information for the intended use. A final method validation report is generated, which includes all data in the validation study. A statement of adequacy and/or equivalency is included in the report. A copy of the report is archived in the quality assurance directory of the company server.

Non-standard methods are validated prior to use. This includes the validation of modified standard methods to demonstrate comparability with existing methods. Demonstrations and validations are performed and documented prior to incorporating technological enhancements and non-standard methods into existing laboratory methods used for general applications. The demonstration includes method specific requirements for assuring that significant performance differences do not occur when the enhancement is incorporated into the method. Validation is dependent upon method application and may include the analysis of quality control samples to develop precision and accuracy information for intended use.

The study procedures and specifications for demonstrating validation include comparable method sensitivity, calibration response, method precision, method accuracy and field sample consistency for several classes of analytical methods are

detailed in this document. These procedures and specifications may vary depending upon the method and the modification.

**8.3 Standard Operating Procedures.** Standard operating procedures (SOP) are prepared for routine methods executed by the laboratory and processes related to sample or data handling. The procedures describe the process steps in sufficient detail to enable an individual, who is unfamiliar with the procedure to execute it successfully. SOPs are reviewed annually and edited if necessary. SOPs can be edited on a more frequent basis if systematic errors dictate a need for process change or the originating regulatory agency promulgates a new version of the method. Procedural modifications are indicated using a revision number. SOPs are available for client review at the SGS Accutest – Orlando facility upon request.

**8.4 Method Detection Limit Determination and verification.** Annual method detection limit (MDL) studies are performed as appropriate for routine methods used in the laboratory. MDL studies are also performed when there is a change to the method that affects how the method is performed or when an instrumentation change that impacts sensitivity occurs. The procedure used for determining MDLs is described in 40 CFR, Part 136, Appendix B. Studies are performed for each method on water, soil and air matrices for every instrument that is used to perform the method. MDLs are established at the instrument level. The highest MDL of the pooled instrument data is used to establish a laboratory MDL. MDLs are experimentally verified through the analysis of spiked quality control samples at 2-3 times the concentration of the experimental MDL, or 1-4 times for multicomponent methods. The verification is performed on every instrument used to perform the analysis. The quality assurance staff manages the annual MDL determination process and is responsible for retaining MDL data on file. Approved MDLs are appended to the LIMS and used for data reporting purposes. MDL values are used as DL values for DOD projects and verification spiking concentrations are listed as LOD values.

Methods certified under DOD ELAP requirements must undergo verification procedure on quarterly basis – see DOD QSM 5.0, Volume 1, Module 4, 1.5.2.1.g)

**8.5 Method Reporting Limit.** The method reporting limit is established at the lowest concentration calibration standard in the calibration curve. The low calibration standard is selected by department managers as the lowest concentration standard that can be used while continuing to meet the calibration linearity criteria of the method being used. The validity of the Method Reporting Limits is confirmed via analysis of a spiked quality control sample at 1 – 2x Method reporting limit concentration. RL values are referred to as LOQ for DOD projects.

By definition, detected analytes at concentrations below the low calibration standard cannot be accurately quantitated and must be qualified accordingly.

Methods certified under DOD ELAP requirements must undergo verification procedure on quarterly basis – see DOD QSM 5.0, Volume 1, Module 4, 1.5.2.2.e).

**8.6 Reporting of Quantitative Data.** Analytical data for all methods is reported without qualification to the reporting limit established for each method. Data may be reported to MDL depending upon the client's requirements provided that all qualitative identification criteria for the parameter have been satisfied. All parameters reported at concentrations between the reporting limit and MDL are qualified as an estimated concentration.

Measured concentrations of detected analytes that exceed the upper limit of the calibration range are either diluted into the range and reanalyzed or qualified as an estimated value. The only exception to this applies to ICP and ICP/MS analysis, which can be reported to the upper limit of the experimentally determined linear range without qualification.

**8.7 Estimated Uncertainty.** A statement of the estimated uncertainty of an analytical measurement accompanies the test result when required. Estimated uncertainty is derived from the performance limits established for spiked samples of similar matrices. The degree of uncertainty is derived from the negative or positive bias for spiked samples accompanying a specific parameter. When the uncertainty estimate is applied to a measured value, the possible quantitative range for that specific parameter at that measured concentration is defined. Well recognized regulatory methods that specify values for the major sources of uncertainty and specify the data reporting format do not require a further estimate of uncertainty.

**8.8 Precision and Accuracy Studies.** Annual precision and accuracy (P&A) studies, which demonstrate the laboratories ability to generate acceptable data, are performed for all routine methods used in the laboratory. The procedure used for generating P&A data is referenced in the majority of the regulatory methodology in use. The procedure requires quadruplicate analysis of a sample spiked with target analytes at a concentration in the working range of the method. This data may be compiled from a series of existing blank spikes or laboratory control samples. Accuracy (percent recovery) of the replicate analysis is averaged and compared to established method performance limits. Values within method limits indicate an acceptable performance demonstration. (See also Sec 4, Training, Demonstration of capability)

**8.9 Method Sources, References and Update Mechanism.** The Quality Assurance Staff maintains a list of active methods used for the analysis of samples. This list includes valid method references such as EPA, American Society of Testing and Materials (ASTM) or Standard Methods designations and the current version and version date.

Updated versions of approved reference methodology are placed into use as changes occur. The Quality Assurance Director informs operations management of changes in method versions as they occur. The operations management staff selects an implementation date. The operations staff is responsible for completing all method requirements prior to the implementation date. This includes modification to SOPs, completion of MDL and precision and accuracy studies and staff training. Documentation of these activities is provided to the QA staff who retains this information on file. The updated method is placed into service on the implementation date and the old version is de-activated.

Multiple versions of selected methods may remain in use to satisfy client specific needs. In these situations, the default method version becomes the most recent version. Client specific needs are communicated to the laboratory staff using method specific analytical codes, which clearly depict the version to be used. The old method version is maintained as an active method until the specified client no longer requires the use of the older version.

SGS Accutest – Orlando will not use methodology that represents significant departures from the reference method unless specifically directed by the client. In cases where clients direct the laboratory to use a method modification that represents a significant departure from the reference method, the request will be documented in the project file. The LQSM lists active methods used for the analysis of samples in Table 8.1. This list includes valid method references from sources such as USEPA, ASTM or Standard Methods designations and the current version and version date.

**8.10 Analytical Capabilities.** Appendix II provides a detailed listing of the methodology employed for the analysis of test samples.

## 9.0 SAMPLE MANAGEMENT, LOGIN, CUSTODY, STORAGE AND DISPOSAL

**Requirement.** A system to ensure that client supplied product is adequately evaluated, acknowledged, and secured upon delivery to the laboratory must be practiced by the laboratory. The system must assure that chain of custody is maintained and that sample receipt conditions and preservation status are documented and communicated to the client and internal staff. The login procedure must assign, document, and map the specifications for the analysis of each unique sample to assure that the requested analysis is performed on the correct sample and enables the sample to be tracked throughout the laboratory analytical cycle. The system must include procedures for reconciling defects in sample condition or client provided data, which occur at sample arrival. The system must specify the procedures for proper sample storage, transfer to the laboratory, and disposal after analysis. The system must be documented in a standard operating procedure.

**9.1 Order Receipt and Entry.** New orders are initiated and processed by the client services group (See Chapter 14, Procedures for Executing Client Specifications). The new order procedure includes mechanisms for providing sampling containers to clients. These containers must meet the size, cleanliness, and preservation specifications for the analysis to be performed.

For new orders, the project manager prepares a bottle request form, which is submitted to sample management department. This form provides critical project details to the sample management staff, which are used to prepare and assemble the sample bottles for shipment to the client prior to sampling.

The bottle order is assembled using bottles that meet USEPA specifications for contaminant-free sample containers. SGS Accutest – Orlando checks all sample containers for cleanliness. Data are reviewed by both the analyst and sample management technician. Results of bottle analyses are retained for minimum of 5 years.

All preservative solutions are prepared in the laboratory and are checked to assure that they are free of contamination from analytes of interest before being released for use. Sample management department retains a copy of the documentation of in-house contamination checks.

Reagent water for trip and field blanks is poured into appropriately labeled containers. Sample bottleware is labeled with durable labels printed on waterproof printing medium with indelible laser or heat transfer printer ink. All bottles are packed into ice chests with blank chain of custody forms and the original bottle order form. Completed bottle orders are delivered to clients using SGS Accutest – Orlando couriers or commercial carriers for use in field sample collection.

**9.2 Sample Receipt and Custody.** Samples are delivered to the laboratory using a variety of mechanisms including SGS Accutest – Orlando couriers, commercial shippers, and client self-delivery. Documented procedures are followed for arriving

samples to assure that custody and integrity are maintained and that handling and preservation requirements are documented and continued.

Sample custody documentation is initiated when the individual collecting the sample collects field samples. Custody documentation includes all information necessary to provide an unambiguous record of sample collection, sample identification, and sample collection chronology. Initial custody documentation employs either SGS Accutest – Orlando or client generated custody forms.

SGS Accutest – Orlando generates a Sample Receipt Confirmation form in situations where the individuals who collected the sample did not generate custody documentation in the field. SGS Accutest – Orlando Project Manager then contacts the client for the CoC information to be faxed or e-mailed from the client to the lab.

SGS Accutest – Orlando defines sample custody as follows:

- The sample is in the actual custody or possession of the assigned responsible person,
- The sample is in a secure area.

The SGS Accutest – Orlando facility is defined as a secure facility. Perimeter security has been established, which limits access to authorized individuals only. Visitors enter the facility through the building lobby and must register with the receptionist prior to entering controlled areas. While in the facility, visitors must be accompanied by their hosts at all times. After hours, building access is controlled using a computerized pass-key reader system. This system limits building access to individuals with a pre-assigned authorization status. After hours visitors are not authorized to be in the building. Clients delivering samples after hours must make advanced arrangements through client services and sample management to assure that staff is available to take delivery and maintain custody.

Upon arrival at SGS Accutest – Orlando, the sample custodian reviews the chain of custody and generates Sample Receipt Confirmation form for the samples received to verify that the information on the form corresponds with the samples delivered. This includes verification that all listed samples are present and properly labeled, checks to verify that samples were transported and received at the required temperature, verification that the sample was received in proper containers, verification that sufficient volume is available to conduct the requested analysis, and a check of individual sample containers to verify test specific preservation requirements including the absence of headspace for volatile compound analysis.

- 9.3** Sample conditions and other observations are documented on the Sample Receipt Confirmation form by the sample custodian prior to completing acceptance of custody. The sample custodian accepts sample custody upon verification that the custody document is correct. Discrepancies or non-compliant situations are documented, flagged and communicated to the SGS Accutest – Orlando project manager, who

contacts the client for resolution. The resolution is documented and communicated to sample management for execution.

- 9.4 **Laboratory preservation of Improperly preserved field samples.** SGS Accutest – Orlando extends every effort to preserve samples which were received without proper field preservation.

Field/Equipment negative controls also receive the same amount of preservation as incorrectly preserved samples, and record made in the preservation logbook.

- 9.5 **Sample Tracking Via Status Change.** An automated, electronic LIMS procedure records sample exchange transactions between departments and changes in analytical status. This system tracks all preparation, analytical, and data reporting procedures to which a sample is subjected while in the possession of the laboratory. Each individual receiving samples must acknowledge the change in custody and operational status in the LIMS. This step is required to maintain an accurate electronic record of sample status, dates of analytical activity, and custody throughout the laboratory.

Sample tracking is initiated at login where all chronological information related to sample collection dates and holding times are entered into the LIMS. This information is entered on an individual sample basis

- 9.6 **Sample Acceptance Policy.** Incoming samples must satisfy SGS Accutest – Orlando sample acceptance criteria before being logged into the system. Sample acceptance is based on the premise that clients have exercised proper protocols for sample collection. This includes sufficient volume, proper chemical preservation, temperature preservation, sample container sealing and labeling, and appropriate shipping container packing.

The sample management staff will make every attempt to preserve improperly preserved samples upon arrival. However, if preservation is not possible, the samples may be refused unless the client authorizes analysis. No samples will be accepted if holding times have been exceeded or will be exceeded before analysis can take place unless the client authorizes analysis.

Sample acceptance criteria include proper custody and sample labeling documentation. Proper custody documentation includes an entry for all physical samples delivered to the laboratory with an identification code that matches the sample bottle and a date and signature of the individual who collected the sample and delivered them to the laboratory. Labeling is done using durable waterproof labels printed with indelible heat-transfer ink.

SGS Accutest – Orlando reserves the right to refuse any sample which in its sole and absolute discretion and judgement is hazardous, toxic and poses or may pose a health, safety or environmental risk during handling or processing. The company will not accept samples for analysis using methodology that is not performed by the laboratory or for

methods that lab does not hold valid accreditation unless arrangements have been made to have the analysis conducted by a qualified subcontractor.

- 9.7 Assignment of Unique Sample Identification Codes.** Unique identification codes must be assigned to each sample bottle to assure traceability and unambiguously identify the tests to be performed in the laboratory.

The sample identification coding process begins with the assignment of a unique alphanumeric job number. A job is defined as a group of samples received on the same day, from a specific client pertaining to a specific project. A job may consist of groups of samples received over multi-day period. The first character of the job number is an alpha-character that identifies the laboratory facility. The next characters are numeric and sequence by one number with each new job.

Unique sample numbers are assigned to each bottle collected as a discrete entity from a designated sample point. This number begins with the job number and incorporates a second series of numbers beginning at one and continuing chronologically for each point of collection. The test to be performed is clearly identified on the bottle label.

Alpha suffixes may be added to the sample number to identify special designations such as subcontracted tests, in-house QC checks, or re-logs. Multiple sample bottles for a specific analysis are labeled Bottle 1, Bottle 2, etc.

- 9.8 Subcontracted Analysis.** Subcontract laboratories are employed to perform analysis not performed by SGS Accutest - Orlando. The quality assurance staff evaluates subcontract laboratories to assure their quality processes meet the standards of the environmental laboratory industry prior to engagement. Throughout the subcontract process, SGS Accutest – Orlando follows established procedures to assure that sample custody is maintained and the data produced by the subcontractor meets established quality criteria.

SGS Accutest network laboratories are considered primary subcontractors.

*Subcontracting Procedure.* Subcontracting procedures are initiated through several mechanisms, which originate with sample management. Samples for analysis by a subcontractor are logged into the SGS Accutest – Orlando system using regular login procedures. If subcontract parameters are part of the project or sample management has received subcontracting instructions for a specific project, a copy of the chain of custody is given to the appropriate project manager with the subcontracted parameters highlighted. This procedure triggers the subcontract process at the project management level. The Sample Management supervisor contacts an approved subcontractor to place the subcontract order. Subcontract chain of custody is processed in Sample Management Department and copy is filed with the original CoC. Sample management signs the subcontract chain of custody and ships the sample(s) to the subcontractor. The subcontract COC is filed with the original COC and the request for subcontract. Copies are distributed to the login department, the project manager, and sample management.



Client is verbally notified by Project Manager of the requirement to subcontract to the outside laboratory as soon as need is identified by the SGS Accutest – Orlando staff. Client notification must be verified in writing, i.e. by e-mail. Client notification may take place during the initial project set-up, or at the time of sample receipt and login.

Subcontractor data packages are reviewed by the QA Staff to assess completeness and quality compliance. If completeness defects are detected, the subcontractor is asked to immediately upgrade the data package. If data quality defects are detected, the package is forwarded to the QA staff for further review. The QA staff will pursue a corrective action solution before releasing data to the client.

Approved subcontract data is entered into the laboratory information management system (LIMS) if possible and incorporated into the final report. All subcontract data is footnoted to provide the client with a clear indication of its source. Copies of original subcontract data are always included in the data report whether in hardcopy or PDF file, depending on the data submission requirements.

*Subcontract Laboratory Evaluation.* The QA staff evaluates subcontract laboratories prior to engagement. As a minimum, the subcontract laboratory must provide SGS Accutest – Orlando with proof of a valid certification to perform the requested analysis for the venue where they were collected, QC criteria summary (LOD/LOQ, LCS, MS/MSD, %RPD, etc.), copy of the most recent regulatory agency audit report, and a copy of the laboratory's Summary of Qualifications (SOQ). Other beneficial materials are QSM, copies of SOPs used for the subcontracted analysis, a copy of the most recent performance evaluation study for the subcontracted parameter, and copies of the most recent third party accreditor's audit report.

Certification verification must be submitted to SGS Accutest – Orlando annually. If possible, the QA staff may conduct a site visit to the laboratory to inspect the quality system. SGS Accutest - Orlando assumes the responsibility for the performance of all subcontractors who have successfully demonstrated their qualifications. When selecting a subcontractor for analysis not performed by SGS Accutest – Orlando, assure qualifications of the subcontractor through local QA officer.

Qualification process of a subcontract laboratory may be bypassed if the primary client directs SGS Accutest – Orlando to employ a specific subcontractor

*Subcontract Laboratory Database.* SGS Accutest Inc. maintains centralized database of preferred contractors in order to optimize sample handling and data submission process, as well as obtain competitive priced services of uniform quality throughout the network. Individual SGS Accutest facilities are assigned "Center of Expertise" status according to unique capabilities.

- 9.9** **Sample Storage.** Following sample custody transfer, samples are assigned to various refrigerated storage areas by the sample management staff depending upon the test to be performed and the matrix of the samples. The location (refrigerator and shelf) of each sample is entered into sample location database on the line

corresponding to each sample number. Samples remain in storage until the laboratory technician retrieves them into the laboratory for analysis.

Samples for volatile organics analysis are placed in storage in designated refrigerators by the sample management staff and immediately transferred to the organics group control. Sample custody is transferred to the VOC department staff. These samples are segregated according to matrix to limit opportunities for cross contamination to occur.

Organics staff is authorized to retrieve samples from these storage areas for analysis. When analysis is complete, the samples are placed back into storage.

- 9.10 **Sample Login.** Following sample custody transfer to the laboratory, the documentation that describes the clients analytical requirements are delivered to the sample login group for coding and entry to the Laboratory Information management System (LIMS). This process translates all information related to collection time, turnaround time, sample analysis, and deliverables into a code which enables client requirements to be electronically distributed to the various departments within the laboratory for scheduling and execution.

The technical staff is alerted to client or project specific requirements through the use of a unique project code that is electronically attached to the job during login. The unique project code directs the technical staff to controlled specifications documents detailing the unique requirements.

- 9.11 **Sample Retrieval for Analysis.** It is a responsibility of individual analyst to retrieve samples for analysis. Sample Management employs a program to facilitate sample placement and retrieval. Sample is traced around the laboratory using Status feature of LIMS.

After sample analysis has been completed, the analyst places the sample back into the storage and updates sample status.

- 9.12 **Sample Disposal.** SGS Accutest - Orlando retains all samples under proper storage for a minimum of 30 days following completion of the analysis report. Longer storage periods are accommodated on a client specific basis if required. Samples may also be returned to the client for disposal.

SGS Accutest – Orlando disposes of all laboratory wastes following the requirements of the Resource Conservation and Recovery Act (RCRA). The Company has obtained and maintains a waste generator identification number, FLR00001263309002 (FLR designates State of Florida).

Sample management generates a sample disposal dump sheet from the LIMS tracking system each week, which lists all samples whose holding period has expired. Data from each sample is compared to the hazardous waste criteria established by the Florida Department of Environmental Protection (FDEP).

Samples containing constituents at concentrations above the criteria are labeled as hazardous and segregated into the following waste categories for disposal as follows:

Chlorinated Waste (Closed Top Steel Drum)- Methylene Chloride

Non-Chlorinated Waste (Closed Top Steel Drum)- Hexane, Methanol, and mixed solvents

Sodium Sulfate/Used Charcoal (Open Top Steel Drum)- Charcoal and paper filters used in the filtering of samples.

Hazardous Flammable Vials (Open Top Polypropylene Drum)- Methylene Chloride, Hexane.

Hazardous Aqueous waste (Closed Top Polypropylene Drum)- High Odor Samples, Lachat Waste.

Non Hazardous Soil (Open Top Steel Drum)- Soils.

Hazardous Solid Waste- (Open Top Steel Drum).

Non-Aqueous/Oil Samples- (Closed Top Steel Drum)

Difference between Open and Closed type of drums is whether it is possible to remove entire lid or just threaded stopper. Drums are closed at all times while in storage.

Non-hazardous aqueous samples are neutralized and collected in HDPP 500 Gal holding tank to be removed by waste company.

Non-hazardous solids are drummed and disposed of by contract waste company. Sample bottles are disposed of as recyclable waste in order to crush the bottles and destroy the labels. VOC vials are crushed on site using PRODEVA glass crusher. Supernatant liquid is siphoned off into the HDPP holding tank and solid residue drummed separately.

Laboratory wastes are collected by waste stream in designated areas throughout the laboratory. Waste streams are consolidated twice a week by the waste custodian and transferred to stream specific drums for disposal through a permitted waste management contractor. Filled, consolidated drums are tested for hazardous characteristics and scheduled for removal from the facility for appropriate disposal based on the laboratory data.

## 10.0 LABORATORY INSTRUMENTATION AND MEASUREMENT STANDARDS

**Requirement:** Procedures, which assure that instrumentation is performing to a pre-determined operational standard prior to the analysis of any samples, must be established by the laboratory. In general, these procedures will follow the regulatory agency requirements established in promulgated methodology. The instrumentation selected to perform specified analysis is capable of providing the method-specified uncertainty and sufficient sensitivity of measurement needed. These procedures must be documented and incorporated into the standard operating procedures for the method being executed. SASE Equipment List attached as Appendix III.

- 10.1 **Mass Tuning – Mass Spectrometers.** The mass spectrometer tune and sensitivity must be monitored to assure that the instrument is assigning masses and mass abundances correctly and that the instrument has sufficient sensitivity to detect compounds at low concentrations. This is accomplished by analyzing a specific mass tuning compound at a fixed concentration. If the sensitivity is insufficient to detect the tuning compound, corrective action must be performed prior to the analysis of standards or samples. If the mass assignments or mass abundances do not meet criteria, corrective action must be performed prior to the analysis of standards or samples.
- 10.2 **Wavelength Verification – Spectrophotometers.** Spectrophotometer detectors are checked on a regular schedule to verify proper response to the wavelength of light needed for the test in use. If the detector response does not meet specifications, corrective action (detector adjustment or replacement) is performed prior to the analysis of standards or samples.
- 10.3 **Inter-element Interference Checks (Metals).** Inductively Coupled Plasma Emission Spectrophotometers (ICP) are subject to a variety of spectral interferences, which can be minimized or eliminated by applying interfering element correction factors and background correction points. Interfering element correction factors are checked on a specified frequency through the analysis of check samples containing high levels of interfering elements. Analysis of single element interferent solutions is also conducted at a specified frequency.

If the check indicates that the method criteria has not been achieved for any element in the check standard, the analysis is halted and data from the affected samples are not reported. Sample analysis is resumed after corrective action has been performed and the correction factors have been re-calculated.

New interfering element correction factors are calculated and applied whenever the checks indicate that the correction factors are no longer meeting criteria. At a minimum, correction factors are replaced once a year.

- 10.4 **Calibration and Calibration Verification.** Many tests require calibration using a series of reference standards to establish the concentration range for performing quantitative analysis. Method specific procedures for calibration are followed prior to any sample analysis.

Calibration is performed using a linear or quadratic regression calculation or calibration factors calculated from the curve. The calibration must meet method specific criteria for linearity or precision. If the criteria are not achieved, corrective action (instrument maintenance or re-calibration) is performed. The instrument must be successfully calibrated before analysis of samples can be conducted.

Initial calibration for metals analysis performed using inductively coupled plasma (ICP) employs the use of two standards and a calibration blank to establish linearity. The calibration blank contains all reagents that are placed into the calibration standard with the exception of the target elements. Valid calibration blanks must not contain any target elements.

Initial calibrations must be initially verified using a single concentration calibration standard from a second source (i.e. separate lot or different provider). The continuing validity of an existing calibration must be regularly verified using a single concentration calibration standard. The response to the standard must meet pre-established criteria that indicate the initial calibration curve remains valid. Samples must be bracketed by passing CCVs. If the criteria are not achieved corrective action (re-calibration) is performed before any additional samples may be analyzed.

- 10.5 **Linear Range Verification and Calibration** Linear range verification is performed for all ICP, ICP/MS and select General Chemistry methods. The regulatory program or analytical method specifies the verification frequency. A series of calibration standards are analyzed over a broad concentration range. The data from these analyses are used to determine the valid analytical range for the instrument.

Some methods or analytical programs require a low concentration calibration check to verify that instrument is sufficient to detect target elements at the reporting limit. The analytical method or regulatory program defines the criteria used to evaluate the low concentration calibration check. If the low calibration check fails criteria, corrective action is performed and verified through reanalysis of the low concentration calibration check before continuing with the field sample analysis.

In accordance with TNI standards minimum number of calibration points in the absence of method-specific requirements is two calibration points and a blank.

- 10.6 **Retention Time Verification (GC/HPLC/IC).** Chromatographic retention time windows are developed for all analysis performed using gas chromatographs with conventional detectors. An initial experimental study is performed, which establishes the width of the retention window for each compound. The retention time range of the window defines the time ranges for elution of specified target analytes on the primary and

confirmation columns. Retention time windows are established upon initial calibration, applying the retention time range from the initial study to each target compound. Retention times are regularly confirmed through the analysis of an authentic standard during calibration verification. If the target analytes do not elute within the defined range during calibration verification, the instrument must be recalibrated and new windows defined. New studies are performed when major changes, such as column replacement are made to the chromatographic system.

## 11.0 INSTRUMENT MAINTENANCE

**Requirement.** Procedures must be established for equipment maintenance. The procedure may include a maintenance schedule if required or documentation of daily maintenance related activities. All instrument maintenance activities must be documented in instrument specific logbooks. All equipment out of service (both analytical and auxiliary) must be clearly marked “Out of Order”.

- 11.1 **Routine, Daily Maintenance.** Routine, daily maintenance is required on an instrument specific basis. It is performed each time the instrument is used. Daily maintenance traditionally includes activities to insure a continuation of good analytical performance. In some cases, they include performance checks that indicate whether non-routine maintenance is required. If the performance check indicates a need for higher level maintenance, the equipment is taken out of service until maintenance is performed. Analysis cannot be continued until the performance checks meet established criteria. Document return to control. Daily maintenance is the responsibility of the individual assigned to the instrument used for the analysis he is performing.
- 11.2 **Non-routine Maintenance.** Non-routine maintenance is reserved for catastrophic occurrences such as instrument failure. The need for non-routine maintenance is indicated by failures in general operating systems that result in an inability to conduct required performance checks or calibration. Equipment in this category are taken out of service and repaired before attempting further analysis. Analysis cannot continue until the instrument meets all performance check criteria and is capable of being calibrated. Section supervisors are responsible for identifying non-routine maintenance episodes and initiating repair activities to bring the equipment on-line. This may include initiating telephone calls to maintenance contractors if necessary. They are also responsible for documenting all details related to the occurrence and the repair.
- 11.3 **Scheduled Maintenance.** Modern laboratory instrumentation rarely requires traditional scheduled maintenance. Where required, the equipment is placed on a schedule, which dictates when maintenance is required. Examples include annual balance calibration by an independent provider and pump oil changes. Section supervisors are responsible for initiating scheduled maintenance on equipment that requires scheduled preventative attention. Scheduled maintenance is documented using routine documentation practices.
- 11.4 **Maintenance Documentation.** Routine and non-routine maintenance activities are documented in logbooks assigned to instruments and equipment used for analytical measurements. The logbooks contain preprinted forms, which specify the maintenance activities required with each use. SGS Accutest - Orlando has adopted a problem – action – follow-up format to conduct instrument maintenance. The analyst or supervisor who performs or initiates the maintenance activity is required to check the activity upon its completion, verify complete statement of return to normal conditions and initial the form. Non-routine maintenance (i.e. repairs, upgrades, etc.) is documented as well either electronically via e-mail from the service provider or receipt attached to the maintenance log.

## 12.0 QUALITY CONTROL PARAMETERS, PROCEDURES, AND CORRECTIVE ACTION

**Requirement.** All procedures used for test methods must incorporate quality control parameters to monitor elements that are critical to method performance. Each quality parameter includes acceptance criteria that have been established by regulatory agencies for the methods in use. Criteria may also be established through client dictates or through the accumulation and statistical evaluation of internal performance data. Data obtained from these parameters must be evaluated by the analyst, and compared to established method criteria. If the criteria are not achieved, the procedures must specify corrective action and conformation of control before proceeding with sample analysis. QC parameters, procedures, and corrective action must be documented within the standard operating procedures for each method. In the absence of client specific objectives the laboratory must define qualitative objectives for completeness and representativeness of data.

**12.1 Procedure.** Bench analysts are responsible for methodological quality control and sample specific quality control. Each method specifies the control parameters to be employed for the method in use and the specific procedures for incorporating them into the analysis. These control parameters are analyzed and evaluated with every designated sample group (batch).

The data from each parameter provides the analyst with critical decision making information on method performance. The information is used to determine if corrective action is needed to bring the method or the analysis of a specific sample into compliance. These evaluations are conducted throughout the course of the analysis. Each parameter being indicative of a critical control feature. Failure of a methodological control parameter is indicative of either instrument or batch failure. Failure of a sample control parameter is indicative of control difficulties with a specific sample or samples.

**Sample Batch.** All samples analyzed in the laboratory are assigned to a designated sample batch, which contains all required quality control samples and a defined maximum number of field samples that are prepared and/or analyzed over a defined time period. The maximum number of investigative and field QC samples in the batch is 20. SGS Accutest – Orlando has incorporated the TNI batching policy as the sample-batching standard. This policy incorporates the requirement for blanks and spiked blanks as a time based function as defined by TNI. The typical batch contains a blank, laboratory control sample (LCS or spiked blank), matrix spike and matrix spike duplicate. Batch documentation includes lot specifications for all reagents and standards used during preparation of the batch.

**12.2 Methodological Control Parameters and Corrective Action.** Prior to the analysis of field sample the analyst must determine that the method is functioning properly. Specific control parameters indicate whether critical processes meet specified requirements before continuing with the analysis. Method specific control parameters must meet criteria before sample analysis can be conducted. Each of these



parameters is related to processes that are under the control of the laboratory and can be adjusted if out of control.

**Method Blank.** A method blank is analyzed during the analysis of any field sample. The method blank is defined as a sample. It contains the same standards (internal standards, surrogates, matrix modifiers, etc.) and reagents that are added to the field sample during analysis, with the exception of the sample itself. If the method blank contains target analyte(s) at concentrations that exceed method or client requirements (typically defined as 1/2 RL concentrations), the source of contamination is eliminated before proceeding with sample analysis. Systematic contamination is documented for corrective action and resolved following the established corrective action procedures. In specific cases, contamination detected in the method blank may be acceptable if the concentrations do not exceed regulatory limits or client defined reporting limits.

**Laboratory Control Samples (LCS or Spiked Blanks).** A laboratory control sample (spiked blank or commercially prepared performance evaluation sample) is analyzed along with field samples to demonstrate that the method accuracy is within acceptable limits. These spike solutions are derived from different sources than the solutions used for method calibration. The performance limits are derived from published method specifications or from statistical controls generated from laboratory method performance data. Spiked blanks are blank matrices (reagent water, clean sand, Teflon chips, or granular sodium sulfate) spiked with the targeted parameters and analyzed using the same method used for samples. Accuracy data is compared to laboratory experimentally derived limits to determine if the method is in control. Laboratory control samples (LCS) may be laboratory or commercially prepared spiked samples in an inert material.

Accuracy data is compared to the applicable performance limits. If the spike accuracy exceeds the performance limits, corrective action, as specified in the SOP for the method is performed and verified before continuing with a field sample analysis. In some cases, decisions are made to continue with sample analysis if performance limits are exceeded; provided the unacceptable result has no negative impact on the sample data.

Marginal exceedance (ME) values are calculated for methods containing more than eleven (11) targeted analytes. The ME is calculated as  $\pm 4$  standard deviations about the mean. MEs are considered for multi-analyte methods because of the increased likelihood of LCS failure as the number of analytes in the method increase. The number of allowable MEs is based on the number of target analytes in the method. Analytes that regularly fall into the ME category are treated as systematic problems, which are resolved using established trend monitoring and corrective action procedures. Marginal Exceedances are not applied to parameters that are detected in field samples. Routine corrective action is initiated for all cases where LCS spike accuracy criteria is beyond the established control limits and the parameter is detected in field samples corresponding to the unacceptable LCS. Use of ME may be disallowed on project-specific basis.

Blanks and spikes are routinely evaluated before samples are analyzed. However, in situations where sample analysis is performed using an autosampler, they may be evaluated after sample analysis has occurred. If the blanks and spikes do not meet criteria, sample analysis is repeated.

**Proficiency Testing.** Performance Evaluation (Proficiency Testing) samples (PEs, PTs) are single or double blind samples spiked with know amount of analytes on interest and introduced to the laboratory to assess method performance. PEs may be introduced as double blinds submitted by commercial clients, single or double blinds from regulatory agencies, or internal blinds submitted by the QA group.

A minimum of two single blind studies must be performed each year for every parameter in aqueous and solid matrices for each field of proficiency testing (FOPT) for which the laboratory maintains accreditation. Proficiency Testing samples must be purchased as blinds from an accredited vendor for every combination of analyte-matrix-method. Data from these studies are provided to the laboratory by the vendor and reported to accrediting agencies. If unsatisfactory performance is noted, corrective action is performed to identify and eliminate any sources of error. A new PT must be analyzed to demonstrate continuing proficiency.

PE samples performed for accrediting agencies or clients, which do not meet performance specifications, require a written summary that documents the corrective action investigation, findings, and corrective action implementation.

Single or double blind PT samples are employed for self-evaluation purposes. Data from these analyses are compared to established performance limits. If the data does not meet performance specifications, the system is evaluated for sources of acute or systematic error. If required, corrective action is performed and verified before initiating or continuing sample analysis.

**Trend Analysis for Control Parameters.** Accuracy data for selected spiked parameters from the laboratory control sample (LCS) is statistically evaluated daily for trends. Data from selected LCS parameters and surrogates are pooled on a method, matrix, and instrument basis. This data is evaluated by comparison to existing control and warning limits. Trend analysis is performed automatically as follows:

- Any point outside the control limit
- Any three consecutive points between the warning and control limits
- Any eight consecutive points on the same side of the mean
- Any six consecutive points increasing or decreasing

The results of the trend analysis are printed for supervisory evaluation prior to sample analysis. Trends that indicate the potential loss of statistical control are further evaluated to determine the impact on data quality and to determine if corrective action is necessary. If corrective action is indicated, the supervisor informs the analysts of

the corrective actions to be performed. Return to control is demonstrated before analysis resumes.

**12.3 Sample Control Parameters and Corrective Action.** The analysis of samples can be initiated following a successful demonstration that the method is operating within established controls. Additional controls are incorporated into the analysis of each sample to determine if the method is functioning within established specifications for each individual sample. Sample QC data is evaluated and compared to established performance criteria. If the criteria are not achieved the method or the SOP specifies the corrective action required to continue sample analysis. In many cases, failure to meet QC criteria is a function of sample matrix and cannot be remedied. Each parameter is designed to provide quality feedback on a defined aspect of the sampling and analysis episode.

**Duplicates.** Duplicate sample analysis is used to measure analytical precision. This can also be equated to laboratory precision for homogenous samples. Precision criteria are method dependent. If precision criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

**Laboratory Control Duplicate, Spikes & Spiked Duplicates.** Spikes and spiked duplicates are used to measure analytical precision and accuracy for the sample matrix selected. Precision and accuracy criteria are method dependent. If precision and accuracy criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

**Serial Dilution (Metals).** Serial dilutions of metals samples are analyzed to determine if analytical matrix effects may have impacted the reported data. If the value of the serially diluted samples does not agree with the undiluted value within a method-specified range, the sample matrix may be causing interference, which may lead to either a high or low bias. If the serial dilution criterion is not achieved, it must be flagged to indicate possible bias from matrix effects. *SGS Accutest – Orlando uses this procedure as opposed to post-digestion spike unless contractual obligations absolutely require latter*

**Post Digestion Spikes (Metals).** Digested samples are spiked and analyzed to determine if matrix interferences are creating biases in the results. It may also be used to determine potential interferences per client's specification. Spike concentration is determined as per analytical method. No action is necessary if the post digestion spike is outside of the method criteria, unless a preparation problem is suspected with the spike, in which case the post digestion spike should remade and reanalyzed.

**Surrogate Spikes (Organics).** Surrogate spikes are organic compounds that are similar in behavior to the target analytes but unlikely to be found in nature. They are added to all quality control and field samples to measure method performance for each

individual sample. Surrogate accuracy limits are derived from published method specifications or by statistical evaluation of laboratory generated surrogate accuracy data. Accuracy data is compared to the applicable performance limits. If the surrogate accuracy exceeds performance limits, corrective action, as specified in the method or SOP is performed before sample data can be reported.

**Internal Standards (Organic Methods).** Internal standards are retention time and instrument response markers added to every sample to be used as references for quantitation. Their response is compared to reference standards and used to evaluate instrument sensitivity on a sample specific basis. Internal standard retention time is also compared to reference standards to assure that target analytes are capable of being located by their individual relative retention time.

If internal standard response criteria are not achieved, corrective action or additional action may be required. The recommended action must be completed before sample data can be reported.

If the internal standard retention time criteria are not achieved corrective action or additional action may be required. This may include re-calibration and re-analysis. Additional action must be completed before sample data is reported.

**Internal Standards (ICP and ICP-MS Metals).** Internal standards are used on ICP instruments to compensate for variations in response caused by differences in sample matrices. This adjustment is performed automatically during sample analysis. The internal standard response of replicated sample analysis is monitored to detect potential analytical problems. If analytical problems are suspected, then the field samples are reanalyzed.

**12.4 Laboratory Derived Quality Control Criteria.** Control criteria for in-house methods and client specific modifications that exceed the scope of published methodology are defined and documented prior to the use of the method. The Quality Assurance staff identifies the responsibility for control criteria needs. Control parameters and criteria, based on best technical judgment are established using input provided by the operations staff. These control parameters and criteria are documented and incorporated into the method.

The laboratory derived criteria are evaluated for technical soundness on spiked samples prior to the use of the method on field samples. The technical evaluation is documented and archived by the Quality Assurance staff.

When sufficient data from the laboratory developed control parameter is accumulated, the data is statistically processed and the experimentally derived control limits are incorporated into the method.

**12.5 Bench Review & Corrective Action.** The bench chemists are responsible for all QC parameters. Before proceeding with sample analysis, they are required to

successfully meet all instrumental QC criteria. They have the authority to perform any necessary corrective action before proceeding with sample analysis. Their authority includes the responsibility for assuring that departures from documented policies and procedures do not occur.

The bench chemists are also responsible for all sample QC parameters. If the sample QC criteria are not achieved, they are authorized and required to perform the method specified corrective action before reporting sample data.

**Data Qualifiers.** An alpha character coding system is employed for defining use limitations for reported data. These limitations are applied to analytical data by the analyst to clarify the usefulness of the reported data for data user. SGS Accutest - Orlando qualifies data in accordance with program-specific requirements, such as State of Florida DEP, DoD QSM, etc., and these qualifiers are hard-coded in the LIMS on project level. Definitions of common qualifiers could be found at the bottom of the sample report form.

- 12.6 **QA Monitoring.** The QA staff prior to client release conducts a spot review of completed data packages. This review includes an examination of QC data for compliance and trends indicative of systematic difficulties. If non-conformances are detected, the QA staff places an immediate stop on the release of the data and initiates corrective action to rectify the situation. The data package is released when the package becomes compliant with all quality requirements.

If the review reveals trends indicative of systematic problems, QA initiates an investigation to determine the cause. If process defects are detected, a corrective action is implemented and monitored for effectiveness.

**Performance Limits.** The Technical Director is responsible for compilation and maintenance of all precision and accuracy data used for performance limits. Quality control data for all test methods are accumulated and stored in the laboratory information management system (LIMS). Parameter specific QC data is extracted annually and statically processed to eliminate outliers and develop laboratory specific warning limits and confidence limits. The new limits are reviewed and approved by the supervisory staff prior to their use for data assessment. The new limits are used to evaluate QC data for compliance with method requirements for a period of one year. Laboratory generated limits appear on all data reports unless method specifies hard-coded limits (mostly General Chemistry and Metals)

- 12.7 **Data Package Review.** SGS Accutest – Orlando employs multiple levels of data review to assure that reported data has satisfied all quality control criteria and that client specifications and requirements have been met. Production departments have developed data review procedures which must be conducted before data is released to the client.

**Analytical Review.** The analyst conducts the primary review of all data. This review begins with a check of all instrument and method quality control and progresses through sample quality control concluding with a check to assure that the client's requirements have been executed. Analyst checks focuses on a review of qualitative determinations and checks of precision and accuracy data to verify that existing laboratory criteria have been achieved. Checks at this level may include comparisons with project specific criteria if applicable. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

Secondary data reviews are performed at the peer level by analysts who have met the qualification criteria for the method in use. Qualification requirements include a valid demonstration of capability and demonstrated understanding of the method SOP. Section supervisors may perform secondary review in-lieu of a peer review. Secondary review is performed on 100% of the data produced by their department. It includes a check of all manual calculations; an accuracy check of manually transcribed data from bench sheets to the LIMS, a check of all method and instrument QC criteria, baseline manipulations (if applicable) and a comparison of the data package to client specified requirements. Also included are checks to assure the appropriate methodology was applied and that all anomalous information was properly flagged for communication in the case narrative. Supervisors have the authority to reject data and initiate re-analysis, corrective action, or reprocessing.

All laboratory data requiring manual entry into LIMS system is double-checked by the analysts performing initial data entry and the section supervisor. Verification of supervisory review is indicated on the raw data summary by the supervisor's initials and date.

Electronic data that is manually edited at the bench by the primary analysts is automatically flagged by the instrument data system indicating an override by the analyst. All manual overrides must be verified and approved by a supervisor who initials and dates all manual changes.

Hard copies of manually integrated chromatographic peaks are printed that clearly depict the manually drawn baseline. The hard copy is reviewed and approved by the reviewer (initialed and dated) and included in the data package of all full tier reports or the archived batch records of commercial report packages.

Electronic data that has been committed to the LIMS can only be edited by a manager or supervisor. These edits may be required if needs for corrections are indicated during the final review. An audit record for all electronic changes in the LIMS is automatically appended to the record.

The section leader performs a tertiary review on a spot check basis. This review includes an evaluation of QC data against acceptance criteria and a check of the data

package contents to assure that all analytical requirements and specifications were executed.

**Report Generation (Administrative) Review.** The report generation group reviews all data and supporting information delivered by the laboratory for completeness and compliance with client specifications. Missing deliverables are identified and obtained from the laboratory. The group also reviews the completed package to verify that the delivered product complies with all client specifications. Non-analytical defects are corrected before the package is sent to the client.

**Project Management/Quality Assurance Review.** Spot-check data package reviews are performed by the project manager. Project management reviews focus on project specifications. If the project manager identifies defects in the product prior to release, he initiates immediate corrective action to rectify the situation.

The QA Staff reviews approximately 10% of the data produced. The QA review focuses on all elements of the deliverable including the client's specifications and requirements, analytical quality control, sample custody documentation and sample identification. QA reviews at this step in the production process are geared towards systematic process defects, which require procedural changes to effect a corrective action. However, if defects are identified that can be corrected prior to data release, the QA staff returns the package to the laboratory for corrective action. QA data review cannot be used in lieu of a peer level review or a supervisory review.

**Data Reporting.** Analytical data is released to clients following secondary departmental review. Data release at this stage of the process is limited to electronic information, which is released to clients through a secure, encrypted, password protected, Internet connection.

Hard copy support data is compiled by the report generation group and assembled into the final report. The report is sent to the client following administrative review by report generation staff, and spot-check by QA staff.

All data reports include specified information, which is required to identify the report and its contents. This information includes a title, name and address of the laboratory, a unique report number, total number of pages in the report, clients name and address, analytical method identification, arriving sample condition, sample and analysis dates, test results with units of measurement, authorized signature of data release, statement of applicability, report reproduction restrictions and TNI requirements certification. Subcontracted data is clearly identified.

In the event of report revision date of the revision, nature of revision and identity of the person revising the report must be clearly stated in the body of the report. All levels of deliverables incorporate letter(s) of report reissue into all subsequent reports. This letter(s) is addressed to the client and briefly outlines reasons for report revision.

12.8 **Electronic Data Reduction.** Raw data from sample analysis is entered into the laboratory information management system (LIMS) using automated processes or manual entry. Final data processing is performed by the LIMS using procedures developed by the Company.

All LIMS programs and internally developed software (including Excel spreadsheets) are tested and validated prior to use to assure that they consistently produce correct results. Validation testing is performed by the Information Technology Staff. The testing procedures are documented in an SOP. Programs are not approved for use until they have demonstrated that they are capable of performing the required calculations.

12.9 **Representativeness.** Data representativeness is based on the premise that qualitative and quantitative information developed for field samples is characteristic of the sample that was collected by the client and analyzed in the laboratory. The laboratory objective for representativeness defines data as representative if the criteria for all quality parameters associated with the analysis of the sample are achieved.

12.10 **Comparability.** Analytical data is defined as comparable when data from a sample set analyzed by the laboratory is representatively equivalent to other sample sets analyzed separately regardless of the analytical logistics. The laboratory will achieve 100% comparability for all sample data which meets the criteria for the quality parameters associated with its analysis using the method requested by the client.



## 13.0 CORRECTIVE ACTION SYSTEM

**Requirement.** The laboratory must have policies and procedures for correcting defective processes, systematic errors, and quality defects, which enables the staff to systematically improve product quality. The system must include procedures for communicating items requiring corrective action, corrective action tracking procedures, corrective action documentation, monitoring of effectiveness, and reports to management. The system must be documented in a standard operating procedure.

**13.1 Procedure.** Corrective action is the step that follows the identification of a process defect. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance.

**Routine Corrective Action.** Routine corrective action is defined as the procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters or analytical system specifications.

Bench analysts have full responsibility and authority for performing routine corrective action. The resolution of defects at this level does not require a procedural change or staff re-training. The analyst is free to continue work once corrective action is complete and the analytical system has been returned to control. Documentation of routine corrective action is limited to bench logbook or maintenance logbook comment.

**Process Changes.** Corrective actions in this category require procedural modifications. They may be the result of systematic defects identified during audits, the investigation of client inquiries, failed proficiency tests, product defects identified during data review, or method updates. Resolution of defects of this magnitude requires formal identification of the defect, development and documentation of a corrective action plan, and staff training to communicate the procedural change.

**Technical Corrective Action.** Technical corrective action encompasses routine corrective action performed by bench analysts for out of control systems and corrective actions performed for data produced using out of control systems. Technical corrective action for routine situations is conducted using the procedures detailed above.

Non-routine corrective actions apply to situations where the bench analysts failed to perform routine corrective action before continuing analysis. Supervisors and Department Managers perform corrective action in these situations. Documentation of all non-routine corrective actions is performed using the corrective action system.

Sample re-analysis is conducted if sufficient sample and holding time remain to repeat the analysis using an in-control system. If insufficient sample or holding time remains, the data is processed and qualifiers applied that describe the out of control situation. The occurrence is further documented in the case narrative and in the corrective

action response. The corrective action must include provisions for retraining the analysts who failed to perform routine corrective action.

- 13.2 **Documentation & Communication.** Routine corrective actions are documented as part of the analytical record. Notations are made in the comments section of the analytical chronicle or data sheet detailing the nonconformance. Continuation of the analysis indicates that return to control was successful.

Corrective actions for process changes are documented, tracked and monitored for effectiveness. Corrective actions may be initiated by any supervisor or senior staff member by completing the corrective action form in Corrective Action database

The corrective action database is an Access application. The initiator generates the corrective action investigation form, which is documented, tracked, distributed to responsible parties and archived through the application. The application assigns a tracking number initiation data and due date to each corrective action initiated and copies the corrective action form to the corrective action database. The application also distributes an E-mail message containing the form to the responsible parties for resolution.

Corrective Action system employs Deficiency – Root Cause – Immediate Fix – Corrective action approach, further divided into categories of Analytical Error, Omission Error, Random Error, Systemic Error and Training Issue.

The responsible party develops and implements the procedural change. Existing documentation such as SOPs are edited to reflect the change. The affected staff is informed of the procedural change through a formal training session. The training is documented and copies are placed into individual training files. The corrective action form is completed and closed in CA database.

Initial and completed corrective action forms are maintained in the Corrective Action directory. This information is archived daily. Copies of training records describing corrective actions are appended to the involved individuals training files.

**Monitoring.** The QA Staff monitors the implemented corrective action until it is evident that the corrective action has been effective and the systematic deficiency has been eliminated. The corrective action database is updated by QA to reflect closure of the corrective action. The QA staff also assigns an error code to the corrective action for classification of the type of errors being committed.

If QA determines that the corrective action procedure has not effectively remedied the deficiency, the process continues with a re-initiation of the corrective action. Corrective action continues until the defective process is eliminated. If another procedural change is required, it is treated as a new corrective action, which is documented and monitored using established procedures.

**Client Notification.** Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, SGS Accutest – Orlando will notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

## 14.0 PROCEDURES FOR EXECUTING CLIENT SPECIFICATIONS

**Requirement.** Systems must be established for evaluating and processing client specifications for routine and non-routine analytical services. The systems must enable the client services staff to identify, evaluate, and document the requested specifications to determine if adequate resources are available to perform the analysis. The system must include procedures for communicating the specifications to the laboratory staff for execution and procedures for verifying the specifications have been executed.

- 14.1 **Client Specific Requirements.** The project manager is the primary contact for clients requesting laboratory services. Client specifications are communicated using several mechanisms. The primary source of information is the client's quality assurance project plan (QAPP) which details analytical and quality control specifications for the project. In the absence of a QAPP, projects specifications can also be communicated using contracts, letters of authorization, or letters of agreement, which may be limited to a brief discussion of the analytical requirements and the terms and conditions for the work. These documents may also include pricing information, liabilities, scope of work, in addition to the analytical requirements. QAPPs include detailed analytical requirements and data quality objectives, which supersede those found in the referenced methods. This information is essential to successful project completion.

Laboratory also reviews its Accreditation status to evaluate whether it is possible to accept proposed project. Discrepancies must be resolved before the work commences.

The client services staff provides additional assistance to clients who are unsure of the specifications they need to execute the sampling and analysis requirements of their project. They provide additional support to clients who require assistance in results interpretation as needed, provided they possess the expertise required to render an opinion.

The project manager is responsible for obtaining project documents, which specify the analytical requirements. Following project management review, copies are distributed to the QA staff and the appropriate departmental managers for review and comment. The original QAPP is numbered with a document control number and filed in a secure location.

- 14.2 **Requirements for Non-Standard Analytical Specifications.** Client requirements that specify departures from documented policies, procedures, or standard specifications must be submitted to SGS Accutest – Orlando in writing. These requirements are reviewed and approved by the technical staff before the project is accepted. Once accepted, the non-standard requirements become analytical specifications, which follow the routine procedure for communicating client specifications. Departures from documented policies, procedures, or standard specifications that do not follow this procedure are not permitted.

*Exception Policy:* With respect to the quality system, incoming non-conforming product refers to received samples that do not meet requirements of custody documentation, are improperly packaged or stored or are contaminated. An internal non-conformance refers to a problem, caused internally due to improper handling of samples, improper sampling methods, and equipment malfunction or data management errors. The individual who identifies the incoming non-conformance is responsible for notifying the project manager. The project manager resolves the issue with the client. The individual who recognizes an internal non-conformance is responsible for initiating corrective action

Departures from standard practices, policies and specifications are reviewed and approved by Technical Director, QA Officer and by Project Manager of the project affected.

*Corrective & Preventative Action:* Once a quality problem has been identified, the analytical or review process stops, until the reason is identified. Primary responsibility for identifying the cause of the problem rests with the instrument operator. Other staff may be called on to assist in reaching the root cause. The problem prevention tracking system, using Corrective Action Tracking Records, provides a method to track systemic problems until resolved/removed. The QA Officer is responsible for the record management with respect to the disposition of problems.

Deviations that do not limit themselves to a single department and/or client are cited on Corrective Action Record. This may include but not limited to: sample arrival outside of EPA specified holding time, analysis completion outside of EPA specified holding time (with explanation of the reason), inconsistencies between chain of custody and cooler contents, including labeling errors, improper preservation, etc.

Deviations from analytical methods' SOP's are reported by the Analyst to the Section Leader. Single occurrences warrant completion of Corrective Action Tracking record, repetitive occurrences may indicate that either an additional training session is in order, or that the SOP does not reflect proper laboratory practice. Training session is conducted by the Technical Director or by QA Officer. In case where SOP does not reflect current laboratory practice, SOP review and correction process may be initiated.

- 14.3 **Evaluation of Resources.** A resource evaluation is completed prior to accepting projects submitted by clients. The evaluation is initiated by the client services staff receives project requirements (usually in the form of QAPjP) and distributes these requirements to the laboratory departments affected. The specifications are evaluated by the department managers from a scheduling and hardware resources perspective. The project is not accepted unless the department managers have the necessary resources to execute the project according to client specifications.

- 14.4 **Documentation**. New projects are initiated using a project set up form, which is completed prior to the start of the project. This form details all of the information needed to correctly enter the specifications for each client sample into the laboratory information management system (LIMS, see example). The form includes data reporting requirements, billing information, data turnaround times, QA level, state of origin, and comments for detailing project specific requirements. The project manager is responsible for obtaining this information from the client and completing the form prior to sample arrival and login.

Sample receipt triggers project creation and the login process. The information on the set-up form is entered into the LIMS immediately prior to logging in the first sample. The set up form may be accompanied by a quotation, which details the analytical product codes and sample matrices. These details are also entered into the LIMS during login.

Special information is distributed to the laboratory supervisors and login department in electronic or hardcopy format upon project setup. All project specific information is retained by the project manager in a secure file. The project manager maintains a personal telephone log, which details conversations with the client regarding the project.

- 14.5 **Communication**. A pre-project meeting is held between client services and the operations managers to discuss the specifications described in the QAPjP and/or related documents. Project logistics are discussed and finalized and procedures are developed to assure proper execution of the client's analytical specifications and requirements. Questions, raised in the review meeting, are discussed with the client for resolution. Exceptions to any requirements, if accepted by the client, are documented and incorporated into the QAPjP or project documentation records.

Non-standard specifications for individual clients are documented in the LIMS at the client account level. Once entered into the LIMS, these specifications become memorialized for all projects related to the client account. Upon sample arrival, these specifications are accessed through a terminal or printed as a hard copy and stored in a binder for individuals who require access to the specification. Specifications that are not entered into the LIMS are prohibited unless documented in an interdepartmental memo, which clearly identifies the project, client and effective duration of the specification.

- 14.6 **Operational Execution**. A work schedule is prepared for each analytical department on a daily basis. Analytical specifications from recently arrived samples have now been entered into the LIMS database. The database is sorted by analytical due date and holding time, into product specific groups. Samples are scheduled for analysis by due date and holding time. The completed schedule, which is now defined as a work list, is printed. The list contains the client requested product codes and specifications required for the selected sample(s). Special requirements are communicated to the analyst using the comments section or relayed through verbal instructions provided by

the supervisor. The bench analyst assumes full responsibility for performing the analysis according to the specifications printed on the work sheet.

- 14.7 **Verification.** Prior to the release of data to the client, laboratory section managers and the report generation staff review the report and compare the completed product to the client specifications documentation to assure that all requirements have been met. Project managers perform a spot check of projects with unique requirements to assure that the work was executed according to specifications.

## 15.0 CLIENT COMPLAINT RESOLUTION PROCEDURE

**Requirement.** A system for managing and reconciling client complaints must be implemented in the laboratory. The system must include procedures for documenting client complaints and communicating the complaint to the appropriate department for resolution. The system must also include a quality assurance evaluation to determine if the complaint is related to systematic defects requiring process changes.

15.1 **Procedure.** Client complaints are communicated to client services representatives, quality assurance staff, or senior management staff for resolution. The individual receiving the complaint retains the responsibility for documentation and communicating the nature of the complaint to the responsible department(s) for resolution. The responsible party addresses the complaint. The resolution is communicated to quality assurance (QA) and the originator for communication to the client. QA reviews the complaint and resolution to determine if systematic defects exist. If systematic defects are present, QA works with the responsible party to develop a corrective action that eliminates the defect.

**Documentation.** Client's complaints are documented by the client service representative receiving the complaint. A record of the telephone conversation is maintained by client services. Client service staff enters the complaint into Data Challenge database or Client Complaint database, depending on the nature of complaint. These databases are cross-linked with corrective action database – see sec. 13. Complaint is communicated to the production departments concerned via auto e-mail. The complaint resolution is documented in the database by the responsible party and resultant e-mail returned to the originator. QA staff is copied on the correspondence.

15.2 **Corrective Action.** Responses to Data Challenges/Client Complaints are required from the responsible party. At a minimum, the response addresses the query and provides an explanation to the complaint. Corrective action may focus on the single issue expressed in the complaint. Corrective action may include job case narrative generation, reprocessing of data, editing of the initial report, and re-issue to the client. If the QA review indicates a systematic error, process modification is required. The defective process at the root of the complaint is changed. SOPs are either created or modified to reflect the change. The party responsible for the process implements process changes.

15.3 **QA Monitoring.** Process changes, implemented to resolve systematic defects, are monitored for effectiveness by QA. If monitoring indicates that the process change has not resolved the defect, QA works with the department management to develop and implement an effective process. If monitoring indicates that the defect has been resolved, monitoring is slowly discontinued. Continued monitoring is incorporated as an element of the annual system audit and annual Management Report (see 18.8).



## 16.0 CONTROL OF NONCONFORMING PRODUCT

**Requirement:** Policies and procedures have been developed and implemented that describe the procedures employed by the laboratory when any aspect of sample analysis or data reporting do not conform to established procedures or client specifications. These procedures include steps to ensure that process defects are corrected and affected work is evaluated to assess its impact to the client.

**Procedure.** Nonconforming product is identified through multiple channels, such as second level analytical data review, routine internal review and audit practices, external auditing or through client inquiry. Responsibility and authority for the management of the non-conforming product is directly defined by a nature of a non-conformance. For example, non-conformances resulting from internal and external reviews are evaluated and managed by QA Staff. Corrective Action items are issued and followed to completion and verification that defect is prevented from reoccurring. Non-conformances stemming from client inquiry are managed by Project Management staff with QA staff oversight.

Data associated with out-of compliance QC are evaluated by bench personnel and section supervisors. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

If non-conformances are detected, the QA staff places an immediate stop on the release of the data and initiates corrective action to rectify the situation

Non-conformances and their significance are communicated in case narrative and sample report footnotes. Case narrative comments and sample report footnotes must state the impact on data quality.

**Corrective Action.** The outcome of the evaluation dictates the course of action. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance. This may include at a minimum client notification, but may also include corrective action. Immediate corrective action is performed using the SOP-specified procedures. However, additional action may be required including cessation of analysis and withholding and/or recalling data reports. If the evaluation indicates that nonconforming data may have been issued to clients, the client is immediately notified and data may be recalled following the procedures specified in respective SOPs. If work has been stopped because of a nonconformance, the Laboratory Director is the only individual authorized to direct a resumption of analysis.

Non-conformances caused by systematic process defects require retraining of the personnel involved as an element of the corrective action solution. Routine corrective actions are documented as part of the analytical record.

## 17.0 CONFIDENTIALITY PROTECTION PROCEDURES

**Requirements:** Policies and procedures are required to protect client data from release to unauthorized parties or accidental release of database information through accidental electronic transmission or illegal intrusion. These policies must be communicated to clients and staff. Electronic systems must be regularly evaluated for effectiveness.

- 17.1 **Client Anonymity.** Information related to the Company's clients is granted to employees on a "need to know" basis. An individual's position within the organization defines his "need to know". Individuals with "need to know" status are given password access to systems that contain client identity information and access to documents and document storage areas containing client reports and information. Access to client information by individuals outside of the Company is limited to the client and individuals authorized by the client.

Individuals outside of the Company may obtain client information through subpoena issued by a court of valid jurisdiction. Clients are informed when subpoenas are received ordering the release of their information.

- 17.2 **Documents.** Access to client documents is restricted to employees in need to know positions. Copies of all client reports are stored in secure archive with restricted access. Reports and report copies are distributed to individuals who have been authorized by the client to receive them. Documents are not released to third parties without verbally expressed or written permission from the client.

- 17.3 **Confidential Business Information (CBI).** Operational documents including SOPs, Quality Manuals, personnel information, internal operations statistics, and laboratory audit reports are considered confidential business information. Strict controls are placed on the release of this information to outside parties.

Release of CBI to outside parties or organizations may be authorized upon execution of a confidentiality agreement between SGS Accutest – Orlando and the receiving organization or individual. CBI information release is authorized for third party auditors and commercial clients in electronic mode as Adobe Acrobat .PDF format only. See also Sec. 6.5.

- 17.4 **Electronic Data.**

**Database Intrusion.** Direct database entry is authorized for employees of SGS Accutest – Orlando only on a need to know basis. Entry to the database is restricted through a user specific multiple password entry system. Direct access to the database outside of the facility is possible through a VPN connection. A unique user and password is required for access to the local area network. A second unique password is required to gain access to the database. All Passwords are required to be changed

semiannually. The staff receives read or write level authorization on a hierarchical privilege basis.

**Internet Access.** Access to client information is through an HTTPS Web application only. It does not contain a mechanism that allows direct access to the database. Clients can gain access to their data only using a series of SGS Accutest assigned accounts, and client specific passwords. The viewable data, which is encrypted during transmission, consists of an extraction of database information only.

**Client Accessibility.** Accessibility to client data delivered via electronic means follows strict protocols to insure confidentiality. Clients accessing electronic data are assigned a company account. The account profile, which is established by the MIS staff, grants explicit access to explicit information pertaining to the client's project activity. Passwords are assigned on an individual basis within a client account. These accounts can be activated or deactivated by the MIS staff only.

**17.5 Information Requests.** Client specific data or information is not released to third parties without verbally expressed or written permission from the client. Written permission is required from third parties, who contact the Company directly for the release of information. Verbal requests will be honored only if they are received directly from the client. These requests must be documented in a record of communication maintained by authorized recipient.

**17.6 Transfer of Records.** Archived data, which has previously been reported and transmitted to clients, is the exclusive property of SGS Accutest. In the event of a cessation of business activities due to business failure or sale, The Company's legal staff will be directed to arrange for the final disposition of archived data.

The final disposition of archived data will be accomplished using the approach detailed in the following sequence:

1. All data will be transferred to the new owners for the duration of the required archive period as a condition of sale.
2. If the new owners will not accept the data or the business has failed, letters will be sent to clients listed on the most recent active account roster offering them the option to obtain specific reports (identified by SGS Accutest – Orlando Job Number) at their own expense.
3. A letter will be sent to the TNI accrediting authority with organizational jurisdiction over the company offering them the option to obtain all unclaimed reports at their own expense.
4. All remaining archived data will be recycled using the most expedient means possible.

## 18.0 QUALITY AUDITS AND SYSTEM REVIEWS

**Requirement.** The quality assurance group will conduct regularly scheduled audits of the laboratory to assess compliance with quality system requirements, technical requirements of applied methodology, and adherence to documentation procedures. The information gathered during these audits will be used to provide feedback to senior management and perform corrective action where needed for quality improvement purposes.

- 18.1 **Quality Systems Review.** Quality system audits are performed annually by the Quality Assurance Director for the Company President. In this audit, the laboratory is evaluated for compliance with the Laboratory Quality Systems Manual (LQSM) and the quality system standards of TNI. Findings, which indicate non-compliance or deviation from the LQSM, are flagged for corrective action. Corrective actions require either a return to compliance or a plan change to reflect an improved quality process. The QA Officer is responsible for making and documenting changes to the LQSM. These changes are reviewed by the Laboratory Director and Technical Director prior to the approval of the revised system.
- 18.2 **Quality System Audits.** Quality system audits are conducted to evaluate the effectiveness and laboratory compliance with individual quality system elements. These audits are conducted on an established schedule. Audit findings are documented and communicated to the management staff and entered into the corrective action system for resolution. If necessary, retraining is conducted to assure complete understanding of the system requirements.
- 18.3 **Technical Compliance Audits.** Technical compliance audits are performed throughout the year following the established schedule. Selected analytical procedures are evaluated for compliance with standard operating procedures (SOPs) and method requirements. If non-conformances exist, the published method serves as the standard for compliance. SOPs are edited for compliance if the document does not reflect method requirements. Analysts are trained to the new requirements and the process is monitored by quality assurance. Analysts are retrained in method procedures if an evaluation of bench practices indicates non-compliance with SOP requirements.
- 18.4 **Documentation Audits.** Documentation audits are conducted periodically. This audit includes a check of measurement processes that require manual documentation and non-analytical logbook review. It also includes checks of data archiving systems and a search to find and remove any inactive versions of SOPs that may still be present in the laboratory and being accessed by the analysts. Non-conformances are corrected on the spot. Procedural modifications are implemented if the evaluation indicates a systematic defect.
- 18.5 **Corrective Action Monitoring.** Defects or non-conformances that are identified during client or internal audits are shared with management and entered into CA database for attention by the responsible party. Audit findings are corrected through

process modifications and/or retraining. Once a corrective action has been designed and implemented, it is monitored for compliance on a regular basis by the QA staff. Monitoring of the corrective action continues until satisfactory implementation has been verified.

- 18.6 Preventive Action.** Laboratory systems or processes, which may be faulty and pose the potential for nonconformances, errors, confusing reports or difficulties establishing traceability may be identified during internal audits. These items are highlighted for systematic change using the corrective action system and managed to resolution using appropriate procedures for corrective action.
- 18.7 Client Notification.** Defective processes, systematic errors, and quality defects detected during routine audits may have negative impact on data quality. In some cases, data that has been released to the client may be affected. If defective data has been released for use, SGS Accutest – Orlando will immediately notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.
- 18.8 Management Reports.** Formal reports of all audit activities are prepared for the management staff. These reports are prepared annually. The report details the status of the Quality System.

The formal report also addresses the following topics:

- *the suitability of policies and procedures;*
- *reports from managerial and supervisory personnel;*
- *the outcome of recent internal audits;*
- *corrective and preventive actions;*
- *assessments by external bodies;*
- *the results of inter-laboratory comparisons or proficiency tests;*
- *changes in the volume and type of the work;*
- *customer feedback;*
- *complaints;*
- *recommendations for improvement;*
- *other relevant factors, such as quality control activities, resources, and staff training.*

## 19.0 HEALTH AND SAFETY

**Requirement.** The company operates a formal health and safety program that complies with the requirements of the Occupational Health and Safety Administration. The program consists of key policies and practices that are essential to safe laboratory operation. All employees are required to receive training on the program elements. Job specific training is conducted to assure safe practices for specific tasks. All employees are required to participate in the program, receive initial and annual training, and comply with the program requirements. All plan and program requirements are detailed in the Health and Safety Program Manual.

- 19.1 Policy.** SGS Accutest will provide a safe and healthy working environment for its employees and clients while protecting the public and preserving the Company's assets and property. The company will comply with all applicable government regulations pertaining to safety and health in the laboratory and the workplace.

The objective of the SGS Accutest Health and Safety Program is to promote safe work practices that minimize the occurrence of injuries and illness to the staff through proper health and safety training, correct laboratory technique application and the use of engineering controls.

- 19.2 Responsibilities.** The Health and Safety Program assists managers, supervisors and non-supervisory employees in control of hazards and risks to minimize the potential for employee and client injuries, damage to client's property and damage or destruction to SGS Accutest's facilities.

The Health and Safety Officer is responsible for implementing the Program's elements and updating its contents as necessary. He also conducts periodic audits to monitor compliance and assess the program's effectiveness and is also responsible for creating and administering safety training for all new and existing employees.

The employee is responsible for following all safety rules established for their protection, the protection of others and the proper use of protective devices provided by the Company. The employee is also expected to comply with the requirements of the program at all times. Department Managers and Supervisors are responsible for ensuring the requirements of the Safety Program are practiced daily. The Company President retains the ultimate responsibility for the program design and implementation.

- 19.3 Program Elements.** The SGS Accutest Health and Safety Program consists of key program elements that compliment the company's health and safety objective. These elements form the essence of the health and safety policy and assure that the objectives of the program are achieved.

***Safety Education and Training and Communication.*** Training is conducted to increase the staff's awareness of laboratory hazards and their knowledge of the safety

practices and procedures required to protect them from those hazards. It is also used to communicate general safety procedures required for safe operation in a chemical laboratory.

Initial health and safety training for new employees is conducted during new employee orientation and administered through SGS Accutest University database.. The training focuses on the SGS Accutest Safety and Health Program and includes specific training for the hazards that may be associated with the employees' duties. Training is also conducted for all program elements focusing on general, acceptable, laboratory safety procedures. Targeted training is conducted to address hazards or safety procedures that are specific to individual employee's work assignments. All training activities are documented and archived in individual training folders. A health and safety training inventory is maintained in the training database.

SGS Accutest - Orlando maintains personnel trained in HAZWOPER, DOT and HazMat operations, as well as respirator fit certification.

**Safety Officer.** The safety officer provides the employees with an opportunity to express their views and concerns on safety issues in an environment where those concerns will be addressed to ensure that the interests of the company and the well being of the employee are protected. Safety Officer is entrusted with elevating the level of safety awareness among their peers.

**Hazard Identification and Communication.** The hazard communication program enables employees to readily identify laboratory hazards and the procedures to protect themselves from those hazards. This program complies with OSHA's Hazard Communication Standard, Title 29 Code of Federal Regulations 1910.1200 that requires the company to adopt and adhere to the following key elements:

- ◆ Material Safety Data Sheets (MSDS) and/or Safety Data Sheets (SDS) must be available to any employee wishing to view them,
- ◆ The Company must maintain a Hazardous Chemicals Inventory (by location), which is updated on an annual basis,
- ◆ Containers are properly labeled,
- ◆ All employees must be provided with annual Personal Protection, Hazard Communication and Right to Know training,

**Chemical Hygiene Plan.** The Chemical Hygiene Plan complies with the requirements of the Occupational Safety and Health Administration's Occupational Exposure to Hazardous Chemicals in the Laboratory Standard, 29 CFR 1910.1450. This plan establishes procedures, identifies safety equipment, personal protective equipment, and work practices that protect employees from the potential health hazards presented by hazardous chemicals in the laboratory if properly used and/or applied.

***Emergency Action & Evacuation Plan.*** The Emergency Action and Evacuation Plan details the procedures used to protect and safeguard SGS Accutest – Orlando employees and property during emergencies. Emergencies are defined as fires or explosions, gas leaks, building collapse, hazardous material spills, emergencies that immediately threaten life and health, bomb threats and natural disasters such as floods, hurricanes or tornadoes. The plan identifies and assigns responsibility for executing specific roles in situations requiring emergency action.

***Lockout/Tagout Plan.*** Lockout/tagout procedures have been established to assure that laboratory employees and outside contractors take steps to render equipment inoperable and/or safe before conducting maintenance activities. The plan details the procedures for conducting maintenance on equipment that has the potential to unexpectedly energize, start up, or release energy or can be operated unexpectedly or accidentally resulting in serious injury to employees. The plan ensures that employees performing maintenance render the equipment safe through lock out or tag out procedures.

***Personal Protection Policy.*** Policies have been implemented which detail the personal protection requirements for employees. The policy includes specifications regarding engineering controls, personal protective equipment (PPE), hazardous waste, chemical exposures, working with chemicals and safe work practices. Safety requirements specific to processes or equipment are reviewed with the department supervisor or the Health and Safety Officer before beginning operations.

***Emergency Preparedness Plan.*** This plan identifies the actions to be taken by SGS Accutest – Orlando staff in the event of terrorism or terrorist actions, to ensure the safety of the employees and the facility. The plan describes the building security actions coinciding with the “Alert Condition”, designated by the Department of Homeland Security.



# Appendix I

## Glossary of Terms

## GLOSSARY OF TERMS

**Acceptance Criteria:** specified limits placed on characteristics of an item, process, or service defined in requirement documents.

**Accreditation:** the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of TNI program, this process is a voluntary one.

**Accuracy:** the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

**Analyst:** the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

**Analytical Uncertainty:** A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

**Audit:** a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity.

**Batch:** environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same quality-system matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

**Blank:** a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

**Blind Sample:** a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

**Case Narrative:** a statement of non-conformances associated with particular data report

**Calibration:** to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

**Calibration Curve:** the mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

**Calibration Method:** a defined technical procedure for performing a calibration.

**Calibration Standard:** a substance or reference material used to calibrate an instrument.

**Certified Reference Material (CRM):** a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

**Chain of Custody:** an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

**Clean Air Act:** the enabling legislation in 42 U.S.C. 7401 *et seq.*, Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and to enforce them.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund):** the enabling legislation in 42 U.S.C. 9601-9675 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 *et seq.*, to eliminate the health and environmental threats posed by hazardous waste sites.

**Confirmation:** verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors or, additional cleanup procedures.

**Conformance:** an affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.

**Corrective Action:** the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

**Data Audit:** a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria).

**Data Reduction:** the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

**Demonstration of Capability:** a procedure to establish the ability of the analyst to generate acceptable accuracy.

**Document Control:** the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

**Duplicate Analyses:** the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

**Federal Water Pollution Control Act (Clean Water Act, CWA):** the enabling legislation under 33 U.S.C. 1251 *et seq.*, Public Law 92-50086 Stat. 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance.

**Field of Testing:** TNI's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required submit to only that portion of the accreditation process not previously addressed (see TNI, section 1.9ff).

**Holding Times (Maximum Allowable Holding Times)** the maximum times that samples may be held prior to analysis and still be considered valid or not compromised.

**Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample ):** a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

**Matrix (or Quality System Matrix):** the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

**Aqueous:** any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other leachates.

**Drinking Water:** any aqueous sample that has been designated a potable or potential potable water source. **Saline/Estuarine:** any aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake. **Non-aqueous Liquid:** any organic liquid with <15% settleable solids.

**Biological Tissue, Biota:** any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

**Solids:** includes soils, sediments, sludges and other matrices with >15% settleable solids.

**Chemical Waste:** a product or by-product of an industrial process that results in a matrix not previously defined.

**Air:** whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

**Matrix Spike (spiked sample or fortified sample):** a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of Target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

**Matrix Spike Duplicate (spiked sample or fortified sample duplicate):** a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

**Method Blank:** a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

**Method Detection Limit:** the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

**National Institute of Standards and Technology (NIST):** an agency of the US Department of Commerce's Technology Administration that is working with EPA, States, TNI, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater.

**The NELAC institute (TNI):** a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories.

**TNI Standards:** the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the The NELAC Institute.

**Performance Audit:** the routine comparison of independently obtained *qualitative and quantitative* measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

**Precision:** the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

**Preservation:** refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

**PT Fields of Testing:** TNI's approach to offering proficiency testing by regulatory or environmental program, matrix type, and analyte.

**Proficiency Testing:** a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

**Proficiency Test Sample (PT):** a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

**Quality Assurance:** an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

**Quality Control:** the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

**Quality Manual:** a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

**Quality System:** a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

**Quantitation Limits:** the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user.

**Range:** the difference between the minimum and the maximum of a set of values.

**Raw Data:** any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.

**Reagent Blank (method reagent blank or method blank):** a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

**Reference Material:** a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

**Reference Method:** a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

**Reference Standard:** a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

**Replicate Analyses:** the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

**Requirement:** denotes a mandatory specification; often designated by the term “shall”.

**Resource Conservation and Recovery Act (RCRA):** the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the “Cradle-to-grave”, including its generation, transportation, treatment, storage, and disposal.

**Safe Drinking Water Act (SDWA):** the enabling legislation, 42 USC 300f *et seq.* (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

**Sample Duplicate:** two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

**Spike:** a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

**Standard:** the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of TNI and meets the approval requirements of TNI procedures and policies.

**Toxic Substances Control Act (TSCA):** the enabling legislation in 15 USC 2601 *et seq.*, (1976), that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture.

**Traceability:** the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

**United States Environmental Protection Agency (EPA):** federal governmental agency with the responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends.

**Validation:** the process of substantiating specified performance criteria.

**Verification:** confirmation by examination and provision of evidence that specified requirements have been met.

**NOTE:** In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.



# Appendix II

## Analytical Capabilities

## TNI-Accredited Fields of Testing

Method Type	Method Number	Regulatory Program
<b>Organics</b>		
EDB and DBCP	EPA 504.1	Drinking Water
Perfluorinated Carboxylic Acids and Sulfonates	EPA 537	Drinking Water
<b>Metals</b>		
ICP: General	EPA 200.7, 1994	Drinking Water
Cold Vapor Mercury	EPA 245.1, 1994	Drinking Water
<b>Organics</b>		
EDB and DBCP	EPA 504, SW846 8011**	Non-Potable Water
Volatile Organics	EPA 624**, SW846 8260B, C**	Non-Potable Water
Semi-Volatile Organics	EPA 625**, SW846 8270D**	Non-Potable Water
Semi-Volatile Organics	SW846 8270D SIM**	Non-Potable Water
Purgeable Aromatics	EPA 602**, SW846 8021A**	Non-Potable Water
Chlorinated Pesticides & PCBs	EPA 608**, SW846 8081B**, 8082A**	Non-Potable Water
Poly-Aromatic Hydrocarbons	EPA 610**, SW846 8310**	Non-Potable Water
Nitroaromatics	SW846 8091**	Non-Potable Water
Explosives	SW846 8330A**, 8332**	Non-Potable Water
Explosives	SW846 8330B**,	Non-Potable Water
Chlorinated Herbicides	SW846 8151A**	Non-Potable Water
Organophosphorus Pesticides	SW846 8141B**	Non-Potable Water
Perchlorate	SW-846 6850	Non-Potable Water
Perfluorinated Carboxylic Acids and Sulfonates	EPA 537 MOD** (ALS MS014)	Non-Potable Water
Dissolved Gases	RSK SOP 147-175**	Non-Potable Water
Alcohols	SW846 8015C,D**	Non-Potable Water
Gasoline Range Organics	SW846 8015C,D**	Non-Potable Water
Diesel Range Organics	SW846 8015C,D**	Non-Potable Water
Total Petroleum Hydrocarbons	FLPRO**	Non-Potable Water
Tennessee EPH	TN-EPH**	Non-Potable Water
Tennessee GRO	TN-GRO**	Non-Potable Water
Wisconsin DRO	WI-DRO**	Non-Potable Water
Petroleum Hydrocarbons	Iowa OA-1**	Non-Potable Water
Petroleum Hydrocarbons	Iowa OA-2**	Non-Potable Water
Volatile Petro. Hydrocarbons	Massachusetts VPH, 2004**	Non-Potable Water

Method Type	Method Number	Regulatory Program
Extractable Petro. Hydrocarbons	Massachusetts EPH, 1998**	Non-Potable Water
Total Petroleum Hydrocarbons	TX-1005**	Non-Potable Water
Acrylamide	SW846 8316	Non-Potable Water
<b>Metals</b>		
ICP: General – EPA WW	EPA 200.7**, 1994; SW-846 6010C**6010D**	Non-Potable Water
ICP/MS: General – EPA WW	EPA 200.8**, 1994; SW-846 6020A**	Non-Potable Water
Cold Vapor Mercury – EPA WW	EPA 245.1, 1994; SW-846 7470A**	Non-Potable Water
<b>Inorganic WetChem</b>		
Alkalinity	SM2320B-11**	Non-Potable Water
CBOD	SM5210B-11	Non-Potable Water
COD	SM5220C-11	Non-Potable Water
BOD	SM5210B-11	Non-Potable Water
Color, Apparent	SM2120B-11	Non-Potable Water
Ion Chromatography (Bromide, Fluoride, Chloride, Sulfate, Nitrite, Nitrate,) – Aqueous	EPA 300.0**, SW846 9056A**	Non-Potable Water
Nitrate/Nitrite	EPA 353.2**	Non-Potable Water
Total Kjeldahl Nitrogen	EPA 351.2**	Non-Potable Water
Ammonia	EPA 350.1**	Non-Potable Water
Oil & Grease, Gravimetric – AQ	EPA 1664A**, SW846 9070A**	Non-Potable Water
Orthophosphate	EPA 365.3**	Non-Potable Water
pH by electrode (Waters)	SM4500H+B-11**; SW846 9040C**	Non-Potable Water
Specific Conductance	EPA 120.1**	Non-Potable Water
Sulfide	SM4500S=F-11**	Non-Potable Water
Total Dissolved Solids	SM2540C-11**	Non-Potable Water
Total Organic Carbon	SM5310B-11, SW846 9060A**	Non-Potable Water
Total Phosphorus	EPA 365.3**	Non-Potable Water
Total Solids	SM2540B-11**	Non-Potable Water
Total Suspended Solids	SM2540D-11**	Non-Potable Water
Turbidity	EPA 180.1	Non-Potable Water
Total CN	EPA 335.4, SW846 9012B**	Non-Potable Water
Un-Ionized Ammonia - calculation	FDEP SOP10/03/83	Non-Potable Water

Method Type	Method Number	Regulatory Program
Calcium Hardness by Calculation	SM2340B-11	Non-Potable Water
Hardness, Total by Calculation	SM2340B-11	Non-Potable Water
MBAS (Anionic Surfactants as)	SM5540C-11	Non-Potable Water
Corrosivity & pH – aqueous	SW846 9040C**	Non-Potable Water
Hexavalent Chromium	SW846 7196A**	Non-Potable Water
<b>Organics</b>		
EDB and DBCP	SW846 8011 Mod**	Solid and Chemical Material
Volatile Organics	SW846 8260B, C**	Solid and Chemical Material
Semi-Volatile Organics	SW846 8270D**	Solid and Chemical Material
Semi-Volatile Organics	SW846 8270D SIM**	Solid and Chemical Material
Gasoline Range Organics	SW846 8015C,D**	Solid and Chemical Material
Diesel Range Organics	SW846 8015C,D**	Solid and Chemical Material
Alcohols	SW846 8015C,D**	Solid and Chemical Material
Polynuclear-Aromatic Hydrocarbons	SW846 8310**	Solid and Chemical Material
Explosives	SW846 8330A**, 8332**	Solid and Chemical Material
Explosives	SW846 8330B**	Solid and Chemical Material
Organochlorine Pesticides	SW846 8081B**	Solid and Chemical Material
Polychlorinated Biphenyls	SW846 8082A**	Solid and Chemical Material
Chlorinated Herbicides	SW846 8151A**	Solid and Chemical Material
Organophosphorus Pesticides	SW846 8141B**	Solid and Chemical Material
Perchlorate	SW-846 6850	Solid and Chemical Material
Perfluorinated Carboxylic Acids and Sulfonates	EPA 537 MOD** (ALS MS014)	Solid and Chemical Material
Total Petroleum Hydrocarbons	FLPRO**	Solid and Chemical Material
Tennessee EPH	TN-EPH**	Solid and Chemical Material

Method Type	Method Number	Regulatory Program
Tennessee GRO	TN-GRO**	Solid and Chemical Material
Wisconsin DRO	WI-DRO**	Solid and Chemical Material
Petroleum Hydrocarbons	Iowa OA-1**	Solid and Chemical Material
Petroleum Hydrocarbons	Iowa OA-2**	Solid and Chemical Material
Volatile Petro. Hydrocarbons	Massachusetts VPH, 2004**	Solid and Chemical Material
Extractable Petro. Hydrocarbons	Massachusetts EPH, 2004**	Solid and Chemical Material
Total Petroleum Hydrocarbons	TX-1005**	Solid and Chemical Material
Acrylamide	SW846 8316	Solid and Chemical Material
<b>Metals</b>		
ICP: General	SW846 6010C**	Solid and Chemical Material
ICP/MS: General	SW846 6020A**	Solid and Chemical Material
Cold Vapor Mercury	SW846 7471B**	Solid and Chemical Material
<b>Inorganic WetChem</b>		
Ion Chromatography (Bromide, Fluoride, Chloride, Sulfate, Nitrite, Nitrate,) – Aqueous	SW846 9056A**	Solid and Chemical Material
Oil & Grease, Gravimetric – Solid	SW846 9071A**	Solid and Chemical Material
Total CN	SW846 9012B**	Solid and Chemical Material
Total Organic Carbon	SW846 9060A**	Solid and Chemical Material
Ammonia	EPA 350.1	Solid and Chemical Material
Total Kjeldahl Nitrogen	EPA 351.2	Solid and Chemical Material
Total Phosphorus	EPA 365.3	Solid and Chemical Material
Waste Ignitability	SW846 1010A**	Solid and Chemical

Method Type	Method Number	Regulatory Program
Hexavalent Chromium/soils	SW846 7196A**	Material Solid and Chemical Material
Corrosivity & pH – aqueous	SW846 9040C**	Solid and Chemical Material
Corrosivity & pH – solid	SW846 9045D**	Solid and Chemical Material
Cyanide Reactivity	SW846 Chapter 7**	Solid and Chemical Material
Sulfide Reactivity	SW846 Chapter 7**	Solid and Chemical Material
 <b>Organics</b>		
Volatile Organics	TO-3	Air and Emissions
 <b>Preparation Methods*</b>		
Liquid/Liquid Extraction, Water	SW846 3510C	
Micro-extraction, Water	SW846 3511	
Solid Phase Extraction, Water	SW846 3535A	
Solids Extraction by Sonication	SW846 3550B	
Microwave-assisted extraction, solids	SW846 3546	
Acid/Base Partitioning	SW846 3650B	
Sulfur Cleanup of Extracts	SW846 3660B	
Sulfuric Acid Cleanup	SW846 3665A	
Purge & Trap - Aqueous	SW846 5030B	
Purge & Trap – Solids	SW846 5035A	
Total Recoverable Metals Digestion	EPA 200.7	
Non-Pot. Water Digest: ICP	SW846 3010A	
Alkaline Digestion of Soils for Hexavalent Chromium	SW846 3060A	
Digestion of Soils for ICP	SW846 3050B	
TCLP	SW846 1311	
SPLP	SW846 1312	

\* Preparation methods are not listed on Primary TNI Accreditation per State of Florida DOH rules. However, for the benefit of other accrediting authorities, these methods are inspected during FDOH visits. Listing of surveyed and approved preparation methods is available from on-site inspection report.

\*\* Methods certified by DoD ELAP

## Non-TNI-Accredited Fields of Testing

Method Type	Method Number	Regulatory Program
<i>Organics</i>		
Thiodiglycol	SASE in-house method (HPLC)	Non-Potable Water, Solid and Chemical Material
Volatile Petroleum Hydrocarbons	Missouri Gasoline Range Organics	Non-Potable Water, Solid and Chemical Material
Extractable Hydrocarbons	Missouri Diesel Range Organics	Non-Potable Water, Solid and Chemical Material
Extractable Hydrocarbons	Missouri Oil Range Organic	Non-Potable Water, Solid and Chemical Material
Volatile Petroleum Hydrocarbons	Alaska AK-101**	Non-Potable Water, Solid and Chemical Material
Extractable Hydrocarbons	Alaska AK-102**	Non-Potable Water, Solid and Chemical Material
Extractable Hydrocarbons	Alaska AK-103**	Non-Potable Water, Solid and Chemical Material
Volatile Petroleum Hydrocarbons	OK GRO**	Non-Potable Water, Solid and Chemical Material
Extractable Hydrocarbons	OK DRO**	Non-Potable Water, Solid and Chemical Material
<i>Inorganic WetChem</i>		
Oxidation-Reduction Potential	ASTM D1498-76, mod. for solids	Solid and Chemical Material
Percent Ash (dry basis)	ASTM D2974-87, D482-91	Solid and Chemical Material
Grain Size (hydrometer)	ASTM D422-63	Solid and Chemical Material
Sieve Testing	ASTM D422-63	Solid and Chemical Material

Method Type	Method Number	Regulatory Program
Specific Gravity	ASTM D1298-85	Material Solid and Chemical Material
Acidity	SM2310B-11	Non-Potable Water
Dissolved Oxygen	EPA 360.1	Non-Potable Water
Mineral Suspended Solids	EPA 160.2/160.4	Non-Potable Water
Oil & Grease, Gravimetric – AQ	EPA 1664B	Non-Potable Water
Percent Solids	SM2540G-11	Solid and Chemical Material
Settleable Solids	EPA 160.5	Non-Potable Water
Total Mineral Solids	EPA 160.4	Non-Potable Water
Total Residual Chlorine	EPA 330.5	Non-Potable Water
Total Volatile Solids	EPA 160.4	Non-Potable Water
Volatile Suspended Solids	EPA 160.2/160.4	Non-Potable Water
CN Amenable to Chlorination	EPA 335.4	Solid and Chemical Material
Bicarbonate, Carbonate, CO <sub>2</sub> - calculation	SM2320B-11, SM4500 CO <sub>2</sub> D-11	Non-Potable Water
Ferrous Iron	SM3500 FE-D-11	Non-Potable Water
Salinity - calculation	SM2520B-11	Non-Potable Water
Paint Filter Test	SW846 9095	Solid and Chemical Material
Corrosivity towards steel	SW846 1110	Solid and Chemical Material
Corrosivity & pH – aqueous	SW846 9040C	Solid and Chemical Material



# Appendix III

## Equipment List

**ORGANIC INSTRUMENTATION**

Instrument	Model	Location	Serial #	Year
GC/MS	Agilent 5975TAD MSD/OI 4551/4660	MS-VOA	US13042A19	2013
GC/MS	Agilent 5975TAD MSD/OI 4551/4660	MS-VOA	US11172705	2011
GC/MS	Agilent 5975TAD MSD/OI 4551/4660	MS-VOA	US11322911	2011
GC/MS	Agilent 5975TAD MSD/OI 4551/4660	MS-VOA	US10102029	2010
GC/MS	Agilent 5975TAD MSD/OI 4551/4660	MS-VOA	US83120965	2008
GC/MS	Agilent 5975N MSD/Agilent 7683 AS	SVOC Lab	US71225975	2007
GC/MS	Agilent 5975N MSD/Agilent 7683 AS	SVOC Lab	US62724401	2006
GC/MS	Agilent 5975N MSD/Agilent 7683 AS	SVOC Lab	US53921303	2005
GC/MS	Agilent 5973N MSD/Agilent 7683 AS	SVOC Lab	US40620599	2004
GC/MS	Agilent 5973 MSD/OI 4551/4660	MS-VOA	US41746628	2004
GC/MS	Agilent 5973 MSD/OI 4551/4660	MS-VOA	US41746633	2004
GC/MS	Agilent 5973 MSD/OI 4560/4552 Archon	Soil VOA	US21843765	2002
GC/MS	Agilent 5973 MSD/OI 4551/4660	MS-VOA	US21844034	2002
GC/MS	Agilent 5973 MSD/OI 4660/4552 Archon	Soil VOA	US02440350	2000
GC/MS	Agilent 5973 MSD/OI 4551/4660	MS-VOA	US94240108	1999
GC/MS	Agilent 5973 MSD/Agilent 7683 AS	SVOC Lab	US82311290	1998
GC/MS	Agilent 5973 MSD/Agilent 7683 AS	SVOC Lab	US81211109	1998
GC/MS	Agilent 5973A MSD/OI 4660/4552 Archon	Soil VOA	US82321728	1998
GC/MS	Agilent 5973A MSD/OI 4660/4551	MS-VOA	US63810329	1996
GC	Agilent 7890A/Dual FID/7693 AS	SVOC Lab	CN13161042	2013
GC	Agilent 7890A/Dual FID/7683B AS	SVOC Lab	CN12121006	2012
GC	Agilent 7890A/Dual ECD/7683B AS	SVOC Lab	CN10842133	2008
GC	Agilent 7890A/Dual FID/7693 AS	SVOC Lab	CN10902149	2009
GC	Agilent 7890A/Dual ECD/7683B AS	SVOC Lab	CN10741128	2007
GC	Agilent 6890/Dual FPD/7683B AS	SVOC Lab	US10643024	2006
GC	Agilent 6890/Dual FID/7683B AS	SVOC Lab	CN10641049	2006

Instrument	Model	Location	Serial #	Year
GC	Agilent 6890/Dual ECD/7683B AS	SVOC Lab	CN10641081	2006
GC	Agilent 6890/Dual ECD/7683B AS	SVOC Lab	US10613003	2006
GC	Agilent 6890/PID/PID/OI 4560/4552 Archon	GC VOA	CN10421047	2004
GC	Agilent 6890/PID/FID/ENTECH 7032A-LB	GC VOA	US10239007	2002
GC	Agilent 6890N/Dual FID/HP 7683 AS	SVOC Lab	CN10425061	2004
GC	Agilent 6890N/Dual ECD/HP 7683 AS	SVOC Lab	US10333015	2003
GC	Agilent 6890/Dual ECD/HP 7683 AS	SVOC Lab	US00036916	2000
GC	Agilent 6890/Dual ECD/HP 7683 AS	SVOC Lab	US00028304	1999
GC	Hewlett-Packard 5890/PID/FID/ OI 4560/4552 Archon	GC VOA	3336A60617	1993
GC	Hewlett-Packard 5890/PID/FID/ OI 4560/4552 Archon	Soil VOA	3336A61096	1993
GC	Hewlett-Packard 5890/PID/FID/ OI 4560/4552 Archon	GC VOA	3336A51045	1993
GC	Hewlett-Packard 5890/PID/FID/OI 4560/4552 Archon	GC VOA	3203A41646	1992
GC	Hewlett-Packard 5890/PID/FID/OI 4560/4552 Archon (screening instrument)	GC VOA	3223A42867	1992
GC	Hewlett-Packard 5890/PID/FID OI 4560/4552 Archon	Soil VOA	3029A29748	1990
GC	Hewlett-Packard 5890/FID	GC VOA	2843A20183	1988
GC	Hewlett-Packard 5890/FID	GC VOA	2728A12705	1987
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE91606857	1999
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE23917648	2002
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE01608404	2000
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE40522115	2004
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE03000863	2003
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE61800775	2006

Instrument	Model	Location	Serial #	Year
HPLC	Agilent 1100 Automated LC System	HPLC Room	DE33219455	2003
LC/MS/MS	Agilent 1200/6460 LC/Triple Quad	HPLC Room	SG10447001	2011
O-Prep	ESSA LM2-P Ring and Puck mill	Explosives Prep Lab	215090-004	2008
O-prep	Microwave extractor, 2 units	Organic Prep Lab	Multiple	Various
O-Prep	TurboVap concentrators, 8 units	Organic Prep Lab	Multiple	Various
O-Prep	Buchi solvent recovery system, 3 units	Organic Prep Lab	Multiple	2014
O-Prep	Sonicator 4 units	Organic Prep Lab		Various
O-Prep	N-Vap	Organic Prep Lab	479200-2000	2000
Data System	Hewlett-Packard/MS ChemStation	Labwide		1999, with subsequent upgrades

### Inorganic Instrumentation

Instrument	Model	Location	Serial #	Year
ICP/MS	Agilent 7700 Series	Metals Lab	JP12151709	2012
ICP	Thermo ICAP 6000 Series	Metals Lab	20100903	2010
ICP	Thermo ICAP 6000 Series	Metals Lab	20103825	2010
Mercury Analyzer	Leeman Hydra AA II	Metals Lab	2019	2012
Mercury Analyzer	Leeman Hydra AA II	Metals Lab	2004	2012
TOC Analyzer	Shimadzu	WetChem IC room	H51404235007	2004
TOC Analyzer	Shimadzu	WetChem IC room	H51404735099	2010
IC	Dionex IC-2100	WetChem IC room	10110002	2010
IC	Dionex IC-2000	WetChem IC room	04070250	2004
Auto Analyzer	QuickChem 8500 Series	WetChem main room	050500000130	2005
Auto Analyzer	QuickChem 8500 Series 2	WetChem main room	111200001380	2011
Spectrophotometer	Milton-Roy Spectronic 200	WetChem main room	2 units	2000

Instrument	Model	Location	Serial #	Year
Digestion block	DigiPrep	WetChem main room	4 units	2005
Centrifuge	CentraCL2	WetChem main room	42613052	2003
MicroDistillation Block	Lachat	WetChem main room	2 units	2005

LIMS		
Instrument	Model	Year
LIMS	Stratus Dual Server; Oracle 10G Database	2013

# Appendix IV

## Certification Summary

<b><u>Certifying Authority</u></b>	<b><u>Certification Program</u></b>	<b><u>Registration No.</u></b>
Alaska	Contaminated Sites	UST-088
Arkansas	Solid/Hazardous Wastes, Non-Potable Water	88-0620
California (NELAP)	Potable Water, Solid/Hazardous Waste	04226CA
Department of Defense (DoD)	Non-Potable Water, Solid and Chemical Materials	L-2229
Florida (NELAP)	Potable, Non-Potable, Solid Waste, UST, Air Toxics	E83510
Georgia	Wastewater/Microbiology analyst	Not Applicable
Illinois	Solid/Hazardous Wastes, Non-Potable Water	
Iowa	UST, Solid/Hazardous Wastes, Non-Potable Water	IA366
Kansas (NELAP)	Solid/Hazardous Wastes, Non-Potable Water	E-10327
Kentucky	Underground Storage Tank Program	0065
Kentucky	Waste Water Program	98023
Louisiana (NELAP)	Solid/Hazardous Wastes	38582
Massachusetts	Non-Potable Water	M-FL946
Mississippi	Potable Water	Not Applicable
Nevada	Non-Potable Water, Solid/Hazardous Wastes	FL009462008A
New Jersey (NELAP)	Solid/Hazardous Wastes, Non-Potable Water	FL002
New York	Solid/Hazardous Wastes, Non-Potable Water	12022
North Carolina	Solid/Hazardous Wastes, Non-Potable Water	573
Oklahoma	Non-Potable Water, Solid/Hazardous Waste	9959
South Carolina	Solid/Hazardous Wastes, Non-Potable Water	96038001
Texas (NELAP)	Non-Potable Water, Solid/Hazardous Waste	T104704040-08-TX
US Dept. of Agriculture	Foreign Soils Permit	P330-16-00126
Utah (NELAP)	Potable, Non-Potable, Solid/Chemical Materials	FL009462008A
Virginia (NELAP)	Potable, Non-Potable, Solid/Chemical Materials	460177
Washington	Potable, Non-Potable, Solid/Chemical Materials, Air	C2046
West Virginia	Solid/Hazardous Wastes, Non-Potable Water	304

# Appendix V

## SOP List



SOP #	TITLE
Organic Preparation Department	
OP002	SOP for Glassware Cleaning and Storage
OP003	SOP for Reagent Prep
OP006	SOP for the Extraction of Semi-volatile Organics (BNAs) from Aqueous Samples
OP007	SOP for the Extraction of Semi-volatile Organics (BNAs) from Solid Samples
OP007TV	SOP for the Extraction of Semi-volatile Organics (BNAs) from Solid Samples, TurboVap option
OP008	SOP for the Extraction of Pesticides/PCBs from Aqueous Samples
OP009	SOP for the Extraction of Pesticides/PCBs from Solid Samples
OP009MW	SOP for the Extraction of Pesticides/PCBs from Solid Samples, microwave
OP010	SOP for the Extraction of Diesel Range Organics (DRO) from Aqueous Samples
OP011	SOP for the Extraction of Diesel Range Organics (DRO) from Solid Samples
OP011MW	SOP for the Extraction of Diesel Range Organics (DRO) from Solid Samples
OP012	SOP for the Extraction of Petroleum Related Organics (FL-PRO) from Aqueous Samples
OP013	SOP for the Extraction of Petroleum Related Organics (FL-PRO) from Solid Samples
OP014	SOP for the Extraction of PAHs from Aqueous Samples (HPLC)
OP015	SOP for the Extraction of PAHs from Solid Samples (HPLC)
OP016	SOP for the Extraction of EDB/DBCP from Aqueous Samples
OP017	SOP for the Extraction of EDB/DBCP from Solid Samples
OP018	SOP for the Extraction of Explosives from Aqueous Samples, 8330A/B
OP019	SOP for the Extraction of Explosives from Solid Samples, 8330A
OP020	SOP for Sample Introduction via SW846-5035
OP021	SOP for Sample Introduction via SW846-5030B
OP024	Standard Operating Procedure For The Extraction Of Nitroaromatics From Water Samples
OP025	SOP For Sample Preparation For Dissolved Gases In Aqueous Samples
OP026	SOP For The Extraction Of Extractable Petroleum Products (OA-2) From Water Samples
OP027	SOP For The Extraction Of Extractable Petroleum Products (OA-2) From Solid Samples
OP028	SOP For The Extraction Of Diesel And Oil Range Organics From Water Samples
OP029	SOP For The Extraction Of Diesel And Oil Range Organics From Solid Samples
OP030	SOP For The Extraction Of Extractable Petroleum Hydrocarbons From Water Samples (Tennessee EPH)
OP031	SOP For The Extraction Of Extractable Petroleum Hydrocarbons From Solid

SOP #	TITLE
	Samples (Tennessee EPH)
OP032	SOP For The Extraction Of Volatile Petroleum Hydrocarbons From Soil Samples, MA-VPH
OP033	SOP For The Extraction Of PCBs From Wipes
OP034	SOP For The Extraction Of Diesel Range Organics (DRO) From Aqueous Samples WI-DRO
OP035	SOP For The Extraction Of Massachusetts Extractable Petroleum Hydrocarbons From Water Samples
OP036MW	SOP For The Extraction Of Massachusetts Extractable Petroleum Hydrocarbons From Solid Samples, Microwave option
OP037	SOP For The Extraction Of Chlorinated Herbicides From Water Samples
OP038MW	SOP For The Extraction Of Chlorinated Herbicides From Soil Samples, microwave
OP039	SOP For The Solid Phase Extraction (SPE) Cartridge Cleanup Of Pesticide Extracts
OP040	SOP For SPLP Leaching Of SVOC And Metals
OP041	SOP For TCLP Leaching Of VOC
OP042	SOP For SPLP Leaching Of SVOC And Metals
OP043	SOP For SPLP Leaching Of VOC
OP044	SOP For The Extraction Of Organophosphorus Pesticides From Water Samples
OP044SP	SOP For The Extraction Of Organophosphorus Pesticides From Water Samples, Solid Phase Extraction
OP045MW	SOP For The Extraction Of Organophosphorus Pesticides From Soil Samples, microwave
OP046	SOP for the Extraction of Explosives from Solid Samples, SW-8330B
OP048	SOP for the Extraction of PCB Congeners from Aqueous Samples
OP049	SOP for the Extraction of PCB Congeners from Solid Samples
OP050	SOP For The Extraction Of Alaska Extractable Petroleum Hydrocarbons From Water Samples
OP051	SOP For The Extraction Of Alaska Extractable Petroleum Hydrocarbons From Solid Samples
OP052	SOP For The Extraction Of Oklahoma Extractable Petroleum Hydrocarbons From Water Samples
OP053	SOP For The Extraction Of Oklahoma Extractable Petroleum Hydrocarbons From Solid Samples
OP054	SOP For The Extraction Of 1,4-Dioxane From Water Samples
OP055	SOP For The Extraction Of Petroleum Hydrocarbons From Water Samples, TX-1005
OP056	SOP For The Extraction Of Petroleum Hydrocarbons From Solid Samples, TX-1005
OP057	SOP for Sample Introduction via AK-101
OP058	SOP For Extraction Perfluorinated Alkyl Compounds From Water Samples
OP059	SOP for Extraction of PAH and select analytes for 8270 SIM analysis from

SOP #	TITLE
OP060	Aqueous samples SOP for Extraction of PAH and select analytes for 8270 SIM analysis from Solid samples
OP061	SOP for Reduced Volume Extraction of PAH from water sample for GC/MS LVI
OP062	SOP for microextraction of PAH from water samples 3511.

### Gas Chromatography/ HPLC SOPs

GC002	Analysis Of 1,2-Dibromoethane (EDB) And 1,2-Dibromo-3-Chloropropane (DBCP) By Gas Chromatography, Electron Capture Detector
GC004	Aromatic Volatiles By Gas Chromatography Using PID Detectors EPA 602
GC005	Analysis Of Organochlorine Pesticides By Gas Chromatography, Electron Capture Detector EPA 608
GC006	Analysis Of Polychlorinated Biphenyls By Gas Chromatography, Electron Capture Detector EPA 608
GC007	Analysis Of Polynuclear Aromatic Hydrocarbons By Gas Chromatography, Flame Ionization Detector EPA 610
GC008	Analysis Of Petroleum Range Organics By Gas Chromatography Using Flame Ionization Detector
GC009	Analysis Of 1,2-Dibromoethane (EDB) And 1,2-Dibromo-3-Chloropropane (DBCP) By Gas Chromatography, Electron Capture Detector SW-846 8011
GC010	Analysis Of Gasoline Range Organics By Gas Chromatography Using Flame Ionization Detector
GC011	Analysis Of Diesel Range Organics By Gas Chromatography Using Flame Ionization Detector
GC014	Analysis Of Polychlorinated Biphenyls By Gas Chromatography, Electron Capture Detector SW-846 8082
GC015	Analysis Of Organochlorine Pesticides By Gas Chromatography, Electron Capture Detector SW-846 8081
GC016	Analysis Of Nitroaromatics And Nitramines By HPLC
GC017	Aromatic Volatiles By Gas Chromatography Using PID Detectors SW-8021
GC018	Analysis Of Polynuclear Aromatic Hydrocarbons By HPLC SW-846 8310
GC019	Analysis Of Dissolved Gases By Gas Chromatography, Flame Ionization Detector
GC020	Analysis Of Nitroglycerine And PETN By HPLC
GC021	Analysis Of Volatile Petroleum Hydrocarbons By Gas Chromatography
GC022	Analysis Of Extractable Petroleum Products By Gas Chromatography Using Flame Ionization Detector OA-2
GC023	Analysis Of Diesel And Oil Range Organics By Gas Chromatography Using Flame Ionization Detector
GC024	Analysis Of Petroleum Hydrocarbons By Gas Chromatography Using Flame Ionization Detector (Tennessee EPH)
GC025	Analysis Of Nitroaromatics By Gas Chromatography Using Electron Capture

SOP #	TITLE
	Detector
GC026	Method For Determination Of Volatile Petroleum Hydrocarbons By GC-PID/FID
GC027	Analysis Of Non-Halogenated Organics By Gas Chromatography Using Flame Ionization Detector
GC028	Analysis Of Gasoline Range Organics By Gas Chromatography Using Flame Ionization Detector TDEC GRO
GC029	Analysis Of Diesel Range Organics By Gas Chromatography Using Flame Ionization Detector Wi DRO
GC030	Analysis Of Extractable Petroleum Hydrocarbons By Gas Chromatography Using Flame Ionization Detector MA-EPH
GC031	Analysis Of Chlorinated Herbicides Using GC-ECD
GC032	Analysis Of Organophosphorus Pesticides Using GC-NPD Or FPD
GC033	Air Analysis By GC-PID/FID
GC034	Analysis Of Nitroaromatics, Nitramines And Nitrate Esters By HPLC Method 8330B
GC035	Screening Of Volatile Organics By GC-PID/FID
GC036	Analysis of PCB Congeners by ECD
GC037	Analysis of Diesel and Oil Range Organics by GC/FID, AK-102, AK-103
GC038	Analysis of Gasoline Range Organics by GC/FID, AK-101
GC039	Analysis of Diesel Range Organics by GC/FID, OK-GRO
GC040	Analysis of Gasoline Range Organics by GC/FID, OK-GRO
GC041	Analysis of N-Nitroso-N-Ethylurea by HPLC
GC042	Analysis of Thiodiglycol by HPLC
GC043	Analysis of Acrylamide by HPLC
GC044	Analysis of Petroleum Organics by TX-1005
GC045	Automated Fractionation of MA-EPH extracts
GC046	SOP for Screening Petroleum Range Organics by FID
GC047	Nitroguanidine by HPLC
GC048	Analysis of KS LRH by GC-FID
GC049	Analysis of KS MRH-HPH by GC-FID

### Mass-Spectrometry SOPs

MS003	Analysis of Volatile Organics by EPA Method 624
MS004	Analysis of Semi-volatile Organics by EPA Method 625
MS005	Analysis of Volatile Organics by EPA Method 8260B
MS006	Analysis of Semi-volatile Organics by EPA Method 8270C
MS008	Analysis of Semi-volatile Organics by EPA Method 8270C SIM
MS009	Analysis of Volatile Organics by GC/MS
MS010	Analysis of Volatile Organics by GC/MS SIM
MS011	Analysis of Semi-volatile Organics by EPA Method 8270D
MS012	Analysis of 1,4-Dioxane by EPA 522
MS013	Analysis of Perchlorate by SW-846 6850

SOP #	TITLE
MS014	Analysis of PFOS/PFOA by LC/MS/MSD
MS015	Analysis of 8270 SIM LVI
MS016	Analysis of Volatile Organics by EPA Method 8260C
MS017	Analysis of PFOS/PFOA by LC/MS/MSD, method EPA 537, Drinking water
MS018	Analysis of Amines by LC/MS/MSD,

### Quality Assurance SOPs

QA001	Preparation, Approval, Distribution & Archiving Of Standard Operating Procedures (SOPs)
QA002	Calibration Of Thermometers
QA003	Personnel Training And Analyst Proficiency
QA004	Temperature Monitoring
QA005	Calibration Of Analytical Balances
QA006	Eppendorf Pipette Calibration
QA007	Sample Batching Procedure
QA008	Creating New Accounts
QA009	Creating New Projects
QA010	Confidentiality Protection Procedures
QA011	Signature Authority
QA012	Employee Technical Ethics Responsibilities
QA013	Client Complaint Resolution Procedure
QA014	Procedures For The Purchase Of Laboratory Supplies
QA015	Procedures For The Preparation, Distribution, Use And Archiving Of Laboratory Logbooks
QA016	Corrective Action Procedure
QA017	Standards Traceability Documentation Procedure
QA018	Procedure For Login, Management, Handling, And Reporting Of Proficiency Test (Pt) Samples
QA019	Quality System Review
QA020	Procedure For Developing Method Performance Criteria And Experimental Method Detection Limits
QA021	Subcontracting Procedures
QA022	Internal Audit Procedure
QA023	Fume Hood Inspection
QA027	Review Of Inorganics Data
QA028	Review Of Organics Data
QA029	Manual Integration Of Chromatographic Peaks
QA030	Procedure For The Development And Use Of in-house Quality Control Criteria
QA031	Air Quality Monitoring Of Extraction Laboratory
QA032	Routine Maintenance For Major Analytical Instrumentation
QA033	Laboratory Safety
QA034	Sample Homogenizing

SOP #	TITLE
QA035	Solvent Testing And Approval
QA036	Data Package Generation
QA037	Deionized Water Quality Control Procedure
QA038	Data Integrity Training Procedure
QA039	Data Integrity Monitoring Procedure
QA040	Procedure For Conducting Data Integrity Investigations
QA041	Procedure For The Confidential Reporting Of Data Integrity Issues
QA042	Basic Calculations For General Chemistry Methods
QA043	Data Qualifier SOP
QA044	Calibration Of Micro-Distillation Tubes
QA045	Estimation of Uncertainty
QA046	Document Control
QA047	Management of Client Project
QA048	Data Entry for Log-In

General Chemistry SOPs

GNSOP: 101	Acidity (pH 8.2)
GNSOP: 102	Alkalinity, Total (pH 4.5)
GNSOP: 103	Ammonia – Distillation Procedure
GNSOP: 104	Nitrogen, Ammonia
GNSOP: 105	Bicarbonate, Carbonate, Free Carbon Dioxide
GNSOP: 106	Chemical Oxygen Demand
GNSOP: 107	Chloride by Titration
GNSOP: 109	Color, Apparent
GNSOP: 110	Chromium, Hexavalent (Water)
GNSOP: 113	Cyanide Distillation/Aqueous And Solid Samples
GNSOP: 115	Cyanide, Total
GNSOP: 116	Dissolved Oxygen
GNSOP: 121	Ignitability
GNSOP: 122	Anionic Surfactants As MBAS
GNSOP: 123	Nitrogen, Nitrite
GNSOP: 126	Ortho Phosphate
GNSOP: 127	Paint Filter Liquids Test
GNSOP: 128	Phenols Distillation, Soil And Water Samples
GNSOP: 130	Phenols, Total Recoverable
GNSOP: 133	Settleable Solids
GNSOP: 134	Total Suspended Solids (Non Filterable Residue)
GNSOP: 135	Total Dissolved Solids (Total Filterable Residue)
GNSOP: 136	Reactive Sulfide And Reactive Cyanide
GNSOP: 137	pH By Electrode - Water
GNSOP: 140	Sulfide
GNSOP: 144	Total Phosphorus
GNSOP: 145	Turbidity

SOP #	TITLE
GNSOP: 147	Winkler Titration For DO Standardization
GNSOP: 161	Percent Solids
GNSOP: 163	Specific Conductance At 25 C.
GNSOP: 166	pH By Electrode – Soil
GNSOP: 167	Biochemical Oxygen Demand (BOD)
GNSOP: 171	Hexachromium In Soils
GNSOP: 179	Corrosivity (Soil pH By Electrode)
GNSOP: 182	Total Kjeldahl Nitrogen
GNSOP: 189	Corrosivity Toward Steel
GNSOP: 190	Total Nitrogen, Organic Nitrogen
GNSOP: 191	Nitrogen, Nitrate
GNSOP: 192	Carbonaceous Biochemical Oxygen Demand (CBOD)
GNSOP: 193	Oxidation-Reduction Potential
GNSOP: 194	Ferrous Iron
GNSOP: 196	Glassware Cleaning
GNSOP: 197	Anions By Ion Chromatography
GNSOP: 211	Oil & Grease And PHC By 1664
GNSOP: 212	Fractional Organic Carbon
GNSOP: 213	Walkley-Black Total Organic Carbon
GNSOP: 214	Particle Size By Sieve
GNSOP: 215	TOC In Water
GNSOP: 216	Particle Size By Hydrometer
GNSOP: 218	Perchlorate
GNSOP: 219	Bulk Density
GNSOP: 222	Un-Ionized Ammonia Calculation
GNSOP: 224	Hardness By Calculation
GNSOP: 225	Cation Exchange Capacity Of Soils (Sodium Acetate)
GNSOP: 226	TOC In Soil
GNSOP: 227	Oil And Grease – Gravimetric Analysis (Soils)
GNSOP: 228	Anions By Ion Chromatography - IC 2000
GNSOP: 231	% Ash
GNSOP: 232	Determination Of Nitrate and Nitrite by Lachat
GNSOP: 233	Sulfite
GNSOP: 234	Total Solids, Gravimetric
GNSOP: 235	Total Volatile Solids, Gravimetric

### Metals SOPs

MET 100	Metals By Inductively Coupled Plasma, EPA 6010C
MET 103	Digestion Of Water Samples For Flame And ICP Analysis
MET 104	Digestion Of Soils For ICP Analysis
MET 105	Cold Vapor Analysis Of Mercury For Soils
MET 106	Cold Vapor Analysis Of Mercury For Water Samples
MET 107	Metals By Inductively Coupled Plasma, Mass-Spectrometry

**SOP #**

**TITLE**

**MET 108**      Metals By Inductively Coupled Plasma, EPA 6010D

**Sample Management SOPs**

**SAM101**      Sample Receipt And Storage

**SAM102**      Procedure For Sample Bottle Preparation And Shipment

**SAM104**      Sample Container Quality Control

**SAM108**      Sample And Laboratory Waste Disposition

**SAM109**      Foreign Soil receipt and Handling



# Appendix VI

## Data Integrity Training Acknowledgement and Ethical Conduct Agreement

*I understand that SGS Accutest is committed to having its employees perform their duties ethically and responsibly. By signing this document, I agree to uphold SGS Accutest commitment to ethics and integrity as follows:*

- I. I understand the high ethical standards required of me with regard to the duties I perform and the data I report in connection with my employment at SGS Accutest.*
- II. I have received formal instruction on the code of ethics that has been adopted by SGS Accutest during my orientation and agree to comply with these requirements.*
- III. I have received formal instruction on the elements of SGS Accutest's Data Integrity Policy and have been informed of the following specific procedures:*
  - a. Formal procedures for the confidential reporting of data integrity issues are available, which can be used by any employee,*
  - b. A data integrity investigation is conducted when data issues are identified that may negatively impact data integrity.*
  - c. Routine data integrity monitoring is conducted on sample data, which may include an evaluation of the data I produce,*
- IV. I have attended the Data Integrity training detailing SGS Accutest Data Integrity and Ethics Program as required.*
- V. I am aware that data fraud is a punishable crime that may include fines and/or imprisonment upon conviction.*
- VI. I also agree to the following:*
  - a. I shall not intentionally report data values, which are not the actual values observed or measured.*
  - b. I shall not intentionally modify data values unless the modification can be technically justified through a measurable analytical process.*
  - c. I shall not intentionally report dates and times of data analysis that are not the true and actual times the data analysis was conducted.*
  - d. I shall not condone any accidental or intentional reporting of inauthentic data by other employees and immediately report it's occurrence to my superiors.*
  - e. I shall immediately report any accidental reporting of inauthentic data by myself to my superiors.*
  - f. I will, at all times, handle client samples and SGS Accutest instrumentation as required by the SGS Accutest Standard Operating Procedures.*

- g. I will not intentionally deviate from, or fail to follow, the SGS Accutest Standard Operating Procedures at any time except as authorized by this document.*
- h. I understand that deviations from a Standard Operating procedure are allowed only when the deviations are clearly presented in writing by supervisory, managerial or director level staff and when those deviations do not contradict any part of the SGS Accutest ethics policy. No other personnel are allowed to approve Standard Operating Procedure deviations.*
- i. Anytime someone suggests, recommends, or requests that I do not follow an SGS Accutest Standard Operating Procedure, other than as noted in h above, I shall immediately notify my supervisor, manager, a Quality Assurance Officer, the Lab Director, or the Director of Human Resources.*
- j. Anytime I am uncomfortable or unsure about an action that I am requested to perform, I shall immediately notify my supervisor, manager, a Quality Assurance officer, the Lab Director, or the Director of Human Resources. By doing so, I understand that I will not be punished or penalized for asking for guidance or reporting potential wrongdoing.*
- k. If I intentionally disregard the SGS Accutest Standard Operating Procedures without written authorization to do so, I may face disciplinary action up to and including termination of my employment. Note: unintentional deviation from a Standard Operating Procedure must be documented on discovery and appropriate corrective actions followed.*
- l. If I become aware of another person who appears to be disregarding the SGS Accutest Standard Operating Procedures without written authorization to do so, I shall immediately report it to my supervisor, manager, a Quality Assurance Officer, the Lab Director, or the Director of Human Resources. By failing to do so, I may face disciplinary action up to and including termination of my employment.*
- m. I am aware that intentionally failing to follow an SGS Accutest Standard Operating Procedure, other than as noted in h above, may be illegal and could be considered data fraud. In addition, providing instruction to another person to deviate from a Standard Operation, other than as noted in c above, may be illegal and could be considered data fraud.*
- n. I am aware that data fraud is a crime and is punishable by fines and/or imprisonment upon conviction. It is the general policy of SGS Accutest to cooperate with law enforcement authorities in the investigation and prosecution of such matters.*
- o. I understand that SGS Accutest strictly prohibits unlawful retaliation and I understand that, if I report a violation of the SGS Accutest Standard Operating Procedures or an instruction that would violate the SGS Accutest Standard Operating Procedures, I will not be subjected in any way to any adverse employment action because of my report. I agree that if I believe I am being, or have been, subjected to an adverse employment action because of my report, then I will immediately notify my supervisor, manager, a Quality Assurance officer, the Lab Director, or the Director of Human Resources. I agree that SGS Accutest cannot address or correct any such retaliatory behavior unless it is reported and SGS Accutest is given an opportunity to address or correct such behavior.*

---

Printed Name

---

Signature

---

Date

Corporate WI Publish to All COR WI-00001 /  
13

Campobello

## Corporate Quality Manual





Maxxam Analytics International Corporation  
Campobello Road  
Mississauga, Ontario  
905-817-5700

<b>Document Identity</b>			
<b>Document Status and Ownership</b>			
<b>Current Status</b>	<b>Approved - Released</b>		
<b>Approval Date</b>	February 3, 2016	<b>Release Date</b>	February 3, 2016
<b>Version Author</b>	Sue Bigg	<b>Version Manager</b>	Paul Fewer
<b>Document Categorization</b>			
<b>Campobello Departments</b>	Quality Assurance and Six Sigma Quality Assurance		

THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION. Its use is restricted to employees with a need to know and third parties with a need to know and who have signed a non-disclosure agreement. ANY REPRESENTATION OF THIS DOCUMENT, PRINTED OR OTHERWISE, OUTSIDE OF THE MAXXAM QSI SYSTEM IS AN UNCONTROLLED COPY UNLESS STAMPED "CONTROLLED COPY" AND SIGNED AND DATED BY AN AUTHORIZED QA REPRESENTATIVE.

<b>Release and Audit Schedule</b>	
<b>Release Schedule</b>	When Approved <input type="checkbox"/> <b>Allow Administrator to Release Document Early</b>
<b>Expiration Schedule</b>	When Superseded or Obsoleted
<b>Audit Schedule</b>	24 Month(s)
<b>Special Handling on Release</b>	
<input checked="" type="checkbox"/> <b>Update Completed Trainee Records</b>	

<b>Quality Manual (English Version)</b>	
<ul style="list-style-type: none"> <li> COR WI-00001 - EN</li> <li> Attachment 1 - Tables</li> <li> Attachment 2</li> </ul>	
<b>Manuel Qualité (Version française)</b>	
<ul style="list-style-type: none"> <li> COR WI-00001 - FR</li> <li> Annexe 1 - Tableaux</li> </ul>	
<b>References</b>	
<b>Associated Documents</b>	
<b>Document Control Documents</b>	
<ul style="list-style-type: none"> <li> Corporate FCD Publish to All COR FCD-00167 : Corporate Quality Policy and Objectives</li> <li> Corporate FCD Publish to All COR FCD-00007 : Maxxam Confidentiality Agreement</li> <li> Corporate FCD Publish to All COR FCD-00072 : Corporate Out of Service Form</li> <li> Corporate FCD Publish to All COR FCD-00144 : Corporate Organizational Structure</li> <li> Corporate FCD Publish to All COR FCD-00209 : Maxxam Management Systems</li> </ul>	

-  Corporate WI Publish to All COR WI-00002 : Corporate Auditing Procedure
-  Corporate WI Publish to All COR WI-00003 : Corporate Management Review Procedure
-  Corporate WI Publish to All COR WI-00004 : Corporate Purchasing Policy
-  Corporate WI Publish to All COR WI-00005 : Corporate Contract Review Procedure
-  Corporate WI Publish to All COR WI-00006 : Corporate Subcontracting Procedure
-  Corporate WI Publish to All COR WI-00007 : Code of Ethical Standards, Business Practices and Data Integrity
-  Corporate WI Publish to All COR WI-00008 : Corporate Management of Change Procedure
-  Corporate WI Publish to All COR WI-00010 : Corporate Procedure for Nonconformances
-  Corporate WI Publish to All COR WI-00011 : Corporate Corrective and Preventive Actions Procedure
-  Corporate WI Publish to All COR WI-00012 : Definitions
-  Corporate WI Publish to All COR WI-00014 : Quality Records and Test Reports
-  Corporate WI Publish to All COR WI-00020 : Kaizen Process
-  Corporate WI Publish to All COR WI-00040 : Corporate Procedure for Deviations
-   Maxxam Environment Health and Safety WIs MEHS WI-00013 : Corporate Environmental, Health and Safety Guide
-   Burnaby GxP FCD BBY1FCD-00049 : GLP Cross Reference Table

### Reason for Change

<b>Date of Change</b>	April 18, 2007	<b>Version 2</b>
<b>Section Changed</b>	2.1, 2.3, 2.4, 6.4.1.3, 6.4.1.17, 6.4.1.15, 6.4.1.2, 6.4.1.14, 6.4.2.2.3, 6.4.2.4.1, 6.4.3, 6.4.6.4, 6.4.9.3, 6.5.9.2, Table A, B and Table C	
<b>Change Made</b>	<p>2.1 Sentence revised regarding which labs are excepted from QM</p> <p>2.3 Removed American Industrial Hygiene Association (AIHA)</p> <p>2.4 Added Sainte-Foy, Québec laboratory. Also added NELAC to Mississauga Environmental laboratory. Removed AIHA from Burlington, ON, Environmental lab. Removed Guelph lab</p> <p>6.4.1.3 Added Sainte-Foy, Québec to Eastern Laboratory locations</p> <p>Revised in 6.4.1.17 to all staff... to supervisors/managers.</p> <p>In 6.4.1.15 added Managers as substitute for operations manager</p> <p>6.4.1.2 added new item to comply with 4.1.2 in ISO 17025:2005. Renumbered items that followed.</p> <p>6.4.1.14 Reworded to comply with ISO 17025 section 4.1.5i QA Managers have access to highest level management.</p> <p>6.4.2.2.3 To comply with ISO 17025 section. Added Kaizen Project in discussion about continuous improvement</p> <p>6.4.2.2 the requirement that quality policy statement will be reviewed during management review meetings.</p> <p>6.4.2.4.1 Updated description of Executive VP position</p> <p>6.4.3 Added discussion regarding allowance of hand written amendments in certain circumstances.</p> <p>6.4.3 Removed (controlled documents for distribution must be numbered) from 4th paragraph.</p> <p>6.4.6.4 Quality Assurance changed to Purchasing</p> <p>6.4.7 Example of another source of customer feedback added</p> <p>6.4.9.2 to 6.4.9.10 numbering corrected</p> <p>6.5.9.2 Added to comply with ISO 17025:2005 Section 5.9.2 Quality Control data will be reviewed and corrective action taken to correct problem.</p> <p>Table C SOP and WI references updated to current numbers in new QSI.</p> <p>Header info added to Tables A,B and C referencing COR WI-00001.</p> <p>Table B Quality Records Matrix added Method Validation Records.</p> <p>6.5.4.6, 2.4, 6.5.4.5.1.2 updated referenced procedures to the new QSI numbers</p> <p>6.5.3.7 added reference for company safety manual in QSI: COR WI-00015</p> <p>Throughout Section 6.4 revised reference to President to Executive Vice President</p>	
<b>Date of Change</b>	October 3, 2007	<b>Version 3</b>
<b>Section Changed</b>	2.4, 6.4.1.1, 6.4.1.3, 6.4.1.15, 6.4.1.17, 6.4.2.2.2, 6.4.2.2.3, 6.4.2.4.3, 6.4.2.4.4, 6.4.3, 6.4.3.1, 6.4.7.1, 6.4.10, 6.4.11.1, 6.4.12.5, 6.4.13.1.4, 6.4.13.2.2, 6.4.13.2.3, 6.4.14.2, 6.4.14.5, 6.5.2.1, 6.5.2.1.4, 6.5.2.2.1, 6.5.3.6, 6.5.3.7, 6.5.4.1.1, 6.5.4.6.1, 6.5.5.5, 6.5.5.8, 6.5.6.1.1, 6.5.6.2.3, 6.5.6.2.7, 6.5.7.2, 6.5.9.1.3, 6.5.9.1.7, 6.5.9.2	
<b>Change Made</b>	<p>2.4 Table updated</p> <p>6.4.1.1 Revised to include incorporation by provincial government where applicable.</p> <p>6.4.1.3 Facilities in Canada organized into Lines of Business. Regina Service Centre added to Western locations. Stettler changed to Red Deer, Sainte-Foy to Quebec</p> <p>6.4.1.15 Substitute for Supervisor changed</p> <p>6.4.1.17 KPI scorecards added newsletters removed. Word "quarterly" removed from Town Hall meetings</p> <p>6.4.14.5 Reworded to indicate that follow-up audits may be conducted and documented in the CAR or NCR system.</p> <p>6.4.2.2.2 Added Quality Objectives as written in Quality Newsletter and the Maxxam website.</p> <p>6.4.2.2.2 Reworded to reflect current practice.</p> <p>6.4.2.2.3 old removed and items renumbered.</p> <p>6.4.2.3.3 formerly 6.4.2.3.4. Last sentence removed regarding quarterly reports about QA issues from QA to lab managers.</p> <p>6.4.2.4.3 Technical changed to Operational</p> <p>6.4.2.4.4 last bullet removed</p>	

6.4.3 QAP changed to WI. Grammatical corrections. Sentence removed in paragraph starting with External Documents... Other reference methods are kept in the lab.  
 6.4.3 Signatures clarified to be electronic signatures  
 6.4.3.1 Approval authority for Method SOPs changed  
 6.4.7.1 Reference to use of corporate form COR FCD-00007 added  
 6.4.10 Kaizen add to last sentence  
 6.4.11.1 4th bullet QC changed to quality. 5th bullet added word Significant before H&S issues  
 6.4.12.5 2nd bullet test codes added  
 6.4.13.1.4 last sentence reworded  
 6.4.13.2.2 added "in ink" to 1st sentence  
 6.4.13.2.3 added crossed out "with a single line"  
 6.4.14.2 added Implementation to objective for method audits  
 6.4.14.5 last sentence added new  
 6.5.2.1 added Employment Policy  
 6.5.2.1.4 Requirement for annual proficiency for NELAC accredited labs stated.  
 6.5.2.2.1 Newsletters replaced with KPI scorecards  
 6.5.3.6 last sentence re monitoring housekeeping removed.  
 6.5.3.7 Reference to corporate H&S manual COR WI-00015 removed as it hasn't been released. Last sentence is not applicable to all locations and was removed.  
 6.5.4.1.1 last sentence reworded  
 6.5.4.6.1 reference to corporate MU WI updated.  
 6.5.5.5 revised  
 6.5.5.8 Reworded  
 6.5.6.1.1 Added statement about calibration frequency can be extended  
 6.5.6.2.3 reworded for clarity  
 6.5.6.2.7 Wording revised to reflect there is more than one lab in Quebec participating in the MDDEP Round Robin. AIHA/MENV changed to MDDEP/CAEAL  
 6.5.7.2 section removed  
 6.5.9.1.3 replicate changed to Duplicate and or different methods removed  
 6.5.6.1.7 Word address in 1st sentence changed to represent. Revised sentence from Staff are to... to It is recommended that staff...  
 6.5.9.2 Added last sentence new.  
 Throughout document 1) the word Industrial replaced with Petroleum and 2) the name QSI with CompliantPro (QSI).

**Date of Change** January 8, 2008

**Version 4**

**Section Changed** 2.4, 6.4.1.3, 6.4.1.17, 6.4.2.4.2, 6.4.2.4.3, 6.4.2.4.4, 6.4.3, 6.4.5.1.5, 6.5.9.1, 6.5.10.7, Table A, B, C

**Change Made** 2.4 Added ISO 17025 CAN-P-1587 to Bedford. Removed CAN-P-1593 from Burlington.

6.4.1.3 Added Point Tupper, NS and Waterloo, ON  
 6.4.1.17 Clarified KPI acronym with Key Performance Indicators.  
 6.4.2.4.2 Reworded VP responsibility for business activities of lab.  
 6.4.2.4.3 GM responsibility added new  
 6.4.2.4.4 Changed Operation manager report to GM or Sr Ops Manager.  
 6.4.3 Distribution of controlled documents via electronic/manual controlled stamp plus initials and date of a QA staff.  
 6.4.5.1.5 Added new. NELAC accredited test can only be subcontracted to NELAC accredited lab  
 6.5.9.1 Added new. Allowance for different batch size and frequency for Petroleum lab.  
 6.5.10.7 Report can be issued by email or fax.  
 Table A Updated responsibility descriptions and corrected header info to reflect current revision.  
 Table B Added PT Results to matrix. Updated legend description for president and corrected header info to reflect current revision.  
 Table C Updated SOPs listed in Cross-Reference guide and corrected header info to reflect current revision.

**Date of Change** February 2, 2009

**Version 5**

**Section Changed** 2.1, 2.2.3, 2.4, 6.4.1.5, 6.4.1.7, 6.4.1.13, 6.4.1.15, 6.4.2.2, 6.4.3, 6.4.8, 6.4.9, 6.4.9.1, 6.4.12.2, 6.4.13.1.2, 6.4.14.5, 6.5.10.11, Tables B, C

**Change Made** 2.1, 2.2.3 - clarified staff responsibilities with respect to policies and procedures

2.4 Index numbering revised to accurately reflect location of sections in 6.4 and 6.5.  
 6.4.1.5, 6.4.8, 6.4.9, 6.4.9.1, 6.4.14.5 Revised NCR to NSC and Nonconformance report to Non-Systemic CAR.  
 6.4.1.7-revised to clarify  
 Throughout document, revised job titles for QA Managers and Director of Quality.  
 6.4.1.13 Added new. HRs responsibility for preparation of Org charts. Subsequent sections renumbered.  
 6.4.1.15 Table modified to include Manager/Dept manager and their substitute  
 6.4.3-revised list of documents to reflect only those that are considered "documents" not technical records.  
 6.4.2.2 Revised the third and fifth bullets quality objective  
 6.4.12.2 Changed Preventive Action records to Requests  
 6.4.13.1.2 Added sentence about retention of records for 5 years unless contractually required to keep longer. (removed last sentence of 6.4.11-  
 Table C Quebec changed to Montreal and reference updated  
 Table B note added, revised nomenclature of NCRs and GM  
 6.4.3-added paragraph regarding issuing SOPs and WIs to clients.  
 -added 6.5.10.11  
 -all references to MENV changed to MDDEP

**Date of Change** February 6, 2009

**Version 6**

**Section Changed** 6.4.1.1, 6.4.2.4.2, 6.5.10.11, table C

**Change Made** 6.4.1.1-revised legal name for Maxxam  
 6.4.2.4.2-revise job summary for VP

Throughout document -revised CAEAL to CALA  
 6.5.10.11 - added regulatory reporting requirements  
 Table C-corrected Ontario procedures

**Date of Change** February 3, 2010

**Version 7**

**Section Changed** Tables, various sections of QM

**Change Made** Table C - added Kaizen procedure to section 4.12, added corporate procedure to 4.3, removed corporate procedure from 5.2, added corporate balance procedure and corporate volume procedure to 5.4.  
 6.4.1.8-revised title to senior management  
 table A - revised VP, added internal auditors  
 6.4.1.1-revised address of headquarters  
 6.4.1.7 and 6.4.1.9-revised statements regarding maintenance of records  
 6.4.1.18-revised to state senior management conduct townhall meetings  
 2.4table- combined some lab locations, removed some rows  
 6.4.7.3-corrected last sentence  
 6.5.6.1-revised frequency of calibrations  
 Table B-added records that were previously missed  
 6.5.5-revised sections highlighted  
 6.5.9-revised sections highlighted

**Date of Change** June 4, 2010

**Version 8**

**Section Changed** Table 6.4.1.3 section 2.2.4, 2.3, 2.4, 6.4.1.4, 6.4.1.11, 6.4.1.14, 6.4.2.3.3, 6.4.3, 6.4.5.1.6, 6.4.6.4, 6.4.7.2, 6.4.8, 6.4.9.1, 6.4.11.3, 6.4.11.5, 6.4.12.1, 6.4.14.3, 6.4.14.5, 6.4.15.1, 6.4.15.2, 6.4.15.3, 6.5.2.1, 6.5.2.2, 6.5.2.3, 6.5.2.5, 6.5.3.5, 6.5.3.6, 6.5.4.1.1, 6.5.4.2.1, 6.5.4.2.2, 6.5.4.5.1, 6.5.4.5.2, 6.5.4.4, 6.5.4.5, 6.5.4.7.2, 6.5.5, 6.5.6, 6.5.7, 6.5.8.4, 6.5.9.2, 6.5.10.

**Change Made** Added section 2.2.4, added highlighted items in section 2.3, Added highlighted items in section 2.4 table. Corrected grammatical errors throughout this document as recommended by SCC from the Ontario lab audit. Added section 6.4.2.3, added note after section 6.4.3, added additional text to section "external Documents". Added highlighted section at the end of section 6.4.3, added section 6.4.5.1.6, added note at the end of section 6.4.8.  
 Revised section 6.4.9.1, added section 6.4.11.3, revised section 6.4.11.5, added statement to the end of section 6.5.2.1.  
 Revised section 6.5.4.1.1 and section 6.5.4.2.1, added additional info to section 6.5.6.1.1, added a note to section 6.5.7.  
 Added a note after section 6.5.10.5, added section 6.5.10.12 and subsection 6.5.10.12.1 – 6.5.10.12.4.

Included Comments from Sue - Modified the Mississauga accreditations in the table -removed HRMS and air since they are all part of Campo. Mgmt review should be done by 'top management' and added GMP (BC only) in section 6.4.2.3.3

Addressed all finding from the CALA Fort Mac audit. Updated Table C

Addressed all DCRs attached in Revision 7.0

**Date of Change** October 3, 2011

**Version 9**

**Section Changed** various-see below

**Change Made** Section 6.4.2.1.2 - added requirement to inform the accreditation body about changes that may affect the accreditation status of the laboratory

**Optional Field A**

June 14th 2011

Section 6.4.13.2.3 Corrected spelling.

As per COR DCR-00189 added:

- CAN-P-1608 to the Management System column to the Burnaby, British Columbia - Canada Way Section of the Table in Section 2.4.

- 6.4.1.2 Maxxam, as an entity, is committed to being free from undue internal or external influences with respect to its Medical Gas Testing Line of Business. Also added commitment statements as per CAN-P-8 requirements.

- 6.4.2.2.2 Added: Accreditation bodies will be notified of any changes to the a) legal, commercial, ownership or organizational status; b) organization, top management and key personnel; c) main policies; d) resources and premises; e) scope of accreditation; and, f) other such matters that may affect the Maxxam's ability to fulfil requirements for accreditation.

- 6.5.2.1 Added: This authorization will be done at least annually, as part of the on-going training, for each Medical Gas Testing Representative (MGTR). During the witnessing of the testing, another authorized MGTR or supervisor will witness the actual observations and will review the inspection decisions or personally verify that the inspection decisions are reliable. This witnessing will be done by technically competent personnel, who are sufficiently independent to carry out the witnessing of inspections objectively.

As per COR DCR-00191 Removed:

6.4.6 and "Selection, Evaluation and Verification of Vendors".

As per COR DCR-00202 Added:

Horizon CNRL to section 6.4.1.3

Added statements that there are client specific reporting procedures at the Horizon CNRL and Joffre labs.

As per COR DCR-00210 Modified:

6.4.3 There are times when clients and external agencies request copies of our procedures. If the procedure is requested due to an impending accreditation assessment, then the documents can be sent by QA as uncontrolled copies. However, if the procedure is requested by a non-Maxxam employee (client) other than an accrediting or regulatory body, then they will NOT be released without the written approval of a General Manager (GM), Regional QA Manager or equivalent management. Whenever possible, a summary of the procedure is sent in place of the procedure (for confidentiality reasons). As always, only the QA staff may distribute procedures after getting

confidentiality agreed upon by the client; these are released as uncontrolled copies unless otherwise specified.  
 As per COR DCR-00215 Added: COR FCD-00167 : Corporate Quality Policy and Objectives to associated Documents.  
 As per COR DCR-00216 Added:  
 Sudbury, Ontario location to 6.4.1.3  
 As per COR DCR-00217 Added:  
 The Statoi, Devon Jackfish & IOL Cold Lake contract labs to section 2.4  
 Also the firebag lab was added and the calgary labs were split by lines of business.  
 As per COR DCR-00231 Added:  
 "or their supervisor" to section 6.4.1.7  
 As per COR DCR-00237 Added:  
 6.4.13.2.1 Quality records may be sent to an external facility for archiving.

Changed font to Calibri

Updated Table C as per requests in COR DCR-000205, 212,234,176 and 178.  
 Updated Table B as per requests in COR DCR-000225 and 234.  
 6.4.11-removed "Significant Health & Safety Issues".

**Optional Field B** July 15 2011

Added tables A,B and C to section 6.6.0 of the document and removed the attachments.  
 Added Note to Table B stating that records are retained for 5 years unless contractual or regulatory requirements state otherwise.

**Optional Field C** July 28 20011

Section 2.3 update title for 1585 and 1587  
 Section 2.4 removed reference to can p 1587 from Bedford  
 Section 6.4.1.4 removed Bedford  
 Section 6.4.2.3.1 added forms  
 6.4.13.1 added statement about automatic numbering  
 Aug 18 2011  
 6.5.6.2.3 Removed: Date of receipt and initials of the receiver are to be noted on the C of A. as this is not a requirement.  
 Sept 06-08, 2011 (Rchen1)  
 Re-formatted entire document  
 Replaced 'client' with 'customer' throughout.  
 Replaced 'MaxLIMS' with 'MaxxLIMS' throughout.  
 Section 2.3: Added reference to GUI-0001 to Canadian GMP, updated reference to the OECD GLP and clarified that the GLPs apply to BC only.  
 Section 2.4: Updated applicable Management Systems for Burnaby, BC (Canada Way and Beta) to include AIHA, US EPA and US FDA.  
 Section 6.4.1.3: Put Facilities in a table.  
 Section 6.4.2.1: Added a reference to the BC only GLP cross reference table.  
 Section 6.4.2.4: Added note that JDs for other positions kept with appropriate staff where required.  
 Section 6.4.3: Revised reference to the Corporate procedure so it's consistent with how Corporate procedure are referenced in the other sections.  
 Section 6.4.3: Revised note to clarify that all Study Documentation (Study Plan, Report, and Raw Data) will be maintained.  
 Section 6.5.6.1.3.1: Changed Section number to 6.5.6.1.4.  
 Table C - added the following references: COR WI-00007, COR WI-00028, COR WI-00047, COR WI-00016, COR WI-00044, COR WI-00049, COR WI-00053, COR WI-00015, COR WI-00029, COR WI-00055.  
 Removed references to 'QA Supervisor' position throughout.  
 Section 6.4.8: Revised to indicate that complaints may be received from customers or other parties.  
 Section 6.6.3 Table C ISO Section 5.6: Updated references to the STL WIs.

**Date of Change** October 30, 2012

**Version** 10

**Section Changed** See below

- Change Made** - 2.1: updated Scope to include field test sites and mobile labs as Maxxam laboratories (requested by Alberta Air).  
 - 2.2.1: added sentence to ensure QA know that the scopes of accreditation are their responsibility  
 - 2.3: Added CAN-P-1583, PSA ID for CAN-P-1587, CAN-P-8 and CAN-P-1608. Added ASTM D7036-05(2011) as requested by Alberta Air.  
 - 2.4: Added Kearn Lake, CAN-P-8 (Canada Way, Burnaby, BC), and Ontario MOE for Bedford, NS (COR DCR-000282); removed 'Beta' location and merged requirements with the 'Commerce Court' location in Burnaby, BC. Also added the province for the Winnipeg facility. Added CAN-P-1585 to the Management System for Edmonton Petroleum and Fort McMurray CNRL locations. Added Passive Lab to the Edm Petroleum location. Removed CAN-P-1585 from Nepean  
 - 6.4.1.3: Corrected 'Suncor' name, added Kearn Lake, AB, and Victoria, BC. Moved Winnipeg, MB from Eastern to Western as per COR DCR-00279 and 292.  
 - 6.4.1.5: Added "Bench Level Non-conformances" and "Maxxam Internal Audits" as per COR DCR-00375.  
 - added policy statements to: 6.4.1.6, 6.4.4.1, 6.4.6, 6.4.9, 6.4.11, 6.5.2  
 - 6.4.1.7: Updated to current practice.  
 - 6.4.1.9: Removed and merged with 6.4.1.7.  
 - 6.4.1.13-revised maintenance of org charts.  
 - 6.4.1.18: Updated to current practice as per COR DCR-00340.  
 - 6.4.2.1-added note to refer to COR FCD-00167  
 - 6.4.2.2-removed objectives as they are found in COR FCD-00167  
 - 6.4.2.4.1-added President/CEO roles and responsibilities, renumbered 6.4.2.4.  
 - 6.4.5.1.3: Added that for BC, Drinking Water samples must be sublet to a lab approved by the BC Provincial Health Officer (available on EWQA website).  
 - 6.4.5.2: Added "When work is subcontracted, the location of the analysis is disclosed on the certificate of

analysis.”

- 6.4.7.2,3-revised to reflect current practices
- 6.4.10-revised to state "regular quality improvement meetings".
- 6.4.13.2.2-changed 'adopted' to 'recommended' for date format
- 6.4.15.1: Added ID of the Management Review procedure.
- 6.5.6.2.7: removed this section as PTs are discussed in 6.5.9.
- 6.5.10.3 - 6.5.10.4: removed details on report content and referenced COR WI-00014
- 6.5.10.12: Added the sentence "Reporting requirements defined by the customer may differ than those outlined above" to the existing note, "The Horizon and Joffre labs report data directly to the customer using a customer-lab specific LIMS system."
- Section 6.5.2.2.1: Revised as per COR DCR-00282.
- Section 6.5.3.7: Revised to reflect current practice.
- 6.5.9.1.8-clarified use of PTs where available and the need to follow appropriate accreditation body requirements.
- 6.5.10.2: Revised to clarify that additional information may be added to the test report as requested by the Customer or as required by a Regulatory Authority.
- 6.5.10.12.4: In the 'Note' added Firebag and Kearl Lake and revised the statement regarding reporting requirements as per COR DCR-00292.
- Table B: Revised as per COR DCR-00363. Added number ('9') for records maintained in CompliantPro.
- Table C: Updated as per COR DCR-00282. Replaced COR WI-00083 with CAM WI-00200 in 4.13 and 5.4. Added COR WI-00081 to 4.14. Added BBY1 WI-00017 to list of Western Procedures in 5.2. Added BBY3 WI-00007, BBY4 WI-00008, EENV WI-00003, and EENV WI-00123 to list of Western Procedures in 5.4, as well as COR1 WI-00003. Removed 64-E-020 and added EENV WI-00022 in 5.7. In list of Western Procedures, removed BRN WI-00002 and added AB WI-00061 and 62, and EENV WI-00040; corrected ID for BBY WI-00002 in 5.8. Removed ATL WI-00002 from list of Atlantic Procedures and CAL WI-00010 from list of Western Procedures in 5.9. Added COR WI-00014 in 5.10.

**Optional Field A** 2.1-removed reference to human drug lab

- Throughout the document - replaced "six sigma" with "continuous improvement"
- 6.4.7.1-removed reference to COR FCD-00010. No longer used as per COR DCR-00428.
- 6.4.7.2-removed reference to surveys as they are not routinely done.
- Table B-added filing and collection where appropriate to CompliantPro.

**Date of Change** March 17, 2014

**Version** 11

**Section Changed** See below

**Change Made**

- Minor formatting changes throughout.
- Page 1: added table of contents.
- Section 2: added Becquerel.
- Section 2.3: removed 'and analysis' from ASTM D7036-04(2011) bullet as per COR DCR-00695.
- Section 2.3: Added USEPA and NELAC program documents as per COR DCR-00478.
- Section 2.3: Updated title to ASTM D7036-04(2011) reference as per CORDCR-00695.
- Section 2.4: Added Becquerel Laboratories Inc. as per COR DCR-00470.
- Section 2.4: Removed CAN-P-1585 from the Nepean lab as they have been CALA Accredited.
- Section 2.4: Changed 'Conklin' to 'Cold Lake' for the Jackfish sites.
- Section 2.4: Changed "ISO 17020:1988" to "ISO 17020:2012" for the Burnaby, Canada Way lab as per CORDCR-00506.
- Section 6.4.1.2: Revised to indicate that employees are free from undue pressure as per COR DCR-00462.
- Section 6.4.1.3: Updated Eastern and Western Facilities as per CORDCR-00539, COR DCR-00631 and CORDCR-00655.
- Section 6.4.1.10 and 6.4.1.12: Moved Section 6.4.1.10 to Section 6.5.10; and clarified "...Human Resources or other defined personnel..." in Section 6.4.1.12, as per CORDCR-00532.
- Section 6.4.1.14: Changed reference from "6.4.1.18" to "6.4.1.15" as per CORDCR-00506.
- Section 6.5.2.4.3: Added "Senior Vice President" as per CORDCR-00655.
- Section 6.4.3: Revised to indicate that Compliant Pro/QSI document control system maintains the master list of all internally created documents and all external documents are either referenced in CPro procedures or are associated documents, as per CORDCR-00503.
- Section 6.4.8: Added use of CRMs by environmental PMs as per COR DCR-00477.
- Section 6.4.8: Replaced "CMRs" with CRM throughout; changed reference from ISO/IEC 17020:1998 to ISO/IEC 17020:2012 in Note, as per CORDCR-00506.
- Section 6.4.2.2.3: Removed 6-Sigma Projects as per CORDCR-00520.
- Sections 6.4.2.3.2 and 6.5.4.1.1: replaced "QSI" with "Compliant Pro/QSI" as per CORDCR-00520.
- Section 6.4.3: Removed client name from reception of external documents statement as per CORDCR-00521.
- Section 6.4.9: Renumbered subsections 6.4.9.2 - 6.4.9.10 to 6.4.9.1 - 6.4.9.9 as per CORDCR-00721.
- Section 6.4.10: Added reference to CORWI-00020, as per CORDCR-00573.
- Section 6.4.11.6: Replaced "long term solution" to "Root cause plan and solution" as per CORDCR-00506.
- Section 6.4.12.5: Referenced COR WI-00008 and removed MOC creation list as per CORDCR-00559.
- Section 6.4.13.2.3: Removed "where space permits" to statement as per CORDCR-00734.
- Section 6.5.7 Note: Added statement that "Alternatively, MaxxScheduler may be used to record all sampling information" as per CORDCR-00638.
- Section 6.5.9.1.2: Removed former Section 6.5.1.9.2 and combined it with Section 6.5.9.1.8 as per CORDCR-00771.
- Section 6.5.10.2 Note: Updated Maxxam's outsourced labs as per CORDCR-00637, CORDCR-00655 and CORDCR-00773.
- Section 6.5.10.8: Reworded to clarify difference between preliminary and partial reports as per CORDCR-00534.
- Section 6.6.1 Table A: Added "Reporting" and "Improvement" to Customer Service/Sales (8) as per CORDCR-00655.
- Section 6.6.3, Table C: Section 5.3 to remove reference to QUEWI-00011; Section 5.4 to add STLWI-00029 and COR1WI-00003; Section 5.6 to replace QUEWI-00007 with QUEWI-00017; Section 5.8 to replace QUEWI-00116 with QUEWI-00100 and to add STLWI-00183; Section 5.9 to remove reference to QUEWI-00113 and STLWI-00065 as per CORDCR-00487.
- Section 6.6.3, Table C: Section 4.7 added QUEWI-00103 as per CORDCR-00494.



- Section 6.6.3, Table C: Section 5.2 added COR1 WI-00016 Microbiology Lab-Training and Proficiency Procedure.
<b>Optional Field A</b> associated documents were reviewed and no changes are required as a result of the modifications to this revision
<b>Date of Change</b> March 26, 2015 <span style="float: right;"><b>Version 12</b></span>
<b>Section Changed</b> See below
<b>Change Made</b> - 2.3 Added CAN-P-1595, removed CAN-P-4E as it will be obsoleted soon
- 2.4
- Added DR-12-SCA07 to Ville St-Laurent Quebec: Chemistry Lab.
- Added DR-12-SCA05 to Québec City.
- Added CAN-P-1595 to Mississauga, Ontario: Campobello Lab.
- 6.4.1.3
- Added Amisk lab under Cold Lake location.
- Added Fort McMurray Regional Laboratory under Fort McMurray locations.
- Added the location Conklin, AB and moved Devon Jackfish and Statoil Leismer labs there. Corrected spelling of Jackfish.
- Added INEOS to Joffre location.
- 6.4.1.4 Added Ottawa & Montreal to list of mobile labs
- 6.4.1.15, 6.4.2.2.2, 6.4.12.2 Changed "MaxxNet" to "Maxxam's intranet."
- 6.4.2.2.2 Changed "newsletters" to "town halls, news posted on MaxxNet (intranet)."
- 6.4.2.4.4 Added "Reports to the Vice President and"
- 6.4.3 External documents; clarified using the most recent version of reference methods
- 6.4.7.2 Add the statement "Feedback will be used and analyzed to improve the management system, testing activities and customer service through channels including but not limited to CARs, NSCs, and meetings with the customer."
- 6.4.14.1 Changed "Coordinators" to "managers or designates"
- 6.5.3.1.1 New section regarding environmental conditions in mobile facilities.
- 6.5.3.6 Added "Special procedures shall be prepared where necessary."
- 6.5.5.5 Revised to remove equipment records are in a database; clarified that it depends on the region/department as to where the records are maintained.
- 6.5.6.1.1 Removed "Considering workload and scheduling of external providers the windows to complete monthly calibration is plus 3 days, quarterly plus 1 week, semi-annually plus 2 weeks and annually plus 4 weeks from calibration expiration date."
- 6.5.10.10.1 New section regarding notification when results are released to regulatory authorities.
- Table B, Filing process for Subcontractor Quality System Questionnaire – changed from 4 to 9 (filing cabinet to CompliantPro)
6.4.13-added director to staff substitution
6.4.5.1.4-clarified that MDDEP accredited tests are to be sent to only MDDEP accredited labs
6.5.10.6-clarified MDDEP accredited labs instead of Quebec labs.
Table B-added filing of certificates in CompliantPro.
<b>Date of Change</b> February 3, 2016 <span style="float: right;"><b>Version 13</b></span>
<b>Section Changed</b> All sections
<b>Change Made</b> This is a complete rewrite of the corporate quality manual. It is intended that only POLICIES and ISO 17025 compliance be included in the quality manual. There are references to other procedures already in place.

<b>Notification List</b>	
<b>Notification Recipients</b>	QA Team (National)

<b>Approval Status Table</b>			
Approver Source	<b>Role for Approvers</b>	<b>Parallel-Everybody</b>	Segment
<b>Approver</b>	<b>Action</b>	<b>Date</b>	<b>Comment</b>
Paul Fewer	Approve	February 3, 2016 12:22 PM GMT-4	
Ray Chapman-Chen	Approve	February 3, 2016 4:34 PM GMT-8	

29/03/16 1:49 PM

## CORPORATE QUALITY MANUAL

### Contents

1.0	INTRODUCTION .....	2
2.0	SCOPE .....	2
3.0	DEFINITIONS .....	3
4.0	SAFETY .....	3
5.0	RESPONSIBILITIES .....	3
6.0	Procedure .....	3
6.4.0	MANAGEMENT REQUIREMENTS.....	4
6.4.2	MANAGEMENT SYSTEM .....	6
6.4.3	DOCUMENT CONTROL .....	9
6.4.4	REVIEW OF REQUESTS, TENDERS AND CONTRACTS .....	9
6.4.5	SUBCONTRACTING OF TESTS .....	9
6.4.6	PURCHASING SERVICES AND SUPPLIES .....	10
6.4.7	SERVICE TO CUSTOMER .....	10
6.4.8	COMPLAINTS .....	11
6.4.9	CONTROL OF NON-CONFORMING TESTING.....	11
6.4.10	IMPROVEMENT .....	11
6.4.11	CORRECTIVE ACTION .....	12
6.4.12	PREVENTIVE ACTION .....	12
6.4.13	CONTROL OF RECORDS .....	12
6.4.14	INTERNAL AUDITS .....	12
6.4.15	MANAGEMENT REVIEWS .....	12
6.5.0	TECHNICAL REQUIREMENTS .....	13
6.5.1	General.....	13
6.5.2	PERSONNEL .....	13
6.5.3	Accommodation and Environmental Conditions .....	14
6.5.4	Test Methods and Method Validation .....	15
6.5.5	EQUIPMENT .....	17
6.5.6	MEASUREMENT TRACEABILITY .....	18
6.5.7	SAMPLING .....	19
6.5.8	HANDLING OF TEST ITEMS .....	20
6.5.9	ASSURING THE QUALITY OF TEST RESULTS .....	20
6.5.10	REPORTING THE RESULTS.....	21

## 1.0 INTRODUCTION

This Corporate Quality Manual (QM) outlines the policies that are in place within Maxxam Analytics and Maxxam Analytique (herein referred to as Maxxam) to ensure that we consistently deliver a known standard of service to our customers.

## 2.0 SCOPE

2.1 This QM applies to all Maxxam laboratories (including, but not limited to field test sites and mobile laboratories), with the exception of the DNA laboratories. The policies and procedures set forth by Maxxam strive to ensure the accuracy and integrity of our services. It is management's commitment to insist upon and demand high quality performance from all personnel. Therefore, all personnel are required to abide by the policies outlined in this quality manual.

### 2.2 Laboratory Scopes

2.2.1 The scopes of accreditations for all Maxxam laboratories are maintained by the respective Quality Assurance Department staff. These Maxxam QA staff are responsible to ensure that these scopes are up to date and current.

2.2.2 Detailed current scopes for each location are found on the accreditor's website.

2.2.3 This quality manual is applicable to all personnel, including part-time contract and summer employees. All of these personnel are responsible for understanding and following the designated procedures as described in the responsibility matrix, see Attachment 1-Table A.

2.2.4 Locations conducting studies that are governed primarily by Good Clinical Practice (GCP), Good Laboratory Practice (GLP) or Good Manufacturing Practice (GMP), follow the systems described in this manual only where they are not conflicting with the above mentioned regulations.

2.3 These policies are written in order to comply with the following relevant national and international standards/policies for laboratory competency:

- ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories. Note: commonly referred to in Maxxam documents as ISO 17025.
- Accreditation Requirements and Operating Criteria for Horseracing Laboratories. International Laboratory Accreditation Cooperation. ILAC-G7.
- American Industrial Hygiene Association (AIHA) Laboratory Accreditation Programs, LLC. General Management System Requirements Modules 1, 2A, 2B, 3, 4, 5, 6A, 6B, 7, 8, and 9.
- ASTM D7036 - 04(2011) "Standard Practice for Competence of Air Emission Testing Bodies" (this standard is applicable to all laboratories conducting sampling for air emissions tests of stationary sources).
- Canadian Good Manufacturing Practices (GMP) Guidelines (GUI-0001), administered by Health Canada (mandatory for those laboratories which process samples from Canadian drug establishments)
- CAN-P-1578 "Guidelines for the Accreditation of Forensic Testing Laboratories, Program Specialty Area – Forensic Testing Laboratories" (PSA-FT).
- CAN-P-1583 "SCC Monitoring Authority Requirements for the Recognition of GLP Compliant Facilities" (mandatory for all labs conducting OECD GLP Studies (PSA-GLP)).
- CAN-P-1585 "Requirements for Accreditation of Environmental Testing Laboratories" (this standard is applicable to all SCC accredited laboratories conducting Environmental analyses other than Ontario drinking water testing)
- CAN-P-1587 "Requirements for the Accreditation of Agriculture Inputs, Food, Animal Health and Plant Protection Testing Laboratories" (mandatory for Agriculture and Food Program Specialty Area (PSA-AFAP) accredited laboratories)

- CAN-P-1595 "Requirements for Accreditation of Laboratories Engaged in Test Method Development and Non-Routine Testing" Standards Council of Canada Publication. Note: laboratories complying with CAN-P-1595 must also comply with all elements of Maxxam quality system and also COR WI-00122.
- CAN-P-8 "General Criteria for the Operations of Various Types of Bodies Performing Inspection" and CAN-P-1608 "Additional Requirements for the Accreditation of Inspection Bodies" (mandatory for Inspection Bodies that inspect and make a determination of conformity (i.e. Medical gas supply systems)).
- E6: Good Clinical Practice: Consolidated guideline, International Conference on Harmonization, ICH Harmonized Tripartite Guideline (1997).
- National Environmental Laboratory Accreditation Conference (NELAC) Standards, Chapter 5 "Quality System Standard" (mandatory for any laboratory accredited by NELAC)
- Organisation for Economic Co-operation and Development (OECD) Principles on Good Laboratory Practice, OECD Series on Principles of Good Laboratory Practice (GLP) and Compliance Monitoring No. 1, US Environmental Protection Agency (EPA) 40 CFR Part 160 and 40 CFR Part 792, and US Food and Drug Administration (FDA) Good Laboratory Practice (GLP) 21 CFR Part 58 (mandatory for those laboratories (BC only) which conduct studies claiming compliance to one or more of these documents).
- Programme d'Accreditation des Laboratoires d'Analyse (PALA) (compliance mandatory for Quebec laboratories)
- US EPA. 1994. Contract Laboratory Program National Functional Guidelines for Inorganic Data. Review Office of Emergency and Remedial Response. U.S. Environmental Protection Agency. Washington, DC 20460. EPA 540/R-94/013.
- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. EPA-540-R-08-01; June 2008
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review OSWER 9240.1-51. EPA 540-R-10-011; January 2010
- USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review. EPA-540-R-11-016; September 2011
- ISO 17020:2012 Conformity assessment -- Requirements for the operation of various types of bodies performing inspection (note that additional policies required for this standard can be found in Attachment 2 of this document).
- The NELAC Institute (TNI); Environmental Laboratory Sector, Standards: EL-V1-2009, EL-V1M2-2009-Rev1.1; EL-V1M4-2009-Rev1.1

#### 2.4 Maxxam Laboratory Management System Requirements

COR FCD-00209 contains the list of Maxxam laboratories and the applicable management system elements for each.

### **3.0 DEFINITIONS**

See COR WI-00012 for list of definitions

### **4.0 SAFETY**

N/A

### **5.0 RESPONSIBILITIES**

See Section 6.4.2.6

### **6.0 Procedure**

Sections 6.1 to 6.3 have been excluded to keep the numbering consistent with ISO 17025.

## **6.4.0 MANAGEMENT REQUIREMENTS**

### **6.4.1 ORGANIZATION**

#### ***Complies with ISO 17025 section 4.1***

- 6.4.1.1 The legal name of the company is Maxxam Analytics International Corporation, operating as Maxxam Analytics (Maxxam Analytique in Québec) incorporated under the laws of the Federal government since 1995, or provincial government, where applicable (i.e. Québec). Business licenses have been obtained if required by Provincial and Municipal jurisdictions. Headquarters are located in Mississauga, Ontario.
- 6.4.1.2 The laboratory is responsible for carrying out its testing activities in a manner that meets ISO 17025, the needs of the customer, regulatory authorities or recognition organizations.
- 6.4.1.3 Maxxam has many facilities in Canada. The facilities in Canada are organized into lines of business. The laboratory facility locations can be found in COR FCD-00209, all Maxxam facilities can be found on [www.maxxam.ca](http://www.maxxam.ca).
- The laboratory management system covers work carried out in the laboratory's permanent facilities and the following non-permanent operations; field services in Grande Prairie, Edmonton, Red Deer and Fort St. John, accredited mobile laboratories operating out of Burnaby, Edmonton, Ottawa and Montreal, and other non-permanent operations that arise in the course of business.
- 6.4.1.4 Maxxam Analytics is an independent testing laboratory (and thus no conflict as in ISO 17025 section 4.1.4).
- 6.4.1.5 a) Maxxam laboratories have appropriate supervision and analysts who, irrespective of other responsibilities, have been given the authority and resources needed to carry out their duties, including implementation, maintenance and improvement of the management system, and identify the occurrence of departures from the management system or from the procedures for performing tests, and to initiate actions to prevent or minimize these departures. Typically, Policy Deviation Forms (PDFs), Contact Management Reports (CRMs or CMRs), Non-Systemic CARs (NSCs) and/or Corrective Action Reports (CARs), Bench Level Non-Conformances and/or Maxxam Internal Audits are used to document these departures or non-conformances.
- 6.4.1.5 b) Maxxam has arrangements to ensure that its management and personnel are free from any undue internal and external commercial, financial and other pressures and influences that may adversely affect the quality of their work. See COR WI-00007 "Code of Ethical Standards, Business Practices and Data Integrity. Upon hire, all Maxxam personnel are required to read and understand COR WI-00007. Once read, the employee then completes the agreement (attestations) in CompliantPro. This agreement is repeated approximately every year and details the high level of ethical conduct that is expected of Maxxam personnel.
- 6.4.1.5 c) Maxxam has policies and procedures to ensure the protection of its customers' confidential information and proprietary rights, including procedures for protecting storage and transmission of results. Maxxam's Confidentiality Policy: It is Maxxam's policy to ensure that our customers' information is kept confidential. This includes protecting any customer proprietary rights and protecting the electronic storage and transmission of results.
- 6.4.1.5 d) It is Maxxam's policy that staff avoids involvement in any activities that would diminish confidence in our competence, impartiality, judgment or operational integrity. This is detailed in COR WI-00007.

- 6.4.1.5 e) Maxxam has defined the organization and management structure of the laboratory within Organizational Charts. These can all be found in CompliantPro as form control documents (FCDs). Each laboratory location maintains its own organizational chart, which outlines the relationships between quality management, technical operations and support services, where required. Maxxam’s corporate structure organizational chart can be found in COR FCD-00144.
- 6.4.1.5 f) The responsibility, authority and interrelationships of all personnel who manage, perform or verify work affecting the quality of results can be found in the appropriate job descriptions for management, as well as the relevant organizational charts.
- 6.4.1.5 g) Adequate supervision is provided by management. This includes supervision of testing staff including trainees, by personnel familiar with our methods and procedures, purpose of each test, and with the assessment of the test results.
- 6.4.1.5 h) Maxxam has technical management who have overall responsibility for the technical operations and the provision of the resources needed to ensure the required quality of laboratory operations. Details can be found in the appropriate job descriptions for management, as well as the relevant organizational charts.
- 6.4.1.5 i) Maxxam has appointed staff as quality manager. At Maxxam this role is held by the regional Quality Assurance Managers. Each Quality Assurance Manager has responsibility and authority for ensuring that the management system is implemented and followed at all times and has direct access to the highest level of management at which decisions are made on laboratory policy or resources. See also section 6.4.2.6 for additional responsibilities.
- 6.4.1.5 j) Maxxam has appointed deputies for key management personnel.

Title	Substitute
Director - Quality & EHS	CEO, or QA Manager
QA Manager	Director - Quality & EHS, QA Specialist
QA Coordinator	QA Manager, other QA coordinator, QA Specialist
QA Specialist	QA Specialist/ QA Coordinator or QA Manager
Vice President, Senior VP	Director, General Manager or CEO
Director	General Manager, Vice President
General Manager	Director, Vice President, Department Manager
Department Manager	General Manager, Supervisor/Technical Specialist
Supervisor	Department Manager or Senior Analyst
Sr. Analysts	Supervisor
Analyst	Sr. Analysts
Analyst/Medical Gas Representative (MGR)	Authorized Analyst/MGR (Same Field of Expertise)

Note that in certain locations, Laboratory Coordinator is equivalent to Supervisor.

- 6.4.1.6 Maxxam’s top management (i.e. senior managers) ensures that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system. This includes monthly scorecards prepared by QA staff and posted on Maxxam’s intranet. The National Director - Quality and EHS emails scorecards to all General Managers, Directors and Vice Presidents, who are responsible for disseminating this information. Each manager at their specific location will have appropriate communication means within their laboratories. QA staff conduct regular audits to monitor the effectiveness of the management system and report findings to management. See section 6.4.14 for more details on the auditing program. There are Town Hall meetings chaired by senior management for all staff to communicate the current activities within the corporation as they pertain to staff.

## 6.4.2 MANAGEMENT SYSTEM

### *Complies with ISO 17025 section 4.2*

- 6.4.2.1 Maxxam has established, implemented and maintains a management system appropriate to the scope of our testing. The laboratory has documented our policies and procedures in the form of Standard Operating Procedures (SOPs) and Work Instructions (WIs) to the extent necessary to assure the quality of test results. See Attachment 1-Table C for the Management System Documentation Cross Reference Guide. A cross reference table is also available for the US EPA, US FDA, and OECD GLPs. Refer to BBY1FCD-00049 (applicable to BC only).

Whenever possible, reference is made in the procedure to other applicable procedures, which are communicated to, read, understood and implemented by staff. All applicable procedures are available to staff; either electronically in our CompliantPro system (see section 6.4.3 for more information regarding CompliantPro) or paper copies. Our documentation is available and presented such that the staff must understand and implement the applicable policies and procedures. Management system training is given to laboratory staff by the Quality Assurance staff upon hire.

- 6.4.2.2 Maxxam's management system policies related to quality, including the quality policy statement is defined within this corporate quality manual. The overall quality objectives are established and are reviewed during management review. See section 6.4.15 for more details on management review.

Maxxam's quality policy and objectives are issued by the QA department, and are approved by the Director of QA and the CEO. They can be found in COR FCD-00167. It includes Maxxam's commitment to good professional practice and to the quality of its testing in servicing its customers, Maxxam's statement of our standard of service, the purpose of the management system related to quality, a requirement that all staff concerned with testing familiarize themselves with the quality documents and implement the policies and procedures in their work, and Maxxam's commitment to comply with ISO 17025 and to continually improve the effectiveness of the management system.

To ensure the success of the quality policy and objectives, senior management is responsible for ensuring that current and successive staff has the appropriate education and training to adequately perform their duties to meet the conditions of the quality policy. This includes the commitment to institute an on-going training program to ensure staff are capable and qualified to carry out assigned work. To monitor the effectiveness of the training program, monitoring mechanisms such as check samples, blind samples, and performance in external performance evaluation studies as well as internal audits shall be initiated and maintained.

- 6.4.2.3 Top management provides evidence of commitment to the development and implementation of the management system and to continually improve its effectiveness. This can be seen by reviewing the organizational charts and job descriptions for the QA staff, reviewing scorecards, meeting minutes and audit reports as examples.

- 6.4.2.4 Senior management communicates to all staff regarding the importance of meeting customer requirements as well as statutory and regulatory requirements. This can be accomplished through town halls, news posted on Maxxam's intranet, and regular operations meetings. The daily implementation and monitoring of the management system is the responsibility of the

quality assurance management and staff. The specifics of the quality assurance program are documented in the appropriate Work Instructions and Standard Operating Procedures.

- 6.4.2.5 This quality manual includes or makes reference to the supporting procedures including technical procedures. Section 6.4.3 of this quality manual outlines the document control structure at Maxxam. This Quality Manual is considered to be the highest level document within Maxxam. Certain quality procedures are considered the second level documents, and must always reflect the policies stated in this quality manual. Analytical and Work Instruction procedures as well as forms are the third level documents.
- 6.4.2.6 Roles and responsibilities of technical management and the QA manager, including their responsibility for ensuring compliance with ISO 17025 and Maxxam's management system are defined below.

**Note:** All job descriptions for other positions are kept by appropriate staff (i.e. Human Resources) where required.

6.4.2.6.1 President/CEO

Manages all aspects of the network laboratories to ensure a high level of customer satisfaction, a positive working environment, and to meet profitability targets. Also determines the long-term strategic plan for the company to ensure it is consistent with corporate requirements.

Responsibilities include:

- Establishing objectives for the laboratory network
- Authorizing and organizing the establishment of departments and associated senior staff positions
- Allocating funds to implement policies and procedures
- Representing or delegating representatives to act on behalf of the organization in negotiations, business development opportunities, external Boards, committees and other functions
- Ensuring that all quality standards and health and safety regulations are adhered to

- 6.4.2.6.2 Director of Quality and EHS (Environment, Health & Safety) Reports to the CEO. The position normally requires a university degree and/or 10+ years of relevant experience. Responsibilities include:

- Establishing objectives for the laboratory health and safety along with the quality focus, formulating and approving policies and procedures.
- Budgeting and allocating funds to implement policies and procedures, approving human resources to assure the corporate risk associated with quality and health and safety are kept to a minimum.
- Selecting and hiring of senior staff and conducting performance reviews
- Representing the organization in business development opportunities, external Boards, committees and other functions
- Assuring proper training programs are established pertaining to health and safety along with maintaining the highest standards relating to quality including the continuous improvement initiatives of the Corporation.

6.4.2.6.3 Vice President and Senior Vice President

Reports to the CEO and is responsible for overall business and financial aspects of the laboratory, to ensure a high level of customer satisfaction, a positive working environment and to ensure that profitability targets are achieved.



The VP will ensure that management is consistent with the long-term strategic plans and policies of the company. This position normally requires a university degree (or equivalent) and 10+ years of experience in operations.

#### 6.4.2.6.4 General Manager or Director

Reports to the Vice President and manages various aspects of Laboratories and Customer Service Centres including technical operations, customer service, sales, marketing, pricing and administrative functions to ensure high levels of customer satisfaction, positive working environments for staff and contribution margins are being achieved.

- Overall management of technical services including instrument acquisition and development and use of accepted, cost effective analytical methodologies.
- Responsible to Quality Assurance management in matters related to QA/QC. Ensures that the management of the laboratory is consistent with the long-term strategic plans and policies of Maxxam.
- This position normally requires a Chemistry university degree (or equivalent) and 10+ years of experience in laboratory operations.

#### 6.4.2.6.5 Department Manager

Report to the General Manager and are responsible for the technical operation of a specific section of the laboratory.

- They are responsible for financial and production performance of their group as well as adherence to QA/QC requirements. They meet the applicable requirements of accreditation standards.
- Technical managers, in conjunction with the QA Manager, have the authority to authorize changes to the Management system if required. This position requires a minimum of a B.Sc. or equivalent and at least 5+ years laboratory experience.

#### 6.4.2.6.6 Project Manager/Customer Service Staff

Report to the appropriate Customer Service Manager and serve as the primary interface between customers and the laboratory. They ensure that customer requirements are understood and transmitted clearly to the appropriate laboratory staff.

- They monitor progress of the customer's samples through the laboratory, promptly respond to inquiries and develop a final report by the date agreed upon with the customer. They provide customer feedback on service issues.
- These positions typically require a B.Sc. in chemistry or a related field with 3-5 years laboratory experience. Prior customer service, sales and marketing experience is beneficial.

#### 6.4.2.6.7 Information Technology (IT) Manager

Reports to the Vice President and is responsible for the maintenance and development of all computer systems within the laboratory and for the validation and documentation of all new software products developed in house.

- The IT Manager is also responsible for archiving and managing the data in the LIMS, maintaining the integrity of any servers in operation and providing necessary guidance for maintaining adequate computer security and virus protection.
- Typically requires a B.Sc. in computer science or a related field with 10+ years experience, 4 years of which relate to laboratory database management.

#### 6.4.2.6.8 Quality Assurance

The management of the management system, as described in this manual, requires the services of QA Coordinators, Specialists, and Managers, under the direction of the

Director of Quality, to carry out the monitoring, documentation and other functions required by the system.

Responsibilities of Quality Assurance personnel are described below:

- The QA Manager is responsible for implementing all aspects of the management system and for taking or recommending measures to ensure the fulfillment of the quality objectives. The QA Manager is also responsible for implementing the tenets of the quality manual in the most efficient and economical manner commensurate with ensuring continuing accuracy and precision of data produced.
- The QA Manager bears the primary responsibility for the preparation, issue, review and upkeep of the Quality Manual. These procedures are detailed in appropriate quality documents. These duties may be delegated to other QA staff.
- The QA Specialist responsibilities include project management and participating and providing input for Corporate Teams.
- The QA Coordinators are responsible for working with laboratory staff to develop and implement QA programs, which meet the needs of customers and accreditation authorities.
- All quality assurance activities of the laboratory are monitored by the QA staff. This is done in order to determine conformance to authorized policies and procedures and to make appropriate recommendations for correction and improvement, as required. The monitoring process covers procedures, external programs, and internal audits.

- 6.4.2.7 Top management ensures that the integrity of the management system is maintained when changes to the management system (this quality manual, corporate work instructions, etc) are planned and implemented. Accreditation bodies will be notified of any changes to the a) legal, commercial, ownership or organizational status; b) organization, top management and key personnel; c) main policies; d) resources and premises; e) scope of accreditation; and, f) other such matters that may affect the Maxxam's ability to fulfill requirements for accreditation.

#### **6.4.3 DOCUMENT CONTROL**

***Complies with ISO 17025 section 4.3***

Maxxam has established and maintains procedures to control all documents that form part of its management system (internally generated or from external sources), such as regulations, standards, other normative documents, test methods, software, specifications, instructions and manuals. These can be hard copy or electronic.

Note: the control of data related to testing is covered in section 6.5.4.7. The control of records is covered in section 6.4.13.

#### **6.4.4 REVIEW OF REQUESTS, TENDERS AND CONTRACTS**

***Complies with ISO 17025 section 4.4***

Maxxam has established and maintains procedures for review of requests, tenders and contracts; see COR WI-00005 for details.

#### **6.4.5 SUBCONTRACTING OF TESTS**

***Complies with ISO 17025 section 4.5***

Subcontracting is the term used when Maxxam sends samples for tests that they are accredited for to another laboratory for testing. This may be due to workload, temporary incapacity, etc. If Maxxam is NOT accredited for the test, but is sending samples for that test to another laboratory, then this is considered to be a 'supplier-vendor' relationship, and not considered 'subcontracting' according to ISO 17025. However, for simplicity at Maxxam, all samples sent to other laboratories for testing is called "Subcontracting".

When Maxxam subcontracts work, whether because of unforeseen reasons (e.g. workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g. through permanent subcontracting or agency arrangements), the work is to be placed with a competent subcontractor.

**6.4.6 PURCHASING SERVICES AND SUPPLIES**

***Complies with ISO 17025 section 4.6***

Maxxam's Purchasing Policy: For services and supplies that affect the quality of tests, Maxxam must select and purchase these services and supplies from approved suppliers.

The corporate purchasing procedure used at Maxxam outlines the selection and purchasing of services and supplies it uses that affect the quality of the tests. These procedures include purchasing, receiving and storage of reagents and laboratory consumable materials relevant for the tests.

**6.4.7 SERVICE TO CUSTOMER**

***Complies with ISO 17025 section 4.7***

6.4.7.1 Maxxam is willing to cooperate with customers or their representatives in order to clarify the customers' request and to monitor the laboratory's performance in relation to the work performed, provided that the laboratory ensures confidentiality to other customers. Customer visits/audits to our laboratories are encouraged, provided that confidentiality of other customers' work is not jeopardized. COR FCD-00007: Maxxam Confidentiality Agreement is to be used in these instances; other than regulatory or accreditation audits.

6.4.7.2 Customer feedback, both positive and negative is encouraged at Maxxam Analytics. Maxxam solicits customer feedback through a variety of mechanisms including but not limited to:

- a) direct customer meetings and formal reviews;
- b) incident based response via our CRM systems that capture customer intelligence including positive and negative feedback;
- c) senior executive customer meetings with Maxxam and customers with specific reference to feedback and areas of improvement which are cascaded down to specific managers.

Feedback will be used and analyzed to improve the management system, testing activities and customer service through channels including but not limited to CARs, NSCs, and meetings with the customer.

6.4.7.3 Maxxam Analytics has a highly trained team of Customer Service / Sales Representatives available to receive calls, answer queries, provide quotations, and assess the customer's needs while understanding and ensuring any regulatory requirements are met. These teams ensure all reporting of results and invoicing meets the customer's requirements within their customer base. Documentation of all customer communication is completed by the service

representatives in various forms, including logbooks, and electronic systems and emails. Complaints are documented as in section 6.4.8.

- 6.4.7.4. Customer service representatives are requested to meet with major customers on average twice per year to better understand customer needs.

#### **6.4.8 COMPLAINTS**

##### ***Complies with ISO 17025 section 4.8***

Maxxam Complaint Policy: Maxxam has implemented a complaint procedure for the resolution of complaints received from customers or other parties. When a complaint is received from a customer or other party, the laboratory must first investigate to ensure that the complaint is a valid one. If it is, then a record is generated and action is completed and documented. These valid complaints are then documented within either the Non-Systemic CAR (NSC) or Corrective Action Report (CAR), both of which are found in the CompliantPro system. See sections 6.4.9 and 6.4.11 for more details.

**Note:** As per ISO/IEC 17020:2012 Section 15 the inspection body shall have documented procedures for the consideration and resolution of appeals against the results of its inspections, where these are carried out under legally delegated authority.

#### **6.4.9 CONTROL OF NON-CONFORMING TESTING**

##### ***Complies with ISO 17025 section 4.9***

Maxxam Policy on Non-conforming Testing: Maxxam will take action when any aspect of the laboratory's testing, or the results of the laboratory's work, do not conform to our own procedures or the agreed requirements of the customer or to accreditation, regulatory and compliance requirements including but not limited to GLP, GMP, ISO, SOP, and policies. Responsibility and authority for the management of nonconforming work are designated and actions are defined and taken when nonconforming work is identified (see COR WI-00010 for details). This policy ensures that an evaluation of the significance of the nonconformance must be made; correction is taken immediately, together with a decision about the acceptability of the nonconformance; where necessary, the customer is notified and work is recalled; and the responsibility of authorizing the resumption of work is defined (in COR WI-00010). See also Maxxam's procedure for escalating quality issues (COR WI-00127).

SCC, CALA and MEQ interpretative guides clarify the following: It is necessary to inform the customer only if non-conforming work has a "significant influence" and affected the test/measurement result.

Where the evaluation indicates the nonconforming work could recur or that there is doubt about the compliance of the laboratory's operations with its own policies and procedures, the corrective action procedures in section 6.4.11 are to be followed.

#### **6.4.10 IMPROVEMENT**

##### ***Complies with ISO 17025 section 4.10***

Maxxam continually improves the effectiveness of our management system through the use of our quality policy and objectives, audit results, analysis of data, non-conformances, management of change, corrective and preventive actions and management reviews.

Regular Quality Improvement (QI) meetings enhance and improve the quality system and are attended by Operations and QA. Quality issues of concern are addressed and resolved such as analysis of data and

conformance to standard operating procedures and quality policies. Quality plans are developed for most Maxxam locations yearly, and many Continuous Improvement and Kaizen initiatives also aid in the continual improvement of our management system.

#### **6.4.11 CORRECTIVE ACTION**

***Complies ISO 17025 section 4.11***

Maxxam Policy on Corrective Action: Maxxam will initiate the corrective action procedure when nonconforming work or departures from policies and procedures in the management system or technical operations have been identified. Maxxam's corrective action procedure (COR WI-00011) designates appropriate authorities for the implementation and approval of the corrective actions.

#### **6.4.12 PREVENTIVE ACTION**

***Complies with ISO 17025 section 4.12***

Needed improvements and potential sources of non-conformances (either technical or concerning the management system) are identified. If improvement opportunities are identified or if preventive action is required, an action plans is developed, implemented and monitored to reduce the likelihood of the occurrence of such non-conformances and to take advantage of the opportunities for improvement.

#### **6.4.13 CONTROL OF RECORDS**

***Complies with ISO 17025 section 4.13***

The laboratory has established and maintains procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records, whatever their type or format. Quality Records shall include reports from internal audits and management reviews as well as records of corrective and preventive actions. Control of internal laboratory procedures and work instructions are discussed in section 6.4.3. See Attachment 1-Table B for the matrix relating to quality records.

#### **6.4.14 INTERNAL AUDITS**

***Complies with ISO 17025 section 4.14 and ISO 19011***

Maxxam periodically, and in accordance to a predetermined schedule and procedure, conducts internal audits of its activities to verify that its operations continue to comply with the requirements of the management system and ISO 17025. The internal audit program addresses all elements of the management system, including the testing activities. It is the responsibility of the quality manager to plan and organize the internal audits as required by the audit schedule and requested by management. These audits are carried out by trained and qualified staffs that are independent of the activity being audited. Auditors shall not audit their own work.

#### **6.4.15 MANAGEMENT REVIEWS**

***Complies with ISO 17025 section 4.15***

Each year, the laboratory's top management conducts a review of the laboratory's management system and testing activities to ensure their continued suitability, adequacy and effectiveness, and to introduce necessary changes or improvements.

The content of the review is detailed in the Corporate Management Review procedure (COR WI-00003).

Findings from management reviews and the actions that arise from them shall be recorded. Top Management ensures that those actions are carried out within an appropriate and agreed timescale.

## **6.5.0 TECHNICAL REQUIREMENTS**

*Complies with ISO 17025 section 5.0*

### **6.5.1 General**

6.5.1.1 Many factors determine the correctness and reliability of the tests performed by Maxxam. These factors include contributions from: human factors (see 6.5.2), accommodation and environmental conditions (see 6.5.3), test methods and method validation (see 6.5.4), equipment (see 6.5.5), measurement traceability (see 6.5.6), sampling (see 6.5.7) and the handling of test items (see 6.5.8).

6.5.1.2 The extent to which the factors contribute to the total uncertainty of measurement differs considerably between test and types of tests. The laboratory shall take account of these factors in developing test methods and procedures, in the training and qualification of personnel, and in the selection and calibration of the equipment it uses.

### **6.5.2 PERSONNEL**

**Complies with ISO 17025 section 5.2**

**6.5.2.1 Maxxam Policy on Training:** Maxxam laboratory management ensures the competence of all who operate specific equipment, perform tests, evaluate results and sign test reports. When using staff who are undergoing training, appropriate supervision is provided. Personnel performing specific tasks are qualified on the basis of appropriate education, training, experience and/or demonstrated skills as required.

6.5.2.2 The management of the laboratory formulates goals with respect to education, training and skills of the laboratory personnel. This is typically done annually with each employee during their personal review or at time of hire. The laboratory has a policy and procedure for identifying training needs and providing training of personnel. The training program is relevant to the present and anticipated tasks of the laboratory. The effectiveness of the training actions taken is evaluated.

6.5.2.3 The laboratory uses personnel who are employed by, or under contract to, the laboratory. Where contracted and additional technical and key support personnel are used, the laboratory ensures that such personnel are supervised and competent and that they work in accordance with the laboratory's management system.

6.5.2.4 The laboratory maintains current job descriptions for managerial, technical and key support staff involved in testing.

6.5.2.5 Maxxam management authorizes specific personnel to perform particular types of sampling, tests, to issue test reports, to give opinions and interpretations and to operate particular types of equipment. Maxxam maintains records of the relevant authorization, competence, educational and professional qualifications, training, skills and experience of all technical personnel, including

contracted personnel. This information is recorded on employee Curriculum Vitae (CVs) and training forms.

### **6.5.3 Accommodation and Environmental Conditions**

#### ***Complies with ISO 17025 section 5.3***

Floor plans of the physical layout of all Maxxam laboratories are available.

- 6.5.3.1 Laboratory facilities for testing, including but not limited to laboratory design, energy sources, lighting and environment conditions, are such as to facilitate correct performance of the tests and to minimize potential sources of contamination. The laboratory ensures that the environmental conditions do not invalidate the results or adversely affect the required quality of any measurement. Particular care shall be taken when tests are undertaken at sites other than the permanent laboratory facilities. The technical requirements for accommodation and environmental conditions that can affect the test results are documented in the appropriate laboratory method and instrument procedures.
- 6.5.3.2 The laboratory monitors, controls and records environmental conditions as required by relevant specifications, methods and procedures or where they influence the quality of the results. Environmental conditions include temperature of rooms, humidity, lighting, etc. Testing is stopped when the environmental conditions jeopardize the results of the tests.
- 6.5.3.3 Wherever applicable, there is effective separation between neighboring areas in which there are incompatible activities. Measures are taken to prevent cross-contamination.
- 6.5.3.4 Access to and use of areas within the laboratory is restricted and controlled (electronically, where available). Each laboratory must determine the extent of control based on its particular circumstances.
- 6.5.3.5 Measures are taken to ensure and promote good housekeeping in the laboratory. Special procedures shall be prepared where necessary.
- 6.5.3.6 Measures are taken to ensure safety in the laboratory. The Maxxam Environment, Health and Safety (EHS) program (found in various Safe Work Procedures, Safety Policies, and the Safety Guide (MEHS WI-00013)) as well as Critical Task Analysis (CTA) provide staff with instructions for all safety measures used in the laboratory. There are Joint Health and Safety Committees, made up of management and laboratory staff, which makes recommendations to senior management regarding safety concerns or improvements.

**6.5.4 Test Methods and Method Validation**  
***Complies with ISO 17025 section 5.4***

6.5.4.1 The laboratory uses appropriate methods and procedures for all tests within its scope. These include sampling, handling, transport, storage and preparation of items to be tested and, where appropriate, an estimation of measurement uncertainty as well as statistical techniques for analysis of test data.

The laboratory uses instructions (procedures) for the use and operation of all relevant equipment, and for the handling and preparation of items for testing where the absence of such instructions could jeopardize the results of tests. Laboratory procedures related to equipment, analytical methods, general and facility procedures are identified within the CompliantPro document control system. All instructions, standards, manuals and reference data relevant to the work of the laboratory are kept up to date and made readily available to personnel. Deviation from test methods occurs only if the deviation is documented, technically justified, authorized and approved by the supervisor/manager and communicated to the customer. See COR WI-00040 Corporate Procedure for Policy Deviation Forms.

6.5.4.2 Selection of Methods

6.5.4.2.1 The laboratory uses test methods which meet the needs of the customer and which are appropriate for the tests it undertakes. Methods published in international, regional or national standards are preferably used. It is intended that the laboratory ensures that it uses the latest valid edition of a standard method. Only if it is not appropriate or possible to do so can an outdated reference method be used. When necessary, the standard method is supplemented with additional details to ensure consistent application (i.e., written into a company procedure, referencing the standard method).

6.5.4.2.2 When a customer does not specify the method to be used, the laboratory selects appropriate methods that have been published either in international, regional or national standards, or by reputable technical organizations, or in relevant scientific tests or journals, or as specified by the manufacturer of the equipment or supplies. Laboratory developed methods or methods adopted by the laboratory may also be used if they are appropriate for the intended use and if they are validated. The customer is informed as to the method chosen. The laboratory shall confirm that it can meet the requirements of a standard method before introducing the test. If there is a significant change to the standard method, the confirmation must be repeated. The laboratory informs the customer when the method proposed by the customer is considered to be inappropriate or out of date.

6.5.4.3 Laboratory Developed Methods

The introduction of test methods developed by the laboratory for its own use are planned activities and are assigned to qualified personnel equipped with adequate resources. Plans are updated as development proceeds and effective communication amongst all personnel involved is ensured.

6.5.4.4 Non-Standard Methods

When it is necessary to use methods not covered by standard methods, these shall be subject to agreement with the customer and shall include a clear specification of the customer's requirements and the purpose of the test. The method developed is appropriately validated before use or qualified as "non routine" with suitable disclaimers.

6.5.4.5 Validation of Methods



- 6.5.4.5.1 Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
- 6.5.4.5.2 The laboratory validates technical procedures, non-standard methods, laboratory designed/developed methods, standard methods used outside their intended scope, and amplifications and modifications of standard methods, to confirm that the methods are fit for their intended use. The validation is as extensive as is necessary to meet the needs of the given application or field of application. The laboratory records the results obtained, the procedure used for validation, and a statement as to whether the method is fit for the intended use.
- 6.5.4.5.3 The range and accuracy of the values obtainable from validated or verified methods (e.g., the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object), as assessed for the intended use, are relevant to the customers' needs.
- 6.5.4.6 Estimation of Uncertainty of Measurement
- 6.5.4.6.1 MU acknowledges that no measurements can be perfect and is defined as a "parameter associated with the result of a measurement, that characterizes the dispersion of values that could reasonably be attributed to the measurand" (VIM 1993 - Ref B6). For example, 20 ppm +/- 2 ppm; where "2" represents the uncertainty around the reported value of 20 ppm.
- 6.5.4.6.2 Maxxam has and applies procedures for estimating uncertainty of measurement. In certain cases the nature of the test method may preclude rigorous, metrologically and statistically valid, calculation of uncertainty of measurement. In these cases the laboratory must at least attempt to identify all the components of uncertainty and make a reasonable estimation, and shall ensure that the form of reporting of the result does not give a wrong impression of the uncertainty. Reasonable estimation shall be based on knowledge of the performance of the method and on the measurement scope and shall make use of, for example, previous experience and validation data.
- 6.5.4.6.3 When estimating uncertainty of measurement, all uncertainty components which are of importance in the given situation shall be taken into account using appropriate methods of analysis.
- 6.5.4.7 **Control of Data**
- 6.5.4.7.1 Calculations and data transfers are subject to appropriate checks in a systematic manner.
- 6.5.4.7.2 When computers or automated equipment are used for the acquisition, processing, recording, storage or retrieval of test data, the laboratory ensures that:
- Computer software developed by the laboratory is documented in sufficient detail and is suitably validated as being adequate for use;
  - Procedures are established and implemented for protecting the data; such procedures include, but not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;
  - Computers and automated equipment are maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of test data;
  - Note: commercial off-the-shelf software in general use within their designed application range may be considered to be sufficiently validated. However, laboratory software configuration/ modifications are to be validated.

## 6.5.5 EQUIPMENT

### *Complies with ISO 17025 section 5.5*

- 6.5.5.1 The laboratory is furnished with all items of sampling, measurement and test equipment required for the correct performance of the tests. In those cases where the laboratory needs to use equipment outside its permanent control, it ensures that the requirements of the ISO 17025 International Standard and Maxxam's management system are met.
- 6.5.5.2 Equipment and its software used for testing and sampling are capable of achieving the accuracy required and comply with specifications relevant to the tests concerned. Calibration programs have been established for key quantities or values of the instruments where these properties have a significant effect on the results. Before being placed into service, equipment is calibrated or checked to establish that it meets the laboratory's specification requirements and complies with the relevant standard specifications. It shall be checked and/or calibrated before use (see section 6.5.6).
- 6.5.5.3 Equipment is operated by authorized personnel. Up to date procedures on the use and maintenance of equipment are readily available for use by the appropriate laboratory personnel.
- 6.5.5.4 Each item of equipment and its software used for testing and calibration and significant to the result is, where practicable, uniquely identified.
- 6.5.5.5 Records are maintained of each item of equipment and its software significant to the test performed. The records include at a minimum the following:
- a) identity of equipment and its software,
  - b) the manufacturer's name, type identification, and serial number or other unique identification,
  - c) checks that the equipment complies with the specification,
  - d) the current location (where appropriate),
  - e) the manufacturer's instructions (if available or reference to their location),
  - f) dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of the next calibration;
  - g) the maintenance plan, where appropriate, and maintenance carried out to date;
  - h) any damage, malfunction, modification or repair to the equipment.
- Dependent upon the location, these records are available in different locations (e.g. equipment list, maintenance logs, etc.).
- 6.5.5.6 The laboratory has procedures for safe handling, transport, storage, use and planned maintenance of measuring equipment to ensure proper functioning and in order to prevent contamination or deterioration. Maxxam takes care to package equipment appropriately, to prevent damage during shipping.
- 6.5.5.7 Equipment that has been subjected to overloading or mishandling, gives suspect results, or has been shown to be defective or outside specified limits, shall be taken out of service. It shall be isolated to prevent its use or clearly labeled or marked as being out of service until it has been repaired and shown by calibration or test to perform correctly. (Use of COR FCD-00072 "Out of Service Form" may be appropriate). The laboratory examines the effect of the defect or

departure from specified limits on previous tests and institutes the control of nonconforming work procedure when appropriate (see section 6.4.9).

- 6.5.5.8 Whenever practicable, all equipment requiring calibration is labeled to indicate the status of the calibration, including the date when last calibrated and the due date of the next calibration. However, frequently calibrated equipment (calibrated on an as-used basis) do not require calibration labels.
- 6.5.5.9 When, for whatever reason, equipment goes outside the direct control of the laboratory, the laboratory ensures that the function and calibration status of the equipment are checked and shown to be satisfactory before the equipment is returned to service.
- 6.5.5.10 When intermediate checks are needed to maintain confidence in the calibration status of the equipment, these checks are carried out according to the defined procedure within the appropriate instrument or method procedure.
- 6.5.5.11 Where calibrations give rise to a set of correction factors, the laboratory has procedures to ensure that copies (e.g., in computer software) are correctly updated
- 6.5.5.12 Test equipment, including both hardware and software are safeguarded from adjustments which would invalidate the test results, wherever possible.
- 6.5.5.13 Any temporary or mobile laboratories operated by Maxxam must have a work instruction defining the specific activities associated with the safe and effective movement of the equipment from site to site. The Work Instruction outlines all set-up and packing steps for all equipment (instruments, gas cylinders, balances etc).

## 6.5.6 MEASUREMENT TRACEABILITY

### *Complies with ISO 17025 section 5.6*

#### 6.5.6.1 General

All equipment used for tests, including equipment for subsidiary measurements (e.g., for environmental conditions) having a significant effect on the accuracy or validity of the result of the test, calibration or sampling is calibrated before being put into service. The laboratory has an established program and procedure for the calibration of its equipment. These procedures can be found in CompliantPro.

#### 6.5.6.2 Specific Requirements

##### 6.5.6.2.1 Calibration

Maxxam is not a calibration laboratory, and this section 5.6.2.1 of ISO 17025 does not apply.

##### 6.5.6.2.2 Testing

Maxxam's management system has been designed so as to ensure that tests conducted by the laboratory are traceable to the International System of Units (SI).

The laboratory establishes traceability of its own measurement standards and instruments to the SI by means of an unbroken chain of comparisons linking them to relevant primary standards of the SI units of measurements. The link to SI units may be achieved by reference to national measurement standards (e.g. NIST, NRC, etc). These national standards may be primary standards or secondary standards (which are standards calibrated by another

national metrology institute). When using external calibration services, traceability of measurement shall be assured by the use of calibration services from laboratories that can demonstrate competence, measurement capability and traceability. The calibration certificates issued by these laboratories shall contain the results, including the measurement uncertainty and/or statement of compliance with the identified metrological specification.

Where the traceability to SI Units is not possible, then calibration must provide confidence in measurements by establishing traceability to appropriate measurement standards, such as: use of certified reference materials, use of specified methods and/or consensus standards that are clearly described and agreed by all parties concerned. Participation in a suitable program of inter-laboratory comparisons is required where possible.

#### 6.5.6.3 Reference Standards and Reference Materials

##### 6.5.6.3.1 Reference Standards

The laboratory has a program for calibration of its reference standards (e.g., Class S weights and reference thermometers). These reference standards are calibrated by a body that can provide traceability to SI Units. These reference standards are used for calibration purposes only. Reference standards shall be calibrated before and after any adjustment.

##### 6.5.6.3.2 Reference Materials

Reference materials shall, wherever possible, be traceable to SI Units or to certified reference materials.

##### 6.5.6.3.3 Intermediate Checks

Checks needed to maintain confidence in the calibration status of reference, primary, transfer or working standards and reference materials are carried out according to defined procedures and schedules.

##### 6.5.6.3.4 Transport and Storage

The laboratory has procedures for safe handling, transport, storage and use of reference standards and reference materials in order to prevent contamination or deterioration and in order to protect their integrity.

## 6.5.7 SAMPLING

### *Complies with ISO 17025 section 5.7*

- 6.5.7.1 There are some laboratories in Maxxam which perform sampling on behalf of our customers. (e.g. Petroleum Department) For these laboratories, detailed sampling procedures have been written. The sampling plan and any sampling procedure must be available at the location where the sampling is undertaken. Sampling plans, whenever reasonable, be based on appropriate statistical methods. The sampling process addresses the factors to be controlled to ensure the validity of the test results.
- 6.5.7.2 Where the customer requires deviations, additions or exclusions from the documented sampling procedure, these are recorded in detail with the appropriate sampling data, are included in all documents containing test results and shall be communicated to the appropriate personnel.

- 6.5.7.3 The laboratory has procedures for recording relevant data and operations relating to sampling that forms part of the testing. These records include the sampling procedure used, the identification of the sampler, environmental conditions (if relevant) and diagrams or other equivalent means to identify the sampling location as necessary and, if appropriate, the statistics the sampling procedure is based on.
- 6.5.7.4 There are times when the submitted sample requires sub-sampling. Analytical methods or supporting procedures detail this process.

## **6.5.8 HANDLING OF TEST ITEMS**

### ***Complies with ISO 17025 section 5.8***

- 6.5.8.1 The laboratory has procedures for the transportation, receipt, handling, protection, storage, retention and/or disposal of test items, including all provisions necessary to protect the integrity of the test item and to protect the interests of the laboratory and the customer.
- 6.5.8.2 The laboratory has a system for identifying test items. This identification is retained throughout the life of the item in the laboratory. This system is designed to ensure that items cannot be confused physically or when referred to in records or other documents. This system accommodates a sub-division of groups of items and the transfer of items within and from the laboratory.
- 6.5.8.3 Upon receipt of the test item, abnormalities or departures from normal or specified conditions, as described in the test method, are recorded. When there is doubt as to the suitability of an item for testing, or when an item does not conform to the description provided, or the test required is not specified in sufficient detail, the laboratory must consult the customer for further instructions before proceeding and shall record the discussion.
- 6.5.8.4 The laboratory has procedures and appropriate facilities for avoiding deterioration, loss or damage to the test item during storage, handling, and preparation. If provided, handling instructions must be followed. When items have to be stored or conditioned under specific environmental conditions, these conditions are maintained, monitored and recorded. Where a test item or portion of an item is to be held secure, the laboratory has arrangements for storage and security that protect the condition and integrity of the secured items or portions concerned.

## **6.5.9 ASSURING THE QUALITY OF TEST RESULTS**

### ***Complies with ISO 17025 section 5.9***

- 6.5.9.1 The laboratory has quality control procedures for monitoring the validity of tests performed. The resulting data is reviewed and recorded in such a way that trends are detectable and, where practicable, statistical techniques are applied to the reviewing of results. This monitoring is planned and reviewed and may include, but not be limited to the following:
- a) regular use of certified reference materials and/or internal quality control using secondary reference materials;
  - b) participation in interlaboratory comparisons or proficiency testing programs
  - c) replicate tests using the same or different methods
  - d) retesting of retained items
  - e) correlation of results for different characteristics of an item.

6.5.9.2 Quality Control (QC) data is analyzed, and when they are found to be outside pre-defined criteria, planned action shall be taken to correct the problem and to prevent incorrect results from being reported.

6.5.9.3 If at any time, the laboratory is suspended for any test/parameter, then the appropriate senior managers must be informed immediately, and alternate arrangements must be made for testing to be conducted at either an accredited laboratory, or customers are informed that the test is suspended (this must be clear on the final report).

**Note:** for any drinking water regulations and microbiology testing, if the laboratory is suspended, the laboratory must not analyze samples for that particular test.

#### **6.5.10 REPORTING THE RESULTS**

##### ***Complies with ISO 17025 section 5.10 and ISO 17020 section 13***

The results of each test or series of tests carried out by the laboratory are reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the test methods.

The results are reported, usually in a test report, and include all the information requested by the customer and necessary for the interpretation of the test results and all information required by the method used. The format of the test report is designed to accommodate each type of test carried out to minimize the possibility of misunderstanding or misuse. Additional information may be included in a test report as requested by the customer or relevant regulatory authority as required.

In the case of a written agreement with the customer, the results may be reported in a simplified way. Any information required by the ISO standards which is not reported to the customer must be readily available in the laboratory which carried out the tests.

#### **7.0 Attachments**

Attachment 1 – Tables A, B, C

Attachment 2 – Additional Requirements for Medical Gas Testing Laboratory

**ATTACHMENT D**

**LABORATORY STANDARD OPERATING PROCEDURES**

**(Included in electronic copy only)**

<b>SOP 12</b>	<b>Revision: 12</b>	<b>Supersedes: Rev. 11</b>
<b>SAMPLE RECEIVING AND SAMPLE CONTROL</b>		
<b>Analyst Review:</b> <i>Beth A. Benedict</i>		
<b>Management:</b> <i>Matthe More</i>		
<b>Quality Assurance:</b> <i>B. C. C.</i>		
<b>Effective Date: 8 November 2016</b>		

<b>Revision</b>	<b>Description of Revision</b>
0	Revised Sample Log-In Checklist. Deleted Internal Transfer C-O-C. Added details on cleaning and decontamination of coolers. Changed C-O-C. Revised C-O-C Anomaly/Sample Acceptance Form. Updated Attachments. Incorporated SOPs 10B, 10C, 10D, 10E. Renamed and reformatted.
1	Section 7.1 – Refrigerator and freezer temperatures are recorded at least once daily. Included an example prep benchsheet Attachment 7.
2	Included procedure for the transfer/custody of samples or extracts back to client. Included procedures for use of IR thermometer. Update company name. Update attachments to current documents.
3	Section 2.1.8.1.6 – added requirement to measure temperature of air sample components wrapped in foil using a temperature probe or blank.
4	Section 2.1.8.1.6 – modified requirement to include all components wrapped in foil; Section 2.1.10 – differentiate between backup bottles received
5	Section 2.1.8 – daily check of the IR for Arizona compliance samples; correction to section 2.2.15
6	2.2.16 – Procedure if the time of the sample collection is not provided, time zone adjustment
7	Minor edits and clarifications; added DRS; email Acknowledgement letter
8	Added Section 2.6.2 – Storage of samples to be frozen
9	Revised SOP to reflect the new LIMS system “Element”. Added Section 8: Waste Disposal



10	Revised order of Sections 2.1.1 and 2.1.2. Added temperature correction to Section 2.1.1.7. Part of Section 2.2.14, now 2.5.15. Renumbered. Section 2.2.20.1.3: noted that samples received in 1 L containers are noted as "consumed". Added Section 2.2.25 for samples on Hold. Added Sections 2.5.4.1.1 and 2.5.4.1.2. Updated Attachment 7.
11	Added Section 8.4 and Attachment 8, Hazardous Materials Drum Form F7.0.
12	Updated Sample Log-in form and assigned F11.1 as the form number. Updated 2.1.7.1.1 with IR note.

CONFIDENTIAL

## 1. PURPOSE

- 1.1. This Standard Operating Procedure (SOP) describes the procedures for receiving and processing samples into the laboratory.

## 2. SAMPLE RECEIPT

- 2.1. Sample Log-In Checklist (Attachment 1)
  - 2.1.1. Initiate a Sample Log-In Checklist for each cooler/container received. Each Sample Log-In Checklist for multiple coolers/containers should be linked to each other (i.e. 1 of 3, 2 of 3, etc.).
  - 2.1.2. Initial, date and time of sample receipt. Initials on Sample Log-In Checklist and sign the C-O-C acknowledge receipt of samples by a Vista employee.
  - 2.1.3. The storage location on the Sample Log-In Checklist is to be filled out and COC signed when samples are not logged-in on the day of receipt (i.e. after hours receipt, see Section 3).
  - 2.1.4. Document the time sample was logged into ELEMENT and sample storage location.
  - 2.1.5. Record the method of delivery and whether shipping documentation is present
  - 2.1.6. Record the method of shipping preservation and the presence of ice, if applicable.
  - 2.1.7. Temperature Measuring and Recording
    - 2.1.7.1.1. Open the cooler and remove a representative sample. Wipe off any moisture. Aim the IR unit at the side of the container being sure that the target fills the field of view of the unit.

Note: If the temperature measured by an IR unit is less than 0°C, then it must be verified by a Digital Thermometer unit.
    - 2.1.7.1.2. Choose a spot on the container that is not obstructed by the sample tag or tamper proof tape.
    - 2.1.7.1.3. Hold the thermometer about three inches from the sample; pull the trigger, read the temperature and record.
    - 2.1.7.1.4. Release trigger to stop.

2.1.7.1.5. Ensure the Units of Measure is set to °C.

**Warning:**

- *Avoid direct exposure of human eyes to laser light. Eye damage may result.*
- *Never point the laser light at another person.*
- *Avoid indirect exposure via reflective surfaces, such as glass and mirrors.*

2.1.7.1.6. Each individual sample does not need to be measured for temperature. If a Temperature Blank is available or included, use the temperature blank to measure the temperature.

- Temperatures of any sample components wrapped in foil (such as air or tissues) must be taken using the temperature probe or temperature blank.

2.1.7.1.7. Record the temperature and the time the temperature was taken on the COC and Sample Login Checklist. Apply the appropriate temperature correction to the recorded temperature.

2.1.7.1.8. Temperature requirements do not apply to Methods M23, M0023A, NCASI 551, CARB 428, Japanese methodologies, or extracts.

2.1.7.1.9. IR Thermometer calibration is verified quarterly.

2.1.7.1.10. The Type-K Beaded Probe may also be immersed in the temperature blank.

- For Arizona compliance samples, the IR thermometer shall be checked the day of use against a bottle of water containing a calibrated thermometer, compliance should be within 0.5°C.

2.1.8. Inspect the condition of the shipping container. Indicate whether container and the container custody seals are present and intact.

2.1.9. Inspect the samples and determine whether adequate sample volume was received. Indicate if backup bottles were received on the Sample Login checklist by documenting Bottle A, Bottle B, etc.

- 2.1.10. Compare the Chain of Custody (C-O-C) or other shipping documentation with the information provided on the sample labels. Document any discrepancies or omissions on the Sample Log-In Checklist, C-O-C Anomaly/Sample Acceptance Form (Attachment 3) or on the shipping documentation.
- 2.1.11. Determine from the method requested on the C-O-C whether the samples meet the holding time criteria.
- 2.1.12. Document whether the shipping containers are to be returned or retained.

## 2.2. ELEMENT Entry

- 2.2.1. Open "Project Management".
- 2.2.2. Open "Projects".
- 2.2.3. From COC, search for client and pick project.
- 2.2.4. Print Client Project Report (prj-Vista.rpt) in Print Format.
- 2.2.5. Close.
- 2.2.6. For all work orders set up a folder
  - 2.2.6.1. Blue: 21-day TAT (standard)
  - 2.2.6.2. Orange: 8 to 14-day TAT
  - 2.2.6.3. Red: 3 to 7-day TAT
- 2.2.7. Navigate to Sample Control, open "Work Order".
- 2.2.8. Click the "ADD" tab at the bottom of the screen. Select client by company name, select project, verify client/lab Project Manager, Input Project Number and or PO (if applicable) click Save.
- 2.2.9. In the Receipt tab input the information from the log- in checklist.
- 2.2.10. Received date, time, by; Logged In date, time, by; TAT (default 21); SDG ID and COC # (if applicable); Shipped By; Tracking Number.
- 2.2.11. Shipping Containers:
  - 2.2.11.1.1. For one cooler input the temp
  - 2.2.11.1.2. .For multiple coolers, click on the Cooler tab.

2.2.11.1.3. .Click Rename tab, rename Cooler X of Y where X is this cooler and Y is the total number of coolers. For example, Cooler 1 of 3.

2.2.12. Click Edit.

2.2.13. Check the “Check/Uncheck All “check all that apply (from the Log in Checklist.

2.2.14. Enter Temp, Type of Coolant, Tracking number, and Shipped By: click SAVE.

2.2.15. In Archive Element on the L:/ drive, create a folder by copying the Archive Template folder, pasting it in the Archive, rename folder to the Work Order number just created.

2.2.16. Click on the Sample tab.

2.2.17. Click “Add” to Add a sample.

2.2.18. Enter from COC

2.2.18.1.1. “Name”, sample ID (reported ID)

2.2.18.1.2. “Alias”, Sub contract lab ID

2.2.18.1.3. Comments, additional information MS/MSD or Dup

2.2.19. Select .Lab Matrix,

2.2.19.1.1. .Report Matrix

2.2.19.1.2. .Sampled (end sample date/ time zone)

2.2.19.1.3. . Sampled Begin (beginning sample date, if only one sample date click on the words “Sampled Begin”

2.2.19.1.4. . Sample Type: Composite, Field Blank, Grab, Trip Blank.

2.2.20. Containers:

2.2.20.1.1. Select the container type from list;

2.2.20.1.2. Select the Location;

2.2.20.1.3. Select the Home Location (“Return to Client” for samples to be returned or “Quarantine” for Foreign soils). Aqueous samples submitted in one liter containers are designated “consumed”.

2.2.20.1.4. Cooler, select cooler of corresponding cooler to sample, (if applicable)

2.2.20.1.5. Comments: to comment on methods, i.e. A bottle 1613, B bottle 1668

2.2.21. Air Samples: the “A” container of a sample train select “MM5 Trap”, select containers of all other components as listed on the COC

2.2.22. Work Analyses: from the COC determine the Analysis for the sample received

2.2.23. Copy Feature: (for samples where the ID is similar)

2.2.23.1.1. Samples can be added by clicking on the “Copy” tab

2.2.23.1.2. Change ID to match COC

2.2.23.1.3. Alias will need to be input again

2.2.23.1.4. Container type and location will remain

2.2.23.1.5. Change the date and time to match COC. Once all sample information is complete click the SAVE tab

2.2.24. Note to make any changes after clicking the save tab, click Edit.

2.2.25. Samples on HOLD.

2.2.25.1.1. In Edit, right click Analysis. Select “Status” a field will populate. Select the Hold Status, select Apply. This will be done to each sample on Hold.

2.2.26. Click Print icon

2.2.26.1.1. Print Format select “wko\_Inventory.rpt” print inventory report.

2.2.26.1.2. In Archive Element on the Ldrive, do a “Save as” into the Work Order number folder created.

2.2.26.1.3. Name document “Sample Inventory”

2.2.26.1.4. Save in “**SmplInven**” folder.

## 2.3. Anomaly

2.3.1. In the Print Format

- 2.3.2. Select the “wko\_anomlies.rpt”.
- 2.3.3. Unselect the PDF option.
- 2.3.4. Click on Print Preview.
- 2.3.5. Click Export Report.
- 2.3.6. Choose Microsoft Word (RTF).
- 2.3.7. Click OK then OK again.
- 2.3.8. In the Ldrive/ArchiveElement/WorkOrder # (xxxxxxx)/Misc folder and save.
- 2.3.9. Close print preview.
- 2.3.10. Navigate to the folder where the anomaly was saved then fill out report.
- 2.3.11. Save report as “COC Anomaly-Sample Acceptance Form\_xxxxxx” print a copy for the work order folder.

## 2.4. Labels

- 2.4.1. Close the Inventory Report and/or the Anomaly form, it will open the Print Sample Labels
- 2.4.2. Choose Print Format “lsx\_vista\_label.rpt” to print labels.
- 2.4.3. Choose Print Format “lsx\_vista\_WO Folder.rpt” to print the folder label. Note: This operation must be completed on the computer in sample control only, where the Zebra 2746e printer is located

## 2.5. Acknowledgement Letter

- 2.5.1. Scan Receipt Documents: COC, LogIn Checklist, Anomaly Form (if applicable) to the Sample control Desktop. From the Bizhub Copier/Scanner, scan the Receipt Docs to “Bettina” Open in the Receipt Docs on the Sample Control desktop in the C:\Scan folder. Rotate COC if needed. Save file as “**Sample Receipt**” in the RecDocs folder in the WorkOrder folder.
- 2.5.2. In Element, Click on Sample Control, open Work Order, select the Work Order of the Scanned Documents, In Project tab, and click on the PDF icon for the Chain of Custody.

- 2.5.3. Click “Add” a file will open, select My Computer/Ldrive/ArchiveElement/WOfolder XXXXXXXX /RecDocs, and select the Sample Receipt. Click “Save” then “Done”.
- 2.5.4. Navigate to “Sample>>>”/ Print icon, in Print Format select “wko\_VistaLogin.rpt” for Ack Letter with Vista Logo and. Select Print preview, an Ack Letter PDF will populate. Save in Misc folder of Work Order#, name letter “WO#xxxxxxx\_Acklet”.
  - 2.5.4.1.1. If client requests hardcopy acknowledgement; select “wko\_VistaLogin\_no\_logos.rpt” for Ack Letter without Logo, print on Vista letterhead paper plus three sheets of Vista Portrait paper. Print clients address on a Vista envelope in Microsoft Word in the mailing tab. Keep in Work order folder for PM to sign letter
  - 2.5.4.1.2. If the Work Order has all samples on HOLD, print using the format “wko\_VistaLogin\_AllHold”.
- 2.6. Photographs
  - 2.6.1. After reconciling the Vista label ID to the sample label ID, arrange samples to obtain a picture of both labels, take multiple pictures if needed.
  - 2.6.2. After picture(s) have been taken, place sample in the assigned storage location.
  - 2.6.3. Download pictures from the digital camera to the sample control computer
  - 2.6.4. Plug in camera, turn on camera.
  - 2.6.5. File will open; select “Microsoft Scanner&Camera Wizard.
  - 2.6.6. Click OK/next/next/next/next/Finish.
  - 2.6.7. This will open a file “Sample Pics”.
  - 2.6.8. View pictures in Filmstrip.
  - 2.6.9. Open Archive Element/WO# /Image and drag picture to file, rename picture i.e. “xxxxxxx-01a,b” for cooler pictures, rename “cooler pics”.
- 2.7. Store samples in designated storage areas, as assigned and indicated on the Sample Log-In Checklist.



- 2.7.1. High level, blood, tissue, and USDA samples must be segregated to prevent cross contamination.
- 2.7.2. Samples to be frozen are checked for adequate headspace prior to storage in case expansion occurs during freezing.

## 2.8. Damaged Containers

- 2.8.1. If there are signs of damage, photograph the damage and close the container; place the shipping container in a fume hood and immediately contact the appropriate project manager. Document the damage on the Sample Log-In Checklist. The project manager will inform the client.

- 2.8.1.1.1. If instructed by the Project Manager, complete logging in the samples.

- 2.8.2. Coolers and containers must be decontaminated with a diluted bleach or equivalent disinfectant.

## 2.9. Foreign Shipments

- 2.9.1. For foreign soils, initiate a "Vista Analytical USDA Foreign Soil Sampling Tracking" form (Attachment 4). This form must accompany the project throughout the entire process. The appropriate department should complete each section depending upon their involvement with the sample.

- 2.9.2. A "Vista Analytical USDA Foreign Soil Log" form (Attachment 5) must be initiated. This form is maintained in a logbook in sample control. The sample custodian must document the initial weight of the sample(s) on the log. All foreign soil sample weights must be determined on a calibrated scale. Any sample usage must also be documented on the log under Method Treatment and Amount. Once the proper disposal has occurred, the log must be updated with the disposal information.

## 3. AFTER HOURS AND WEEKEND RECEIPT

- 3.1. For sample shipments received after normal business hours, date, initial and record the method of delivery on the Sample Log-In Checklist.
- 3.2. Inspect the condition of the shipping container for any damage. Indicate on the Sample Log-In Checklist whether the shipping container is sealed.
- 3.3. Open the shipping container and inspect the contents for damage. Document any damage on the Sample Log-In Checklist.

- 3.4. Record the method of shipping preservation on the Sample Log-In Checklist.
- 3.5. Record the temperature of the sample(s).
- 3.6. Place the shipping container in either the walk-in freezer or walk-in refrigerator. Document the storage location on the Sample Log-In Checklist.
- 3.7. If the shipping container is to be unpacked and logged-in, follow the steps outlined in Section 2.

#### **4. PREPARING A C-O-C ANOMALY/SAMPLE ACCEPTANCE FORM**

- 4.1. If any anomalies are noted during sample receipt and Log-In, the sample custodian fills out the Chain of Custody/Sample Acceptance Form (Attachment 3).
- 4.2. The Project Manager reviews the Chain of Custody/Sample Acceptance Form and notifies the client. Upon resolution of the anomaly, the form is completed and scanned into the archive database.

#### **5. INTER-LABORATORY SAMPLE TRACKING**

- 5.1. Removal of samples from the sample control area for extraction must be documented on the Extraction Bench Sheet.
- 5.2. The chemist must enter the date/time and initials when checking out or returning samples.
- 5.3. If samples are returned to a different storage location than indicated by the sample label or Process Sheet, this must be noted in the checkout/in section.
- 5.4. Samples must be returned the same day of checkout.
- 5.5. Indicate on the check in line if the containers are empty and note the method of disposal using the corresponding letter (Attachment 6)

#### **6. SAMPLE RETURN**

- 6.1. All unused samples either will be disposed of or returned to the client 90 days after the report is completed or as otherwise instructed by the client.
- 6.2. When the samples are returned to the client, the original COC forms shall accompany the samples. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the original chain of custody. Copies of the forms shall be made before shipping and retained by Vista Analytical Laboratory.
- 6.3. Samples are shipped according to appropriate DOT regulations regarding environmental samples.

- 6.4. Whenever samples are split with another lab or government agency, a separate Chain of Custody is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt.

## 7. MAINTENANCE PROCEDURES

- 7.1. Refrigerator and freezer temperatures will be recorded at least once daily.
- 7.2. In the event that a refrigerator or freezer should fail criteria noted on the temperature log, the following actions must be taken:
- 7.2.1. Samples should be transferred immediately to another appropriate storage location. Sample location identification must be changed in ELEMENT, C-O-C forms (when applicable) and sample labels. Measure the temperature of the failed unit prior to transferring samples.
  - 7.2.2. Notify the appropriate study director/project manager as soon as possible.
  - 7.2.3. Document the failure in the non-routine maintenance log and file corrective action, if necessary
  - 7.2.4. If samples are destroyed during an equipment failure, sample handling or shipping, notify the project manager immediately.

## 8. WASTE DISPOSAL

- 8.1. All laboratory waste have a specific profile for disposal. For wastes that do not fit an existing profile, a new profile may be developed.
- 8.2. All unused samples (solid and aqueous) are combined for disposal if the concentrations for; polychlorinated dioxins and furans are below one part per billion (1 ppb), polychlorinated biphenyls are below 50 ppb.
- 8.2.1. Wastes are disposed following the guidelines in Section XIII of the Vista Analytical Laboratory Chemical Hygiene Plan.
- 8.3. All DOT, EPA, and OSHA federal and state laws are followed in the disposal of laboratory waste. All waste is associated and tracked by a manifest that is left upon pick-up of the waste and a formal copy is received by mail. Copies are retained in a file noted by calendar year.
- 8.4. Records of all drum's proper torque are maintained on a Vista form for each waste streams.

### Attachment 1

#### SAMPLE LOG-IN CHECKLIST



Vista Project #: \_\_\_\_\_ TAT \_\_\_\_\_

<b>Samples Arrival:</b>	<b>Date/Time</b>	<b>Initials:</b>	<b>Location:</b>			
			<b>Shelf/Rack:</b> _____			
<b>Logged In:</b>	<b>Date/Time</b>	<b>Initials:</b>	<b>Location:</b>			
			<b>Shelf/Rack:</b> _____			
<b>Delivered By:</b>	FedEx	UPS	On Trac	DHL	Hand Delivered	Other
<b>Preservation:</b>	Ice	Blue Ice	Dry Ice	None		
<b>Temp °C:</b>	(uncorrected)	<b>Time:</b>				<b>Thermometer ID:</b> IR-1
<b>Temp °C:</b>	(corrected)	<b>Probe used:</b> Yes <input type="checkbox"/> No <input type="checkbox"/>				

	YES	NO	NA
Adequate Sample Volume Received?			
Holding Time Acceptable?			
Shipping Container(s) Intact?			
Shipping Custody Seals Intact?			
Shipping Documentation Present?			
Airbill			
Trk #			
Sample Container Intact?			
Sample Custody Seals Intact?			
Chain of Custody / Sample Documentation Present?			
COC Anomaly/Sample Acceptance Form completed?			
If Chlorinated or Drinking Water Samples, Acceptable Preservation?			
Preservation Documented:	Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	Trizma	Yes No NA
Shipping Container	Vista	Client	Retain Return Dispose

Comments:



# CHAIN OF CUSTODY

**FOR LABORATORY USE ONLY**

Storage Secured

Laboratory Project ID: \_\_\_\_\_

Yes  No

Storage ID \_\_\_\_\_

Temp \_\_\_\_\_ °C

Project I.D.: \_\_\_\_\_ P.O.# \_\_\_\_\_ Sampler: \_\_\_\_\_  
(Name)

TAT: (Check One):  
Standard:  21 Days  
Rush (surcharge may apply):  
 14 days  7 days Specify: \_\_\_\_

**Invoice to:** Name Company Address City State Zip Ph# Fax#

Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

**See "Sample Log-in Checklist" for additional sample information**

SHIP TO: Vista Analytical Laboratory  
1104 Windfield Way  
El Dorado Hills, CA 95762  
(916) 673-1520 • Fax (916) 673-0106

Method of Shipment: \_\_\_\_\_

Add Analysis(es) Requested

Tracking No.: \_\_\_\_\_

Container(s)

Sample ID	Date	Time	Location/Sample Description	Quantity	Type	Matrix	2378-TCDD	2378-TCDF/TCDF	PCDD/PCDF	2378-TCDF	2378-TCDF/TCDF	PCDD/PCDF	2378-TCDD	2378-TCDF/TCDF	PCDD/PCDF	TOTALS	COP-LANAR PCB's	209 CONGENERS	PBDE	PAH	EPA1613	EPA8290	EPA8280	EPA1668	EPA1614	CARR-429	

Vista Analytical Laboratory  
El Dorado Hills, CA 95762

SOP12, Rev. 12

Page 14 of 20

Special Instructions/Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SEND DOCUMENTATION AND RESULTS TO:**

Name: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Email: \_\_\_\_\_  
Matrix Types: DW = Drinking Water, EF = Effluent, PP = Pulp/Paper,  
SD = Sediment, SL = Sludge, SO = Soil, WW = Wastewater, B = Blood/Serum  
AQ = Aqueous, O = Other \_\_\_\_\_

Container Types: A = 1 Liter Amber, G = Glass Jar  
P = PUF, T = MMS Train, O = Other \_\_\_\_\_

\*Bottle Preservative Type: T = Thiosulfate,  
O = Other \_\_\_\_\_

WHITE - ORIGINAL                      YELLOW - ARCHIVE                      PINK - COPY

**Attachment 2**



### Attachment 3

## Chain of Custody Anomaly / Sample Acceptance Form

Client: \_\_\_\_\_ Project Number: \_\_\_\_\_

Contact: \_\_\_\_\_ Date Received: \_\_\_\_\_

Fax Number: \_\_\_\_\_ Documented by/date: \_\_\_\_\_

**Please review the following information and complete the Client Authorization section. To comply with NELAC regulations, we must receive authorization before proceeding with sample analysis. Thank You! (Fax # 916-673-0106)**

**The following information or item is needed to proceed with the analysis:**

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Completed Chain-of-Custody  | <input type="checkbox"/> Preservative                 | <input type="checkbox"/> Collector's Name |
| <input type="checkbox"/> Test Method Requested       | <input type="checkbox"/> Sample Identification        | <input type="checkbox"/> Sample Type      |
| <input type="checkbox"/> Analyte List Requested      | <input type="checkbox"/> Sample Collection Date /Time | <input type="checkbox"/> Sample Location  |
| <input type="checkbox"/> Sample Acceptance Checklist |   |   |

**The following anomalies were noted. Authorization is needed to proceed with the analysis:**

- |  |   |
|--|---|
| <input type="checkbox"/> Temperature outside <math>6^{\circ}\text{C}</math> range Temp. _____ $^{\circ}\text{C}$ | Ice Present? Yes <input type="checkbox"/> No <input type="checkbox"/> |
| <input type="checkbox"/> Sample ID Discrepancy   | <input type="checkbox"/> Sample Container(s) Broken                   |
| <input type="checkbox"/> Sample holding time missed  | <input type="checkbox"/> Incorrect Container Type                     |
| <input type="checkbox"/> Custody seals broken  | <input type="checkbox"/> Other  |
| <input type="checkbox"/> Insufficient Sample Size  |   |

Samples Affected: \_\_\_\_\_

---



---



---



---



---



---

**Client Authorization:**

Proceed With Analysis: YES  NO  Signature and Date: \_\_\_\_\_

Client Comments/Instructions: \_\_\_\_\_

**Attachment 4**
**Vista Analytical Laboratory USDA Foreign Soil Sample Tracking**

<b>Project Number:</b>						
<b>Client ID:</b>						
<b>Project Manager:</b>						
<b>Country of Origin:</b>						
<b>Sample ID</b>	<b>Date / Initial</b>	<b>Aliquot Weight (g)</b>	<b>Action (i.e. % Solids, Extraction)</b>	<b>Method of Treatment Prior to Disposal</b>	<b>Disposed By</b>	<b>Date Disposed</b>

Method of treatment prior to disposal:  
 1 – Heated  $\geq 2$  hours at 121°C - 154°C  
 2 – Solvent Extract for Analysis

Attachment 5

Vista Analytical Laboratory USDA Foreign Soil Log

<b>Project Number:</b>						
<b>Client ID:</b>						
<b>Project Manager:</b>						
<b>Country of Origin:</b>						

Sample ID	Date Received	Received Weight* (g)	Disposal Weight (g)	Method of Treatment Prior to Disposal	Date of Disposal	Disposal Performed By

Container plus Contents  
 – Heated ≥ 2hours at 121°C - 154°C



## Attachment 6

### METHOD OF DISPOSAL/DISPOSITION CODES

- A = Sample was consumed during analysis. Container was solvent rinsed, air dried and broken into the laboratory glassware waste stream.
- B = Sample and container were placed into appropriate waste stream.
- C = Sample and container were returned to client.
- D = Sample was extracted. The container was solvent rinsed and broken into glassware waste stream.
- E = Sample was placed into Lab Pack. The container was solvent rinsed, air dried and broken into the laboratory glassware waste stream.
- F = Container plus sample broken into dumpster immediately prior to pick-up.
- G = Sample was consumed during analysis. Container was placed into a Lab Pack.
- H = Sample was placed in solvent/aqueous waste drum. Container was placed into glassware waste stream.
- I = Sample transferred to new container. Original container was placed into glassware waste stream.
- J = Sample consumed during analysis, awaiting Sponsor notification for return or disposal.
- K = Sample consumed during analysis. The container was cleaned and reused.

CONFIDENTIAL

PREPARATION BENCH SHEET

Matrix: Solid

B4I0004

Chemist: \_\_\_\_\_

Method: Percent Solids

Prep Date/Time: 02-Sep-14 11:21

Prepared using: HRMS - Solids

C	VISTA Sample ID	Sample Amt. (g)	IS/NS CHEM/WIT DATE	CRS CHEM/WIT DATE	ABSG CHEM/ DATE	AA CHEM/ DATE	Florisol CHEM/ DATE	Charcoal CHEM/ DATE	RS CHEM/WIT DATE
<input type="checkbox"/>	1400567-01								
<input type="checkbox"/>	1400567-02								
<input type="checkbox"/>	1400567-03								
<input type="checkbox"/>	1400567-04								
<input type="checkbox"/>	1400567-05								
<input type="checkbox"/>	1400567-06								
<input type="checkbox"/>	1400567-07								
<input type="checkbox"/>	1400567-08								
<input type="checkbox"/>	1400567-09								
<input type="checkbox"/>	1400567-10								
<input type="checkbox"/>	1400567-11								

IS Name	NS Name	CRS Name	RS Name	Cycle Time	APP: SEFUN SOX SDS	Check Out: Chemist/Date: _____
PCDD/F _____	PCDD/F _____	PCDD/F _____	PCDD/F _____	Start Date/Time	SOLV: _____	Check In: Chemist/Date: _____
PCB _____	PCB _____	PCB _____	PCB _____	_____	Other _____	Balance ID: _____
PAH _____	PAH _____	PAH _____	PAH _____	Stop Date/Time	Final Volume(s) _____	
_____	_____	_____	_____	_____	_____	

Comments:





The content of the SOP is the confidential property of Vista Analytical Laboratory, Inc. and may not be copied, modified, retransmitted, or used for any purposes other than those that have been determined by associated contractual agreements without Vista's written authorization.



SOP 49	Revision: 8	Supersedes: 7
<b>PREPARATION AND ANALYSIS FOR THE DETERMINATION OF PER and POLY-FLUORINATED COMPOUNDS</b>		
Analyst Review: <i>Boyan Rubet</i>		
Management: <i>Alvin Clarke</i>		
Quality Assurance: <i>Hajdeh Teh</i>		
Effective Date: 27 July 2016		

Revision	Description of Revision
1	Section 1.1: Removed aqueous matrix, Section 4.3: Modification from 537 method regarding peak symmetry, Section 8: Addition of equipment used for Soil/Tissue method, Section 13.2: Addition of the Soil/Tissue digestion and extraction, Section 13.5: Final volume modified, Section 14.1: Changed the Desolvation Temperature, deleted Section 14.3.2.1.3: following EPA 537 limits, Section 15: Calculations modified, Section 19.2: Soil/Tissue method reference, Table 1A and B: ICAL concentrations changed, Table 3A-C: Addition of table for the Acceptance Criteria for Performance Tests for Aqueous (A), Soil (B) and Tissue (C), Table 5: Table added (reporting limits)
2	Added Section 4.5: Modification of detection limit calculation
3	Deleted Table 3C. Combined Soil and Tissue into Table 3B. Updated IS recoveries in Table 3B.
4	Added Section 4.6: Modification from 537 method regarding forcing ICAL through zero, Added Section 4.7: Maintaining the OPR at a static, mid-level concentration. Section, Added Section 4.8: Modification from 537 method regarding rotating of CCAL points, Section 11.2.1: Changed 10 samples per batch to 20. Section 11.3: Removed section on rotating OPR between low, medium, and high concentrations. Section 11.4: Added MS/MSD per client request, Section 11.5: Duplicate performed every sample batch, Section 11.4 and 11.5: Perform duplicate samples instead of MS/MSD, Section 11.6: FRB per client request, Section 11.7.1: Updated to reflect that a Second Source is run with every calibration curve, Added section 13.1.3: Aqueous samples with high particulate section, Section 13.5: Modification for the adjustment to final volume, Section 14.4.1: signal to noise modified, 14.5.2: natives within 0.1 min of IS retention time, Section 15.1 added sample weight to calculation, Added Table 3, Table 5A-B: Updated percent recoveries

5	<p>Section 2: Added N-EtFOSAA and N-MeFOSAA to compound list, changed FOSA to PFOSA. Updated section 4.1. Added sections 4.2-4.5 in method modifications. Deleted section 4.6 in Method Modifications, as the calibration is now forced through zero. Added Sections 8.20 – 8.22 for new instrument. Added Section 9.2.7: Isopropyl Alcohol. Updated section 11.5 to only perform duplicates per request. Section 13.1.2 changed 250mL to 125mL. Section 13.2.1.1.3: Added vortexing step. Added Section 13.3.2 with volumes used for 100mg/3mL cartridge. 13.4.1: Added spiking of RS. Section 13.5.2: Changed final volume from 0.5mL to 1mL. Section 14.2.1: Changed the Ical to specify quadratic fit and forcing through zero. Sections 14.2.4 and 14.2.5: Added Coefficient of Determination and RSD requirements. Section 14.3.1: All CCCs at midlevel concentration. Added Section 14.5.6: Totals Added section 15.1 quantitation for natives using quadratic regression. Tables: Added N-EtFOSAA, N-MeFOSAA, d<sub>5</sub>-N-EtFOSAA, d<sub>3</sub>-N-MeFOSAA, <sup>13</sup>C<sub>3</sub>-PFPeA to appropriate tables, changed FOSA to PFOSA where required. Updated OPR, IPR and sample recovery limits. Updated curve concentrations. Table 3: Updated masses monitored where appropriate. Table 5: Updated recoveries to reflect only reporting those ISs in EPA methods.</p>
6	<p>Added Section 4.9: Two PFOS transitions are monitored for. Added Section 4.14: Using EDL to check sensitivity. Added Section 14.5.7: Estimated Detection Limits.</p>
7	<p>Updated 11.2.2: Changed the allowable limits for the method blank, 11.7.2: Second Source Standards must be within 25% of true value, 14.2.1: changed at least 5 points to at least 6 points in ICAL.</p> <p>Updated section 11.3.4 with internal standard requirements.</p> <p>Section 13.3: Updated wash solvent</p>
8	<p>Removed sections 13.3.2, 14.5.7</p> <p>Modified sections 13.3</p> <p>Updated sections 2.2, 8.20-8.22, 12.1.3, 13.3.1.2, 13.4.1, 13.5.2, 14.1, 14.2.1, 12, 13.5.1, 13.5.2, 14.1.</p> <p>All tables have been updated with the most recent information.</p> <p>Added curve requirement to section 14.2.1.</p>

## 1. PURPOSE

- 1.1 This SOP outlines and describes the preparative and analytical techniques used for the determination of per and poly-fluorinated compounds (PFAS).

## 2. SCOPE

- 2.1 All differences between EPA 537, ISO 25101 and actual laboratory techniques have been developed to reduce interference and increase sensitivity.
- 2.2 Data determined to be out-of-control from criteria stated within this SOP, is handled according to procedures addressed within the applicable section.

<b>Compound</b>	<b>CAS Registry No.*</b>
Perfluorobutanesulfonic acid (PFBS)	375-73-5
Perfluoroheptanoic acid (PFHpA)	375-85-9
Perfluorohexanesulfonic acid (PFHxS)	355-46-4
Perfluorohexanoic acid (PFHxA)	307-24-4
Perfluorooctanesulfonic acid (PFOS)	1763-23-1
Perfluorooctanoic acid (PFOA)	355-67-1
Perfluorobutanoic acid (PFBA)	375-22-4
Perfluoroheptanesulfonate (PFHpS)	60270-55-5
Perfluorodecanesulfonate (PFDS)	13419-61-9
Perfluoropentanoic acid (PFPeA)	2706-90-
Perfluorononaic acid (PFNA)	375-95-1
Perfluoroundecanoic acid (PFUdA)	2058-94-8
Perfluorodecanoic acid (PFDA)	335-76-2
Perfluorododecanoic acid (PFDoA)	307-55-1
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8
Perfluorotetradecanoic acid (PFTeDA)	376-06-7
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5
Perfluorooctadecanoic acid (PFODA)	16517-11-6
6:2 Fluorotelomer sulfanate (6:2 FTS)	27619-97-2
8:2 Fluorotelomer sulfanate (8:2 FTS)	39108-34-4
N-methylperfluoro-1-octanesulfonamide (N-MeFOSA)	31506-32-8
N-ethylperfluoro-1-octanesulfonamide (N-EtFOSA)	4151-50-2
Perfluorooctane sulfonamide (PFOSA)	754-91-6
N-methylperfluoro-1-octanesulfonamido ethanol (N-MeFOSE)	24448-09-7
N-ethylperfluoro-1-octanesulfonamido ethanol (N-EtFOSE)	1691-99-2
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	2991-50-6
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	2355-31-9

\*Chemical Abstract Service

### 3. SUMMARY OF METHOD

- 3.1 This procedure uses ultra performance liquid chromatography/tandem mass spectrometry (UPLC/MS/MS) for detection and quantitation of per and poly-fluorinated compounds, commonly referred to as PFAS.
- 3.2 All differences between the method and actual laboratory techniques have been developed to reduce interferences and increase sensitivity.
- 3.3 Detection limits are sample-specific and congener-specific.

### 4. MODIFICATIONS

- 4.1 Calibration standards made using methanol and water.
- 4.2 The extraction volume for aqueous samples is 125mLs.
- 4.3 The internal standard (IS) is not spiked directly into the sample bottle. The IS is spiked into a test tube containing methanol. Then the test tube is poured into the sample bottle.
- 4.4 Drinking water samples follow the IS recovery limits set in EPA Method 537; version 1.1, September 2009. IS recovery limits from all other matrices are derived from the EPA Draft Sludge Method, December 2011.
- 4.5 MS/MSDs and Duplicates performed by client request only.
- 4.6 SPE extracts are concentrated to near dryness and reconstituted in [REDACTED]
- 4.7 Symmetry of peaks not calculated due to the greatly improved chromatography of UPLC versus HPLC.
- 4.8 The SPE cartridge used is a polymeric weak anion cartridge and therefore requires the reagents used in the SPE procedure.
- 4.9 The calculation of the detection limit, SOP Section 15.2, differs from Section 9.2.7 in EPA Method 537, version 1.1, September 2009.
- 4.10 The OPR is spiked at a static, mid-level concentration.
- 4.11 Continuing calibration standards are not rotated between a mid and a high concentration.
- 4.12 Section 10.3.2 in EPA Method 537; version 1.1, September 2009 states that absolute areas of ISs must be compared to the most recent ICAL and CCAL. Vista utilizes embedded Estimated Detection Limits (EDL) on a per analyte basis to qualify system sensitivity as well as quantitation by isotope dilution.

## 5. CONTAMINATION AND INTERFERENCES

- 5.1 Solvents, reagents, glassware and other sample processing hardware may yield discrete artifacts or elevated baselines that may cause misinterpretation of the chromatographic data. All of these materials must be demonstrated to be free from interfering substances under the conditions of analysis by performing laboratory method blanks. Analysts should avoid using materials containing PTFE, where possible.
- 5.2 All differences between EPA 537, ISO 25101 and actual laboratory techniques have been developed to reduce interference and increase sensitivity.
- 5.3 The use of high purity reagents and solvents helps to minimize interference problems.
- 5.4 Interferants co-extracted from the sample will vary considerably from matrix to matrix.

## 6. DEFINITIONS

- 6.1 Definitions are presented in the Glossary.

## 7. SAFETY

- 7.1 Procedures shall be carried out in a manner that protects the health and safety of all Vista employees.
- 7.2 Each chemical compound should be treated as a potential health hazard. Exposure to these compounds should be reduced to the lowest possible level. All compounds or reagents should be handled only by highly trained personnel thoroughly familiar with handling and cautionary procedures and the associated risks.
- 7.3 Additional health and safety information can be obtained from material safety data sheets (MSDSs) available to all personnel involved in these analyses.
- 7.4 In the event of a known or potential compromise to the health and safety of a Vista associate, all work must stop and the incident reported immediately to management.
- 7.5 Contamination of the laboratory will be minimized by conducting most of the manipulations in a hood
- 7.6 The toxicity or carcinogenicity of each chemical used in this method has not been precisely determined; however, each compound should be treated as a potential health hazard. Exposure to these compounds should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the



chemicals specified in this method. A reference file of MSDS should also be made available to all personnel involved in these analyses.

## 8. APPARATUS AND MATERIALS

*Note: All materials used should be suitable for LC work, and comparable brand materials can be substituted where specific brands are mentioned.*

- 8.1 Analytical Balances, capable of reading to 0.01g and 0.0001g
- 8.2 Solid Phase Extraction Manifold (Waters)
- 8.3 [REDACTED]
- 8.4 Silicone tubing, 1/16" diameter, various lengths (Nalgene)
- 8.5 Screw top polypropylene LC vials, 12x32mm (Waters)
- 8.6 HDPE Bottle various sizes (Nalgene)
- 8.7 Screw caps with pre-slit polypropylene septa, for 12x32mm vials (Waters)
- 8.8 Disposable polypropylene Pasteur pipets, various sizes
- 8.9 Chlorine test strips (Hach Aquacheck, or equivalent)
- 8.10 Organomation 24-Station N-Evaporator with water bath [REDACTED]
- 8.11 Polypropylene centrifuge tubes, 13 mm x 100 mm
- 8.12 Wiretrol II Precision Disposable Micropipettes
- 8.13 Sonicator, VWR, Model 150T
- 8.14 Eppendorf Centrifuge, Model 5804
- [REDACTED]
- 8.16 Acquity PFC Isolator Column (Waters)
- 8.17 Acquity Ultra Performance LC (Waters)
- 8.18 Lenovo computer work station with MassLynx Software
- 8.19 Quattro Premier XE with Micromass Technology (Waters)
- 8.20 Shimadzu Nexera X2 UHPLC LC System (Shimadzu USA)
- 8.21 Dell Optiplex XE2 computer work station with Analyst and MultiQuant Software
- 8.22 4000 Q Trap (Sciex)

## 9. REAGENTS, SOLVENTS AND STANDARDS

### 9.1 Reagents (HPLC grade or above)

- 9.1.1 Trizma pre-set crystals (Supelco cat #T-7193)
- 9.1.2 Sodium Acetate, HPLC grade
- 9.1.3 Ammonium Acetate, HPLC grade
- 9.1.4 Ammonium Hydroxide, Concentrated
- 9.1.5 Formic Acid, Concentrated
- 9.1.6 Ultra-pure nitrogen gas
- 9.1.7 Ultra-pure argon gas

### 9.2 Solvents (HPLC Grade or above)

- 9.2.1 Reagent Water
- 9.2.2 Acetonitrile
- 9.2.3 Hexane
- 9.2.4 Methanol (MeOH)
- 9.2.5 Methylene chloride (DCM)
- 9.2.6 Acetone
- 9.2.7 Isopropyl Alcohol

### 9.3 Standards

- 9.3.1 All analytical standards are obtained from a certified vendor.
- 9.3.2 See SOP 15 and the current spike sheet for more information.

## 10. COLLECTION, PRESERVATION, AND HANDLING

- 10.1 HDPE or polypropylene bottles and jars must be used for collection.
- 10.2 Trizma is added to the sample bottles prior to the collection of drinking water samples in the amount of 5.0g/L.
- 10.3 Aqueous samples must be extracted or frozen within 14 days of collection and analyzed within 28 days of extraction.

Note: For DoD projects, samples shall not be frozen.

- 10.4 Solid and Tissue samples must be extracted within 60 days from collection and analyzed within 30 days of extraction.
- 10.5 Store at < 6°C.

## 11. QUALITY CONTROL

- 11.1 Each time a modification is made to this method and the detection limit will be affected by the change, the laboratory is required to demonstrate that the MDL is lower than one-third the regulatory compliance level or one-third the method reporting limit (MRL) in the method, whichever is higher.
- 11.2 Method Blank (MB): Method blank is a matrix preparation that is free of native analyte that has been prepared and analyzed using the same procedures followed for the rest of the analytical batch. Simulate as close as possible the matrix to be extracted.
- 11.2.1 Daily or with each extraction batch of up to 20 samples, (whichever is more frequent).
  - 11.2.2 For the determination of native PFAS, the levels measured in the method blank of all method analytes must be below 1/2 the LOQ.
  - 11.2.3 If amount found is greater than the minimum level or one-third the regulatory compliance limit, whichever is greater; or if any potentially interfering compound is found in the blank at or above the minimum level for each congener, the data must be evaluated to determine whether the batch shall be re-extracted or the data are qualified appropriately.
  - 11.2.4 If there is evidence of contamination within the MB, then the source of the contamination must be located. The data must be evaluated to determine whether the batch shall be re-extracted or the data is qualified appropriately.
- 11.3 Ongoing Precision and Recovery Samples (OPR): An ongoing precision and recovery sample is prepared by adding a known quantity of native standards to an interferant free matrix and used to assess method performance (precision and recovery).
- 11.3.1 Add the appropriate amount of native spike. The native spikes contain the compounds listed in Table 1.
  - 11.3.2 An OPR is analyzed with every analytical batch.
  - 11.3.3 The OPR % recoveries for native and internal standards must be within the limits shown in Table 5.
  - 11.3.4 If the percent recovery of the native or, two or more of the internal standards of an isomer in the OPR is out of method limits, it is recommended that the sample(s) be re-extracted and/or re-analyzed.
- 11.4 Matrix Spike (MS/MSD): A matrix spike sample is prepared by adding the appropriate quantity of native standards to a sample matrix prior to extraction.

MS/MSD's are performed by client request

11.4.1 The relative percent difference (RPD) between MS/MSD samples should be  $\leq 30\%$ .

11.4.2 If RPD does not meet the acceptance criteria, the data is evaluated and qualified appropriately.

11.5 Duplicate Samples: Duplicate samples are two separate aliquots taken from the same source. Duplicate samples are analyzed independently to assess laboratory precision. Duplicate samples are performed by client request.

11.5.1 The relative percent difference between duplicate samples should be  $\leq 30\%$

11.5.2 If the concentration is within a factor of 2 of the MRL, the relative percentage difference (RPD) must be  $\leq 50\%$

11.5.3 If the RPD does not meet the acceptance criteria, the data are evaluated and qualified appropriately.

11.6 Field Reagent Blank (FRB): A field reagent blank is a matrix preparation that is free of native analyte transported to the field in sealed containers and returned with the samples. FRB's are performed upon client request.

11.6.1 Analysis of the FRB is only necessary if a Field Sample contains a method analyte at or above the MRL.

11.7 Second source standard: Analytes from a different source than that of the calibration standards. This is prepared and analyzed in the same way as a CCC.

11.7.1 This is analyzed with every calibration curve.

11.7.2 The calculated value for the second source standard must be within  $\pm 25\%$  of the true value.

## 12. SAMPLE PREPARATION

12.1 pH Determination

12.1.1 Obtain a pH strip and place it directly into a small amount of sample in a disposable weigh boat. Move the strip back and forth for 30 seconds.

12.1.2 Check the color on the strip against the color chart on the pH container.



## 13. EXTRACTION PROCEDURES

13.1 Aqueous Samples

13.1.1 Record the combined weight of the bottle, cap and sample for each sample to be extracted. After the sample has been removed from the bottle, allow it to drain overnight and reweigh it and the cap to determine the amount of sample extracted.

13.1.2 For the method blank (MB) and OPR(s), transfer [REDACTED] reagent water into a bottle for each.

[REDACTED]

13.1.4 Add the appropriate volume of Internal Standard (IS) solution and the appropriate volume of Native Standard (NS) solution to OPR, MS or MSD. Allow the spiked samples to equilibrate for at least 1 hour before extraction.

## 13.2 Solid/Tissue Samples

### 13.2.1 Digestion

Weigh out [REDACTED] solid or well ground fish/tissue into a polypropylene test tube.

Add the appropriate volume of Internal Standard (IS) solution and the appropriate volume of Native Standard (NS) solution to OPR, MS, or MSD.

Add [REDACTED], then vortex.

Sonicate [REDACTED]

[REDACTED]

### 13.2.2 Neutralization

13.2.2.1 Add [REDACTED] Hydrochloric Acid, vortex briefly.

### 13.2.3 Extraction

13.2.3.1 [REDACTED]

13.2.3.2 [REDACTED]

[REDACTED]

13.2.3.3 Decant [REDACTED]

[REDACTED]

13.2.3.4 Repeat the extraction process (13.2.3.1.1-13.2.3.1.3)

## 13.3 SPE Cleanup

13.3.1 Assemble the SPE apparatus and attach the SPE cartridges as shown in the appendix A, Figure 1.

13.3.1.1 Condition the cartridges by eluting with methanol.

Discard eluant.

13.3.1.2 Condition the cartridge with reagent water. Discard eluant.

13.3.1.3 Load sample onto cartridge by way of siphon,

13.3.1.4 Once sample has passed through, rinse bottle with reagent water and re-siphon.

13.3.1.5 Upon completion of siphon wash cartridge

13.3.1.6 Dry the cartridge under vacuum

#### 13.4 Cartridge Elution

13.4.1 Elute . Collect extracts eluted from the column into clean test tube containing the appropriate amount of RS.

#### 13.5 Adjustment to Final Volume

13.5.1 Concentrate extract

13.5.2

13.5.3

### 14. LC/MS ANALYSIS

14.1 Establish the necessary conditions. The LC conditions may be optimized for compound separation and sensitivity. Once optimized, the same LC conditions must be used for the analysis of all standards, blanks, OPR aliquots and samples. The following LC operating conditions are guidance and adjustments may be required

**Instrument:** Aquity UPLC/ Waters Quattro Premier XE

**Column:**

**Ionization:** Negative Ion Electrospray

**Acquisition:** MRM mode, unit resolution

**Injection Volume:** 5-15 $\mu$ L

[REDACTED]	
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
<b>MS Conditions</b>	
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

**Instrument:** Shimadzu DGU-20Asr/Sciex 4000 Q trap

**Column:** [REDACTED]

**Ionization:** Negative Ion Electrospray

**Acquisition:** MRM mode, unit resolution

**Injection Volume:** 1-5 µL

<b>General LC Conditions</b>	
<b>Column</b>	
<b>MS Conditions</b>	
<b>MS Conditions</b>	

<b>LC Gradient Program</b>			<b>LC Gradient Program</b>	<b>Parameter</b>	<b>Events</b>
<b>Time (min)</b>	<b>Flow Mixture*</b>				



LC Gradient Program			LC Gradient Program	Parameter	Events
Time (min)	Flow Mixture*				
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

- [REDACTED]
- [REDACTED]

## 14.2 Initial Calibration (ICAL)

**14.2.1** An initial calibration curve is created using a quadratic fit weighted 1/X over the calibration range and consisting of at least 6 points. This curve must be forced through zero. An initial calibration is repeated at least annually, whenever a new set of spiking calibration standards is created or whenever the continuing calibration falls outside the acceptance criteria. [REDACTED]

Note: If estimated concentrations below ICAL levels are not needed for a specific project or requirement, the curve may not be forced through zero.

14.2.2 Establish the operating conditions suggested in Section 14.1

14.2.3 The following retention time criterion must be met:

14.2.3.1 The absolute retention time of the last-eluted compound must be  $\pm 0.5\%$  of its targeted value.

14.2.4 The Coefficient of determination for all native compounds must be greater than or equal to 0.96.

14.2.5 RSD requirements are  $\leq 35\%$  for all internal standards.

14.2.6 The following analyte recovery criteria must be met: Each calibration point for each analyte must calculate to be with 75-125%, except the lowest cal point which must calculate to within 70-130%.

## 14.3 Continuing Calibration

14.3.1 A continuing calibration check (CCC) must be analyzed at the beginning, after every 10 samples and at the end of each analytical run. All CCC's are at a midlevel concentration.

14.3.2 The continuing calibration verification is acceptable if the following criteria are met:

- 14.3.2.1 The LC peak representing each native and labeled compound must be present with a S/N  $\geq 10$ .
- 14.3.2.2 The percent recovery for native standards and the internal standards must be within the limits shown in Table 5.
- 14.3.2.3 The retention times for internal compounds must be within  $\pm 15$  seconds of the respective retention times in the most recent CCC.

#### 14.4 Qualitative Determination

- 14.4.1 The signal to noise ratio (S/N) at the LC peak maximum for each native compound must be greater than or equal to 3 for each compound detected in a sample extract.
- 14.4.2 The retention time of the peak for a native compound must be within  $\pm 15$  seconds of its RT in the most recent CCC standard.

#### 14.5 Quantitative Determination

- 14.5.1 Calibration by Isotope Dilution: Isotope dilution calibration is used for the native PFAS for which labeled compounds are available.
- 14.5.2 Native compounds should have a retention time within 0.1 mins. of its equivalent internal standard.
- 14.5.3 Recovery of each internal standard versus the recovery standard must be within the limits shown in Table 5.
- 14.5.4 Recoveries below the limits may be accepted if the signal to noise is  $>10:1$ . If the signal to noise is not  $>10:1$ , samples must be re-extracted and re-analyzed or the data must be qualified.
- 14.5.5 If a chromatographic peak of any of the analytes saturates the detector, a dilution of the extract must be analyzed.
- 14.5.6 PFBS, PFHpS, PFHxS, PFOA, PFOS, N-MeFOSAA and N-EtFOSAA have both linear and branched isomers. All chromatographic peaks for these compounds are integrated and the areas totaled. Technical mixtures are referenced when available.

## 15. CALCULATIONS

15.1 The concentrations of native compounds are determined by quadratic regression:

$$NRR = \frac{A_x}{A_y} Q_y$$

Where:

<i>NRR</i>	=	<i>Normalized relative response</i>
<i>A<sub>x</sub></i>	=	<i>Area of the quantitation ion for the native compound in sample</i>
<i>A<sub>y</sub></i>	=	<i>Area of the quantitation ion for the labeled compound in sample</i>
<i>Q<sub>y</sub></i>	=	<i>Quantity of Internal Standard in sample</i>

15.1.1 Determine the calibration equation for each compound by regressing the NRR against the native compound concentration (See Appendix B).

15.1.2 The curve may be concentration weighted based on the analysts discretion.

15.2 The concentration of each internal standard is calculated as follows:

$$C_{Samp} = \frac{A_x Q_y}{A_y RRF S_w}$$

Where:

<i>C<sub>Samp</sub></i>	=	<i>Concentration of compound in sample</i>
<i>A<sub>x</sub></i>	=	<i>Area of the quantitation ion for the native compound in sample</i>
<i>A<sub>y</sub></i>	=	<i>Area of the quantitation ion for the labeled compound in sample</i>
<i>Q<sub>y</sub></i>	=	<i>Quantity, in pg, of Internal Standard in sample</i>
<i>S<sub>w</sub></i>	=	<i>Sample weight</i>
<i>RRF</i>	=	<i>Relative response factor, a sum of the response factors (RF):</i>

$$\sum RF = \frac{A_n C_l}{A_l C_n}$$

Where:

<i>C<sub>l</sub></i>	=	<i>Internal Standard Concentration at the curve point</i>
<i>A<sub>x</sub></i>	=	<i>Area of daughter m/z for native compound</i>
<i>A<sub>l</sub></i>	=	<i>Area of daughter m/z for labeled compound</i>
<i>C<sub>n</sub></i>	=	<i>Concentration of Native Standard at the curve point</i>

15.3 Internal standard recoveries are calculated by using the formula:

$$\%Rec = \frac{(A_{IS})(Q_{RS}) \times 100}{(A_{RS})(Q_{IS})(RRF_{IS})}$$

Where:

$A_{IS}$  = Area of the quantitation ion for the internal standard.  
 $A_{RS}$  = Area of the quantitation ion for the recovery standard.  
 $Q_{IS}$  = Quantity of the internal standard.  
 $Q_{RS}$  = Quantity of the recovery standard.  
 $RRF_{IS}$  = Calculated relative response factor for the internal std. analyte.

15.4 Relative Response Factors can be calculated using the following formula:

$$RRF = \frac{(A_N)(Q_{IS})}{(A_{IS})(Q_N)}$$

Where:

$A_N$  = Area of the quantitation ion for the native compound  
 $A_{IS}$  = Area of the quantitation ion for the labeled compound.  
 $Q_{IS}$  = Quantity of the internal standard in the calibration standard.  
 $Q_N$  = Quantity of the native compound in the calibration standard

15.5 RRF for unlabeled analytes (optional) (RRFN) and for labeled analytes (RRFIS):

$$RRF_N = \frac{(A_X)(Q_{IS})}{(Q_X)(A_{IS})} \quad RRF_{IS} = \frac{(A_{IS})(Q_{RS})}{(Q_{IS})(A_{RS})}$$

Where:

$A_X$  = Sum of the integrated ion abundances of the quantitation ions for the unlabeled analyte  
 $A_{IS}$  = Sum of the integrated ion abundances of the quantitation ions for the labeled standards  
 $A_{RS}$  = Sum of the integrated ion abundances of the quantitation ions for the labeled recovery standards  
 $Q_{IS}$  = Quantity of internal standard injected (pg)  
 $Q_{RS}$  = Quantity of recovery standard injected (pg)  
 $Q_X$  = Quantity of unlabeled analyte injected (pg)

15.6 The RPD is calculated as follows:

$$RPD = \frac{(H - L)}{(H + L) / 2} * 100$$

Where:

$RPD$  = Relative Percentage Difference  
 $H$  = Highest area  
 $L$  = Lowest area

## 16. POLLUTION PREVENTION

16.1 The solvent evaporation techniques used in this method are amenable to solvent recovery, and the laboratory shall recover solvents wherever feasible.

16.2 Standards should be prepared in volumes consistent with laboratory use to minimize disposal of standard.

## 17. WASTE MANAGEMENT

- 17.1 Waste generated in the procedure must be segregated and disposed according to the facility hazardous waste procedures. Safety officer should be contacted if additional information is required.
- 17.2 The laboratory waste management is in compliance with all federal, state, and local regulations to protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations

## 18. METHOD PERFORMANCE

18.1 This SOP is based on methods noted as references (Section 19).

## 19. REFERENCES

- 19.1 ISO 25101:2009 – Water Quality – Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanonate (PFOA) – Method for unfiltered samples using solid phase extraction and liquid chromatography/mass spectrometry, 1<sup>st</sup> edition, Dated March 2009.
- 19.2 EPA 821-R-11-007- Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS, Draft, December 2011.
- 19.3 Method 537, Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), Version 1.1, September 2009.

**Table 1**  
**Calibration Curve Concentration (pg/ $\mu$ L)**

Compound	CS(-2)	CS(-1)	CS0	CS1	CS2	CS3	CS3.5*	CS4	CS4.5	CS5	CS6
PFBS (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFHpA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFHxS (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFHxA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFOS (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFOA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFBA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFHpS (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFDS (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFPeA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFDA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFNA (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFUdA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFDoA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFTrDA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFTeDA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFHxDA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
PFODA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
6:2 FTS (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
8:2 FTS (A)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200

**Table 1 Continued**

Compound	CS(-2)	CS(-1)	CS0	CS1	CS2	CS3	CS3.5*	CS4	CS4.5	CS5	CS6
N-MeFOSA (B)	0.625	2.5	5.0	10	25	50	125	250	375	500	1000
N-EtFOSA (B)	0.625	2.5	5.0	10	25	50	125	250	375	500	1000
PFOSA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
N-MeFOSE (B)	0.625	2.5	5.0	10	25	50	125	250	375	500	1000
N-EtFOSE (B)	0.625	2.5	5.0	25	25	50	125	250	375	500	1000
N-EtFOSAA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200
N-MeFOSAA (B)	0.125	0.5	1.0	2.0	5.0	10	25	50	75	100	200

\* Calibration Verification Solution

\*\* CS(-2) used for PFOS only

\*\*\* A and B reflects associated FV composition and injection

**Table 2**  
**Calibration Curve Concentration (pg/ $\mu$ L)**

Internal Standard	CS-2	CS-1	CS0	CS1	CS2	CS3	CS3.5*	CS4	CS4.5	CS5	CS6
<sup>13</sup> C <sub>3</sub> -PFBA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>3</sub> -PFPeA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>3</sub> -PFBS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -PFHxA	5	5	5	5	5	5	5	5	5	5	5
<sup>13</sup> C <sub>2</sub> -PFDA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>4</sub> -PFHpA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>18</sup> O <sub>2</sub> -PFHxS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -6:2 FTS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -PFOA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>8</sub> -PFOS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>5</sub> -PFNA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -8:2 FTS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>8</sub> -PFOSA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -PFUdA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -PFD <sub>0</sub> A	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
d <sub>3</sub> -N-MeFOSA	150	150	150	150	150	150	150	150	150	150	150
d <sub>7</sub> -N-MeFOSE	150	150	150	150	150	150	150	150	150	150	150
d <sub>9</sub> -N-EtFOSE	150	150	150	150	150	150	150	150	150	150	150
d <sub>5</sub> -N-EtFOSA	150	150	150	150	150	150	150	150	150	150	150
<sup>13</sup> C <sub>2</sub> -PFTeDA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -PFHxDA	5	5	5	5	5	5	5	5	5	5	5



Internal Standard	CS-2	CS-1	CS0	CS1	CS2	CS3	CS3.5*	CS4	CS4.5	CS5	CS6
d <sub>5</sub> -N-EtFOSAA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
d <sub>3</sub> -N-MeFOSAA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Recovery Standard	CS-2	CS-1	CS0	CS1	CS2	CS3	CS3.5*	CS4	CS4.5	CS5	CS6
<sup>13</sup> C <sub>6</sub> -PFDA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>4</sub> -PFBA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -4:2FTS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>5</sub> -PFHxA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>3</sub> -PFHxS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>8</sub> -PFOA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>4</sub> -PFOS	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>9</sub> -PFNA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>7</sub> -PFUdA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
<sup>13</sup> C <sub>2</sub> -FOUEA	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5

\* Calibration Verification Solution

**Table 3**  
**Exact Masses Monitored Waters Quattro Premier XE**

<b>Compound</b>	<b>Native Parent-Daughter</b>	<b>Internal Standard</b>	<b>Native Parent-Daughter</b>
PFBS	299.0 – 79.7	<sup>13</sup> C <sub>3</sub> -PFBS	302.0 – 98.8
PFHpA	363.0 – 318.9	<sup>13</sup> C <sub>4</sub> -PFHpA	367.2 – 321.8
PFHxS	398.9 – 79.6	<sup>18</sup> O <sub>2</sub> -PFHxS	403.0 – 102.6
PFHxA	313.2 – 268.9	<sup>13</sup> C <sub>2</sub> -PFHxA	315.0 – 269.8
PFOS	499.0 – 79.9	<sup>13</sup> C <sub>8</sub> -PFOS	507.0 – 79.998.6
PFOA	413.0 – 368.7	<sup>13</sup> C <sub>2</sub> -PFOA	414.9 – 369.7
PFBA	213.1 – 168.8	<sup>13</sup> C <sub>3</sub> -PFBA	216.1 – 171.8
PFHpS	449.0 – 98.7	<sup>13</sup> C <sub>2</sub> -PFOA	414.9 – 369.7
PFDS	598.8 – 98.7	<sup>13</sup> C <sub>2</sub> -PFUdA	565.0 – 519.8
PFPeA	263.1 – 218.9	<sup>13</sup> C <sub>3</sub> -PFPeA	266.0 – 221.8
PFDA	513.0 – 468.8	<sup>13</sup> C <sub>2</sub> -PFDA	515.1 – 469.9
PFNA	463.0 – 418.8	<sup>13</sup> C <sub>5</sub> -PFNA	468.2 – 422.9
PFUdA	563.0 – 518.9	<sup>13</sup> C <sub>2</sub> -PFUdA	565.0 – 519.8
PFDoA	612.9 – 318.8	<sup>13</sup> C <sub>2</sub> -PFDoA	615.0 – 569.7
PFTTrDA	662.9 – 618.9	<sup>13</sup> C <sub>2</sub> -PFDoA	615.0 – 569.7
		<sup>13</sup> C <sub>2</sub> -PFTTeDA	715.0 – 669.7
PFTTeDA	712.9 – 668.8	<sup>13</sup> C <sub>2</sub> -PFTTeDA	715.0 – 669.7
PFHxDA	813.1 – 768.6	<sup>13</sup> C <sub>2</sub> -PFHxDA	815.0 – 769.7
PFODA	913.1 – 868.8	<sup>13</sup> C <sub>2</sub> -PFHxDA	815.0 – 769.7
6:2 FTS	427.1 – 407.0	<sup>13</sup> C <sub>2</sub> -6:2 FTS	429.1 – 408.9
8:2 FTS	527.0 – 506.9	<sup>13</sup> C <sub>2</sub> -8:2 FTS	529.1 – 508.7
N-MeFOSA	512.1 – 168.9	d <sub>3</sub> -N-MeFOSA	515.2 – 168.9
N-EtFOSA	526.1 – 168.9	d <sub>5</sub> -N-EtFOSA	531.1 – 168.9
PFOSA	498.1 – 77.8	<sup>13</sup> C <sub>8</sub> -PFOSA	506.1 – 77.7
N-MeFOSE	616.1 – 58.9	d <sub>7</sub> -N-MeFOSE	623.1 – 58.9
N-EtFOSE	630.1 – 58.9	d <sub>9</sub> -N-EtFOSE	639.2 – 58.8
N-EtFOSAA	584.2 – 419.0	d <sub>5</sub> -N-EtFOSAA	589.3 – 419.0
N-MeFOSAA	570.1 – 419.0	d <sub>3</sub> -N-MeFOSAA	573.3 – 419.0
<b>Recovery Standard</b>			
<sup>13</sup> C <sub>6</sub> -PFDA	519.1 – 473.7	NA	NA
<sup>13</sup> C <sub>2</sub> -FOUEA	459.1 – 393.9	NA	NA
<sup>13</sup> C <sub>4</sub> -PFBA	217 – 171.8	NA	NA
<sup>13</sup> C <sub>2</sub> -4:2 FTS	329.2 – 308.9	NA	NA

<b>Compound</b>	<b>Native Parent-Daughter</b>	<b>Internal Standard</b>	<b>Native Parent-Daughter</b>
<sup>13</sup> C <sub>8</sub> -PFOA	421.3 – 376.0	NA	NA
<sup>13</sup> C <sub>5</sub> -PFHxA	318.0 – 272.9	NA	NA
<sup>13</sup> C <sub>3</sub> -PFHxS	401.9 – 79.9	NA	NA
<sup>13</sup> C <sub>4</sub> -PFOS	503.0 – 79.9	NA	NA
<sup>13</sup> C <sub>9</sub> -PFNA	472.2 – 426.9	NA	NA
<sup>13</sup> C <sub>7</sub> -PFUdA	570.1 – 524.8	NA	NA

**Table 4**  
**Exact Masses Monitored Sciex 4000 Q trap**

<b>Compound</b>	<b>Native Parent-Daughter</b>	<b>Internal Standard</b>	<b>Native Parent-Daughter</b>
PFBS	299.0 – 79.9	<sup>13</sup> C <sub>3</sub> -PFBS	301.9 – 79.95
PFHpA	363.0 – 318.9	<sup>13</sup> C <sub>4</sub> -PFHpA	367.0 – 321.9
PFHxS	399.0 – 79.91	<sup>18</sup> O <sub>2</sub> -PFHxS	403.0 – 102.9
PFHxA	313.0 – 268.9	<sup>13</sup> C <sub>2</sub> -PFHxA	315.0 – 269.9
PFOS	498.9 – 79.92	<sup>13</sup> C <sub>8</sub> -PFOS	507.0 – 78.01
PFOA	413.0 – 368.9	<sup>13</sup> C <sub>2</sub> -PFOA	415.0 – 369.9
PFBA	213.0 – 168.9	<sup>13</sup> C <sub>3</sub> -PFBA	216.0 – 172.0
PFHpS	449.0 – 80.0	<sup>13</sup> C <sub>2</sub> -PFOA	415.0 – 369.9
PFDS	599.0 – 98.9	<sup>13</sup> C <sub>2</sub> -PFUdA	565.0 – 520.0
PFPeA	263.0 – 218.9	<sup>13</sup> C <sub>3</sub> -PFPeA	266.0 – 221.9
PFDA	513.0 – 469.0	<sup>13</sup> C <sub>2</sub> -PFDA	515.0 – 470.0
PFNA	463.0 – 419.0	<sup>13</sup> C <sub>5</sub> -PFNA	468.0 – 422.9
PFUdA	563.0 – 519.0	<sup>13</sup> C <sub>2</sub> -PFUdA	565.0 – 520.0
PFDoA	613.0 – 569.0	<sup>13</sup> C <sub>2</sub> -PFDoA	615.1 – 570.0
PFTTrDA	663.0 – 619.0	<sup>13</sup> C <sub>2</sub> -PFDoA	615.1 – 570.0
		<sup>13</sup> C <sub>2</sub> -PFTTeDA	715.0 – 670.0
PFTTeDA	713.0 – 669.0	<sup>13</sup> C <sub>2</sub> -PFTTeDA	715.0 – 670.0
PFHxDA	813.0 – 769.0	<sup>13</sup> C <sub>2</sub> -PFHxDA	815.0 – 770.0
PFODA	913.0 – 868.8	<sup>13</sup> C <sub>2</sub> -PFHxDA	815.0 – 770.0
6:2 FTS	427.0 – 406.9	<sup>13</sup> C <sub>2</sub> -6:2 FTS	429.0 – 408.9
8:2 FTS	527.0 – 506.9	<sup>13</sup> C <sub>2</sub> -8:2 FTS	529.0 – 508.7
N-MeFOSA	512.0 – 168.91	d <sub>3</sub> -N-MeFOSA	515.2 – 168.93
N-EtFOSA	526.0 – 168.92	d <sub>5</sub> -N-EtFOSA	531.1 – 168.94
PFOSA	498.0 – 78.0	<sup>13</sup> C <sub>8</sub> -PFOSA	506.0 – 78.01
N-MeFOSE	616.1 – 59.1	d <sub>7</sub> -N-MeFOSE	623.0 – 59.12
N-EtFOSE	630.2 – 59.11	d <sub>9</sub> -N-EtFOSE	639.2 – 59.13
N-EtFOSAA	584.0 – 418.9	d <sub>5</sub> -N-EtFOSAA	589.1 – 419.02
N-MeFOSAA	570.0 – 419.01	d <sub>3</sub> -N-MeFOSAA	573.1 – 418.91
<b>Recovery Standard</b>			
<sup>13</sup> C <sub>6</sub> -PFDA	519.0 – 474.0	NA	NA
<sup>13</sup> C <sub>2</sub> -FOUEA	459.0 – 393.9	NA	NA
<sup>13</sup> C <sub>4</sub> -PFBA	217.0 – 171.9	NA	NA
<sup>13</sup> C <sub>2</sub> -4:2 FTS	329.0 – 308.9	NA	NA
<sup>13</sup> C <sub>8</sub> -PFOA	421.0 – 375.9	NA	NA
<sup>13</sup> C <sub>5</sub> -PFHxA	318.1 – 273.0	NA	NA

<b>Compound</b>	<b>Native Parent-Daughter</b>	<b>Internal Standard</b>	<b>Native Parent-Daughter</b>
<sup>13</sup> C <sub>3</sub> -PFHxS	402.0 – 80.01	NA	NA
<sup>13</sup> C <sub>4</sub> -PFOS	503.0 – 79.94	NA	NA
<sup>13</sup> C <sub>9</sub> -PFNA	472.0 – 427.0	NA	NA
<sup>13</sup> C <sub>7</sub> -PFUdA	570.0 – 525.0	NA	NA

**Table 5**  
**Acceptance Criteria for Performance Tests**

Compound	CCC	IPR		OPR %	Labeled compound recovery in samples %
		RSD %	Ave %		
PFBA	75-125	20	70-130	70-130	NA
PFPeA	75-125	20	70-130	70-130	NA
PFBS	75-125	20	60-130	60-130	NA
PFHxA	75-125	20	70-130	70-130	NA
PFHpA	75-125	20	70-130	70-130	NA
PFHxS	75-125	20	70-130	70-130	NA
6:2 FTS	75-125	20	60-130	60-130	NA
PFOA	75-125	20	70-130	70-130	NA
PFHpS	75-125	20	60-130	60-130	NA
PFOS	75-125	20	70-130	70-130	NA
PFNA	75-125	20	50-130	50-130	NA
PFDA	75-125	20	70-130	70-130	NA
8:2 FTS	75-125	20	60-130	60-130	NA
PFOSA	75-125	20	20-130	20-130	NA
PFDS	75-125	20	40-130	40-130	NA
PFUdA	75-125	20	70-130	70-130	NA
PFDoA	75-125	20	70-130	70-130	NA
N-MeFOSA	75-125	20	5-130	5-130	NA

Compound	CCC	IPR		OPR %	Labeled compound recovery in samples %
		RSD %	Ave %		
N-MeFOSE	75-125	20	40-130	40-130	NA
PFTTrDA	75-125	20	20-130	20-130	NA
N-EtFOSA	75-125	20	5-130	5-130	NA
N-EtFOSE	75-125	20	10-130	10-130	NA
PFTeDA	75-125	20	20-130	20-130	NA
PFHxDA	75-125	20	40-130	40-130	NA
PFODA	75-125	20	40-130	40-130	NA
N-EtFOSAA	75-125	20	70-130	70-130	NA
N-MeFOSAA	75-125	20	70-130	70-130	NA
<sup>13</sup> C <sub>3</sub> -PFBA*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>3</sub> -PFPeA*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>3</sub> -PFBS*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>2</sub> -PFHxA*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>4</sub> -PFHpA*	60-150	20	60-150	60-150	60-150
<sup>18</sup> O <sub>2</sub> -PFHxS*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>2</sub> -6:2 FTS*	40-150	20	40-150	40-150	40-150
<sup>13</sup> C <sub>2</sub> -PFOA*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>8</sub> -PFOS*	60-150	20	60-150	60-150	60-150
<sup>13</sup> C <sub>5</sub> -PFNA*	50-150	20	50-150	50-150	50-150
<sup>13</sup> C <sub>2</sub> -PFDA*	60-150	20	60-150	60-150	60-150

Compound	CCC	IPR		OPR %	Labeled compound recovery in samples %
		RSD %	Ave %		
<sup>13</sup> C <sub>2</sub> -8:2 FTS*	40-150	20	40-150	40-150	40-150
<sup>13</sup> C <sub>8</sub> -PFOSA*	20-150	20	20-150	20-150	20-150
<sup>13</sup> C <sub>2</sub> -PFUnA*	50-150	20	50-150	50-150	50-150
<sup>13</sup> C <sub>2</sub> -PFDoA*	30-150	20	30-150	30-150	30-150
d <sub>3</sub> -N-MeFOSA*	10-150	20	10-150	10-150	10-150
d <sub>7</sub> -N-MeFOSE*	5-150	20	5-150	5-150	5-150
d <sub>9</sub> -N-EtFOSE*	5-150	20	5-150	5-150	5-150
d <sub>5</sub> -N-EtFOSA*	10-150	20	10-150	10-150	10-150
<sup>13</sup> C <sub>2</sub> -PFTeDA*	20-150	20	20-150	20-150	20-150
<sup>13</sup> C <sub>2</sub> -PFHxDA*	20-150	20	20-150	20-150	20-150
d <sub>5</sub> -N-EtFOSAA*	20-150	20	20-150	20-150	20-150
d <sub>3</sub> -N-MeFOSAA*	20-150	20	20-150	20-150	20-150

\* If two or more of the internal standards are exceeding limits, corrective action will be taken and deviation will be narrated.



**Table 6**  
**Reporting Limits**

<b>Compound</b>	<b>RL Aqueous (ng/L)</b>	<b>RL Solid (ng/g)</b>	<b>RL Tissue (ng/g)</b>
PFBS	8.0	2.0	2.0
PFHpA	8.0	2.0	2.0
PFHxS	8.0	2.0	2.0
PFHxA	8.0	2.0	2.0
PFOS	8.0	2.0	2.0
PFOA	8.0	2.0	2.0
PFBA	8.0	2.0	2.0
PFHpS	8.0	2.0	2.0
PFDS	8.0	2.0	2.0
PFPeA	8.0	2.0	2.0
PFDA	8.0	2.0	2.0
PFNA	8.0	2.0	2.0
<b>Compound</b>	<b>RL Aqueous (ng/L)</b>	<b>RL Solid (ng/g)</b>	<b>RL Tissue (ng/g)</b>
PFUdA	8.0	2.0	2.0
PFDoA	8.0	2.0	2.0
PFTTrDA	8.0	2.0	2.0
PFTeDA	8.0	2.0	2.0
PFHxDA	8.0	2.0	2.0
PFODA	8.0	2.0	2.0
6:2 FTS	8.0	2.0	2.0
8:2 FTS	8.0	2.0	2.0
N-MeFOSA	40	10	10
N-EtFOSA	40	10	10
PFOSA	8.0	2.0	2.0
N-MeFOSE	40	10	10
N-EtFOSE	40	10	10
N-MeFOSAA	8.0	2.0	2.0
N-EtFOSAA	8.0	2.0	2.0

\*RL's based on 125mLs for aqueous samples and 1g for solids and tissues.

## Glossary

Analyte — Compound of interest. The analytes are listed in Table 1.

Calibration Standard — A solution prepared from a stock solution and used to calibrate the response of the HPLC/MSMS.

Calibration Verification Standard (CCC) — Calibration Standard containing a known concentration of native analytes, internal standard and recovery standards. This is analyzed to verify the accuracy of the existing calibration for those analytes.

Field Reagent Blank — A field reagent blank is a matrix preparation that is free of native analyte transported to the field in sealed containers and returned with the samples

Internal Standard – A labeled compound used as a reference for quantitation of other labeled and native compounds.

IPR — Initial precision and recovery; four aliquots of a reference material spiked with analytes of interest are analyzed to establish the ability of the laboratory to generate acceptable precision and recovery. An IPR is performed anytime the method or instrumentation is modified.

Isotope dilution quantitation – Determination of a naturally occurring (native) compound by reference to the same compound in which one or more atoms has been isotopically enriched. This method employs  $^2\text{H}$  or  $^{13}\text{C}$  labeled analogs which are spiked into each sample

LC – Liquid chromatography

Labeled Compound – A molecule in which one or more of the atoms is isotopically enriched, thereby increasing the mass of the molecule

Laboratory Blank — See method blank.

May — This action, activity, or procedural step is neither required nor prohibited.

May Not — This action, activity, or procedural step is prohibited.

Method Blank — An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with samples. The method blank is used to determine if analytes or interferences are present in the laboratory environment, the reagents, or the apparatus.

Method Detection Limit (MDL) — The lowest concentration at which an analyte can be detected under routine operating conditions (see 40 CFR 136, Appendix B).

MS — Mass spectrometer or mass spectrometry.

Must — This action, activity, or procedural step is required.

Native Compound – A molecule in which all atoms have naturally occurring isotopic abundances

OPR — Ongoing precision and recovery sample (OPR); a laboratory blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery.

Reagent Water — Water demonstrated to be free from the analytes of interest and potentially interfering substances at the method detection limit for the analyte.

Relative Standard Deviation (RSD) — The standard deviation times 100 divided by the mean. Also termed "coefficient of variation."

RPD – Relative Percent Difference shown

RF — Response factor.

RRF — Relative response factor.

Should — Although this action, activity, or procedural step is suggested, it is not required.

SICP — Selected ion current profile; the line described by the signal at an exact m/z.

Signal-to-noise ratio (S/N) – The height of the signal as measured from the mean of the noise to the peak maximum divided by the width of the noise.

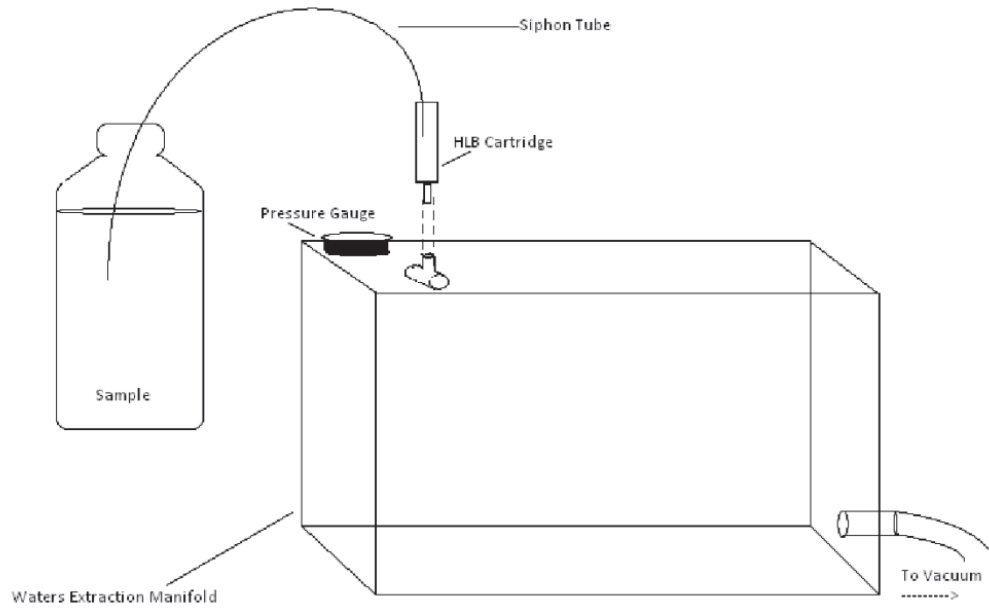
SPE — Solid-phase extraction; an extraction technique in which an analyte is extracted from an aqueous sample by passage over or through a material capable of reversibly adsorbing the analyte.

Stock Solution — A solution containing an analyte that is prepared using a reference material traceable to EPA, the National Institute of Science and Technology (NIST), or a source that will attest to the purity and authenticity of the reference material.

UPLC — Ultra performance liquid chromatography

**Appendix A**

Figure 1. Extraction Manifold Set-up



## Appendix B:

### Quadratic and Higher Order Curves

---

MassLynx uses a general Least Squares Fit algorithm to regress a polynomial of any order against the calibration points. The method used is outlined below.

Polynomial regression can be described as the fitting of  $m$  'independent' variables ( $X_j$ ,  $j = 0$  to  $m-1$ ) to a single 'dependent' variable  $y$ . In other words:

$$y = Xb + e$$

Where:

- $y$  is the  $n \times 1$  vector containing the  $n$   $y$  values ( $y_i$ ).
- $X$  is the  $n \times m$  matrix of  $x$  values, ( $x_i^j$ ).
- $b$  is the  $m \times 1$  vector of regression coefficients ( $b_j$ ).
- $e$  is the  $n \times 1$  vector of residuals from the fit to each  $y_i$  value.

The familiar least squares solution for the regression coefficients is given by:

$$b = (X'X)^{-1}X'y$$

Where:

- $^{-1}$  indicates matrix inverse
- $'$  indicates matrix transpose

The above equation can then be solved using Gauss-Jordan elimination.

To implement weighted regression  $X$  and  $y$  are first multiplied by a diagonal  $n \times n$  matrix  $P$  (in other words,  $X$  becomes  $PX$  and  $Y$  becomes  $PY$ ), before the above equation is solved.

Where each element ( $p_{ij}$ ) of  $P$  is given by:

$$p_{ij} = w_i^{1/2} \text{ for } i=j$$

$$p_{ij} = 0 \text{ for } i < > j$$

$w_i$  is weighting of  $i^{\text{th}}$  calibration point, all set to 1 for no weighting.

## Quadratic and Higher Order Curves

---

MassLynx uses a general Least Squares Fit algorithm to regress a polynomial of any order against the calibration points. The method used is outlined below.

Polynomial regression can be described as the fitting of  $m$  'independent' variables ( $X_j, j = 0$  to  $m-1$ ) to a single 'dependent' variable  $y$ . In other words:

$$y = Xb + e$$

Where:

- $y$  is the  $n \times 1$  vector containing the  $n$   $y$  values ( $y_i$ ).
- $X$  is the  $n \times m$  matrix of  $x$  values, ( $x_i^j$ ).
- $b$  is the  $m \times 1$  vector of regression coefficients ( $b_j$ ).
- $e$  is the  $n \times 1$  vector of residuals from the fit to each  $y_i$  value.

The familiar least squares solution for the regression coefficients is given by:

$$b = (X'X)^{-1}X'y$$

Where:

- $^{-1}$  indicates matrix inverse
- $'$  indicates matrix transpose

The above equation can then be solved using Gauss-Jordan elimination.

To implement weighted regression  $X$  and  $y$  are first multiplied by a diagonal  $n \times n$  matrix  $P$  (in other words,  $X$  becomes  $PX$  and  $Y$  becomes  $PY$ ), before the above equation is solved.

Where each element ( $p_{ij}$ ) of  $P$  is given by:

$$p_{ij} = w_i^{1/2} \text{ for } i=j$$

$$p_{ij} = 0 \text{ for } i < > j$$

$w_i$  is weighting of  $i^{\text{th}}$  calibration point, all set to 1 for no weighting.

## Sample Receipt and Storage

Prepared by: Svetlana Izosimova Date: 01/29/2016

Reviewed by: Randy Shields Date: 01/29/2016

### Annual Review

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

### Document Control

Issued to: QA Department Date: 01/29/2016

Issued to: Sample Management – 2 copies Date: \* 01/29/2016

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

**Effective 7 days after “\*” date**

## Sample Receipt and Storage

Summary of changes: 3.1.5.1 – detailed discussion of short-hold VOC handling; 3.2.7 – detailed discussion on sample labeling and verification;

- 1.0 **Scope and application:** To maintain documentation of custody of all bottle sets, samples (domestic and foreign), digestates, distillates, and extracts that fall under the responsibility of SGS Accutest - Orlando.
- 2.0 **Responsibility:** Sample Management Staff, Receiving.
- 3.0 **External Chain-of-Custody Procedure:**
  - 3.1 Samples are received via commercial carrier, client delivery, or are picked up by SGS Accutest - Orlando employees. Upon receipt, sample management inspects the outside of the container for signs of tampering, such as a torn or missing custody seal. The staff reviews Chain Of Custody (CoC) document for the following information:
    - 3.1.1 Client Information- Name / Address, Phone and Fax contact numbers
    - 3.1.2 Facility Information- Project name, Location, Project Number.
    - 3.1.3 Field ID / Point of Collection- Date- Time-(HOLD TIMES) Samplers Initials- # of containers Shipped, Preservative types.
    - 3.1.4 Matrix of samples: WW- water, GW-ground water, SW-surface water, DW-drinking water, SO-Soil, SOL-other solid, LIQ-other liquid, OI-Oil, AIR-air, WP- Wipe, FB-field blank, TB-trip blank.
    - 3.1.5 Analytical Information- Samples with hold times of 72 hrs or less remaining on analyses upon receipt are considered Short Hold Samples and are listed on Short Hold Notification form in order of hold times, from ASAP to 7 days with less than 3 days left. These samples are processed immediately. Job Numbers are assigned, and the samples are given directly to the appropriate lab. Copy of CoC and completed Short Hold Notification Form are relinquished to the appropriate lab by the sample receiving technician. Laboratory personnel accept the samples, time of transfer is recorded, both parties sign SHNF and a copy of the SHNF is placed in project folder.
      - 3.1.5.1 VOC soil sample vials must be frozen within 48 hours of collection. Receiving technicians review sample times and deliver samples with a SHNF if sufficient hold-time remains to process the samples. If samples are close to expiring the samples are immediately placed in the freezer with a card notating the time they were placed in the freezer.

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE



- 3.1.6 TURN AROUND TIME- Samples with a 6 day or less TAT are processed as soon as possible, depending on samples with short hold status.
  - 3.1.7 Sample custody documentation signatures – relinquished/received in Client – Carrier – Laboratory sequence. Per FL DEP SOPs signature shall consist of full signature – no initials allowed – and business affiliation.
  - 3.1.8 Special Requirements and or comments - Compositing, filtering or preservation of samples, Extended sample storage etc.
- 3.2 Samples are processed by a two-technician team, The sample custodian(s) accepts sample custody upon receipt of samples and verifies that the custody document is correct. Sample conditions, sample temperature, and other observations, including custody seal condition, are documented in detail on the Sample Receipt Confirmation form.
- 3.2.1 Temperature is measured using IR thermometer against white label on temperature blank, or on the sample container, if temperature blank is absent. **NOTE: For jobs originated in West Virginia every sample container must be checked.** This thermometer is calibrated measuring the temperature off of white sample label against NIST-traceable liquid-in-glass thermometer – see SOP QA002, current revision. When recording the cooler temperature with the use of an IR gun the following needs to be documented on Sample Receipt Confirmation Form:
    - 3.2.1.1 IR gun used.
    - 3.2.1.2 Correction factor.
    - 3.2.1.3 Observed cooler temperature.
    - 3.2.1.4 Corrected cooler temperature.
  - 3.2.2 Apply temperature correction factor for a face value – positive number to be added to direct reading temperature, negative correction factor to be subtracted.
  - 3.2.3 **Samples must remain in coolers full of ice until it is time to process the job for login. Coolers received out of temperature range have initial temperature recorded and are then placed into a Walk-In cooler until resolution from client is received.** 40 CFR part 136, TNI Standards 2009 revision and DoD QSM 5.0 all designate acceptable temperature as “above freezing and below 6°C”.
  - 3.2.4 Any discrepancies or non-compliant situations are documented on the Sample Receipt Confirmation Form and then communicated to

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE

the SGS Accutest - Orlando Project Manager (PM) assigned to the particular client, who then contacts the client for resolution. A system of red and yellow flags on the folders quickly identifies the chains of custody that have discrepancies and severity of the discrepancy. Red flags require the client to be contacted before the samples can be logged in, such as but not limited to missing COC's, samples being out of hold, insufficient sample volume, bottles received not on COC or out of temperature range. If resolution of the problem is taking time, the samples are labeled as is and placed into refrigerated storage until the problems are resolved. Samples are then removed and adjusted accordingly. Yellow flags identify discrepancies that do not interfere with log-in and/or analysis of the samples, such as 1 of 2 PAH bottles received broken or supplied. The resolution is documented and communicated to sample management for execution via a changeorder.

- 3.2.5** Once the sample custodian(s) is (are) satisfied with the information on the chain of custody document, the job number is assigned with the next available SGS Accutest - Orlando sequential job ID in FXXXXXX convention and recorded in sample job logbook.
- 3.2.6** First technician arranges samples on the counter in the order of CoC. Every different point of collection must have a different fraction number, i.e. -1, -2, etc. The assigned fraction number must be written on the chain of custody, to the left of the line identifying the point of collection (Client ID) unless there is insufficient space. The custodian then assigns a unique sample identifier to each sample container, i.e. FAXXXXX-1.4, where 4 is a unique container designation.
- 3.2.7** The same technician enters samples in the sample location database and prints the labels for the samples. A second technician then attaches the labels to the samples and re-verifies sample client ID and Lab fraction number against CoC. After all the steps in Sec. 3 are completed, first technician signs the Sample Receipt Confirmation Form and second technician reviews it for completeness and accuracy of recorded information.
- 3.2.7.1** Wherever samples are designated to be put on hold by the client, labels on these samples are highlighted in bright pink and additional bright pink "**HOLD – Do Not Dispose**" label is attached to the individual containers
- 3.2.8 After Hours Delivery Procedure.** Upon return to the lab Accutest-employed couriers will visually inspect the coolers and add ice if needed. Coolers will then be placed into Refrigerated storage until Sample Receiving Technicians can process the coolers. Sample Receiving technicians will arrive first thing in the morning to verify Short Holds, Rushes etc as per sec. 3.1.5 and 3.1.6.

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE

3.3 When assigning a job number, job information on the chain of custody is entered in the sample receipt logbook (see attached). The following information shall be documented in the sample receipt logbook:

- 3.3.1 SGS Accutest - Orlando Assigned Job #
- 3.3.2 Client Name
- 3.3.3 Project Name
- 3.3.4 Date Samples Received.
- 3.3.5 # of coolers Received.
- 3.3.6 Courier Information
- 3.3.7 Skif # (Sample Kit Information Sheet)
- 3.3.8 Technician Initials

3.4 The sample custodian then checks the samples' preservation, with the exception of the volatile samples, which are checked by the analyst after the sample is analyzed. Should a sample be received preserved incorrectly the following actions are taken:

- 3.4.1 pH and residual chlorine: For samples requiring preservation (HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, NaOH and NaOH/Zn Acetate) each container is tested by applying the sample with disposable capillary to narrow-range pH paper. Residual chlorine presence/absence is measured using potassium iodide/starch paper in samples for all EPA 600 series and samples originated in North Carolina (one bottle per well). 45-ml VOC vials are exempt from this procedure and are being tested in the lab after the requested tests are completed (purge-and-trap GC and GC/MS, TOC/TC and EPA 504/8011).
- 3.4.2 Organochlorine pesticides and PCBs by EPA 608 - samples that are not extracted within 72 hours of collection need to have pH checked and adjusted, if necessary, to a pH within 5.0-9.0 using H<sub>2</sub>SO<sub>4</sub> or NaOH. Coordinate with Extraction department.
- 3.4.3 Pesticides/PCB's/Semivolatile Organic aqueous samples with residual chlorine present: Add 1 ml of 8% sodium thiosulfate solution per 1liter (0.008%) to all containers except VOA. Record event on Sample Receipt Confirmation Form and in preservative adjustment log.
- 3.4.4 Cyanide is preserved to pH  $\geq$  12 using 10N NaOH, prepared by WetChem personnel.
- 3.4.5 Sulfide is preserved to pH  $\geq$  9 using 10N NaOH and Zn acetate, prepared by WetChem personnel.
- 3.4.6 Aqueous samples for metals are preserved to pH  $\leq$  2 with nitric acid, prepared by WetChem Personnel. These samples are marked with colored label "**Metals Sample Received Unpreserved. Preserved**

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE

**Date\_\_\_\_\_Time\_\_\_\_\_ Analyze after 24 hours”**. For correctly preserved aqueous metals sampling date and time from COC is recorded as date and time of preservation.

- 3.4.7** Aqueous samples for TRPH and some WetChem parameters are preserved to a pH of  $\leq 2$  with H<sub>2</sub>SO<sub>4</sub>, prepared by WetChem Personnel.
- 3.5** If Sample volume is incorrect for the requested tests, insufficient sample volume will be recorded on Sample Receipt Confirmation form, the folder to be flagged with a red sticker and the project manager will contact the client immediately for further instruction. Any comments should be noted in detail, such as obvious headspace in VOA vials or TOX bottles, leaking bottles, or broken bottles, on the Sample Receipt Confirmation form and given to the project manager to resolve with the client on how to proceed with the samples. The form is filed in the job folder with the chain of custody and any other paperwork relevant to the job.
- 3.6** Incorrectly preserved samples have the proper amount of preservative added, upon confirmation from PM or client, volume added is recorded on the Sample Receipt Confirmation form and in preservative adjustment log. The same volume and type of preservative is then added to the Equipment Blank and/or Field Blank, regardless of pH reading. Volume added is recorded on the Sample Receipt Confirmation form and in the preservative adjustment log. Also see Sec. 3.4.5.

Job Number, Sample ID, Bottle Number, Parameter, Preservative Type, Preservative Lot, and Amount of Preservative Added. Date/Time Added and the technician's initials.

- 3.7** All bottles must be labeled. Each bottle will be labeled both on the cap and on the bottle. VOA vials have the label wrapped around the top of the vial, just below the cap. The labels are generated by the electronic sample receipt log. The following information is entered into the electronic log:

- 3.7.1** Job #:
- 3.7.2** Client Name and Project
- 3.7.3** Date and time samples were received.
- 3.7.4** The number of coolers received
- 3.7.5** The temperature of each cooler
- 3.7.6** Initials of custodian logging in the job
- 3.7.7** Number of samples
- 3.7.8** Number of bottles
- 3.7.9** Bottle type
- 3.7.10** Preservative by code. Preservatives codes are:

“1” = preservative is checked by analyst  
“2” = not applicable

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE

“3” = correctly preserved for the analysis requested

- 3.7.11 Bottle storage location
- 3.7.12 Department to do the analysis
- 3.7.13 The information is saved and labels can be printed.

3.8 The following information must be on the bottle:

- 3.8.1 The sample number and bottle number
- 3.8.2 Storage location
- 3.8.3 The preservative used during sampling as indicated on the chain
- 3.8.4 Any hazard the Sample Custodian may be aware of

3.9 The samples must be placed in their assigned locations and kept at above freezing and below 6.0°C until preparation and/or analysis. Water samples preserved with HNO<sub>3</sub> for metals analyses are stored at room temperature. Access to the area is limited.

3.10 The original chain of custody, the Sample Receipt Confirmation form, Subcontract COC and any additional documented information relative to the job, is put in the folder indicated with the job number and forwarded to computer log in.

3.11 **Foreign samples** are referred to samples originated outside of continental United States. These samples must be segregated from domestic samples in storage, processing and disposal. Objective of such segregation is to keep agricultural pests and pathogens from entering continental US territory and interfering with animal and plant health.

3.11.1 Foreign Samples shall be shipped in securely closed watertight containers and free of debris and macro organisms (insects, mollusks, worms, ticks and mites).

3.11.2 Foreign samples are stored in lockable cage in WI#3 to prevent accidental disposal. This cage is clearly marked *for foreign samples only*.

3.11.3 Keep lids tightly closed while in storage.

3.11.4 All unconsumed samples and containers must be separately collected for disposal. SGS Accutest - Orlando employs outside contractor to sterilize and dispose of foreign samples – see SOPs SAM108 and SAM109, current revision.

#### 4.0 **Sample Storage Temperature and Cross-Contamination Monitoring:**

4.1 While in the laboratory, samples shall be stored in limited-access, temperature – controlled areas. Refrigerators shall be monitored for temperature daily.

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE

Acceptance criteria for the temperature of refrigerator is 0.5 to 6.0 °C \* and is listed in the refrigerator log. Thermometers that have been calibrated with a NIST traceable thermometer monitor all cold storage areas. As indicated by the finding of the calibration, a correction factor is applied to each thermometer for a face value. Records that include acceptance criteria shall be maintained.

\*According to TNI 2009, V1M2, sec. 5.8.9.a.i) temperature should be above freezing point and below 6.0°C, when specified storage temperature is 4°C. Lowest temperature that can be practically read above freezing point is 0.5°C.

- 4.2 Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Acceptance criteria for the temperature of a volatile refrigerator is 0.5 to 6.0 °C and is listed in the refrigerator's log. VOC Soil freezers are maintained between -10.0°C and -20.0°C per SW-846 5035A. For further details refer to SOP QA004, current revision.
- 4.3 Sample storage area for volatile organics shall be monitored for cross contamination through the use of refrigerator blanks. Refrigerator blanks shall be analyzed every other week.
  - 4.3.1 If contamination of the refrigerator is confirmed, the samples must be removed from the refrigerator and placed in coolers with ice, or in alternate refrigerated storage.
  - 4.3.2 All samples received after the date of the last clean refrigerator blank must be checked for the same contaminants. If present, they must be reported and flagged with a qualifier indicating possible lab contamination.
  - 4.3.3 The source of the contamination must be located and removed.
  - 4.3.4 A new refrigerator blank is then placed in the refrigerator and analyzed after 24 hours.
  - 4.3.5 Samples may be returned to the refrigerator when all contaminants are removed as indicated by the analysis of a refrigerator blank without contamination.

## 5.0 Documentation

All samples received by SGS Accutest - Orlando must come with a chain-of-custody (COC). Special attention shall be paid to client-specific COCs.

SGS Accutest - Orlando personnel MUST record dates and time in **mm/dd/yy 24:00** format, and both observed and corrected temperatures.

PROPERTY OF SGS ACCUTEST  
CONTROLLED COPY  
DO NOT DUPLICATE

Current revisions of forms and label templates used in sample receipt process are maintained as controlled documents in limited access directory on LAN.

## 6.0 References

- 6.1 TNI Standards, 2009 revision
- 6.2 State of Florida DEP SOPs
- 6.3 40 CFR, Part 136.
- 6.4 DoD QSM 5.0, 2013

## PROCEDURE FOR SAMPLE BOTTLE PREPARATION AND SHIPMENT

Prepared by: Svetlana Izosimova Date: 10/10/16

Approved by: Randy Shields Date: 10/10/16

### Annual Review

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

### Document Control

Issued to: QA Department Date: 10/10/16

Issued to: Shipping Department Date: \* 10/13/16

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Effective 7 days after "\*" date

**CONTROLLED COPY  
DO NOT DUPLICATE**



# TITLE: PROCEDURE FOR SAMPLE BOTTLE PREPARATION AND SHIPMENT

**REVISED SECTIONS:** Sec. 3.0 – Sample cooler preparation procedure updated

## 1.0 SCOPE AND APPLICATION; SUMMARY

This procedure is used to prepare sample kits for shipment to the clients. Client's specifications are reviewed and sampling containers of appropriate size and preservation are assembled into sampling kits according to the list of tests requested and number of sites tested.

Sampling containers are later packaged to prevent damage in shipment. Necessary safety warning and sampling paperwork is placed inside the shipping cooler; shipping information attached, custody seal wrapped across opening and cooler is taped shut.

Shipping performed by either commercial carriers or SASE couriers.

## 2.0 RESPONSIBILITY

Shipping Department Manager

## 3.0 SAMPLE COOLER PREPARATION PROCEDURE

- 3.1 Light-to moderately dirty sample coolers are wiped clean, rinsed, and air-dried between uses.
- 3.2 Heavily soiled and malodorous coolers are washed with detergent using a stiff brush, rinsed, and air-dried. If dirt or odor persists, remove cooler from use.

## 4.0 PRESERVATION AND CONTAINERS TYPES AND SIZES

See attachment 1. NOTE: SW-846 Update IV has revised holding times on several analytes, i.e PCBs and Dioxins/Furans. At present not all the States have adopted Update IV methodology. Therefore SGS Accutest continues to follow holding times and preservation outlined in Update III, chapters 3 and 4.

- 4.1 SGS Accutest - Orlando purchases pre-preserved vials for analysis of VOC accompanied by Manufacturer Certificates of Analysis (CoA) whenever possible. VOC group representative should review CoA to ensure acceptable level of cleanliness. In the event when pre-preserved bottles are not commercially available, preservatives are prepared in-house by General Chemistry staff and recorded in the log.

**CONTROLLED COPY  
DO NOT DUPLICATE**

- 4.2 Upon preservation bottle lot is tested for purity by laboratory staff and data kept on file with Sample Manager. This data also traceable through LIMS and LabLink utility.
- 4.3 All bottleware received is run through bottle QC within SASE regardless of CoA. See SOP SAM104, current revision.
- 4.4 All Preservatives generated in Wet Chemistry department for use in kit preparation is passed through QC specification. For further details refer to SOP SAM104, current revision.
- 4.5 For PCB wipe kit preparation obtain n-Hexane, pesticide grade, pre-tested for PCB from O-Prep department. Hexane lot is also recorded on the SKIF.

## **5.0 INSTRUCTIONS FOR FILLING A BOTTLE ORDER**

- 5.1 Upon request for a bottle order, the Client Services representative or project manager will complete an Internal Kit Request form and SKIF
  - 5.1.1 The organization's name, address, contacts and phones number.
  - 5.1.2 The date needed.
  - 5.1.3 The project name, or number, or contract number.
  - 5.1.4 The shipping instructions.
  - 5.1.5 The number of samples for each matrix.
  - 5.1.6 The analysis requested
  - 5.1.7 The number of Field and/or Trip Blanks to be included.
- 5.2 A sample kit information form (SKIF) is produced from the above information and is entered in the same format. The SKIF is then given to Sample management, who is responsible for filling the bottle order. Upon receipt of the SKIF, Sample Management will review the information on the form and begin to obtain bottles, which have passed QC to complete the order (See 4.2).
- 5.3 Each bottle is labeled with the analysis, and the preservative used. All preservatives are prepared in the lab to the proper concentration. Preservative Lot number(s) and Bottle lot number(s) are recorded on Kit Request Form.
- 5.4 Residual chlorine preservation kits are made available per client's request.
- 5.5 Provide soil field kits for VOC soil sampling for the following clients: BP, UTC, EIPaso, GE, TransCanada, and SUNOCO

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

5.6 Field and Trip blanks:

- 5.6.1 All Trip and Field Blank water must be obtained from activated charcoal filtered, deionized water originating from the volatiles laboratory source of blank water, which is monitored daily.
- 5.6.2 The area in which the blanks are created should be clean and free of all contaminants.
- 5.6.3 Trip Blanks are filled at the lab and travel with the cooler for the length of the traveling time, from lab to sampling site and back to the lab. They are in the same type of bottles and preserved with the same preservatives as the samples. Depending on analyses requested 2 vials are filled and labeled with the date and time they were made. These are placed into a ziplock bag and wrapped in a bubble bag a trip blank custody seal is placed around the package to prevent tampering. This procedure will check for any volatile contamination in the glassware, cooler or other outside factor. All trip blank vials must be free of bubbles or headspace.
- 5.6.4 Field/Equipment blanks – In the field, filtered deionized analyte-free water from the laboratory's main source of blank water is poured over or through the field sampling apparatus and collected and preserved as applicable into the empty bottles provided. This is a check for cleanliness or cross contamination of the field sampling equipment. 1-gallon HDPE containers are provided on a limited basis.

## 6.0 SHIPMENT OF SAMPLE KITS

- 6.1 All sample bottles, temperature blanks, DI water, and other requested materials are then placed into a clean cooler. The bottles must be packed in the sample cooler in a fashion to prevent breakage during shipment by placing them in bubble bags or wrapping with bubble wrap. **The use of Styrofoam pellets as packing material is prohibited.** A copy of the SKIF, blank Chain of Custody forms, bottle labels, return airbill and blank Custody seals are placed in a ziplock bag and put in the cooler with the bottles.
- 6.2 Since sampling bottles may contain small amounts of skin-corrosive preservatives, such as acids and Sodium Hydroxide, highly visible safety warning is taped to the inside of cooler lid.
- 6.3 Place a custody seal, initialed and dated, over the opening edge of the sample cooler and tape over the seal with clear tape on the sample cooler. The cooler is labeled with the client name, project name, project manager or the name of the person to whom the kit is being sent along with the number of coolers in the shipment.

Cooler shipment information is retained in a project tracking database with the following information. SKIF #, Client Name, Project Name, Request Date, Ship Date, # of coolers in shipment and the shipment method. SASE uses FedEx, UPS, Greyhound and its own Courier Fleet.

- 6.4 Coolers being shipped via Federal Express and UPS should use coolers with handles and a preprinted label placed on a hangtag if available.
- 6.5 Coolers shipped by Greyhound Bus must use a bus bill, which must be filled out manually. Up to 5 coolers may be shipped on a single bus bill.
- 6.6 Coolers being shipped by couriers must have the clients' name and address, as well as SGS Accutest's return address clearly marked on the cooler.

## **7.0 DOCUMENTATION**

- 7.1 Kit requests are documented on internal and computer-generated kit requisition forms. One copy is provided to the client with the sampling kit(s) for their records. A copy of the SKIF is retained for reference.
- 7.2 All cooler shipments via SASE courier are documented on the courier sheet

## **8.0 REFERENCES**

Code of Federal Register, Title 40, Part 136 and part 141  
SW-846, Updates III, IV and V  
FDEP SOPs  
DoD QSM 5.0, 2013  
TNI Standards, 2009 revision  
SASE SOP SAM104, current revision.

**DRINKING WATER - 40 CFR PART 141  
METHODOLOGIES HOLDING TIMES  
PRESERVATION  
CONTAINER REQUIREMENTS**

**Attachment I**

**CONTROLLED COPY  
DO NOT DUPLICATE**

**SGS ACCUTEST**  
**STANDARD OPERATING PROCEDURE**  
**FN: SAM102.09**  
**Rev. Date: 10/2016**  
**Page 7 of 14**

Holding time/Preservation/Container Sheet for Drinking Water - 40 CFR Part 141

\* Residual chlorine preservation kits are made available per client's request.

<u>Parameter</u>	<u>Sample Container</u>	<u>Container Volume</u>	<u>Preservation</u>	<u>Maximum Holding Time (from time of sampling)</u>	<u>Analytical Methodology</u>
Volatile Organic Compounds -Potable Water	Glass screw cap vial with PTFE-faced silicone septum	3x45 ml VOC vials	pH<2 with 1:1 HCL Storage at 4 <sup>0</sup> C from time of collection until analysis. If disinfect on products are to be measured, add ascorbic acid or sodium thiosulfate as per method.	14 days	40 CFR 141 Method 524.1
Volatile Organic Compounds -Potable Water	Glass screw cap vial with PTFE-faced silicone septum	3x45 ml VOC vials	pH<2 with 1:1 HCL Storage at 4 <sup>0</sup> C from time of collection until analysis. If disinfect on products are to be measured, add ascorbic acid or sodium thiosulfate as per method.	14 days	40 CFR 141 Method 524.2
1,2-Dibromomet hane (EDB) and 1,2-Dibromo-3-chloropropan e(DBCP) - Potable Water	Glass screw cap vial with PTFE-faced silicone septum	3x45 ml VOC vials	pH<2 with 1:1 HCL , 3mg sodium Thiosulfate or 75 ml solution of 40 mg/l, storage at 4 <sup>0</sup> C until time of analysis.	28 days	40 CFR 141 Method 504.1
Organochlori ne Pesticides and PCBs	Glass screw cap vial with TFE-Polyethylene film/foam septum	3x45 ml VOC vials	3 mg of sodium thiosulfate crystals prior to shipping bottles, storage at 4 <sup>0</sup> C until analysis	Heptachlor: extraction in 7 days analysis in 40 days.	40 CFR 141 method 505
Asbestos	Amber Glass, screw cap	1000 ml	Cool, 4 <sup>0</sup> C, dark	Analysis in 14 days.	40 CFR 141
Fluoride	Plastic	500ml	4 <sup>0</sup> C until time of analysis	1 month	40 CFR 141
Mercury	Plastic	500ml	Conc. HNO <sub>3</sub> to pH<2	28 days	40 CFR 141
Metals, except mercury	Plastic	500ml	Conc. HNO <sub>3</sub> to pH<2	180 days	40 CFR 141
Nitrate-Nitrite Chlorinated	Plastic	500ml	Cool 4 <sup>0</sup> C, Conc. H <sub>2</sub> SO <sub>4</sub> to pH<2	28 days	40 CFR 141
Nitrate Non-chlorinated	Plastic or Glass	500ml	Cool 4 <sup>0</sup> C	48 hours	40 CRF 141
Nitrite	Plastic or Glass	500ml	Cool 4 <sup>0</sup> C	48 hrs.	40 CFR 141
Perchlorate	Plastic	125 ml	Cool 4 <sup>0</sup> C	28 days.	40 CFR 141
Perfluorinated Compounds (PFCs)	HDPP, wide-mouth, no PTFE cap liner	250 ml	Cool 4 <sup>0</sup> C	14 days.	EPA 537

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

**SW-846 3rd EDITION  
METHODOLOGIES HOLDING TIMES  
PRESERVATION  
CONTAINER REQUIREMENTS**

**Attachment I, cont'd**

**CONTROLLED COPY  
DO NOT DUPLICATE**

**SGS ACCUTEST**  
**STANDARD OPERATING PROCEDURE**  
**FN: SAM102.09**  
**Rev. Date: 10/2016**  
**Page 9 of 14**

Holding time/Preservation/Container Sheet for SW-846 3rd Edition  
Aqueous and Non-aqueous Samples

<u>Parameter</u>	<u>Sample Container</u>	<u>Container Volume</u>	<u>Preservation</u>	<u>Maximum Holding Time (from time of sampling)</u>	<u>Analytical Methodology</u>
Volatile Organics – Concentrated Waste Samples	Glass, wide mouth teflon liner	8 oz	None	14 days	SW-846 8015, 8021; GC/MS - 8260
Volatile Organics - Liquid Samples, no residual Cl	Glass vial, teflon lined septum cap	3X 40 ml	pH<2 with HCL cool, 4 <sup>0</sup> C	14 days	SW-846 8015, 8021; GC/MS - 8260
Volatile Organics - Liquid Samples residual Cl*	Glass vial, teflon lined septum cap	3 X 40 ml	Collect sample in 4 oz soil VOA container, 4 drops prepreserved with 10% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> . Gently mix sample and transfer to 40 ml VOA vial prepreserved with 4 drops conc. HCL, cool, 4 <sup>0</sup> C	14 days	SW-846 8015, 8021; GC/MS - 8260
Volatile Organics - Soil/Sediments/Sludge	Glass, wide mouth, teflon liner or septum	4 oz 1 x 40ml MeoH 2 x 40 ml with DI Water	Cool 4 <sup>0</sup> C 5035A	14 days Freeze within 48 hours	SW-846 8015, GC/MS 8260
Volatile Organics - Soil/Sediments/Sludge**	Glass, wide mouth, teflon liner or septum	8 oz 1x25g EnCores	Cool 4 <sup>0</sup> C 5035A	14 days Freeze within 48 hours	GC/MS 8260
Volatile Organics - Soil/Sediments/Sludge***	Glass, wide mouth, teflon liner or septum	4 oz glass jar with 25 ml of Methanol, surrogate added	Cool 4 <sup>0</sup> C AK-101	14 days	Alaska samples only – GC/MS 8260; AK-101 GRO

\* Residual chlorine preservation kits are made available per client's request.

\*\* State of FL UST-specific sampling requirement for TCLP Volatiles.

\*\*\*State of AK Contaminated Sites Program-specific VOC sampling requirement

**CONTROLLED COPY**  
**DO NOT DUPLICATE**



**SGS ACCUTEST**  
**STANDARD OPERATING PROCEDURE**  
**FN: SAM102.09**  
**Rev. Date: 10/2016**  
**Page 10 of 14**

Holding time/Preservation/Container Sheet for SW-846 3rd Edition  
Aqueous and Non-aqueous Samples

<u>Parameter</u>	<u>Sample Container</u>	<u>Container Volume</u>	<u>Preservation</u>	<u>Maximum Holding Time (from time of sampling)</u>	<u>Analytical Methodology</u>
Total Organic Carbon	Glass	2 x 40ml amber vial	Cool, 4 <sup>0</sup> C, dark, HCL or H <sub>2</sub> SO <sub>4</sub> to pH<2 if analysis can't be done within 2 hours.	2 hrs if unpreserved, 28 days if preserved	SW-846 9060
Total Organic Carbon – soil and sediment	Glass	4 oz	Cool, 4 <sup>0</sup> C, dark	28 days	SW-846 9060
Phenols	Glass , teflon lined cap	250ml	Cool, 4 <sup>0</sup> C, H <sub>2</sub> SO <sub>4</sub> to pH<4	28 days	SW-846 9065, 9066, 9067
Total recoverable oil and grease	Glass only, wide mouth	1 liter amber x 2	None or 5 ml h2so4, Cool 4 <sup>0</sup> C	unpreserved - <6hrs. preserved - 28 days	SW-846 9070 (EPA 1664A)
Oil and grease for soil and sludge	Glass only, wide mouth	8 oz jar	None	28 days	SW-846 9071
Total Coliform	Plastic	60ml	cool 4 <sup>0</sup> C, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if residual Cl, EDTA if high in heavy metals	6 hrs	SW-846 9131, 9132
Common anions – Br, F, Cl, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub>	Plastic	500ml	None	28 days, 48 hours for NO <sub>2</sub> and NO <sub>3</sub>	SW-846 9056
Extractable organics – Concentrated Waste samples	Glass, wide mouth with teflon liner	8 oz	None	Extraction in 14 days, Analysis in 40 days from extraction	SW-846 GC-8081; 8082, 8141, 8151 8310, 8330; 8015 GC/MS - 8270
Extractable Organics - Liquid Samples no residual Cl	Glass, amber, with teflon liner	1 liter amber x2; 250ml amber x2	Cool, 4 <sup>0</sup> C	Extraction in 7 days, Analysis in 40 days from extraction	SW-846 GC-8081; 8082, 8141, 8151 8310, 8330, 8015 GC/MS - 8270
Extractable Organics - Liquid Samples residual Cl present * Residual chlorine preservation kits are made available per client's request.	Glass, amber, with teflon liner	1 liter amber x2; 250ml amber x2	with residual chlorine present: Add 3 mL of 10% sodium thiosulfate solution per gallon (0.008%). Addition can be performed prior to field use. Cool, 4 <sup>0</sup> C, dark	Extraction in 7 days, Analysis in 40 days from extraction	SW-846 GC-8081, 8082; 8141, 8151, 8310, 8330; 8015 GC/MS - 8270

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

**SGS ACCUTEST**  
**STANDARD OPERATING PROCEDURE**  
**FN: SAM102.09**  
**Rev. Date: 10/2016**  
**Page 11 of 14**

Extractable Organics - Soils/Sediments sludges	Glass, wide mouth with teflon liner	8 oz	Cool, 4 <sup>0</sup> C	Extraction in 14 days, Analysis in 40 days from extraction	SW-846 GC-8081, 8082; 8141, 8151, 8310, 8330, 8015 GC/MS - 8270
Extractable Organics – Wipe Samples	Glass	2 oz jar, 10 ml of Hexane, pesticide grade	Cool, 4 <sup>0</sup> C	14 days	SW-846 GC-8082
Metals except CR <sup>+6</sup> and mercury	Plastic, glass	4 oz, 500 ml	AQ samples - HNO <sub>3</sub> to pH<2	180 days	SW-846 6010, 6020
Mercury	Plastic, glass	4 oz 500ml	AQ samples - HNO <sub>3</sub> to pH<2	28 days	SW-846 7470, 7471
Hexavalent Chromium - AQ	Plastic	500ml	Cool, 4 <sup>0</sup> C	24 hrs	SW-846 7196
Hexavalent Chromium - SO	Glass	4 oz	Cool, 4 <sup>0</sup> C	24 hrs	SW-846 7196
Cyanide, total and amenable to chlorination	Plastic	500ml	Cool, 4 <sup>0</sup> C, 10 N NaOH to pH>12, if oxidizing agents present, preserve with 0.6g ascorbic acid per liter or 5 ml 0.1N NaAsO <sub>2</sub> per liter	14 days	SW-846 9012
	Amber glass or amber plastic – NV state-specific requirements	250ml			
Total Organic Halides (TOX)	Glass, vials, teflon septa. Amber glass, teflon lined cap/foil lined cap	250 ml	Cool, 4 <sup>0</sup> C, dark, H <sub>2</sub> SO <sub>4</sub> to pH<2, no headspace	28 days	SW-846 9020, 9021
Sulfides	Plastic	3x 250ml	Cool, 4 <sup>0</sup> C, add 4 drops 2N zinc acetate per 100 ml sample, NaOH to pH>9	7 days	SM4500S=F-MOD
Cyanide solids and oils	Glass Amber glass or glass wrapped in foil – NV state-specific requirement	8 oz. 4oz - 8 oz.	Cool, 4 <sup>0</sup> C	14 days	SW-846 9012
Perchlorate, solid and AQ	HDPP, wide-mouth	4 oz	Cool 4 <sup>0</sup> C	28 days.	SW-846 6850
Perfluorinated Compounds (PFCs), solid and AQ	HDPP, wide-mouth, no PTFE cap liner	4 oz	Cool 40C	14 days.	EPA 537 MOD

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

**AQUEOUS - 40 CFR PART 136  
METHODOLOGIES HOLDING TIMES  
PRESERVATION  
CONTAINER REQUIREMENTS**

**Attachment I, cont'd**

**CONTROLLED COPY  
DO NOT DUPLICATE**

**SGS ACCUTEST**  
**STANDARD OPERATING PROCEDURE**  
**FN: SAM102.09**  
**Rev. Date: 10/2016**  
**Page 13 of 14**

Holding time/Preservation/Container Sheet for 40 CFR Part 136  
Aqueous Samples

<u>Parameter</u>	<u>Sample Container</u>	<u>Container Volume</u>	<u>Preservation</u>	<u>Maximum Holding Time (from time of sampling)</u>	<u>Analytical Methodology</u>
Halogenated Volatile	Glass, teflon lined septum	3x40ml	Cool, 4 <sup>0</sup> C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if residual Cl present	14 days	40 CFR 136; GC/MS-624, 1624
Aromatic Volatile	Glass, teflon lined septum	3x40ml	Cool, 4 <sup>0</sup> C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if residual Cl, optional: HCL to pH of 2	Without HCL - 7 days, With HCL - 14 days	40 CFR 136; GC-602, GC/MS-624, 1624
Base-Neutral-Acid Extractables	Glass, amber, teflon lined screw cap	1 literx2	Cool, 4 <sup>0</sup> C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if residual Cl present	Extraction in 7 days, Analysis in 40 days from extraction	40 CFR 136: GC/MS-625, 1625
Polynuclear Aromatic Hydrocarbons	Glass, amber teflon lined screw cap	1 literx2	Cool, 4 <sup>0</sup> C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if residual Cl present	Extraction in 7 days, Analysis in 40 days from extraction	40 CFR 136: HPLC-610, GC/MS-625, 1625
Chlorinated Pesticides and PCBs	Glass, amber, teflon lined screw cap	1 amber literx2	Pesticides - Cool, 4 <sup>0</sup> C, pH adjustment to 5-9. PCBs - Cool, 4 <sup>0</sup> C. Aldrin - Cool, 4 <sup>0</sup> C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if residual Cl, pH adjust to 5-9	Extraction in 7 days Analysis in 40 days from extraction	40 CFR 136: GC-608, GC/MS-625
Chlorinated Hydrocarbons	Extractable methods - Glass, amber, teflon lined screw cap	Extractable methods - 1 literx2	Cool 4 <sup>0</sup> C	Extractable methods - 7 days to extraction, 40 days to analysis from time of extraction	40 CFR 136: GC-602, GC/MS-624, 625
	Purgeable Methods - Glass, teflon lined septum	Purgeable Methods - 40mlx3	HCl		
Common Anions and Orthophosphate	Plastic	500ml	Cool 4 <sup>0</sup> C	28 days., NO <sub>2</sub> , NO <sub>3</sub> , OPO <sub>4</sub> – 48 hours	40 CFR 136: - EPA 300; 365.3
Total Phenolics	Glass	250ml	Cool 4 <sup>0</sup> C, pH <2 with H <sub>2</sub> SO <sub>4</sub>	28 days.	40 CFR 136; 420.4
Complex Nutrients (TKN, TPO <sub>4</sub> ) and Ammonia	Plastic	500ml	Cool 4 <sup>0</sup> C, pH <2 with H <sub>2</sub> SO <sub>4</sub>	28 days.	40 CFR 136: 351.2, 365.3 and 350.1

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

**SGS ACCUTEST**  
**STANDARD OPERATING PROCEDURE**  
**FN: SAM102.09**  
**Rev. Date: 10/2016**  
**Page 14 of 14**

Sulfide	Plastic	3x250 ml	Cool 4 <sup>0</sup> C, pH >9 with NaOH, Zn Acetate added	7 days.	40 CFR 136: SM 4500 S=F
Surfactants (MBAS)	Plastic	500ml	Cool 4 <sup>0</sup> C	48 hours	40 CFR 136 SM 5540C
BOD and CBOD	Plastic	1000ml	Cool 4 <sup>0</sup> C	48 hours.	40 CFR 136 SM 5210B
Total Organic Carbon	Glass	2x40 ml VOC, amber	Cool, 4 <sup>0</sup> C, dark, HCL or H <sub>2</sub> SO <sub>4</sub> to pH<2,	28 days.	40 CFR 136; SM 5310C
COD	Plastic	500ml	Cool 4 <sup>0</sup> C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 days.	40 CFR 136: SM5220C
Minerals (Alkalinity, pH, Conductivity, TDS, TS, Color, Turbidity)	Plastic	500ml	Cool 4 <sup>0</sup> C	14 days, 7 days, immediate.	40 CFR 136: SM 4500H-B; 2320B: 2540B,C; 2120B, EPA 120.1, 180.1
TSS	Plastic	1000ml	Cool 4 <sup>0</sup> C	7 days.	40 CFR 136: 2540 D;
Cyanide	Plastic	500ml	Cool, 4 <sup>0</sup> C, 10 N NaOH to pH>12	14 days.	40 CFR 1 335.4
Metals	Plastic	500ml	Cool 4 <sup>0</sup> C, pH <2 with HNO <sub>3</sub>	Metals – 6 months, Mercury - 28 days.	40 CFR 136, 200.7, 200.8, 245.1
Nitrate/Nitrite, total	Plastic	500ml	Cool 4 <sup>0</sup> C, pH <2 with H <sub>2</sub> SO <sub>4</sub>	28 days.	40 CFR 136 353.2

**CONTROLLED COPY**  
**DO NOT DUPLICATE**



**DATA ENTRY for SAMPLE LOG-IN**

Prepared by: Lovelie Metzgar Date: 08/03/2016

Approved by: Ellen Pampel Date: 08/15/2016

Annual Review

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Document Control

Issued to: QA Department Date: 08/15/2016

Issued to: Log-In Department Date: \* \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Effective 7 days after "\*" date

**CONTROLLED COPY  
DO NOT DUPLICATE**

## TITLE: DATA ENTRY for SAMPLE LOG-IN

### REFERENCES: Seed Pack1, Laboratory Manual

**REVISED SECTIONS:** re-branded to SGS Accutest throughout document; Sec. 9.3.2.5 – edited PO number

### 1.0 SCOPE AND APPLICATION

1.1 This SOP describes the processes used for entering sample and order related information provided by the client during initial project set-up and through sample collection, delivery, and custody transfer. This SOP applies to all commercial samples analyzed by SGS Accutest.

### 2.0 SUMMARY

2.1 Project specifications are defined by the clients and combined with critical information obtained during sample collection. This information is documented and translated into coded information that is translatable by laboratory staff into operating instructions that describe client specifications. The coded information is entered into the laboratory information management system (LIMS) by the login staff for permanent storage and retrieved by departmental and technical staff for scheduling purposes. Analysts are responsible for reviewing and applying the technical specifications that have been entered into the LIMS before proceeding with analysis. Report generation staff accesses report configuration specifications from the LIMS to determine the type of report required by the client.

### 3.0 DEFINITIONS

**ACCURACY:** The closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and of a common systematic error (or bias) component.

**ANALYST:** The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

**BATCH:** A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

**CHAIN OF CUSTODY:** An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

**CONTROL SAMPLE:** A QC sample introduced into a process to monitor the performance of the system.

**CORRECTIVE ACTION:** The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

**CONTROLLED COPY  
DO NOT DUPLICATE**

DUPLICATE ANALYSES: The analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurements precision but not the precision of samplings, preservation or storage internal to the laboratory.

EQUIPMENT RINSATE: A sample of analyte-free media which has been used to rinse the sampling equipment. It is collected after completion of decontamination and prior to sampling. This blank is useful in documenting adequate decontamination of sampling equipment.

FIELD DUPLICATES: Independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process.

HOLDING TIMES (MAXIMUM ALLOWABLE HOLDING TIMES): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised .

LOG IN REVIEW REPORT: A form generated in LIMs which summarizes all of the specifications pertaining to the log in of a single job. This form is used to check the accuracy of log in and document the review process.

LOG IN REVIEW CHECKLIST: A form which lists the salient points that need to be reviewed for the logged in job, including the initials of the reviewer. This form is used to check the accuracy of log in and document the review process.

MANAGER: The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.

MATRIX: The component or substrate (e.g., surface water, drinking water) which contains the analyte of interest.

PRESERVATION: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

PROFICIENCY TESTING: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

PROFICIENCY TESTING PROGRAM: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results, and the collective demographics and results summary of all participation laboratories.

PROFICIENCY TESTING SAMPLE: A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.



PROJECT: Single or multiple data collection activities that are related through the same planning sequence.

PROTOCOL: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed.

QUALITY ASSURANCE: An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROJECT PLAN (QAPjP): An orderly assemblage of detailed procedures designed to produce data of sufficient quality to meet the data quality objectives for a specific data collection activity.

QUALITY CONTROL: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

QUALITY CONTROL SAMPLE: An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

RAW DATA: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.

SPLIT SAMPLES: Aliquots of sample taken from the same container and analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicate samples should be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra- or inter-laboratory precision.

SUPERVISOR: The individual designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.

SURROGATE: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples.

TECHNICAL DIRECTOR: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.

TEST: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.

TEST METHOD: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP.

TRIP BLANK: A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.

#### **4.0 HEALTH AND SAFETY**

4.1 This administrative procedure does not require specific health and safety precautions. For general requirements refer to the SGS Accutest Health and Safety Program.

#### **5.0 INTERFERENCES N/A**

#### **6.0 EQUIPMENT AND SUPPLIES NA**

#### **7.0 STANDARDS AND REAGENTS NA**

#### **8.0 SAMPLE COLLECTIONS< PRESERVATION AND HOLDING TIME NA**

#### **9.0 PROCEDURE**

##### 9.1 Custody Receipt

9.1.1 The job folder containing the chain of custody and sample receipt confirmation form is retrieved by the login staff after samples are delivered to SGS Accutest, unpacked, and documented by Sample Management.

9.1.2 New project information data sheets, which include client specifications not included on a chain of custody, are kept by the Client Services associates. This information must be entered into the laboratory information management system (LIMS)

##### 9.2 Data Entry

9.2.1 All client and custody information pertaining to samples delivered to SGS Accutest must be entered into the LIMS as quickly as possible.

9.2.2 New Accounts Information. LIMS data screens must be completed with the following information

9.2.2.1 Query the system to make sure that the account does not exist. To query LIMS in all SGS Accutest locations, go to Maint, Client info, then F12 for Account or F11 for project search. A query of account information for any or all SGS Accutest facilities

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

can be initiated to determine if an account or project exists. If it does, use the same root name for the account code, or the same code if it matches an existing account name, state and city.

9.2.2.2 All accounts must have a contact address, telephone number and fax number (optional)

9.2.2.3 Accounts are created under the Maintenance, Client Info headings in the LIMS. Create an account name as follows:

9.2.2.3.1 The maximum number of characters allowed by the system for accounts is 8.

9.2.2.3.2 If a submitter name is a multiple word name, use first initials of primary words only for the account name. Do not include initials for words such as Inc., Corp., Co., or LTD. Some examples are listed below.

<u>Company</u>	<u>Account Name</u>
All American Water Company	AAW
Franklin Twp. Health Dept.	FTHD
Handex of Western Pennsylvania	HOWP

9.2.2.3.3 If a company already uses some form of initials as their name or logo, then use their trademark or initials for the account name. Some examples are shown below.

<u>Company</u>	<u>Account Name</u>
Groundwater Technology, Inc.	GTI
MDL Consulting Group	MDL

9.2.2.3.4 If the submitter name is only one word (excluding Corp., Inc., etc.), then use the first three letters of the word as the account name. Never use the "&" in an account name. Some examples are shown below.

<u>Company</u>	<u>Account Name</u>
Handex	HAN
Aqualon	AQU
Claremont Co.	CLA
Hydronics Corp.	HYD

9.2.2.4 For companies with two word names, applying the above rules would often result in non-descriptive account names and potential duplication of two letter root names. To avoid this problem, the naming conventions must be flexible to allow for choosing account names that are unique and can be intuitively correlated with the company name. The name should be created by using three to four letters from the first and second words in the company name to create a more descriptive root name.

9.2.2.5 Clients with multiple offices will be designated by using up to 4 letters for the first part of the account name followed first by a 2 letter abbreviation for the state and then by a 1-2 letter abbreviation for the town. The town abbreviation may be

obtained by either using the first letter of the town or, for a multiple word town, using the first letter of each word (example - Toms River would be TR).

9.2.2.6 Using the above rules, a new account set up for Absolute Environmental located in Tampa, Florida would be ABENFLT rather than AEFLT.

9.2.3 After the new account name has been created, enter the other account information. This should include, at a minimum, the contact name, address, telephone number and fax number.

9.2.4 After creating a new account, review all of the account information and check that it is correct.

### 9.3 New Projects

9.3.1 Before creating any new project for an account you must verify the project does not already exist. This can be done by using a query in the system. The query must be done in a number of different combinations to verify that the project does not exist.

9.3.2 Primary Client Information. Fill out the project information screen making sure that all of the relevant information is complete. Information that must be included on this form is outlined below.

9.3.2.1 Description - Name of Project, Address (including street, city, and state) if provided.

9.3.2.2 Project type

9.3.2.3 TA Time. This is the client's normal turnaround time.

9.3.2.4 Project Manger

9.3.2.5 PO number. This field is primarily populated by accounting and may contain Purchase Order or other billing information.

9.3.2.6 Client project number.

9.3.2.7 Terms. NET30 is the standard payment term.

9.3.2.8 Deliverable Type. This is the deliverable type required for the project.

9.3.2.9 State. This is the two letter abbreviation for state the project site is located in.

9.3.2.10 Soil ppm (Y/N). The default for this category is no. This means that organics soil results will be reported in ug/kg. If the client needs results reported in mg/kg (ppm) for organics, then a Y should be entered. However, this must remain the same for the life of the project.

9.3.2.11 CS Code. The client services code should be used to designate SGS Accutest's internal project manager/client services associate.

9.3.2.12 Sales Code. The sales code should be used to designate who's sales region this falls under

9.3.2.13 Reporting Addresses

9.3.2.14 Billing Address (entered by Accounting dept.)

9.3.2.15 Number of report copies required.

9.3.3 Clients may send in the same project and write the project location differently, even though it is the same project. Examples of this include using a project number instead of a name, changing the way the location of the project is written or using abbreviations for the project location. Also, if the project location is at an intersection, the client may use the various street names. If a street is known by several different names, clients may use either or both of these names. For example, Route 522 is also referred to as Dayton-Jamesburg Road. **NOTE:** Do Not Create New Projects for These.

9.4 A new project may be set up by copying an existing project or by committing to create a new project. In either case, all the information outlined in 9.1 must be included in the project screen.

9.4.1 The information in 9.3.1 through 9.3.11 can be entered in one screen.

9.4.2 After the above information is entered, then page down and fill in the Address Type. All projects must have a reporting address type. The reporting address can be sent to a different person than the project manager. If the client requires multiple report copies or faxed data, it should also be entered here

9.5 Custody and Technical Information

9.5.1 After the project screens are completed, complete the individual sample custody information, analytical requirements, and hard copy deliverables requirements.

9.5.2 Primary Point of Collection. Enter the location and identifiers for each sample collected using the information on the chain of custody.

9.5.3 Analysis Requirements. Select the product codes for each sample. The product codes automatically link the sample into a specific department for scheduling

9.5.3.1 Product codes with definitions are found in the system under Maintenance in the Product definition area.

9.6 Specifications Review. After completing data entry, review the entered data for accuracy.

9.6.1 Print the login review report. This form details all information that was entered into the LIMs for the project. Use the original project information and chain of custody data for comparison. Record the review on the Log-In Review Checklist, along with any corrections that are needed.

9.6.1.1 If errors are detected, have them corrected immediately and reprint the login review report. Email the laboratory manager/supervisor to inform them of the changes.

9.7 Change Orders. Change orders originate with the client services representative and are delivered to the login group via email.

9.7.1 The login supervisor prints a copy of the Email for scanning. Alternately, the Change Order may be placed on the server electronically.

9.7.2 The login record is modified to reflect the change. The login review report is reprinted and is sent to the PM/CSA for verification.

9.7.3 Affected departments are notified of the change.

## 10.0 CREATING NEW PRODUCT CODES

10.1 Product codes are standardized between SGS Accutest offices.

10.1.1 The team leader at corporate (NJ) establishes new product codes. The new product codes are approved by the lab manager of that department.

10.1.2 The New Jersey Login supervisor creates or oversees the creation of all new product codes.

10.2 Procedure

10.2.1 Email the log in team leader at corporate (NJ) to have a new test code created.

10.2.2 Product codes should be limited to 10 characters (12 is the maximum allowed by the system) and must consist of the method, product definition, and exact department codes.

10.2.3 New organic product codes will consist of three distinct parts: the fraction, the method, and the list. Example test codes are shown below.

<u>Fraction</u>	<u>Method</u>	<u>List</u>
V	624	PPL
V	8240	TCL+
AB	625	PPL

10.2.4 Organic fractions will be designated using the letter codes shown below.

<u>Code</u>	<u>Fraction</u>	<u>Example</u>
V =	Volatile	V624PPL
B =	Base Neutral	B625PPL
A =	Acid Extractable	A8270PPL
AB =	Acid/Base Neutrals	AB8270TCL
D =	Direct Injection	D8015METH

**CONTROLLED COPY**  
**DO NOT DUPLICATE**

P	=	Pest and/or PCB	P608PPL
H	=	Herbicides	H8150HERB
X	=	Package/Parent	XPP40
F	=	Field Analysis	SCONF

10.2.5 When creating an add-on test (i.e. Acetone, MTBE, and DIPE) use the format of fraction, department, plus symbol, and add-on compound. Examples are shown below.

<u>Fraction</u>	<u>Dept.</u>	<u>Plus</u>	<u>Compound</u>	<u>Instructions/Comments</u>
V	MS	+	MTBE	Added to V624PPL, V8240TC or V524STD, V8240TCL
V	GC	+	MTBE	Added to V6012PPL, V602STD or V502STD

10.2.6 Once the product code is approved, it can be created in the SGS ACS system.

10.2.7 Go into the system into Maintenance and Product Definition. Before creating the new test code, query to make sure that the product code does not exist. If it does not, proceed with creating a new product.

10.2.8 Query up a product that is similar to the one you are creating or use the "Copy Products" command. Then use Options and Copy to copy the product. Modify the product name, pricing, product description, and method. Also verify that department paths are correct

10.2.9 After the product is created, review the entry for errors. Then notify the appropriate staff (normally area managers or supervisors) so that the product can be added to the appropriate group(s) and entry links can be created.

## 11.0 QUALITY ASSURANCE

11.1 Following the review of the printed login review report, the login technician signs and dates the form.

11.2 The job folder is sent to the client services representative/project manager for secondary review and signature on the login review report.

11.3 The job folder is then sent to the scanning department, where login review report is reviewed for sample ID, date and time. Then the chain of custody and the sample receipt confirmation form are scanned.

11.4 Errors noted during the review are hand corrected and returned to the login technician for correction. After correction, the review process is re-initiated.

## 12.0 DOCUMENTATION

12.1 Login review reports, field sheets, miscellaneous documentation and chains of custody are scanned into the Document (COC) database. Original COCs are kept on file for 1 year before being disposed of.

## 13.0 POLLUTION PREVENTION AND WASTE MANAGEMENT NA

**CONTROLLED COPY  
DO NOT DUPLICATE**

# STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF PERFLUORINATED ALKYL ACIDS FROM SOIL SAMPLES FOR LC/MS/MS ANALYSIS

Prepared by: Norm Farmer Date: 09/24/16

Approved by: Mike Eger Date: 09/27/16

### Annual Review

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

### Document Control

Issued to: QA Department Date: 09/30/16

Issued to: Organics Prep Department Date: \* 10/03/16

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Effective 7 days after "\*" date

**CONTROLLED COPY  
DO NOT DUPLICATE**



# TITLE: STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF PERFLUORINATED ALKYL ACIDS FROM SOIL SAMPLES FOR LC/MS/MS ANALYSIS

## REFERENCES: LC/MS/MS

REVISED SECTIONS: 6.3, 7.3 and 7.4

### 1.0 SUMMARY, SCOPE AND APPLICATION

#### 1.1 Summary

Soil samples are extracted in methanol or basic methanol using ultrasonic bath and vortexer, centrifuged to separate the supernatant, and stored in polyethylene screw cap vials.

#### 1.2 Scope and Application

This procedure is applicable to soil samples submitted for Perfluorinated alkyl acids (PFAA) analysis by LC/MS/MS.

### 2.0 DISCUSSION AND COMMENTS

This method is adapted from various US EPA methods and modified for the analysis of environmental soil samples per DoD QSM 5.0.

The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) or Teflon products, HPLC solvent lines, methanol, aluminum foil, SPE transfer lines, bottle caps, etc. All of the materials used for this method must be demonstrated to be free from interferences.

Contact with glass containers, pipettes, or syringes should be minimized since the PFAA compounds can potentially adsorb (stick) to glass surfaces.

Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the soil or sediment. Humic and/or fulvic material can be co-extracted and can cause enhancement and/or suppression in the electrospray ionization source.

### **3.0 PRESERVATION AND HOLDING TIMES**

#### **3.1 Preservation**

3.1.1 Samples shall be collected in wide mouth 125ml polyethylene bottles fitted with a polyethylene screw cap. Alternate size polyethylene bottles may be used depending on project requirements. **Glass bottles with Teflon lined caps can NOT be used.**

3.1.2 The samples must be chilled to  $\leq 10^{\circ}\text{C}$  from the time of collection until arrival at the laboratory. Samples must not exceed  $10^{\circ}\text{C}$  during the first 48 hours after collection. The samples must be refrigerated at  $\leq 6^{\circ}\text{C}$  from the time of receipt until extraction.

3.1.3 The extracts should be stored at  $\leq 6^{\circ}\text{C}$  to minimize the potential for methanol evaporation but must be allowed to come to room temperature prior to analysis.

#### **3.2 Holding Time**

3.2.1 Soil samples must be extracted within 14 days of collection. The Date/Time that the extraction is started and completed must be recorded on the prep sheet.

3.2.2 Extracts must be analyzed within 28 days of extraction.

### **4.0 DEFINITIONS**

4.1 **Batch:** A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 12 hours whichever comes first.

4.2 **Blank Spike (BS):** An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 **Holding Time:** The maximum times that samples may be held prior to preparation and/or analysis and are still considered valid.

4.4 **Matrix Spike (MS):** A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.5 **Matrix Spike Duplicate (MSD):** A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

- 4.6 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.
- 4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.
- 4.8 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.
- 4.9 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

## **5.0 REAGENTS**

- 5.1 Methanol – HPLC grade or equivalent
- 5.2 Reagent water – HPLC grade or equivalent - free of interferences
- 5.3 0.1% Ammonium Hydroxide – HPLC grade or equivalent
- 5.4 Soil extraction mix – 250ml HPLC water, 250ml HPLC Methanol, and 0.1% NH<sub>4</sub>OH. pH~9
- 5.5 Acetic Acid – HPLC grade or equivalent
- 5.6 PFAA Surrogate Solution – prepared in methanol at a concentration specified by the LC/MS/MS analyst. All surrogate solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.
- 5.7 UCMR3 Spike Solution – prepared in methanol at a concentration specified by the LC/MS/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.
- 5.8 PFAA Spike Solution – prepared in methanol at a concentration specified by the LC/MS/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

## **6.0 GLASSWARE AND APPARATUS**

- 6.1 Vortexer
- 6.2 Ultrasonic Bath
- 6.3 15ml and 50ml Polyethylene Centrifuge tubes with caps

- 6.4 25ul, 50ul, 250ul, and 500ul syringes
- 6.5 Volumetric Pipettor and tips
- 6.6 Disposable polyethylene transfer pipettes
- 6.7 Spatula – Stainless Steel or Wood
- 6.8 10ml, 25ml, and 100ml Polyethylene or Polypropylene volumetric flasks
- 6.9 4.0ml polyethylene screw cap vials
- 6.10 Polyethylene Wash Bottles
- 6.11 Top loading balance – capable of weighing samples to +/- 0.01 grams
- 6.12 Centrifuge – Adequate for clarifying soils extracts.

## 7.0 PROCEDURE

- 7.1 The extraction of all samples must be documented on a “prep sheet”. The prep sheet will include such items as: batch number, sample ID, bottle number, initial amount, final volume, solvent lot numbers, spike and surrogate lot numbers, batch numbers, extraction dates and times, and extraction technician.  
  
The extraction technician is responsible for filling out all the required information on the prep sheet. A copy of the prep sheet will be submitted to the LC/MS/MS analyst with the extracts. The Batch number, extraction technician, and extraction start Date and Time are entered into LIMS.
- 7.2 Decant any free liquid from the solid sample. Remove any foreign objects such as twigs or rocks. Gently mix the sample with a spatula. Refer to SOP QA034 for more information on sample homogenization.
- 7.3 Transfer approximately 5.0 gram of each sample to the appropriately labeled 15ml centrifuge tube. Use a clean spatula for each sample. Record the weight to the nearest 0.01gram on the prep sheet.
- 7.4 Use 5.0 gram of blank sand for the method blank (MB) and blank spike (BS). Use additional 5.0 gram aliquots for the matrix spike (MS) and matrix spike duplicate (MSD).
- 7.5 Using the dedicated surrogate syringe add **100ul** of surrogate solution to each of the samples including the QC samples. Record the surrogate lot number on the prep sheet.
- 7.6 Using the dedicated spike syringe or volumetric pipettor add **400ul** of the UCMR3 spike solution **OR 50ul** of the PFAA spike solution to the BS, MS, and MSD. Record the spike lot number on the prep sheet.

**7.7 Methanol Extraction**

- 7.7.1 Add 5ml methanol to each centrifuge tube. Cap and shake for about 1 minute.
- 7.7.2 Vortex each sample to thoroughly mix the contents.
- 7.7.3 Place the centrifuge tubes in an ultrasonic bath for 30 minutes.
- 7.7.4 Remove the samples from the ultrasonic bath and centrifuge the samples for 5 minutes to separate the solids from the extract (methanol).
- 7.7.5 Proceed to 7.9

**7.8 Basic Methanol Extraction**

- 7.8.1 Add 5ml of soil extraction mix to each centrifuge tube. Cap and shake for about 1 minute.
  - 7.8.2 Vortex each sample to thoroughly mix the contents.
  - 7.8.3 Place the centrifuge tubes in an ultrasonic bath for 30 minutes.
  - 7.8.4 Remove the samples from the ultrasonic bath.
  - 7.8.5 Add 35ul of acetic acid. Cap and vortex for about 30 seconds.
  - 7.8.6 Centrifuge the samples for 5 minutes to separate the solids from the extract.
- 7.9 Transfer 2-3ml of extract to a labeled 4ml screw top vial. Store the extracts at  $\leq 6^{\circ}\text{C}$  to minimize the potential for methanol evaporation. Allow the extracts to come to room temperature prior to analysis.

**8.0 QUALITY ASSURANCE AND QUALITY CONTROL**

- 8.1 An extraction batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours; however, samples should not be added after the QC set has been completed. **NOTE:** Some project plans may require different batch definitions.
- 8.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be extracted with each new batch of samples.

## 9.0 SAFETY AND WASTE DISPOSAL

### 9.1 Safety

- 9.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.
- 9.1.2 Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS or SDS prior to using any new reagents or solvents.
- 9.1.3 Methanol is an inhalation hazard. Use in well ventilated area.

### 9.2 Waste Disposal

- 9.2.1 Waste methanol is placed in the “non-chlorinated waste” container.
- 9.2.2 Extracted soil samples are placed in a waste container after the solvent has drained.
- 9.2.3 Waste soil from the homogenizing process should be placed in the “soil waste” container. **NOTE:** Waste soil from foreign soils must follow “foreign soil” disposal requirements.
- 9.2.4 Samples are archived and stored for 30 days after analysis. After the storage time has elapsed, the remaining aqueous samples are transferred to the appropriate drums for disposal.

## 10.0 REFERENCES

Standard Operating Procedure for the Extraction and Quantitation of Perfluorinated Compounds from Surface Soils, Methods Development and Application Branch, US EPA, Mark Strynar, October 2008

Standard Test Method for Determination of Perfluorinated Compounds by LC/MS/MS, ASTM D7968-14

Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS, December 2011

EPA Method 537 Revision 1.1, September 2009

**STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF PERFLUORINATED  
ALKYL ACIDS FROM WATER SAMPLES FOR  
LC/MS/MS ANALYSIS**

Prepared by: Norm Farmer Date: 01/08/16

Approved by: Mike Eger Date: 01/15/16

Annual Review

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Document Control

Issued to: QA Department Date: 01/22/16

Issued to: Organics Prep Department Date: 01/22/16\*

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

**Effective 7 days after "\*" date**

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

**TEST NAME: STANDARD OPERATING PROCEDURE FOR THE EXTRACTION OF  
PERFLUORINATED ALKYL ACIDS FROM WATER SAMPLES FOR  
LC/MS/MS ANALYSIS**

**Method: SW846 3535A / LC/MS/MS**

**Dept: OP**

**Revised Sections: 5.3-5.6, 5.12, 7.2, formatted 7.2.1-7.2.21, added 7.3.1-7.3.23**

**1.0 Summary, Scope and Application**

1.1 Summary

Aqueous samples are extracted using solid-phase extraction cartridges, eluted with methanol, and stored in polyethylene screw cap vials.

1.2 Scope and Application

This procedure is applicable to low level aqueous samples submitted for Perfluorinated alkyl acids (PFAA) analysis by LC/MS/MS. For samples that require direct injection only, see SOP MS014.

**2.0 Discussion and Comments**

This method is adapted from EPA 537 and modified for the analysis of environmental water samples per DoD QSM 5.0. This SOP is not designed to be used to analyze drinking water by EPA 537. Samples expected to contain high levels of PFAA compounds should be screened using the direct injection technique.

The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) or Teflon products, HPLC solvent lines, methanol, aluminum foil, SPE transfer lines, bottle caps, etc. All of the materials used for this method must be demonstrated to be free from interferences.

Contact with glass containers, pipettes, or syringes should be minimized since the PFAA compounds can potentially adsorb (stick) to glass surfaces.

SPE cartridges can be a source of interferences. The analysis of method and field blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent.

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**



### 3.0 Preservation and Holding Times

#### 3.1 Preservation

- 3.1.1 Samples shall be collected in 125ml polyethylene bottles fitted with a polyethylene screw cap. Alternate size polyethylene bottles may be used depending on project requirements. **Glass bottles with Teflon lined caps can NOT be used.**
- 3.1.2 The samples must be chilled to  $\leq 10^{\circ}\text{C}$  from the time of collection until arrival at the laboratory. Samples must not exceed  $10^{\circ}\text{C}$  during the first 48 hours after collection. The samples must be refrigerated at  $\leq 6^{\circ}\text{C}$  from the time of receipt until extraction.
- 3.1.3 Chlorinated finish waters or samples expected to have extreme pH's may be treated with 5.0 g/L of Trizma<sup>®</sup>.
- 3.1.4 The extracts should be stored at  $\leq 6^{\circ}\text{C}$  to minimize the potential for methanol evaporation but must be allowed to come to room temperature prior to analysis.

#### 3.2 Holding Time

- 3.2.1 Aqueous samples must be extracted within 14 days of collection. The Date/Time that the extraction is started and completed must be recorded on the prep sheet.
- 3.2.2 Extracts must be analyzed within 28 days of extraction.

### 4.0 Definitions

- 4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 12 hours which ever comes first.
- 4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).
- 4.3 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and are still considered valid.
- 4.4 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

- 4.5 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.
- 4.6 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.
- 4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.
- 4.8 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.
- 4.9 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the extraction efficiency.

## 5.0 Reagents

- 5.1 Methanol – HPLC grade or equivalent
- 5.2 SPE Cartridges – Strata-X SDB, Oasis Wax or equivalent
- 5.3 SPE Cartridges – H2O-Phobic DVB or equivalent
- 5.4 Acetic Acid – HPLC grade or equivalent
- 5.5 Ammonium Hydroxide – HPLC grade or equivalent
- 5.6 5% Ammonium Hydroxide in Methanol – 5ml NH<sub>4</sub>OH + 95ml Methanol
- 5.7 Reagent water – HPLC grade or equivalent - free of interferences
- 5.8 Trizma<sup>®</sup> - A premixed blend of Tris [Tris(hydroxymethyl)aminomethane] and Tris HCL [Tris(hydroxymethyl)aminomethane hydrochloride] – Sigma cat# T-7193 or equivalent.
- 5.9 PFAA Surrogate Solution – prepared in methanol at a concentration specified by the LC/MS/MS analyst. All surrogate solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

- 5.10 UCMR3 Spike Solution – prepared in methanol at a concentration specified by the LC/MS/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.
- 5.11 PFAA Spike Solution – prepared in methanol at a concentration specified by the LC/MS/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.
- 5.12 PFAA25 Spike Solution - prepared in methanol at a concentration specified by the LC/MS/MS analyst. All spike solutions must be logged in the Spike and Surrogate Logbook and each solution must be verified prior to use.

## **6.0 Glassware and Apparatus**

- 6.1 Solid-phase cartridge extraction system – suitable for use with extraction cartridges
- 6.2 Vacuum pump
- 6.3 2000ml Vacuum Flasks
- 6.4 70-100ml SPE reservoirs
- 6.5 15ml and 50ml Polyethylene Centrifuge tubes with caps
- 6.6 10ml, 25ml, 250ml, and 1000ml Polyethylene graduated cylinder
- 6.7 25ul, 50ul, and 500ul syringes
- 6.8 Volumetric Pipettors and tips
- 6.9 Disposable polyethylene transfer pipettes
- 6.10 10ml, 25ml, and 100ml Polyethylene or Polypropylene volumetric flasks
- 6.11 2.0ml or 4.0ml polyethylene screw cap vials
- 6.12 Polyethylene Wash Bottles
- 6.13 Nitrogen evaporator
- 6.14 Centrifuge

## **7.0 Procedure**

- 7.1 The extraction of all samples must be documented on a “prep sheet”. The prep sheet will include such items as: batch number, sample ID, bottle number, initial

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

amount, final volume, solvent lot numbers, spike and surrogate lot numbers, batch numbers, extraction dates and times, and extraction technician.

The extraction technician is responsible for filling out all the required information on the prep sheet. A copy of the prep sheet will be submitted to the LC/MS/MS analyst with the extracts. The Batch number, extraction technician, and extraction start Date and Time are entered into LIMS.

7.2 **NOTE:** Selection of the SPE cartridge type will depend on the analytes being reported. SPE cartridge types must NOT be mixed within the same prep batch. **Primary analysis requires that the samples be extracted via sections 7.2.1 to 7.2.21.** LC537PFAA23 and LC537PFAA25 codes contain analytes that also require the procedure in sections 7.3.1 to 7.3.21.

7.2.1 Assemble the solid-phase extraction system. Label the side of each cartridge with the sample ID.

7.2.2 Wash each cartridge (Section 5.2) with 15ml of methanol (approximately 3 cartridge volumes). Use gravity flow if possible or a 1 to 2 ml/min flow rate. Do not allow the cartridge to go dry.

7.2.3 When only a small layer of methanol remains above the sorbent bed, add 20ml of reagent water (approximately 4 cartridge volumes). Do not allow the cartridge to go dry. Stop the flow just before the cartridge goes dry.

7.2.4 Fill each cartridge with about 5ml of reagent water (approximately 1 cartridge volume). Attach a labeled sample reservoir and adapter to each cartridge.

7.2.5 Mark the level of the sample (upper edge) on the bottle with a marker.

7.2.6 **Alternative procedure for samples with high solids content.**

The entire contents of the sample bottle should be analyzed for aqueous samples, including any solids that may have been collected. However, high levels of solids in the sample can clog the SPE cartridge.

The solids will normally settle out during storage. If the sample bottle contains more than a quarter inch of solids, it may be necessary to centrifuge the sample in order to separate the aqueous and solid phases. The decision to centrifuge a water sample should be based on the experience and judgment of the extraction technician or the department supervisor. If the sample is centrifuged, it must be noted on the prep sheet. **Prepare an extra MB2 and BS2 as listed in 7.2.7-7.2.11 and process them through the centrifuging step below.**

Transfer sample to multiple appropriately labeled 50ml centrifuge tubes. Rinse the original bottle with DI water and transfer that to one of the centrifuge tubes. Centrifuge the sample for 5 to 10 minutes. Carefully

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

decant the aqueous phase back into the original 125ml bottle. Set the centrifuge tubes aside until step 7.2.17.

- 7.2.7 Use 125ml polyethylene bottles for the method blank (MB) and blank spike (BS). Fill each of these bottles with 125ml of reagent water.
- 7.2.8 Use a separate bottle for the matrix spike (MS) and the matrix spike duplicate (MSD). If there is only one bottle for the MS/MSD, it can be split into two aliquots. This should be noted on the prep sheet. Record the sample ID, bottle number, and volume on the prep sheet.
- 7.2.9 Check the pH of each sample by dipping a disposable polyethylene transfer pipette into the sample and touching it to the pH paper. Record the pH on the prep sheet. Samples for PFAA analysis should be extracted at the pH at which they were received.
- 7.2.10 Using the dedicated surrogate syringe add **20ul** of surrogate solution to each of the samples including the QC samples. Record the surrogate lot number on the prep sheet.
- 7.2.11 Using the dedicated spike syringe or volumetric pipettor add **80ul** of the UCMR3 spike solution **OR 10ul** of the PFAA spike solution to the BS, MS, and MSD. Record the spike lot number on the prep sheet.
- 7.2.12 Transfer an aliquot of each sample including the QC samples to the appropriate sample reservoirs.
- 7.2.13 Turn on the vacuum and draw the sample through the cartridge at a rate of about 10 ml/min. Add additional sample aliquots to the sample reservoirs until the entire sample has passed through the cartridge. As particulate clogs the cartridge, increase the vacuum to maintain a reasonable flow rate.
- 7.2.14 Once the entire sample has been pulled through the cartridge, shut off the vacuum. Rinse each sample bottle and reservoir with ~20ml of reagent water. Turn on the vacuum. Draw the reagent water through the cartridge. Shut off the vacuum once the water has passed through the cartridge.
- 7.2.15 Place an appropriately labeled 15.0ml centrifuge tube under each cartridge.
- 7.2.16 Rinse each sample bottle and reservoir with ~10ml of methanol. Allow it to pass through the cartridge under gravity flow. A slight vacuum may need to be applied if the cartridge media is clogged.
- 7.2.17 **NOTE:** If the sample was centrifuged, rinse each centrifuge tube with a small aliquot of methanol and transfer that to the reservoir too. Be careful not to disturb the solids on the bottom of the centrifuge tubes.

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

- 7.2.18 Fill each sample bottle to the sample mark with tap water. Transfer the water to a 250ml graduated cylinder and record the sample volume. Discard the tap water.
- 7.2.19 Remove each of the centrifuge tubes from the SPE apparatus and place them in the rack for the nitrogen evaporator. Use a steady stream of nitrogen to concentrate the extract to ~0.5ml.
- 7.2.20 Adjust the volume to 1.0ml with methanol and mix thoroughly. Extracts may be stored in the 15ml centrifuge tubes or they may be transferred to appropriately labeled 2.0ml or 4.0ml screw cap vials.
- 7.2.21 Polyethylene vials and caps may still allow some methanol to evaporate, so the extracts may be stored at  $\leq 6^{\circ}\text{C}$  until they are needed for analysis.
- 7.3 **NOTE:** Selection of the SPE cartridge type will depend on the analytes being reported. SPE cartridge types must NOT be mixed within the same prep batch. Primary analysis requires that the samples be extracted via sections 7.2.1 to 7.2.21. **LC537PFAA23 and LC537PFAA25 codes contain analytes that also require the procedure in sections 7.3.1 to 7.3.21.**
- 7.3.1 Assemble the solid-phase extraction system. Label the side of each cartridge with the sample ID.
- 7.3.2 Wash each cartridge (Section 5.3) with 15ml of methanol (approximately 3 cartridge volumes). Use gravity flow if possible or a 1 to 2 ml/min flow rate. Do not allow the cartridge to go dry.
- 7.3.3 When only a small layer of methanol remains above the sorbent bed, add 20ml of reagent water (approximately 4 cartridge volumes). Do not allow the cartridge to go dry. Stop the flow just before the cartridge goes dry.
- 7.3.4 Fill each cartridge with about 5ml of reagent water (approximately 1 cartridge volume). Attach a labeled sample reservoir and adapter to each cartridge.
- 7.3.5 Mark the level of the sample (upper edge) on the bottle with a marker.
- 7.3.6 **Alternative procedure for samples with high solids content.**

The entire contents of the sample bottle should be analyzed for aqueous samples, including any solids that may have been collected. However, high levels of solids in the sample can clog the SPE cartridge.

The solids will normally settle out during storage. If the sample bottle contains more than a quarter inch of solids, it may be necessary to centrifuge the sample in order to separate the aqueous and solid phases. The decision to centrifuge a water sample should be based on the experience and judgment of the extraction technician or the department supervisor. If the sample is centrifuged, it must be noted on the prep

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

sheet. **Prepare an extra MB2 and BS2 as listed in 7.3.7-7.11 and process them through the centrifuging step below.**

Transfer sample to multiple appropriately labeled 50ml centrifuge tubes. Rinse the original bottle with DI water and transfer that to one of the centrifuge tubes. Centrifuge the sample for 5 to 10 minutes. Carefully decant the aqueous phase back into the original 125ml bottle. Set the centrifuge tubes aside until step 7.3.19.

- 7.3.7 Use 125ml polyethylene bottles for the method blank (MB) and blank spike (BS). Fill each of these bottles with 125ml of reagent water.
- 7.3.8 Use a separate bottle for the matrix spike (MS) and the matrix spike duplicate (MSD). If there is only one bottle for the MS/MSD, it can be split into two aliquots. This should be noted on the prep sheet. Record the sample ID, bottle number, and volume on the prep sheet.
- 7.3.9 Check the pH of each sample by dipping a disposable polyethylene transfer pipette into the sample and touching it to the pH paper. Record the pH on the prep sheet. Samples for PFAA analysis should be extracted at the pH at which they were received.
- 7.3.10 Using the dedicated surrogate syringe add **20ul** of surrogate solution to each of the samples including the QC samples. Record the surrogate lot number on the prep sheet.
- 7.3.11 Using the dedicated spike syringe or volumetric pipettor add **50ul** of the PFAA25 spike solution to the BS, MS, and MSD. Record the spike lot number on the prep sheet.
- 7.3.12 Transfer an aliquot of each sample including the QC samples to the appropriate sample reservoirs.
- 7.3.13 Turn on the vacuum and draw the sample through the cartridge at a rate of about 10 ml/min. Add additional sample aliquots to the sample reservoirs until the entire sample has passed through the cartridge. As particulate clogs the cartridge, increase the vacuum to maintain a reasonable flow rate.
- 7.3.14 Once the entire sample has been pulled through the cartridge, shut off the vacuum. Rinse each sample bottle and reservoir with ~20ml of reagent water. Turn on the vacuum. Draw the reagent water through the cartridge. Shut off the vacuum once the water has passed through the cartridge.
- 7.3.15 Place an appropriately labeled 15.0ml centrifuge tube under each cartridge.
- 7.3.16 Add 50ul of Acetic Acid to each centrifuge tube.

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

- 7.3.17 Rinse each sample bottle and reservoir with ~4ml of methanol. Allow it to pass through the cartridge under gravity flow. A slight vacuum may need to be applied if the cartridge media is clogged.
- 7.3.18 Add 1ml of 5% Ammonium Hydroxide and Methanol. Allow it to pass through the cartridge under gravity flow. A slight vacuum may need to be applied if the cartridge media is clogged.
- 7.3.19 **NOTE:** If the sample was centrifuged, rinse each centrifuge tube with a small aliquot of methanol and transfer that to the reservoir too. Be careful not to disturb the solids on the bottom of the centrifuge tubes.
- 7.3.20 Fill each sample bottle to the sample mark with tap water. Transfer the water to a 250ml graduated cylinder and record the sample volume. Discard the tap water.
- 7.3.21 Remove each of the centrifuge tubes from the SPE apparatus. Adjust the volume to 5.0ml with methanol and mix thoroughly. Extracts may be stored in the 15ml centrifuge tubes or they may be transferred to appropriately labeled 2.0ml or 4.0ml screw cap vials.
- 7.3.22 **NOTE:** Concentrating the extracts will result in the loss of various analytes in the supplemental list. If extracts must be concentrated to 1.0ml, it must be done after the initial analysis for the supplemental analytes has been completed.
- 7.3.23 Polyethylene vials and caps may still allow some methanol to evaporate, so the extracts may be stored at  $\leq 6^{\circ}\text{C}$  until they are needed for analysis.

## 8.0 Quality Assurance and Quality Control

- 8.1 An extraction batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours; however, samples should not be added after the QC set has been completed. **NOTE:** Some project plans may require different batch definitions.
- 8.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be extracted with each new batch of samples.

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**



## **9.0 Safety and Waste Disposal**

### **9.1 Safety**

9.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.

9.1.2 Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS or SDS prior to using any new reagents or solvents.

9.1.3 Methanol is an inhalation hazard. Use in well ventilated area.

### **9.2 Waste Disposal**

9.2.1 Waste methanol is placed in the "non-chlorinated waste" container.

9.2.2 Spent solid-phase extraction cartridges may be disposed of in the trash.

9.2.3 Extracted water samples are rinsed down the drain with large amounts of water.

9.2.4 Samples are archived and stored for 30 days after analysis. After the storage time has elapsed, the remaining aqueous samples are transferred to the appropriate drums for disposal.

## **10.0 References**

SW-846 Method 3500C, Rev. 3, 02/07

SW-846 Method 3535A, Rev. 1, 11/00

EPA Method 537 Revision 1.1, September 2009

DOD QSM 5.0, July 2013

**Property of SGS Accutest  
Controlled Copy  
Do Not Duplicate**

**ANALYSIS OF PERFLUORINATED ALKYL ACIDS BY LC/MS/MS**

Prepared by: Norm Farmer Date: 09/14/15

Approved by: Mike Eger Date: 09/15/15

Annual Review

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Document Control

Issued to: QA Department Date: 09/17/15

Issued to: SVOC Department Date: 09/17/15\*

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

Issued to: \_\_\_\_\_ Date: \_\_\_\_\_

**Effective 7 days after "\*" date**

**TEST NAME: ANALYSIS OF PERFLUORINATED ALKYL ACIDS BY LC/MS/MS**

**METHOD REFERENCE: LC/MS/MS**

**DEPT: HPLC**

**Revised Sections: 1.1.2-1.1.4, 1.2.3-1.2.4, 5.5-5.6, 6.5, 7.2.1-7.2.2, 7.3.3, 9.1, 9.2, 9.4.1 and 12.0 (Soil Prep moved to OP063)**

## **1.0 SCOPE AND APPLICATION, SUMMARY**

### **1.1 Scope and Application**

- 1.1.1 This method is used to determine the concentrations of select Perfluorinated Alkyl Acids (PFAA) in water and solid matrices utilizing an HPLC equipped with a tandem mass spectrometer (MS/MS).
- 1.1.2 Analytes that may be reported under this method are listed in TABLE 1.
- 1.1.3 The reporting limits (RL) are based on the extraction procedure and the lowest calibration standard. Reporting limits may vary depending on matrix complications and volumes. Reporting limits for this method are 5-25 ug/l for direct inject aqueous samples, 0.02-0.10 ug/l for SPE extracted aqueous samples and 12.5-62.5 ug/kg for solid samples.
- 1.1.4 **PFBA** tends to recover poorly by SPE cartridge. Data for these analytes should be reviewed carefully. Alternate cartridges may be used depending on the specific analytes of interest.
- 1.1.5 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the RL. Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported RL.
- 1.1.6 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a "J" or "I" qualifier. Some program or project specifications may require that no values below the RL be reported.
- 1.1.7 For DOD projects refer to QSM 5.0, Table 15 for additional method requirements and data qualifying guidance.

### **1.2 Summary**

- 1.2.1 This method is adapted from EPA 537 and modified for the analysis of environmental water and soil samples per DoD QSM 5.0. This SOP is not designed to be used to analyze drinking water by EPA 537. For the

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

purpose of the AFCEE ERPIMS EDD, this method is referred to as MS014.0.

- 1.2.2 Samples are received, stored, and extracted within the appropriate holding times.
- 1.2.3 Sample preparation is performed in accordance with Accutest SOP OP058 and OP063.
- 1.2.4 Direct inject water samples are analyzed directly by LC/MS/MS. See section 7.3.1.
- 1.2.5 Perfluorinated compounds are separated, detected and quantitated using an LC/MS/MS. After HPLC separation and ionization, the specific Perfluorinated compound is isolated in the first mass spectrometer and transferred to a collision cell for fragmentation. The resulting fragments are introduced into the second mass spectrometer where they are detected and quantified.
- 1.2.6 Manual integrations are performed in accordance with SOP QA029.

## 2.0 PRESERVATION AND HOLDING TIME

### 2.1 Preservation

- 2.1.1 Samples shall be collected in 125mL polyethylene bottles. A 125mL polyethylene wide mouth bottle is recommended for solid samples. Caps must not have Teflon liners.
- 2.1.2 The samples must be chilled to  $\leq 10^{\circ}\text{C}$  from the time of collection until arrival at the laboratory. Samples must not exceed  $10^{\circ}\text{C}$  during the first 48 hours after collection. The samples must be refrigerated at  $\leq 6^{\circ}\text{C}$  from the time of receipt until extraction.
- 2.1.3 The extracts should be stored at  $\leq 6^{\circ}\text{C}$  to minimize the potential for methanol evaporation but must be allowed to come to room temperature prior to analysis.

### 2.2 Holding Time

- 2.2.1 Aqueous samples must be extracted within 14 days of collection. Direct injection samples should be analyzed within 14 days of collection.
- 2.2.2 Solid and waste samples must be extracted within 14 days of collection.
- 2.2.3 Extracts must be analyzed within 28 days of extraction.

### 3.0 INTERFERENCES

- 3.1 Data from all blanks, samples, and spikes must be evaluated for interferences. Method interferences may be caused by contaminants in solvents, reagents, or glassware. The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) or Teflon products, HPLC solvent lines, methanol, aluminum foil, SPE transfer lines, bottle caps, etc. All of these materials must be demonstrated to be free from interferences.
- 3.2 Contact with glass containers, pipettes, or syringes should be minimized since the Perfluorinated compounds can potentially adsorb to glass surfaces.
- 3.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of the humic content of the sample.
- 3.4 SPE cartridges can be a source of interferences. The analysis of field and method blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.
- 3.5 Water and containers used for equipment blanks or field blanks should be tested prior to use. For smaller sampling events DI water will be provided in the same type of bottle used for sample collection. For larger sampling events four liter collapsible LDPE containers should be used. Containers should be filled with DI water and allowed to sit for several hours before testing. If the bottles are from the same lot and filled with DI on the same day, then one analysis per 10 containers should suffice. The DI water and container blanks must be free of any analytes of interest or interferences at  $\frac{1}{2}$  the required reporting level to be acceptable.

### 4.0 DEFINITIONS

- 4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples.
- 4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

- 4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all GC and HPLC methods, a CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.
- 4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still considered valid.
- 4.5 Internal Standards (ISTD): A compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples.
- 4.6 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.
- 4.7 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.
- 4.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.
- 4.9 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.
- 4.10 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.
- 4.11 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.
- 4.12 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

## **5.0 REAGENTS**

- 5.1 Water – HPLC grade or equivalent
- 5.2 Methanol – HPLC grade or equivalent

**PROPERTY OF ACCUTEST LABORATORIES**  
**CONTROLLED COPY**  
**DO NOT DUPLICATE**

- 5.3 Acetonitrile – HPLC grade or equivalent
- 5.4 Perfluorinated Alkyl Acids stock standards – Traceable to Certificate of Analysis.
- 5.5 Mass labeled – Internal Standards

- Perfluoro-[1,2-<sup>13</sup>C<sub>2</sub>]octanoic acid (13C<sub>2</sub>-PFOA)
- Perfluoro-1-[1,2,3,4-<sup>13</sup>C<sub>4</sub>]octanesulfonic acid (13C<sub>4</sub>-PFOS)
- Perfluoro-n-[1,2-<sup>13</sup>C<sub>2</sub>]dodecanoic acid (13C<sub>2</sub>-PFDoDA)
- Perfluoro-n-[1,2-<sup>13</sup>C<sub>2</sub>]hexadecanoic acid (13C<sub>2</sub>-PFHxDA)
- N-methyl-d<sub>3</sub>-perfluoro-1-octanesulfonamidoacetic acid (d<sub>3</sub>-NMeFOSAA)
- 1H,1H,2H,2H-perfluoro-1-[1,2-<sup>13</sup>C<sub>2</sub>]-octane sulfonate (13C<sub>2</sub>-6:2FTS)

- 5.6 Mass labeled – Surrogates

- Perfluoro-n-[1,2-<sup>13</sup>C<sub>2</sub>]hexanoic acid (13C<sub>2</sub>-PFHxA)
- Perfluoro-n-[1,2-<sup>13</sup>C<sub>2</sub>]decanoic acid (13C<sub>2</sub>-PFDA)
- N-ethyl-d<sub>5</sub>-perfluoro-1-octanesulfonamidoacetic acid (d<sub>5</sub>-NEtFOSAA)

## 6.0 APPARATUS

- 6.1 HPLC – Agilent Technologies 1260

Suitable HPLC equipped with an autosampler, pump, and column compartment. System should have a membrane degasser.

- 6.2 MS/MS – Agilent Technologies 6460A

LC/MS/MS must be capable of negative ion electrospray ionization near the required flow rate of the HPLC Column. The system must be capable of performing MS/MS to produce unique precursor and product ions for the PFAA method analytes within the specified retention time segments. A minimum of 10 scans across each peak is required to ensure adequate precision.

- 6.3 Data System – Agilent Technologies MassHunter B.04.0x and B.05.0x.

- 6.3.1 A computer system interfaced to the HPLC/MS/MS that allows for the continuous acquisition and storage of all data obtained throughout the duration of the chromatographic program.

- 6.3.2 The software should allow for the viewing of the specific MS/MS Spectra acquired over the analytical run. Comparisons can then be made between spectra from standards and samples.

- 6.3.3 Data is archived to a backup server for long term storage.

- 6.4 Column – Poroshell 120 EC C18 2.7um, 100 x 4.6 mm ID or equivalent

- 6.5 Disposable polyethylene transfer pipettes

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

- 6.6 15ml Centrifuge tubes
- 6.7 Polyethylene screw cap and autosampler vials
- 6.8 Volumetric Pipettors and volumetric “plasticware” for dilutions of standards and extracts.
- 6.9 4 liter collapsible LDPE containers – For Field and Equipment Blanks, shown to be PFC free - Fisher 11-375-115B or equivalent

## 7.0 PROCEDURE

### 7.1 Standards Preparation

Standards are prepared from commercially available certified neat or reference standards. All standards must be logged in the HPLC Standards Logbook. All standards shall be traceable to their original source. The standards should be stored at  $\leq 6^{\circ}\text{C}$ , or as recommended by the manufacturer. Calibration levels, spike and surrogate concentrations, preparation information, and vendor part numbers can be found in the MS STD Summary in the Active SOP directory.

#### 7.1.1 Stock Standard Solutions

Stock standards are available from some commercial vendors. All vendors must supply a “Certificate of Analysis” with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor’s expiration date. Once opened, the hold time is reduced to one year or the vendor’s expiration date (whichever is shorter).

#### 7.1.2 Intermediate Standard Solutions

Intermediate standards are prepared by quantitative dilution of the stock standard with methanol. The hold time for intermediate standards is six months or the vendor’s expiration date (whichever is shorter). Intermediate standards may need to be remade if comparisons to other standards indicate analyte degradation or concentration changes. Intermediate standards should be stored in polyethylene vials.

#### 7.1.3 Calibration Standards

Calibration standards for Perfluorinated analytes are prepared at a minimum of five concentration levels through quantitative dilutions of the intermediate standard. Calibration standards are prepared in methanol. The low standard is at a concentration at or below the RL and the remaining standards defines the working range of the detector. Calibration standards should be stored in polyethylene vials.



Calibration standard concentrations are verified by the analysis of an initial calibration verification (ICV) standard.

7.2 HPLC/MS/MS Conditions

7.2.1 HPLC Conditions

5-10ul autosampler injection

Column temperature – 50.0 °C      Flow – 1.0 ml/min

Gradient Table: Short List

Time (min)	Water (5% ACN)	MeOH (0.1% acetic acid)
0-0.0	65%	35%
0-7.0	0%	100%
7.0-10.0	0%	100%
10.0-16.0	65%	35%

Gradient Table: Extended List

Time (min)	Water (5% ACN)	MeOH (0.1% acetic acid)
0-0.0	65%	35%
0-3.0	55%	45%
3.0-12.0	25%	75%
12.0-14.0	15%	85%
14.0-14.5	0%	100%
14.5-22.0	0%	100%
22.0-28.0	65%	35%

7.2.2 MS/MS Conditions

Parameter	Value	Parameter	Value
Gas Temp C	325	Sheath Gas Flow (l/min)	10
Gas Flow (l/min)	10	Capillary (V)	4500
Nebulizer (psi)	55	V Charging	600
Sheath Gas Heater	300	Ionization Mode	Neg ESI

See TABLE 2 for ion information and fragmentation voltages.

LC/MS/MS conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

**PROPERTY OF ACCUTEST LABORATORIES**  
**CONTROLLED COPY**  
**DO NOT DUPLICATE**

## 7.3 Sample Preparation

### 7.3.1 Aqueous Samples

- 7.3.1.1 Remove samples to be analyzed from the storage cooler and allow them to warm to ambient temperature. Transfer 1.0ml of sample to a 4ml screw top vial.
- 7.3.1.2 Use 1.0ml of reagent water for the method blank (MB) and blank spike (BS). Use additional 1.0ml aliquots for the matrix spike (MS) and matrix spike duplicate (MSD).
- 7.3.1.3 Add 20ul of spike mix to the BS, MS, and MSD.
- 7.3.1.4 Add 40ul of surrogate solution to each of the samples including the QC samples. Cap and invert several times.
- 7.3.1.5 Add 1.0ml methanol to the screw top vial. Cap and shake for about 1 minute. Store until ready for analysis.

### 7.3.2 Low Level Aqueous Samples

A 125ml aliquot of sample is extracted utilizing a solid phase extraction cartridge. The cartridge is eluted with methanol. The extract is concentrated and the final volume is adjusted to 1.0ml. Refer to SOP OP058.

### 7.3.3 Solid Samples

A 1-gram aliquot of sample is extracted with methanol or a basic methanol and water mix utilizing an ultrasonic bath. The extract is centrifuged to separate the extract from the sample. Refer to SOP OP063.

## 7.4 HPLC/MS/MS Analysis

Instrument calibration consists of three major sections:

- Mass Tuning and Calibration
- Initial Calibration Procedures
- Continuing Calibration Verification

### 7.4.1 Mass Tuning and Calibration

Before samples can be run, the LC/MS/MS system must be mass tuned and calibrated.

The instrument should be hardware tuned per manufacturer's instructions after any maintenance is performed and prior to analyzing a new calibration curve.

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

The instrument must have a valid mass calibration prior to any sample analysis. The mass calibration should be updated as needed. (i.e. QC failures, ion masses showing large deviations from known masses, or major instrument maintenance is performed).

Verify the instrument tune and mass calibration by analyzing a mid-point Perfluorinated compound standard. This may be done using the daily CCV. The ions should be within  $\pm 0.5$  *m/z* of the expected mass.

#### 7.4.2 Initial Calibration Procedures

Before samples can be run, the LC/MS/MS system must be calibrated.

##### 7.4.2.1 Internal Standard Calibration

A minimum 5-point calibration curve is created for the Perfluorinated compounds and surrogates using an internal standard technique. Accutest Laboratories routinely performs a 6-point calibration to maximize the calibration range.

Use the LC/MS/MS data system to generate a linear regression or quadratic calibration curve for each of the analytes. This curve **must** be forced through zero and may be concentration weighted. Forcing zero allows for a better estimate of the background levels of method analytes.

The correlation coefficient (*r*) should be  $\geq 0.995$  ( $r^2 \geq 0.990$ ). Additionally, each calibration point for each analyte must be recalculated against the current initial calibration. The recovery of each analyte must be within 75%-125%, except for the low calibration point which must be within 50%-150% (70%-130% for DoD QSM) of the expected value.

- The mass labeled ISTDs in this method may undergo suppression in the ESI source if the concentration of the co-eluting unlabeled method analyte(s) is too high. The analyte concentration at which suppression may occur can vary depending on the instrument, LC conditions, ESI conditions, ISTD concentration, etc. To evaluate whether suppression is occurring during calibration, calculate the relative percent difference (RPD) between the high standard (H) and low standard (L) areas for each ISTDs using the following equation:

$$RPD = [(H-L) / \{(H+L)/2\}] \times 100$$

- The RPD calculated above must be  $< 20\%$  for each ISTD during calibration. If the calculated RPD is  $> 20\%$  for any ISTD, the analyst must recalibrate at lower analyte concentrations until the ISTD RPDs are  $< 20\%$ .

#### 7.4.2.2 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV should be prepared from a second source at a mid-range concentration.

The %D for the compound of interest should be  $\leq 25\%$ . If the ICV does not meet these criteria, a second standard should be prepared. If the ICV still does not meet criteria, analyze an ICV prepared from a third source (if available). If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

**NOTE: Second source standards are not be available for all of the Perfluorinated analytes.**

#### 7.4.2.3 Retention Time Windows

Retention time windows must be established whenever a new column is installed in an instrument or whenever a major change has been made to an instrument.

Retention time windows are crucial to the identification of target compounds. Absolute retention times are used for compound identification in all GC and HPLC methods that do not employ internal standard calibration. Generally internal calibration methods utilize relative retention times. Retention time windows are established to compensate for minor shifts in absolute retention times that result from normal chromatographic variability. The width of the retention time window should be carefully established to minimize the occurrence of both false positive and false negative results.

Retention time windows are established by injecting all standard mixes three times over the course of 72 hours. The width of the retention time window for each analyte, surrogate, and major constituent in multi-component analytes is defined as  $\pm 3$  times the standard deviation of the mean absolute retention time or 0.03 minutes, whichever is greater.

Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for

each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

Peak identification is based on the retention time of a peak falling within the retention time window for a given analyte. Time reference peaks internal standards and surrogates are used to correct for run-to-run variations in retention times due to temperature, flow, or injector fluctuations. HPLC retention times tend to shift more than GC retention times.

The retention time windows should be used as a guide for identifying compounds; however, the experience of the analyst should weigh heavily in the interpretation of the chromatograms. The analyst should monitor the retention times of known peaks (internal standards and surrogates) throughout an instrument run as an indication of instrument performance.

Because calculated retention time windows are generally very tight (less than  $\pm 0.03$  minutes), the retention time windows for the data processing method are generally set wider than the calculated window. This is done to ensure that the software does not miss any potential "hits". The analyst will then review these "hits" and determine if the retention times are close enough to the retention time of the target analyte to positively identify the peak or to require confirmation.

### 7.5.3 Continuing Calibration Verification (CCV)

Continuing calibration verification standards for the Perfluorinated compounds are prepared at a mid-range concentration.

The CCV must be analyzed at the beginning and end of each run to verify that the initial calibration is still valid. Additionally the mid-point CCV must be analyzed after every 10 samples.

The percent difference (%D) for each analyte of interest will be monitored. The  $|\%D|$  should be  $\leq 25\%$  for the analyte in the mid-point CCV.

If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated.

If the  $|\%D|$  is outside the control limits, then documented corrective action is necessary. This may include recalibrating the instrument and reanalyzing the samples, performing instrument maintenance to correct the problem and reanalyzing the samples, or qualifying the data. Under

**PROPERTY OF ACCUTEST LABORATORIES**  
**CONTROLLED COPY**  
**DO NOT DUPLICATE**

certain circumstances, the data may be reported, i.e. The CCV failed high, the associated QC passed, and the samples were ND.

**NOTE: Any target analytes that are detected in the samples must be bracketed by an acceptable initial calibration curve and acceptable CCV standards; otherwise, the samples must be reanalyzed or the data must be qualified.**

#### 7.5.4 Sample Extract Analysis

7.5.4.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Initial Calibration Standards (or Initial CCV)  
QC Extracts  
Sample Extracts  
CCV Standards

7.5.4.2 Two microliters of internal standard solution is added to every 100ul of extract in the autosampler vial. Generally, 500ul of extract are transferred to the autosampler vial with a gas tight syringe.

7.5.4.3 Five to ten microliters (same amount as standards) of extract is injected into the HPLC by the autosampler. The data system then records the resultant peak responses and retention times.

7.5.4.4 Tentative identification of an analyte occurs when the peak from the sample extract fall within the retention time window of the target compound.

7.5.4.5 Positive identification is confirmed by comparing the mass spectra in the sample to the mass spectra of the standards.

7.5.4.6 Some of the PFAAs may have multiple chromatographic peaks due to the presence of linear and branched isomers. This is prevalent in PFHxS and PFOS. The areas of all the linear and branched isomers peaks must be included and the concentrations reported as a total for each of these analytes.

7.5.4.7 If the compound identification does not confirm, then the result should be reported as ND or "U".

7.5.4.8 If the analyte response exceeds the linear range of the system, the extract must be diluted and reanalyzed. It is recommended that extracts be diluted so that the response falls into the middle of the calibration curve.

7.5.4.9 If peak identification is prevented by the presence of interferences, further cleanup may be required or the extract must be diluted so that the interference does not mask any analytes.

## 7.6 Maintenance and Trouble Shooting

7.6.1 Refer to SOP GC001 for routine instrument maintenance and trouble shooting.

7.6.2 All instrument maintenance must be documented in the appropriate "Instrument Repair and Maintenance" log. The log will include such items as problem, action taken, correction verification, date, and analyst.

7.6.3 Repairs performed by outside vendors must also be documented in the log. The analyst or Department Supervisor responsible for the instrument must complete the log if the repair technician does not.

7.6.4 PC and software changes must be documented in the "Instrument Repair and Maintenance" log. Software changes may require additional validation.

## 8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, blank spike duplicate, matrix spike, and matrix spike duplicate samples are compared to **DoD QSM defined** control limits. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

## 9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the use of surrogates and by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD). All control limits are updated annually and are listed in the LIMS.

### 9.1 Internal Standards

Perfluoro-[1,2-<sup>13</sup>C<sub>2</sub>]octanoic acid (<sup>13</sup>C<sub>2</sub>-PFOA) and Perfluoro-1-[1,2,3,4-<sup>13</sup>C<sub>4</sub>]octanesulfonic acid (<sup>13</sup>C<sub>4</sub>-PFOS) are used as internal standards for this method. Additional analytes listed in Section 5.5 may be used for internal standards when reporting additional analytes.

The response of the internal standard in all subsequent runs should be  $\pm 50\%$  of the internal standard average response from the initial calibration.

9.1.1 If the internal standard responses are not within limits, the following are required.

9.1.1.1 Check to be sure that there are no errors in calculations, integrations, or internal standards solutions. If errors are found, recalculate the data accordingly.

9.1.1.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.1.1.3 If no problem is found, prepare a second aliquot of extract and reanalyze the sample.

9.1.1.4 If upon reanalysis, the responses are still not within limits, the problem is considered matrix interference.

9.1.1.5 The sample may need to be reported from the dilution or the results qualified.

## 9.2 Surrogates

9.2.1 Perfluoro-n-[1,2-<sup>13</sup>C<sub>2</sub>]hexanoic acid (<sup>13</sup>C<sub>2</sub>-PFHxA) and Perfluoro-n-[1,2-<sup>13</sup>C<sub>2</sub>]decanoic acid (<sup>13</sup>C<sub>2</sub>-PFDA) are used as the surrogate standards to monitor the efficiency of the extraction. Additional analytes such as N-ethyl-d<sub>5</sub>-perfluoro-1-octanesulfonamidoacetic acid (d<sub>5</sub>-NEtFOSAA) may be used for surrogate standards when reporting additional analytes.

A known amount of surrogate standard is added to each sample including the QC set prior to extraction. The percent recovery for each surrogate is calculated as follows:

$$\% \text{ Recovery} = (\text{Sample Amount} / \text{Amount Spiked}) \times 100$$

The percent recovery for each surrogate must fall within 70-130% of true value for the results to be acceptable.

9.2.2 If any surrogate recovery is not within the established control limits, the following are required.

9.2.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, surrogate solutions or internal standard solutions. If errors are found, recalculate the data accordingly. If errors are suspected, re-vial and re-inject the extract to verify.

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**



- 9.2.2.2 Check instrument performance. It may be necessary to re-vial and re-inject the extract in order to verify performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.
- 9.2.2.3 If no problem is found, re-extract and reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then re-extraction may not be necessary. For any DoD QSM projects the resulting data must be qualified accordingly. If there is insufficient sample for re-extraction, reanalyze the sample and footnote this on the report.
- 9.2.2.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis should be reported on the final report.

## 9.2 Method Blank

- 9.3.1 The method blank is either HPLC water or cleaned sand (depending upon sample matrix). The method blank is then taken through all procedures along with the other samples to determine any contamination from reagents, glassware, or high level samples. The method blank must be free of any analytes of interest or interferences at  $\frac{1}{2}$  the required reporting level to be acceptable. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples, re-extracting and reanalyzing the samples or qualifying the results with a "B" or "V" qualifier.
- 9.3.2 If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results can be reported without qualification.
- 9.3.3 If the MB is contaminated but the samples results are  $> 10$  times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate "B" or "V" qualifier. This must be approved by the department supervisor.
- 9.3.4 If the MB is contaminated but the samples results are  $< 10$  times the contamination level, the source of the contamination should be investigated and documented. The samples should be re-extracted and reanalyzed for confirmation. If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

#### 9.4 Blank Spike

- 9.4.1 The blank spike is either HPLC water or cleaned sand (depending upon sample matrix) to which the spike standard has been added. The blank spike is then taken through all procedures along with the other samples to monitor the efficiency of the extraction procedure. The percent recovery for each analyte is calculated as follows:

$$\% \text{ Recovery} = (\text{Blank Spike Amount} / \text{Amount Spiked}) \times 100$$

The percent recovery for each analyte of interest should fall within 70-130% of true value for the results to be acceptable. As additional analytes are added to this method, the recoveries will need to be carefully evaluated. Alternate SPE cartridges may improve the recovery of select analytes such as PFBA.

- 9.4.2 If the blank spike recoveries are not within the established control limits, the following are required.

9.4.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, or spike solutions. If errors are found, recalculate the data accordingly. If errors are suspected, re-vial and re-inject the extract to verify.

9.4.2.2 Check instrument performance. It may be necessary to re-vial and re-inject the extract in order to verify performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.4.2.3 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable. For any DoD QSM projects the resulting data must be qualified accordingly.

9.4.2.4 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples, re-extracting and reanalyzing the samples, or qualifying the results as estimated.

9.4.2.5 If there is insufficient sample to re-extract, or if the sample is re-extracted beyond hold time, the appropriate footnote and qualifiers should be added to the results. This must be approved by the department supervisor.

#### 9.5 Matrix Spike and Matrix Spike Duplicate

- 9.5.1 Matrix spike and spike duplicates are replicate sample aliquots to which the spike standard has been added. The matrix spike and spike duplicate are then taken through all procedures along with the other samples to

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

monitor the precision and accuracy of the procedure. The percent recovery for each analyte is calculated as follows:

$$\% \text{ Recovery} = [(\text{Spike Amount} - \text{Sample Amount}) / \text{Amount Spiked}] \times 100$$

The percent recovery for each analyte of interest must fall within 70-130% of true value for the results to be acceptable.

9.5.2 If the matrix spike recoveries are not within the established control limits, the following are required.

9.5.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, or spike solutions. If errors are found, recalculate the data accordingly. If errors are suspected, re-vial and re-inject the extract to verify.

9.5.2.2 Check instrument performance. It may be necessary to re-vial and re-inject the extract in order to verify performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.5.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for re-extract but are indications of the sample matrix effects.

9.5.3 Precision

Matrix spike and spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

$$\text{RPD} = [ | \text{MS Result} - \text{MSD Result} | / \text{Average Result} ] \times 100$$

The RPD for each Perfluorinated compound should be less than 30%. If the RPDs fall outside of the established control limits, the MS and MSD should be reanalyzed to ensure that there was no injection problem. If upon reanalysis the RPDs are still outside of the control limits, the department supervisor shall review the data and determine if any further action is necessary. RPD failures are generally not grounds for re-extraction.

## 10.0 CALCULATIONS

The concentration of each Perfluorinated compound in the original sample is calculated as follows:

$$\text{Water (ug/l)} = (\text{CONC}_{\text{inst}}) \times (V_F / V_I) \times \text{DF}$$

$$\text{Soil (ug/kg)} = [(\text{CONC}_{\text{inst}}) \times (V_F / W_I) \times \text{DF}] / \% \text{solids}$$

CONC <sub>inst</sub>	=	Instrument concentration calculated from the initial Calibration using mean CF, linear curve, or Quadratic curve
DF	=	Dilution Factor
V <sub>F</sub>	=	Volume of final extract (ml)
V <sub>I</sub>	=	Volume of sample extracted (ml)
W <sub>I</sub>	=	Weight of sample extracted (g)
%solids	=	Dry weight determination in decimal form

## 11.0 SAFETY AND POLLUTION PREVENTION

### 11.1 Safety

The analyst should follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses, gloves, and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample should be treated as a potential health hazard. Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment should be used by all analysts.

### 11.2 Pollution Prevention

Wastewater and methanol from the instrument are collected in waste storage bottles and are eventually transferred to the non-chlorinated waste drum.

Sample Extracts are archived and stored for 30 days after analysis. Old extracts and standards are disposed of in the waste vial drum.

## 12.0 REFERENCES

SW846 Method 8000C Revision 3, March 2003

EPA Method 537 Revision 1.1, September 2009

DOD QSM 5.0, July 2013

**PROPERTY OF ACCUTEST LABORATORIES  
CONTROLLED COPY  
DO NOT DUPLICATE**

Standard Operating Procedure for the Extraction and Quantitation of Perfluorinated Compounds from Surface Soils, Methods Development and Application Branch, US EPA, Mark Strynar, October 2008

Standard Test Method for Determination of Perfluorinated Compounds by LC/MS/MS, ASTM D7968-14

Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS, December 2011

**TABLE 1: Analytes**

Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnDA	2058-94-8
Perfluorododecanoic acid	PFDoDA	307-55-1
Perfluorotridecanoic acid	PFTTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluorohexadecanoic acid	PFHxDA	67905-19-5
Perfluorooctadecanoic acid	PFOcDA	16517-11-6
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorooctane sulfonamide	FOSA or PFOSA	754-91-6
N-Methyl perfluorooctane sulfonamide	N-MeFOSA	31056-32-8
N-Ethyl perfluorooctane sulfonamide	N-EtFOSA	4151-50-2
Perfluoro-1-octanesulfonamidoacetic acid	FOSAA	2806-24-8
N-Methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
N-Ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6
N-Methyl perfluorooctane sulfonamidoethanol	N-MeFOSE	24448-09-7
N-Ethyl perfluorooctane sulfonamidoethanol	N-EtFOSE	1691-99-2
6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4

**TABLE 2: Ion information and Fragmentation Voltages**

Compound	ISTD/SURR	Precursor Ion	Product Ion	Frag (V)	CE (V)	Polarity
13C2-PFOA	ISTD	415	370	60	3	Negative
13C2-PFHxA	SURR	315	270	40	2	Negative
13C2-PFDA	SURR	515	470	42	9	Negative
PFBA		213	169	60	0	Negative
PFPeA		263	219	47	7	Negative
PFHxA		313	269	40	0	Negative
PFHpA		363	319	50	8	Negative
PFOA		413	369	60	3	Negative
PFOA		413	169	60	15	Negative
PFNA		463	419	40	10	Negative
PFDA		513	469	42	9	Negative
13C4-PFOS	ISTD	503	80	180	70	Negative
PFBS		299	99	133	29	Negative
PFBS		299	80	133	45	Negative
PFHxS		399	99	105	45	Negative
PFHxS		399	80	95	45	Negative
PFHpS		449	80	100	45	Negative
PFOS		499	99	180	51	Negative
PFOS		499	80	180	70	Negative
13C2-PFDoDA	ISTD	615	570	48	10	Negative
PFDS		599	80	95	45	Negative
PFUnDA		563	519	45	9	Negative
PFDoDA		613	569	48	10	Negative
PFTTrDA		663	619	40	10	Negative
PFTeDA		713	669	20	11	Negative
d3-MeFOSAA	ISTD	573	419	100	19	Negative
d5-EtFOSAA	SURR	589	419	90	19	Negative
EtFOSAA		584	419	35	15	Negative
FOSA		498	78	65	33	Negative
FOSAA		556	498	65	25	Negative
N-MeFOSAA		570	419	90	25	Negative
N-EtFOSA		526	169	35	15	Negative
N-EtFOSE		630	59	45	25	Negative
N-MeFOSA		512	169	90	25	Negative
N-MeFOSE		616	59	40	15	Negative
13C2-6:2FTS	ISTD	429	409	100	23	Negative
6:2FTS		427	407	100	23	Negative
8:2FTS		527	507	110	30	Negative
13C2-PFHxDA	ISTD	815	771	45	10	Negative
PFHxDA		813	769	45	10	Negative
PFODA		913	869	45	10	Negative

**Receiving and Inspecting Environmental and Air Samples**



Maxxam Analytics International Corporation  
 Campobello Road  
 Mississauga, Ontario  
 905-817-5700

<b>Document Identity</b>			
<b>Document Status and Ownership</b>			
<b>Current Status</b>	<b>Approved - Released</b>		
<b>Approval Date</b>	February 12, 2016	<b>Release Date</b>	February 12, 2016
<b>Version Author</b>	Ashitha Sukumar	<b>Version Manager</b>	Malgosia Dancziger
<b>Document Categorization</b>			
<b>Campobello Departments</b>	Environmental Environmental Sample Reception		

THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION. Its use is restricted to employees with a need to know and third parties with a need to know and who have signed a non-disclosure agreement. ANY REPRESENTATION OF THIS DOCUMENT, PRINTED OR OTHERWISE, OUTSIDE OF THE MAXXAM CompliantPro SYSTEM IS AN UNCONTROLLED COPY UNLESS STAMPED "CONTROLLED COPY" AND SIGNED AND DATED BY AN AUTHORIZED QA REPRESENTATIVE.

<b>Release and Audit Schedule</b>	
<b>Release Schedule</b>	When Approved <input type="checkbox"/> <b>Allow Administrator to Release Document Early</b>
<b>Expiration Schedule</b>	When Superseded or Obsoleted
<b>Audit Schedule</b>	24 Month(s)
<b>Special Handling on Release</b>	
<input checked="" type="checkbox"/> <b>Update Completed Trainee Records</b>	

<b>Insert Text</b>	
<ul style="list-style-type: none"> <li> CAM WI-00405v17</li> <li> Attachment 1</li> <li> Attachment 2</li> <li> Attachment A-Summa Cannister Flow Chart</li> <li> CTA Sample Reception-2015-2016</li> </ul>	

<b>Associated Documents</b>
<b>Document Control Documents</b>
<ul style="list-style-type: none"> <li> Campobello FCD CAM FCD-00464 : Sample Reception Locker Check Form</li> <li> Campobello FCD CAM FCD-00602 : Instructions How to Measure Temperatures with Infrared Thermometers</li> <li> Campobello WI CAM WI-00015 : Calibration of Thermometers</li> <li> Campobello WI CAM WI-00409 : Login and Handling of Legal Samples</li> <li> Campobello WI CAM WI-00410 : Receiving and Reporting Ontario Drinking Water Samples</li> <li> Campobello WI CAM WI-00026 : Bottle Preparation</li> <li> Campobello WI CAM WI-00027 : Instructions on Completing the Chain of Custody Form</li> <li> Campobello SOP CAM SOP-00101 : Disposal of Samples</li> <li> Campobello FCD CAM FCD-00665 : Immediate Tests</li> <li> Campobello FCD CAM FCD-00630 : Check points to Process IOL Jobs</li> <li> Campobello WI CAM WI-00006 : Handling of Proficiency Testing Samples</li> <li> Campobello FCD CAM FCD-01101 : Drinking Water Chain of Custody Record</li> <li> Campobello FCD CAM FCD-01240 : Water Sample Receipt at 6660 by Microbiology Lab</li> <li> Corporate WI Publish to All COR WI-00073 : Legal Sample Submission Protocol</li> </ul>



- 📄 Campobello FCD CAM FCD-01013 : O. Reg. 153/04 Presence of Visible Particulate/Sediment
- 📄 Campobello FCD CAM FCD-01102 : FLAG Checkpoints for Regulated Drinking Water COCs

**Reason for Change**

<b>Date of Change</b> July 4, 2006	<b>Version 2</b>
<b>Section Changed</b> Sections: 3, 5.4, 5.5.2, 5.6.8	
<b>Change Made</b> 2006/06/29	
Section 3	
-Update list of SOPs and WIs with the new QSI SOPs and WIs numbers	
Section 5.4	
-Addition of Asterisks in number 2	
-3 additional reasons to create a SIF	
-1 reason (exception) why a SIF is not created	
Section 5.5.2	
-Addition "Refer to CAM FCD 00602 (Instructions how to measure Temperatures with Infrared Thermometer)"	
section 5.6.8	
- Addition of FCD-00646 (Sample reception Locker and Scanner check form)	
<b>Date of Change</b> February 23, 2007	<b>Version 3</b>
<b>Section Changed</b> section 5.1, 5.3, 5.4, 5.4.1.2, 5.5.2, 5.5.4, 5.5.4.35, 5.5.4.37, 5.7.1, 5.7.2, 5.7.3, 5.9.5, 5.10.2, 5.14.2.15, 7.1, 7.1.5	
<b>Change Made</b> section 5.1 Addition of "refer to CAM FCD-00665 - Immediate Tests"	
section 5.3 change temperature range to 1-6C	
section 5.4 Reword bullet 13	
section 5.4.1.2 Addition of Menu	
section 5.5.2 Addition of "refer to CAM FCD-00630", and "name printed"	
section 5.5.4 "Addition of "Refer to CAM FCD-00630 "Check points to Process IOL Jobs""	
section 5.5.4.35 "Addition of " This number is then recorded on the chain of custody form and initialed by the person that did the inspection"	
section 5.5.4.37 Addition of "project manager"	
section 5.7.1 and 5.7.2 Addition of "This category is inspected and then forwarded to the Maxxam Burlington lab"	
Section 5.7.3 Addition of the last paragraph	
section 5.9.5 Addition of "Sanicult Swab" on table 1	
Addition of subsections 5.9.6 and 5.9.7	
section 5.10.2 Addition of " 105 for the Sanicult Swab"	
section 5.14.2.15 Addition of inspection procedure	
Addition of section 5.14.2.16	
section 7.1 Addition of "Food Bins"	
Addition of subsection 7.1.5	
<b>Date of Change</b> April 26, 2007	<b>Version 4</b>
<b>Section Changed</b> 4.0, 5.1, 5.6.4, 5.21	
<b>Change Made</b> 4.0 Definitions for DW and Frozen sample added	
5.1 Section added Microbiological Sample Rejection Criteria added	
5.6.4 New section added Verification of Metals Preservation for Ont. DW Samples as per MOC-00074	
5.21 New section added Re-Logs as per DCR-00085	
Throughout WI sections re-numbered	
<b>Date of Change</b> August 22, 2007	<b>Version 5</b>
<b>Section Changed</b> 5.6.3, 5.6.5, 5.11.1, 5.11.2, 5.11.4, 5.14.1, 5.16.2.16, 5.19	
<b>Change Made</b> 5.6.3 Addition of International samples	
5.6.5 Addition of the 3th paragraph "creation of SIF for Chain of Custodies received without samples"	
5.11.1 and 5.11.2 reword the paragraphs	
5.11.4 removed	
5.14.1 removed "samples are kept in the fridge"	
5.16.2.16 Addition of subsections "a" and "b"	
5.19 Addition of Handling contaminated and international samples	
<b>Date of Change</b> June 18, 2008	<b>Version 6</b>
<b>Section Changed</b> Title, Scope, section 3.0, 4.0, 5.1.6, 5.1.9, 5.3, Figure 5.0a and 5.0f, 5.6.2, Figure 5.0g, 5.0h, 5.0i, 5.0o, 5.0q, 5.0r, section 5.10, 5.10.15, 10.7, 5.12, 5.14.1, 6.1.3, 6.1.6, 6.2.1.8, figure 6.0a	
<b>Change Made</b> CAM WI-00405/6 was reformatted. Receiving and Inspecting food samples procedure was removed and added to CAM SOP-00119.	
Title changed to " Receiving and Inspecting Environmental and Air Samples"	
Scope: Food inspection was removed from the scope	
section 3.0 Addition of CAM WI-00006	
section 4.0 Removal of "food link", addition of PN	
section 5.1.9 Addition of acceptance criteria	
section 5.1.9 Addition of " If the infrared thermomter is outside the range, it must be discarded"	
section 5.1 Removal of "Microbiological Sample Rejection Criteria"	
section 5.3 Addition of " CAM FCD-00680"	
section 5.5 Addition of figures 5.0a	
section 5.5.1.19 Addition of label 5.0f	
section 5.6.2 Addition of Note and Air types	
section 5.6.3 Addition of figures: 5.0g, 5.0h, 5.0i, 5.0o, 5.0q, 5.0r,	
section 5.10.1 addition of note	
section 5.10.7 addition of "attach unique barcode labels to each sample container"	
section 5.12 Addition of re-logs	
added section 5.14.1	
section 6.1.3 Addition of " All air samples except for non volatiles on Tedlar Bags are placed in brown folders"	
section 6.1.6 Addition of "Use prefix M for all IOL submissions"	

section 6.2.1.8 Addition of "on the cylinder tag"  
 Addition of figure 6.0a

**Date of Change** July 8, 2009 **Version 7**  
**Section Changed** All sections  
**Change Made** The flow of this work instruction was rearranged to reflect current practice. In addition, the following new information was added.  
 Section 2: Redefined the scope by adding informatin on inspected samples.  
 Section 3: Added additional WI references (CAM WI-00071 and CAM WI-00406).  
 Section 5: Rewrote entire section and provided examples for acceptance and rejection of daily verification of IR thermometer. Added additional examples of labels that are in use. Added new section 5.6.2 Handling of International Soils.  
 Section 6: Changes made reflect more accurately type of air samples inspected.

**Date of Change** February 9, 2010 **Version 8**  
**Section Changed** 3.0, 5.0b, 5.0c,5.0d, 5.0f, 5.0u. 5.0v, 5.0x, 5.1, 5.1.11, 5.2, 5.2.1.19, 5.3.1, 5.6, 5.9.4, 5.9.8, 5.9.9, 5.11, 6.1.4, and 6.2.13  
**Change Made** Updated Figures 5.0b, 5.0c, 5.0d, 5.0f, 5.0u, 5.0v and 5.0x to reflect current screens and procedures.

3.0 Replaced CAM WI-00006 with COR WI-00029. Added "Corporate Procedure for" to title of work instruction  
 Added "The Maxxam Environment Health & Safety (MEHS) policies and The Critical Task Analysis attached to this document" to Responsibilities.

5.1 Added "Perform 2nd reading to confirm 1st result. If result outside the acceptance range" to example 1 and 2 if thermometer fails.

5.1.11 Added "correction factor outside the range"

5.2 Added "Note: Inspect all DI waters (Free Organic and Inorganic)" to SIF item 9. Added "Note: Headspace for waters is considered when the bubble covers the entire base of the vial. \*\*\*Note: Headspace for soils is considered when soil jar has void space at top and bottom of jar regardless of soil type and fails the rattle test."

5.2.1.19 Deleted "Attach a SIF label to". Added "Stamp the Job Label on"

Figure 5.0f Deleted "Label". Added "Stamp".

5.3.1 Added "and at inspection be replaced by a SIF stamp." to the end of paragraph six.

5.6 Deleted "For these extreme, non-routine, hazardous samples, fill out form CAM FCD-00785 (Hazards Samples Analysis Signing off Sheet). Staple the form to the COC and the form will in the end reach Archiving to ensure proper sample disposal." from paragraph two.

5.9.4, step 5, point 3 Removed "Any sample container discrepancy previously noted should correspond to the condition entered here. If the sample bottle and subsequent testing is Temperature Sensitive, E.g. Microbiology, toggle on the Temp Sensitive checkbox." Added "The Sample Condition and the Temp Sensitive fields are not required since all discrepancies are recorded in the SIF module and samples transferred to an appropriate storage location after inspection."

5.9.4, step 5, point 5 Removed "(5) Sample Condition, and (6) temperature sensitive."

5.9.8, 5.9.9, Figure 5.0w Replaced receipt label with job label.  
 5.11 Added 5.11.4 "Toggle the Re-log box on the Sample Inspection and Inventory screen".  
 6.1.4 Added "if test is BTEX/F1.", "Inspect as one Id if test is VOC"  
 6.2.13 Added "and client # 50000 for Aviator Oxygen cylinders"

**Date of Change** August 16, 2010 **Version 9**  
**Section Changed** 4.0, 5.1.1, 5.1.2, 5.1.6, 5.3.1, 5.8, 5.9.2, 5.9.4, 5.9.7, 5.9.8, 5.9.13, 5.12.2, 6.0, 6.1.2, 6.1.3, 6.1.8, 6.1.9, 6.1.10, 6.1.11  
**Change Made** Addition of highlighted sections

**Date of Change** October 14, 2010 **Version 10**  
**Section Changed** 5.1, 5.2, 5.6, 5.6.2, 5.9, 5.9.8, 5.12, 5.12.4, 6.1.8, 6.1.9  
**Change Made** Addition of highlighted sections

**Date of Change** November 16, 2010 **Version 11**  
**Section Changed** 5.2 A and E, F  
**Change Made** revised to clarify when SIFs will be created for all water samples.

**Date of Change** August 10, 2011 **Version 12**  
**Section Changed** All  
**Change Made** Changes are highlighted in yellow.

3.0:  
 Added "COOLER PACKING"  
 Removed "CAM SOP-00101 -"DISPOSAL OF SAMPLES"  
 Added "CAM SOP-00105 -"ARCHIVING, RETRIEVAL AND DISPOSAL OF SAMPLES"

4.0:  
 Added: "O. Reg. 153/04: Ontario Regulation 153/04 Records of Site Condition: Part XV.1 of the Environmental Protection Act"

5.1:  
 Added: "once certificate of calibration expires for IR thermometers at 1oC resolution and"  
 Added: "for IR thermometers at 0.1oC resolution"  
 Added: "For new IR thermometers at 1oC resolution, a correction factor is not applicable until it has been determined at the first time of verification. For new IR thermometers at 0.1oC resolution,"  
 Added: "if outside the acceptance criteria"

5.1.7  
 Removed: 0 from the model number  
 Added: "(if applicable)"

## 5.1.9

Removed: "(rounding up to the nearest whole number)"

## 5.1.11

Added: "The infrared thermometer will be discarded if the malfunction cannot be corrected"

Example 1

Removed: 0 from model number

## 5.2

Added: "\*\*\*\*Note: For O. Reg. 153/04 a temperature < 10°C is required."

Added: "\*\*\*\*Note: A SIF will be created for all IOL samples received > 10°C (≥ 10°C for O. Reg. 153/04) sampled and received at any time"

Added: "\*\*\*\*Note: A SIF will be created for all samples (sampled and received on the same day) that are > 10°C (≥ 10°C for O. Reg. 153/04) and NO attempt has been made to cool the samples"

Added: Figure 5.0a "No Attempt to Cool Label"

Added: "\*\*\*\*Note: A SIF will not be created for environmental samples (other than IOL) sampled and received on the same date, that are > 10°C (≥10°C for O. Reg. 153/04), and an attempt has been made to cool the samples (ice or ice packs)"

Added: "\*\*\*\*Note: A SIF will be created for all samples (sampled at least one day prior than submission date) that are received > 10°C (≥ 10°C for O. Reg. 153/04)"

Added: "\*\*\*\*Note: If a Temperature Blank is submitted with the samples, record the temperature of the Temperature Blank in addition to the three temperature readings."

Added: "\*\*\*\*Note: Submissions under O. Reg. 243/07 and O. Reg. 170 Sch. 15.1 for lead analyses do not require SIFs for temperature exceedences."

Added: "\*\*\*\*Note: Refer to CAM FCD-00463 for bottle types listing."

Added: "\*\*\*\*Note: Methanol preserved soil and sediment samples for volatiles require a soil jar for moisture determination. This does not apply to Field/Travel Blanks."

Added: "air"

Added: "\*\*\*\*Note: Prior to analysis, regulated drinking water submissions for VOC analysis are examined for headspace and if on inversion, there is an air bubble present that covers the bottom of the vial, the sample is compromised and should not be analyzed."

Added: "Sediment Levels Spread Sheet",

Added: " SIF must be created for"

Removed: "must be flagged for"

Added: "with"

Added: "particulate"

Added: "\*\*\*\*Note: O. Reg. 153/04 requires field filtration for Chromium VI, Metals and Mercury. A SIF will be created for any visible particulate/sediment."

Added: "\*\*\*\*Note: O. Reg. 153/04 requires documentation of samples containing visual particulate/sediment. Any visible particulate/sediment will be recorded on CAM FCD-01013, "O. Reg. 153/04 Presence of Visible Particulate/Sediment". A SIF will be created if sediment level is > 1cm."

Added: "\*\*\*\*Note: Prior to analysis, regulated drinking water submissions for VOC analysis are inspected for particulate and the approximate amount of visible particulate noted."

Added: "\*\*\*\*Note: A SIF will be created for any non-routine sample, anything that is not water or soil, for confirmation and suitability for testing."

Removed: "\*\*\*\* Note: SIF will also be created for the following reasons:"

Removed: "A) All IOL samples received greater than 10°C (sampled and received at any time)."

Removed: "B) All samples (sampled and received on the same day) that are greater than 10°C and NO attempt has been made to cool the samples"

Removed: Figure 5.0a "No Attempt to Cool Label"

Removed: "C) All samples (sampled at least one day prior than submission date) that are received greater than 10°C"

Removed: "D) Any non-routine samples, anything that is not water nor soil"

Removed: "\*\*\*\*Note: SIF will not be created for the following reason:"

Removed: "E) Environmental samples (other than IOL) sampled and received on the same date, that are greater than 10°C, and an attempt has been made to cool the samples (ice or ice packs)"

Removed: "F) Submissions under O. Reg 243/07 and O. Reg 170 Sch. 15.1 for lead analyses do not require SIFs for temperature exceedences."

## 5.3

Added: "Form"

## 5.3.1

Added: "block letters"

Added: "(≥ 10°C for O. Reg. 153/04)"

Added: "(≥ 10°C for O. Reg. 153/04)"

Added: "For O. Reg. 153/04 it is required to document presence of custody seals and whether intact."

## 5.4

Added: "AND PACKING"

Added: "and on the back of the COC"

## 5.5

Added: "(Refer to CAM FCD-00665, "Immediate Tests")"

## 5.6

Added: "deemed as potentially"

Added: "Potential radioactive/radionuclide samples are prescreened at a designated external laboratory to be declared safe for handling."

Added: "via e-mail"

Added: "Lab staff are trained to handle these samples at the Sample Reception fume hood. These original samples are then archived once completed."

## 5.6.2

Added: "and then disposed of into the biohazard totes of the micro lab for appropriate disposal."

Removed: "with yellow liner."

## 5.7.4

Removed: "about 5mL of"

5.7.8

Removed: "5.7.8 PM is responsible for notifying the client that metals analysis is cancelled due to improper preservation. PM completes SIF resolution, removes affected sample from job and approves job for analysis"

5.9

Added: "Sudbury,"

Added: "Broken glass is packed up in cardboard boxes and taped up. Boxes are marked and disposed as glass."

5.9.5

Added: "At any point, a line can be inserted after replication by pressing the "Insert" key"

5.9.8

Added: "Re-logs and samples from Maxxam Montreal"

5.9.13

Added: "Rushes and"

5.13.7

Added: "Note: Samples cannot be "Moved In" to a bin that is already scanned into a fridge location. Scan into a new bin and scan this bin into a fridge location"

**Date of Change** March 31, 2014**Version 13****Section Changed** Edited Entire Document**Change Made** Section 4.0. Added FLAG: Fundamental Laboratory Acceptance Guideline

Section 5.2 Added FLAG

Section 5.2.2 a, b, and c Added all

Section 5.2. Changes made

2. Deleted \*\*\*Note: For O. Reg. 153/04 a temperature &lt; 10°C is required.

\*\*\*Note: A SIF will be created for all IOL samples received > 10°C (≥ 10°C for O. Reg. 153/04) sampled and received at any time

\*\*\*Note: A SIF will be created for all samples (sampled and received on the same day) that are > 10°C (≥ 10°C for O. Reg. 153/04) and NO attempt has been made to cool the samples

12. Added: \*\*Use for IOL samples only

14. Added: FLAG need not be included for a container subcontracted by another Maxxam location

23. Deleted: CAM FCD-00765 "Sediment Levels Spread Sheet"

24. Changed to 010130 CAM FCD-00765 010130, "O Reg 153/04 Presence of Visible Particulate/Sediment" may be used when recording sediment levels

Removed: \*\*\*Note: A SIF must be created for all Mercury bottles with visible particulate/sediment as it does have an effect on the analysis.

30. Added: Other --- NOTE: This FLAG item is not to be used.

Section 5.3.1. Changes made: Added Note: Record thermometer ID alongside the temperatures for clients' COCs as per contractual agreements whenever applicable.

Take a photocopy of the COC, highlighting the sample IDs that area affected with high temperature. Scan this photocopy in LIMS.

Added: Note: If a COC is not received with the submission, use CAM FCD-01053 "Internal sample Receipt Form."

Added: The Internal Sample Receipt Form is used to record all receiving information, including signature, print name, date, time of receipt, custody seal status, and temperatures.

Added: If air samples are submitted on the same COC as other matrices, inspect the different matrices as separate jobs.

Deleted: The waybill is attached to a blank piece of paper and received. These samples must be inspected and a SIF will be created.

Edited Sentence to read as: Note: If air samples are submitted on the same COC as other matrices, inspect the different matrices as separate jobs

Added 5.3.2 Copies of waybills are to be attached to the COCs or waybill #s are to be recorded on the COC if multiple jobs/COCs are received on a single waybill.

Section: 5.5 Changes made

Added in paragraph: "client tier level"

Added: Figure 5.0m "AIR" Stamp

Added: Air COCs are stamped with the "AIR" stamp:

Added: Environmental samples COCs submitted by Food clients are to be stamped with the "FOOD" stamp. The Chain of Custody form is to be submitted to Food Data Entry after inspection.

Added: Figure 5.0n "Food Stamp"

Section 5.6

Changes Made. A Potential radioactive/radionuclide samples are prescreened at Becquerel Labs to be declared safe for handling

Added: Use bin locations, SRFumeHood and SRFH-2

Added: via e-mail

Section 5.6.1. Added Scan the MSDS sheets, if available, under Images in JOB.

Section 5.9.1. Added. Samples from Other Maxxam Locations:

Added: Samples from Maxxam Ontario Labs

Added: Becquerel and Port Hope

Section 5.9.2 Added: Subcontract Sample SAIL Approval (Samples from Shared SAIL Labs):

Samples from Shared SAIL Labs (Samples subcontracted from other Maxxam locations sharing the same LIMS as Maxxam Campobello) need to be Sub-Approved by Sample Reception.

Subcontract Sample SAIL Approval Procedure:

Scan the samples into a bin location.

Scan the subcontracted label with the prefix in JOB into the SubApproval module.

If an error is encountered, investigate the problem in Progress Plan Inquiry in Operatans, and print the appropriate label.

Affix on the sample container and the proceed with the SubApproval process

Deleted: 5.0u "Cooler Inventory Application" to reflect current practice and replaced with Figure 5.0 v "Containers Tracking."

Edit: Scan all empty coolers that have a barcode into the "Cooler Inventory Application"

Added: Scan all empty coolers that have a barcode into the Cooler Tracking application in CLINTc (Csharp)

Pick the Client # from the drop down list, if not sure go to the Client/Quote System( CLINTc CSharp)

Section 5.9.4. Changes made:  
 Edited Step 3STEP 3: ADD PREFIX:  
 Change prefix to location that has received the Chain of Custody forms for all Ontario Regulations:  
 M for COCs received in Mississauga  
 O for COCs received in London  
 T for COCs received in Ottawa  
 W for COCs received in Waterloo  
 ESU for COCs received in Sudbury  
 EPH for COCs received in Port Hope  
 Edited Step 4, 5, 6 by re-numbering.  
 Added Step 4. 4) to reflect current practice: NOTE: Do not part vials.  
 If one among a set of vials is noted to have headspace, mark the vial with a red "\*" on the barcode label and mention in the SIF that one of the vials has headspace and is indicated with a red Sharpie.  
 Section 5.9.8. Changes Made.  
 Edited: "Note: When inspecting Trip Blanks, Trip Spikes, Field Blanks, Re-logs and samples from other Maxxam locations, Montreal and added: "Re-logs and samples from other Maxxam locations"  
 Added: " Note: 7 QC checks must be performed daily. Seven jobs are"  
 Added: "Drinking water and microbiology jobs are to be verified by a second person, and the entry sheet is co-signed."  
 Section 5.10. Added new section to reflect current practice: "Instructions on Filling out the Sediment Sheet/Presence of Particulates:  
 Use CAM FCD-01030 for recording the level of sediment in all containers for ON Reg 153 submissions:  
 The sediment/particulates are recorded in the rows against the client sample ID for the relevant bottle type.  
 TS: Trace sediment  
 S: Sediment that covers the bottom of the container. If sediment is greater that 1cm, then record the value on the sheet.  
 P: Particulate  
 SP: Suspended particulates.  
 Affix job label in the field provided on the sheet. The sheet is to be signed by the inspection staff and co-signed by a witness.  
 Section 5.10. Renumbered as "Section 11"  
 Section 5.11.7 Added: "Follow all steps in 5.10 to scan waybill documents, Incoming Additional Sample form, Field Information Forms, Sediment Level Sheet, parameter lists and MSDS. Please refer to respective images below:"  
 Added: Figures 5.0z1, 5.0z2, 5.0z3, 5.0z4,  
 Section 5.13. Added: INCOMING ADDITIONAL SAMPLES:  
 Additional samples to in-house jobs may need to be added in occasionally. Use CAM FCD-00923 to receive these samples. Samples are added by SAIL edit. Scan the Incoming Additional Sample form into job. Scan the samples into a bin location.  
 Section 6.1 Changes Made  
 Edited 6.1.2 and 6.1.3 for easy reading.  
 Edited 6.1.6 with ", or as instructed/client specifics."  
 Deleted: 6.1.7. Inspect VOST Tubes as one sample ID and two containers.  
 Added 6.1.7. To reflect current practice as "Inspect all Suma canisters received, including samples as mentioned on the Chain of Custody form, those that are Unused, those designated as "Do not Analyze. Scan them into the Suma canister inventory system in MaxxLIMS and label accordingly."  
 Deleted 6.1.8. to reflect current practice. \*\*When inspecting\*\* Summa Canisters, confirm with Customer Service how to proceed if there is no COC with the submission or if there is a COC but there are extra/unused samples not to be analyzed. If there are Summa Canisters without a COC and there is a notification that clearly states unused/do not analyse, label samples as "Unused" or "Do Not Analyze" and take them straight to Sort and Distribute without inspection. Refer to the Summa Canister Flow Chart (Attachment A) attached to this document.  
 Deleted: 6.1.9. "Summa Canisters to be analyzed must be scanned into the Summa Canister Tracking system during inspection" as current practice is reflected in 6.1.7.  
 Section 6.2.11. Edited "For biomedical cylinders, a back up cylinder and a filter are included, inspect both"  
 Changed Figure 6.0c  
  
 Section 6.3. Added "E-mail notifications: Whenever deemed appropriate, communicate with the project managers, customer service and the lab via e-mail.  
 Email notifications are sent out for heads up for the following:  
 PT samples  
 Bacteria close/past hold time  
 Waste Management with pH samples  
 Jobs for short holdtime analyses like NTA, ferrous iron, chlorine, and Tedlar bags  
 Jobs with methanol vials with additional labels"  
 Associated documents were reviewed

**Date of Change** May 18, 2014 **Version 14**

**Section Changed** header

**Change Made** Add Header to the WI

**Date of Change** March 10, 2015 **Version 15**

**Section Changed** All sections

**Change Made** Section 3.0 Edited to reflect current revisions: COR WI 00071 - "LOGIN AND HANDLING OF LEGAL SAMPLES"  
 Deleted: CAM WI-00409

Figures: Re-numbered all figures in the entire document as deletion of the first figure "NO attempt to Cool" sticker resulted in a chronological change.

Section 5.0 Deleted from from third paragraph of 5.1 and inserted into CAM FCD-00602 for better clarity and compliance.

Rewrote Section 5.1 INFRARED THERMOMETERS  
 Infrared thermometers are used at Sample Reception to measure sample temperatures.

For instructions on how to measure temperatures with infrared thermometers refer to CAM FCD-00602.

**VERIFICATION**

For additional details on verification, refer to CAM FCD-00602

Section 5.0 added "(this thermometer used for US (NELAC/DOD))"

Section 5.2, Item 2, Figure 5.0a and Figure 5.0g "No attempt to Cool" sticker deleted to reflect current practices.

Section 5.2. Item 2. Added under Notes for temperature blank "when the temperature of the submitted samples does not meet the required temperature criteria"

Section 5.2, item 9 Added sentence "when submitted with water. Dispose if bottles are empty."

Section 5.2 Item 15 Note added for headspace in amber bottles submitted for residual chlorine " Note: 1 litre amber bottles submitted for residual chlorine requires a FLAG for headspace when the container is not completely filled to the top."

Section 5.3 Added sentence: "The freezer and the one-day fridge is checked for uninspected samples." To reflect current practices.

Section 5.3.1 Sentence added: "or on the Additional Cooler Temperature Record COR FCD-00265."

Section 5.3.1 Deleted last sentence in paragraph in keeping with current practices and changes to COCs. Deleted " Attempt to Cool Label" must be affixed to the COC after receipt. and at inspection be replaced by a SIF stamp."

Section 5.3.2 Sentence added : or courier company names

Section 5.5. Added "COCs with samples for dissolved gasses in water are to be prioritized for inspection, sample entry and the lab.

Figure 5.0m "DG Sticker"

Hold Time (HT) Sticker is attached for micro water samples that are close to hold times.

Figure 5.0n "HT sticker"

Section 5.6 Added sentence " Record the job # in the log book provided. SRSA24."

Section 5.6 Deleted sentence: "(for these samples and communicate via e-mail the hazard to the labs involved with the analysis.)"

Section 5.6 Added " Use bin locations, SRFumeHood or a cooler, which is designated a location of SRFH2"

Section 5.7 Edited for to read as "pH verification is to be done at Sample Reception for samples for metals analysis submitted on the Maxxam DW Chain of Custody form, CAM FCD-01101."

Section 5.7 Deleted: "pH verification of DW samples for metals analysis is done upon sample receipt by Sample Inspection staff when a COC indicates that samples are DW samples regulated under the Ontario Safe Drinking Water Act" Section 5.7.1 Deleted "Review COC to verify samples are DW samples for metals testing under the Safe Drinking Water Act"

Section 5.7.2 Deleted "When DW samples are identified, pH of all metals bottles for the job are verified using pH 0-14 indicator strips (EMD or equivalent)"

Re-numbered 5.7.1 to 5.7.5 instead of 5.7.1 to 5.7.7.

Section 5.7 Added "Note: Refer to CAM FCD-02110 for FLAG checkpoints for the DW samples.

Section 5.8 2) Deleted "Pour off a small amount (about 20ml) of well shaken sample into small plastic cup"

Renumbered Section 5.8 from 1 to 5.

Section 5.9.1. Added "Winnipeg"

Section 5.9.6. to read as "Scan or type the bin number to be used to store the samples. All bins are pre-numbered and bar coded.

4) Enter number of parts.

5) To input multiple Parts of a sample -

E.g. Metals + Nutrients + General bottles = 3 parts

Press the Enter key once the required number of parts are typed under the "Parts" field of the sample line.

This will automatically replicate the sample line by that number. All information from that sample line will be copied as well. Change the bottle type and number of containers in each line as required."

Section 5.9.6 Note; Edited to read as "Do not separate/split vials for a single test code. Eg. 3 vials for VOC are inspected together as one part."

Section 5.9.10 Added item 6. "6. Region ("E" denotes eastern region)

Section 5.9.6. Step 3 Added Prefixes.

Change prefix to location that has received the Chain of Custody forms for all Ontario Regulations:

M for COCs received in Mississauga

O for COCs received in London

T for COCs received in Ottawa

W for COCs received in Waterloo

ESU for COCs received in Sudbury

EPH for COCs received in Port Hope

Renumbered Section 5.9.

Section 5.9.4 Step 5. Deleted "Stamp" and added "recorded" in sentence:

Enter Date / Time Received corresponding to the time recorded on the COC

Section 5.9.4 Step 6. Deleted: For Maxx Express BO Service Level:

a) Choose the Client Sample ID from the Pick-List

b) Choose the Bottle Type from the Order List

c) Enter # of Containers for that particular bottle type

Section 5.9.4 Step 6 Item 3) Deleted as currently not used in JOB: "The Sample Condition is defaulted to GC - Good

Condition. The Sample Condition and the Temp Sensitive fields are not required since all discrepancies are recorded in the SIF module and samples transferred to an appropriate storage location after inspection."

Section 5.11.7 Added "Note: Save scanned documents under the correct description. Each page of a COC is to be saved under the respective COC # as recorded on the COC (available usually at top right hand corner of page).

Section 6.3 Deleted: "Bacteria close/past hold times"

Section 6.4 Added 6.4 Job Remarks:

Any communication with regard to the job/samples that may be relevant to the Operations or Customer Service, Eg, Trip Blank Lot #s are entered as Job remarks

Section 5.10 Corrected FCD # to "CAM FCD-01013"

Section 5.14 Added " For storage of air sample media refer to Section 6.1.8"

Added Section 7.0

Added Section 8.0

**Date of Change** June 10, 2015

**Version 16**

**Section Changed** Sections 5.6.2, 9.0, attachments

**Change Made** 5.6.2 - Addition of "Sturdy Leak-proof containers" and "not contained, broken"

Added Section 9.0 to reflect in the current

Added Page number to Attachment A

Added Attachment 1

Section 1.0 Added: "and 6660 Campobello Road, Mississauga."

Section 5.3: Added: "For transfer of microbiology water samples between the two Campobello facilities, i.e. 6740

Campobello Road and 6660 Campobello Road, Mississauga, ON, refer to Attachment 1"

Section 5.10 Deleted "and co-signed by a witness." to reflect current practise

**Optional Field A** associated documents reviewed

**Date of Change** February 12, 2016

**Version 17**

**Section Changed** Inserted Attachment 2 and edited body of document to reflect current changes

**Change Made** Associated Documents:

Added in associated documents: CAM FCD-01240, CAM FCD-01013, CAM FCD\_01102 and COR WI-00073

Added: "applicable staff only" against CAM WI-00027 And CAM WI-00406

Changed: CAM WI-00105 to CAM SOP-00105

Section: 5.2

Edited item #12. "Samples received > 5 days after sampling" by deleting " \*\*Use for IOL samples only"

Deleted item #s 24, 25, 26 and 27

Edited to reflect current practice:

5.2.1.19 "A circle will appear on job label when a FLAG is created in LIMS. In case a FLAG is applied after the job has been signed off, stamp the Job Label on the COC to indicate there is a deficiency (Figure 5.0e - "SIF Stamp")"

Section:5.6 Becquerel changed to 6790 Kitimat Laboratory to reflect name change of laboratory

Edited Sentence 5.6.2 Edited sentence. "Bleach is prepared and supplied by the Micro Lab" to "Bleach is prepared and supplied by Bottle Prep Bottle Prep"

5.7. Changed "sticker" to "stamp" in sentence to reflect current practice as "A stamp saying "DW Metals Preservation Checked" will be attached to the COC once pH verification is completed for all metals bottles submitted."

Edited to read as "DW Metals Preservation Checked" is stamped on the COC once pH verification is completed for all metals bottles submitted."

5.7.4. Edited sentence to reflect current practice "When pH verification is completed for all samples, attach sticker to COC "DW Metals Preservation Checked."" To "When pH verification is completed for all samples, indicate "DW Metals Preservation Checked" on COC with a stamp."

Section 5.9.2: Deleted section on cooler tracking as this application has been discontinued. "Scan all empty coolers that have a barcode into the Cooler Tracking application in CLINTc (Csharp) "Container Tracking" Application. Deleted Figure 5.0x Containers Tracking as application has been discontinued.

Edited: Section 5.9.3 " Arrange samples on the bench according to the COC and number the samples containers from left to right and top to bottom. Note: Do not number 40mL vials for Volatiles to prevent" as it has been discontinued due to adequate training and experience of the group.

Edited to read as " Arrange samples on the bench according to the COC, sequentially streaming containers from left to right, and top to bottom"

Deleted 5.9.6. Item .4 " Enter PN notification if applicable" as it is a discontinued process.

Section 5.14: FZ-13 changed to FZ-46

Section 7.0: Removed: " Waste Management, short holdtime tests like chlorine, NTA, ferrous iron." To reflect current process.

Added "puf and filter" to second item.

Removed: Section 5.6.2: "and be unpacked on a designated bench area to ensure that no contamination will occur"

Edited as: "These soil samples are inspected as per routine procedure but cannot be mixed with other domestic samples in the same storage bin. The bench used for the inspection of these samples is to be disinfected after the process of inspection has been completed"

Edited to read as:"The bench area." Removed "designated."

Removed: "In Addition" for better reading.

Figure 5.7.4 Figure 5.0u "Drinking Water Metals Preservation Checked Label" changed to Drinking Water Metals Preservation Checked Stamp"

Edited: 5.9.10 "Drinking water and microbiology jobs are to be verified by a second person, and the entry sheet is co-signed" to read as "Regulated drinking water jobs are to be verified by a second person, and the entry sheet is co-signed."

Removed.5.9.15. "Rushes and DW COCs must be separated from non DW submissions in a separate inbox"

Deleted: 5.11.5 Click "Ok." Due to change in scanning application.

5.14.1 Edited Store microbiology samples in "red bins" changed to "red totes"

Added: Note: Refer to Attachment 2 for the sample login process for environmental, summa and cylinder samples.  
 Revised: CTA-Sample Reception 2015-2016. Revised document on updated template attached

**Notification List**

**Notification Recipients**

Campo Enviro Samp Entry - YYZ  
 Campobello Sample Reception - YYZ  
 Ottawa Inspection Entry and CS-Maxxam

**Approval Status Table**

Approver	Source	Role for Approvers	Parallel-Everybody	Segment
Approver	Action	Date	Comment	
Anuradha Ramesh	Approve	January 28, 2016 9:51 AM GMT-5		
Christine MacDermid	Approve	January 28, 2016 9:14 AM GMT-5		
Quinn Smith	Approve	February 12, 2016 11:35 AM GMT-5		

11/9/16 10:28 AM



## **RECEIVING AND INSPECTING ENVIRONMENTAL AND AIR SAMPLES**

### **1.0 INTRODUCTION**

This work instruction outlines the process of receiving and inspecting samples at Maxxam Analytics, 6740 Campobello Road, Mississauga, London, Waterloo, Ottawa, Sudbury, and Port Hope, ON, and 6660 Campobello Road, Mississauga.

### **2.0 SCOPE**

This procedure is applicable for the receipt and inspection of Environmental and Air samples and already inspected samples received from other Maxxam locations using the same database. It outlines the process to be followed for receiving, prioritizing, inspecting, labeling, sample storage, safety precautions, and the prevention of cross-contamination.

### **3.0 RESPONSIBILITIES**

This procedure is to be used by the Sample Reception staff to ensure all samples are received, stored, and analyzed in a timely and efficient manner. All Sample Reception staff is required to read, understand and follow the procedure outlined in this work instruction.

In addition to this work instruction, staff must read and understand the following procedures:

- COR WI-00029 – “CORPORATE PROCEDURE FOR HANDLING PROFICIENCY TESTING SAMPLES”
- CAM WI-00015 – “VERIFICATION OF THERMOMETERS”
- CAM WI-00026 - “ENVIRONMENTAL - SAMPLE CONTAINER PREPARATION AND COOLER PACKING”
- CAM WI-00027 - “INSTRUCTIONS ON COMPLETING THE CHAIN OF CUSTODY FORM” (applicable staff only)
- CAM WI-00073 – “LABORATORY REQUIREMENTS UNDER THE ONTARIO DRINKING WATER LEGISLATION”
- CAM WI-00406 - “COLLECTION OF DRINKING WATER SAMPLES” (applicable staff only)
- COR WI 00073 - "LOGIN AND HANDLING OF LEGAL SAMPLES"
- CAM WI-00410 - "RECEIVING AND REPORTING ONTARIO DRINKING WATER SAMPLES"

- CAM SOP-00105 -"ARCHIVING, RETRIEVAL AND DISPOSAL OF SAMPLES"
- MAXXAM ENVIRONMENTAL HEALTH & SAFETY (MEHS) POLICIES
- CRITICAL TASK ANALYSIS ATTACHED TO THIS DOCUMENT

#### 4.0 DEFINITIONS

- SIF: Sample Integrity Form
- FLAG: Fundamental Laboratory Acceptance Guideline
- COC: Chain of Custody
- DW: Drinking Water
- Frozen Sample: A sample where ice crystals are visually detected in the sample
- LIMS: Laboratory Information Management System
- O. Reg. 153/04: Ontario Regulation 153/04 Records of Site Condition: Part XV.1 of the Environmental Protection Act
- PN: Preliminary Notices – A system notifying the lab about prearranged rushes, immediate or other specific job submission
- psi: pounds per square inch is a unit of pressure

#### 5.0 PROCEDURE FOR ENVIRONMENTAL SAMPLES

##### 5.1 INFRARED THERMOMETERS

Infrared thermometers are used at Sample Reception to measure sample temperatures.

For instructions on how to measure temperatures with infrared thermometers refer to CAM FCD-00602.

##### 5.1.1 VERIFICATION

Any new IR thermometer must be verified according to CAM WI-00015, "Verification of Thermometers", once certificate of calibration expires for IR thermometers at 1°C resolution and prior to being put into use for IR thermometers at 0.1°C resolution, and at prescribed frequency thereafter:

- Annually for IR thermometers at 1°C resolution (ref. CAM WI-00015)
- Every three months for IR thermometers at 0.1°C resolution. This thermometer used for US (NELAC/DOD) samples, (ref. CAM WI-00121)
- For additional details on verification, refer to CAM FCD-00602

## 5.2 DISCREPANCY AND SAMPLE INTEGRITY FORM (SIF)/FLAG

Discrepancies or problems with sample integrity and/or suitability of samples for testing are documented in a SIF.

Sample integrity ensures that samples are received in the appropriate container type, volume and preservation.

Samples are stored in the proper storage conditions, and are clearly identified and shall agree with the information on the COC.

The Sample Integrity Form (Figure 5.0d) is used to address and document the following discrepancies. (Note: For the purposes of this section 5.2, the numbering below reflects exact LIMS SIF window.)

1. Custody seal not intact
2. Temperature > 10°C

FLAG this item for the following scenarios: \*\*\*

- a. Temperature > 10°C ( $\geq 10^\circ\text{C}$  for O. Reg. 153/04) - for same-day samples with **no attempt to cool**.
- b. Temperature > 10°C ( $\geq 10^\circ\text{C}$  for O. Reg. 153/04) for submissions with a sampling date other than same day sampling is to be flagged.
- c. For US (NELAC, DOD)(water/soil/solid) samples requiring thermal preservation FLAG for temperature lower than 1°C or greater than 6°C.

\*\*\*Note: If a Temperature Blank is submitted with the samples, record the temperature of the Temperature Blank in addition to the three temperature readings when the temperature of the submitted samples does not meet the required temperature criteria.

\*\*\*Note: Submissions under O. Reg. 243/07 and O. Reg. 170 Sch. 15.1 for lead analyses do not require SIFs for temperature exceedances.

3. Broken bottle in transit
4. No COC
5. COC information incomplete
6. COC not signed/dated
7. Non current COC
8. Bottles/Samples listed on COC but not received
9. Bottles/Samples received but not listed on COC

\*\*\*Note: Inspect all DI waters (Free Organic and Inorganic) when submitted with QC samples. Dispose off if bottles are empty.

10. Analysis requirements absent/unclear
11. Labeling issue (missing/incorrect)
12. Samples received > 5 days after sampling
13. Samples received past holding time
14. Wrong bottle(s) used

\*\*\*Note: Refer to CAM FCD-00463 for bottle types listing. Containers subcontracted from other Maxxam locations don't need to be flagged.

\*\*\*Note: Methanol preserved soil and sediment samples for volatiles require a soil jar for moisture determination. This does not apply to Field/Travel Blanks.

15. Incorrect preservation or headspace

\*\*\*Note: Headspace for waters is considered when the air bubble covers the entire base of the vial.

\*\*\*Note: Prior to analysis, regulated drinking water submissions for VOC analysis are examined for headspace and if on inversion, there is an air bubble present that covers the bottom of the vial, the sample is compromised and should not be analyzed.

\*\*\*Note: 1 litre amber bottles submitted for residual chlorine require a FLAG for headspace when the container is not completely filled to the top.

\*\*\*Note: Headspace for soils is considered when soil jar has void space at top and bottom of jar regardless of soil type and fails the rattle test.

16. Insufficient number of bottles (with no flag)
17. Incorrect Task Order # (IOL only)
18. Insufficient sample volume for requested test
19. Sample Requiring Filtration Received Preserved
20. Cap missing or broken
21. Sample container received empty
22. Sample received frozen
23. Sediment is >1cm in groundwater Org. container

\*\*\*Note: When measuring sediment levels in ground water organic samples, do not shake the samples. Measure the sediment layer at the highest point if the sediment at the bottom is uneven. CAM FCD-01013, "O Reg 153/04 Presence of Visible Particulate/Sediment" may be used when recording sediment levels.

\*\*\*Note: O. Reg. 153/04 requires field filtration for Chromium VI, Metals and Mercury. A SIF will be created for any visible particulate/sediment.

\*\*\*Note: O. Reg. 153/04 requires documentation of samples containing visual particulate/sediment. Any visible particulate/sediment will be recorded on CAM FCD-01013, "O. Reg. 153/04 Presence of Visible Particulate/Sediment". A SIF will be created if sediment level is >1cm.

\*\*\*Note: Prior to analysis, regulated drinking water submissions for VOC analysis are inspected for particulate and the approximate amount of visible particulate noted.

28. Special analysis required

\*\*\*Note: A SIF will be created for any non-routine sample, anything that is not water or soil, for confirmation and suitability for testing.

29. Test code does not exist
30. No quote or incorrect quote on COC
31. Other --- NOTE: This FLAG item is not to be used.

#### 5.2.1 CREATE A SIF/FLAG

5.2.1.1 Click "SIF" found in the Menu Bar on the Sample Inspection and Inventory Screen (Figure 5.0a) after a job has been generated or selects SIF from the Job Entry Screen (Figure 5.0b)

Figure 5.0a "Sample Inspection and Inventory Screen"

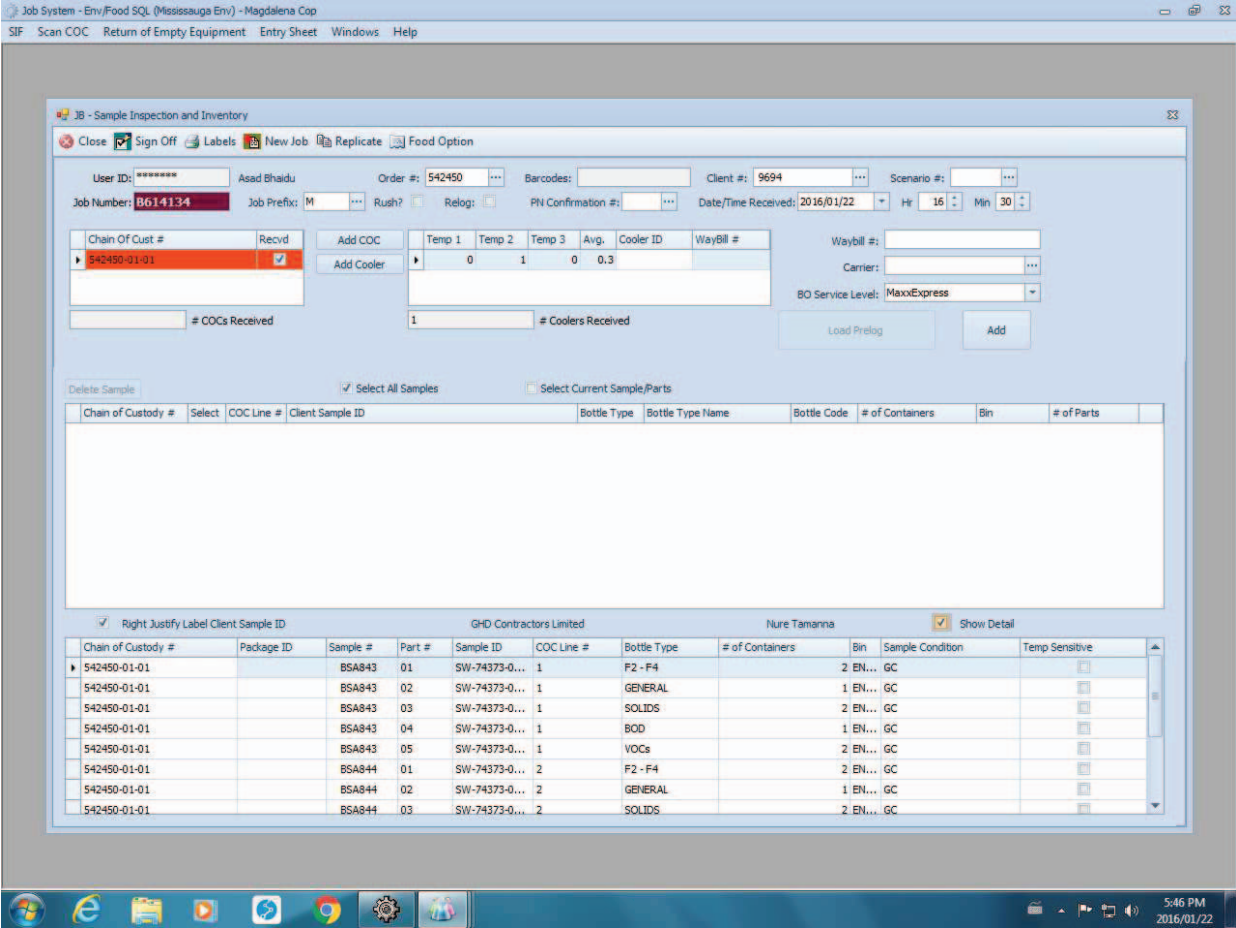
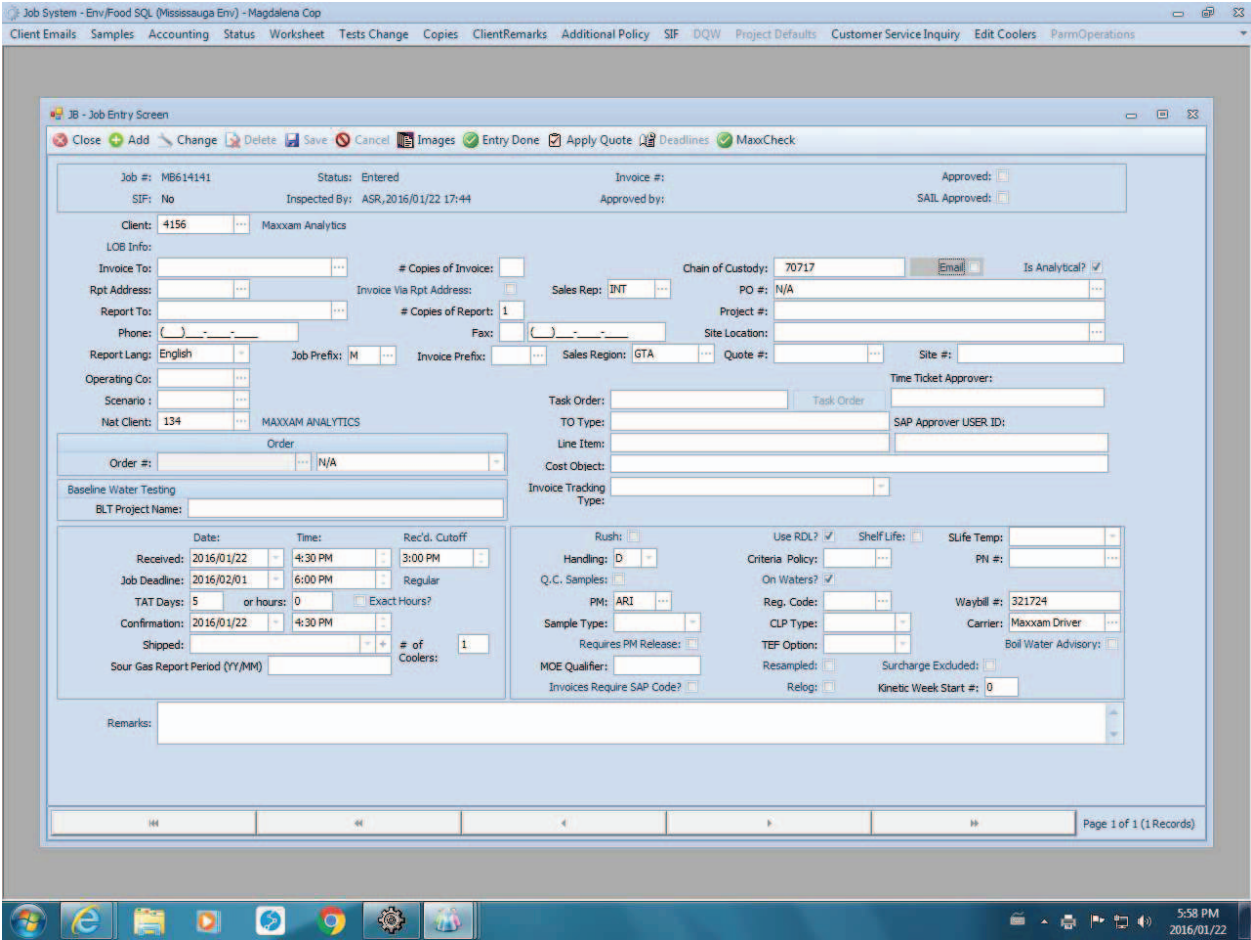


Figure 5.0b "Job Entry Screen"



5.2.1.2 Click "Add" on the Sample Integrity Form (Figure 5.0c)

Figure 5.0c "Sample Integrity Form"

Job System - Env/Food SQL (Mississauga Env) - Magdalena Cop

Windows Help

JE - Sample Integrity Form B614106

Close (Alt-X) Add Change Delete Save Cancel Print

**Job Data:**  
Invoice Client Name: GE Water Process Technologies  
Invoice Client: 19292 Invoice PM: Accounts Payable  
Rpt Client Name: GE Water ProcessTechnologies  
Rpt Client #: 14087 Rpt PM: Marc Clouser  
Client Project #: Rush: No  
Quote #: B30095 TAT: 6 days  
COC/Submission #: 492656-01-01 Task Order:  
Site #: Maxxam PM: Marijane Cruz

**Received Data:**

Date	Time	By:
2016/01/22	16:15 PM	GK1
2016/01/22	05:13 PM	GK1

Waybill #: Courier: Samples Stored By: GK1

Temp 1	Temp 2	Temp 3	Avg. Temp	Package ID
14	17	17	16	1863249

Temperature: Labeled By: GK1 Labels Checked By: GK1

**SIF Dates**  
Created By: Magdalena Cop  
SIF Created: 2016/01/22 17:17  
E-mail sent: 2016/01/22 17:20

Resolved By: Resolved

Date/Time SIF Resolved: Resolved

**Regulation/Guideline to be followed:**

**Report Comments:**

**Internal Comments:**  
Sample Inspection Comments:  
2. Temperature is greater than 10  
14. For all samples non-maxxam 250ml plastic containers are used

**Sample Entry Comments:**

**Resolution Comments:**

**Check List:**

- 1. Custody seal NOT intact
- 2. Temperature > 10 degrees
- 3. Broken Bottle in Transit
- 4. No C of C
- 5. C of C information incomplete
- 6. C of C not signed/dated
- 7. Non-current C of C
- 8. Bottles/Samples listed on COC but not received
- 9. Bottles/Samples received but not listed on COC
- 10. Analysis Requirements absent/unclear
- 11. Labelling issue (missing/incorrect)
- 12. Samples received >5 days after sampling
- 13. Samples received past hold time
- 14. Wrong bottle(s) used
- 15. Incorrect preservation or headspace
- 16. Insufficient # of bottles (with no flag)
- 17. Incorrect Task Order #

**Extended CheckList** **Region CheckList**

- 18. Insufficient Sample Volume for Requested Test
- 19. Sample Requiring Filtration Received Preserved
- 20. Cap Missing or Broken
- 21. Sample Container Received Empty
- 22. Sample Received Frozen
- 23. Sediment > 1 CM in Groundwater Org. Container
- 28. Special Analysis Required
- 29. Test Code Does Not Exist
- 30. No Quote or incorrect Quote on COC
- 31. Other

5:53 PM  
2016/01/22



5.2.1.3 Check off the box on the checklist next to the problem(s) identified. For SIF items specific to Ontario Drinking Water click on the Regional Check List tab

5.2.1.4 Click on the “Add” button beside the Sample Inspection Comments

5.2.1.5 Pick the selected SIF from the Checklist # Lookup screen

5.2.1.6 Record clear and concise comments in the Sample Inspection Comments field as required

5.2.1.7 Click “Save”

5.2.1.8 Click “Close”

5.2.1.9 Repeat if multiple SIFs

5.2.1.10 Click “Save” and a screen containing the Maxxam Project Manager Codes will be displayed (Figure 5.0d – Maxxam Project Manager Pick List)

5.2.1.11 Click “OK”

5.2.1.12 Click “Close” to return to Sample Inspection and Inventory screen or Job Entry Screen

5.2.1.13 To edit the SIF, click “Change” on the Sample Integrity Form

5.2.1.14 Select the SIF item from the Sample Inspection Comments

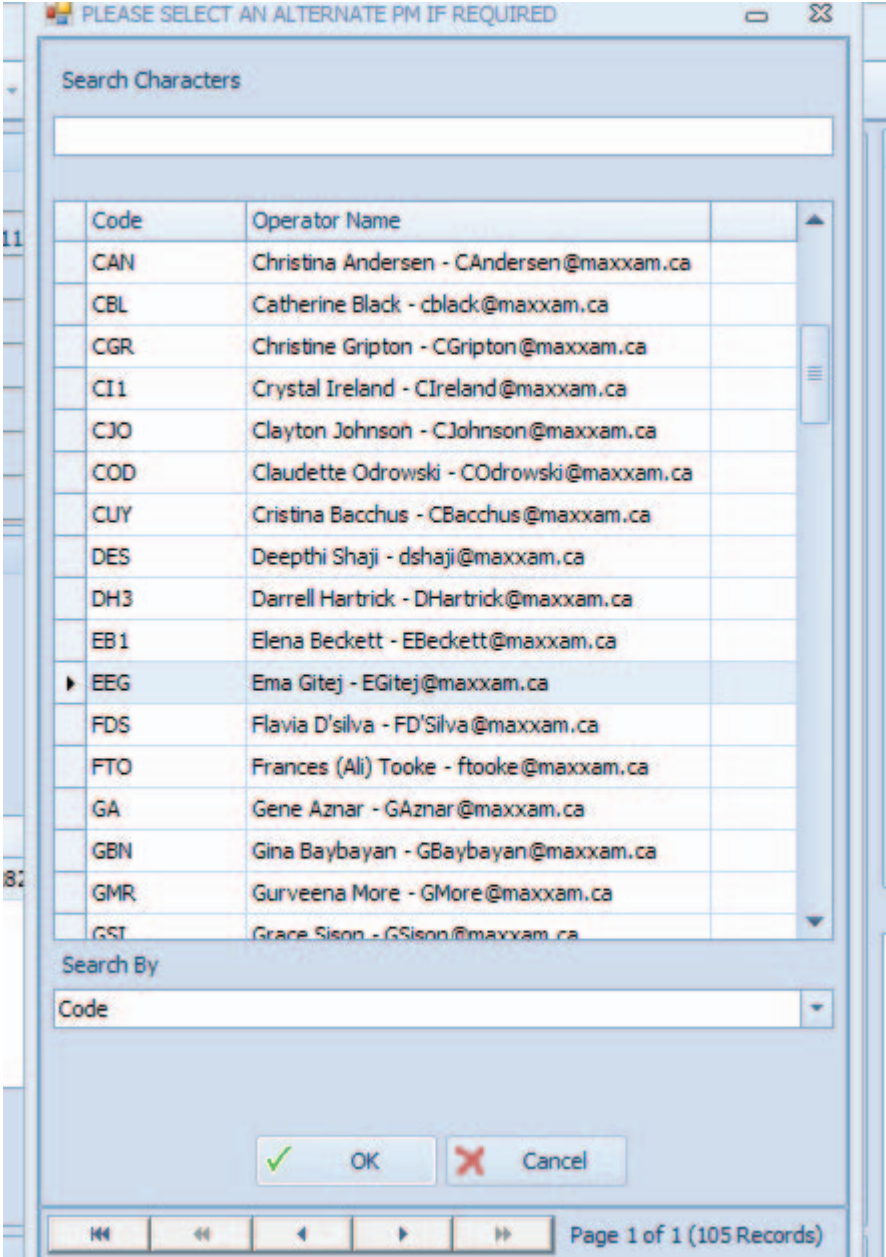
5.2.1.15 Click on the “View” button

5.2.1.16 Click “Change” and enter comments

5.2.1.17 Click “Save” and “Close”

5.2.1.18 To delete the SIF, select the SIF item and click on the “Delete” button

Figure 5.0d "Maxxam Project Manager Pick List"



- 5.2.1.19 A circle will appear on job label when a FLAG is created in LIMS. In case a FLAG is applied after the job has been signed off, stamp the Job Label on the COC to indicate there is a deficiency (Figure 5.0e – “SIF Stamp”)

Figure 5.0e “SIF Stamp”



- 5.2.1.20 Align the COC on the scanner and save the Images on to the Job
- 5.2.1.21 An e-mail will be automatically sent to the Project Manager to address the discrepancy
- 5.2.1.22 Deliver the COC to Data Entry

Note: When the SIF is resolved the Project Manager will enter the resolution comments into the SIF screen and the appropriate personnel are informed how to proceed with the sample.

### 5.3 SAMPLE RECEIVING

The 24hr drop-off lockers are checked first for samples in the morning. The freezer and the one-day fridge are checked for uninspected samples. CAM FCD-00464, “Sample Reception Locker and Scanner Check Form,” must be filled out by two staff members as proof of check.

All samples received must be handled and stored in a manner which satisfies the requirements for sample integrity, safety, security and easy retrieval of those samples.

Samples received that have relatively short holding times or samples that are close to exceeding holding times must be processed immediately (Refer to CAM FCD-00665, “Immediate Tests”).

Samples that are received with discrepancies and incomplete information that falls under the Sample Integrity Form (SIF) must be documented in the SIF module (Figure 5.0c).

For Receiving IOL jobs, refer to CAM FCD-00630 "Check Points to Process IOL jobs".

For transfer of microbiology water samples between the two Campobello facilities, i.e. 6740 Campobello Road and 6660 Campobello Road, Mississauga, ON, refer to Attachment 1.

### 5.3.1 RECEIVING THE COC

Upon receipt, the COC or the client analytical request form must be signed, first and last name printed in block letters, date and time recorded using the date format YYYY/MM/DD and the time using a 24 hr clock.

If a submission has only one cooler, three (3) separate temperatures must be randomly taken from samples in the cooler, using an infrared thermometer (Refer to CAM FCD-00602 – Instructions How to Measure Temperatures with Infrared Thermometers). The temperature is recorded on the COC and entered in LIMS system.

If multiple coolers for a single submission are received from the same client, three temperature measurements from samples from each cooler are recorded on the COC, or on the Additional Cooler Temperature Record COR FCD-00265. If one cooler out of many for a single submission does not meet the temperature requirements, that individual cooler must be flagged at receipt and a temperature SIF created for those sample IDs in that particular cooler. Take a photocopy of the COC, highlighting the sample IDs that are affected with high temperature. Scan this photocopy in LIMS. If multiple coolers are received from the same client and each cooler has its own COC, only 3 temperature readings for that individual cooler is required.

For samples with an average  $>10^{\circ}\text{C}$  ( $\geq 10^{\circ}\text{C}$  for **O. Reg. 153/04**), sampled prior to current date and received without any evidence of cooling or insufficient cooling (e.g., freezer packs, ice bags, loose ice), the comments "no ice," "no cooling," "not enough ice," "melted ice," "warm ice packs," "Y" or "N" must be noted on the COC in conjunction with the temperature readings.

For samples with an average  $>10^{\circ}\text{C}$  ( $\geq 10^{\circ}\text{C}$  for O. Reg. 153/04), sampled and received on the same day and NO attempt has been made to cool the samples, a “No ice” Or the “No cooling media” box is toggled on the COC and a SIF is created.

Note: Record thermometer ID alongside the temperatures for clients’ COCs as per contractual agreements whenever applicable.

If custody seals are present on the cooler, the condition of these custody seals is noted on the chain of custody form or receiving documentation.

For O. Reg. 153/04 it is required to document presence of custody seals and whether intact.

Note: If a COC is not received with the submission, use CAM FCD-01053 “Internal Sample Receipt Form.”

The Internal Sample Receipt Form is used to record all receiving information, including signature, print name, date, time of receipt, custody seal status, and temperatures.

Note: It is not required to record temperatures for inorganic air sampling media, compressed gas cylinders, Tedlar Bags and Summa Canisters.

It is required to record temperatures for the following air sampling media:

- 1) Charcoal Tubes
- 2) PUF and Filters
- 3) Stack work
- 4) TD Tubes
- 5) VOST Tubes
- 6) XAD Tubes

Note: If air samples are submitted on the same COC as other matrices, inspect the different matrices as separate jobs.

### 5.3.2 SAMPLES RECEIVED BY COURIER

The Maxxam Chain of Custody form or client analytical request documentation is removed from the shipping container.

Waybills received from courier companies must be removed from coolers and attached to COCs. Multiple coolers from the same client should be received together.

If coolers are being dropped off by courier companies at the door, Reception staff must sign the waybill, receive a copy and attach it to the COC.

Receiving staff must ensure delivery time is recorded on Maxxam driver waybills. Copies of waybills are to be attached to the COCs or waybill #s or courier company names are to be recorded on the COC if multiple jobs/COCs are received on a single waybill.

### 5.3.3 CLIENT DROP OFFS AT THE DOOR

The Chain of Custody form or analytical request form must be first inspected to ensure that it is correctly filled out. If the form is incomplete, the client must be instructed to complete it. The client, upon relinquishing their package, must sign, date and time the Chain of Custody form. This is exempted for couriers delivering closed up coolers.

### 5.4 HOLDING TIMES

Holding times and preservation requirements for analyses can be found in CAM WI-00026 – “ENVIRONMENTAL - SAMPLE CONTAINER PREPARATION AND PACKING” and CAM FCD-00680 – “DRINKING WATER SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME INF” and on the back of the COC.

### 5.5 PRIORITIZATION OF JOBS

Jobs are prioritized according to turnaround time and holding time and client tier level (**Refer to CAM FCD-00665, “Immediate Tests”**) based on the information on the COC, and flagged as follows:

- Rush submissions are labeled with a red rush label

Figure 5.0f “Rush Label”



- Immediate tests are stamped in green

Figure 5.0g “Immediate Test Stamp”



- Microbiology jobs are stamped in blue

Figure 5.0h “Micro Test Stamp”



- IOL submissions with a green label

Figure 5.0i “IOL Label”



- COC and sample for Formaldehyde in water are labeled with a rush preparation label

Figure 5.0j “Rush Preparation Label”



- Environmental samples are distributed either to the microbiology, drinking water, rush, IOL, immediate test or the standard table.
- Air samples are brought to a specific table for air inspection. Air COCs are stamped with the “AIR” stamp:

Figure 5.0k “Air Stamp”



- Environmental samples COCs submitted by Food clients are to be stamped with the “FOOD” stamp. The Chain of Custody form is to be submitted to Food Data Entry after inspection.

Figure 5.0l “Food Stamp”



COCs with samples for dissolved gasses in water are to be prioritized for inspection, sample entry and the lab.

Figure 5.0m “DG Sticker”





Hold Time (HT) Sticker is attached for micro water samples that are close to hold times.

Figure 5.0n “HT sticker”



## 5.6 HANDLING OF CONTAMINATED AND INTERNATIONAL SAMPLES

Samples that are identified as hazardous, deemed as potentially contaminated samples, explosives (soils), international soils and solids (including USA, Newfoundland, and PEI) and international food are required to be flagged. These samples also require proper storage and disposal. Potential radioactive/radionuclide samples are prescreened at **6790 Kitimat Laboratory** to be declared safe for handling.

Samples with strong smell and that could possibly contaminate other samples should be handled in the fume hood. Use bin locations, SRFumeHood or a cooler, which is designated a location of SRFH2. Lab staff is trained to handle these samples at the Sample Reception fume hood. These original samples are then archived once completed.

Affix the appropriate WHMIS or alternative label on the COC and samples or use the “Caution” label to flag the COC and the samples. Specify the potential hazard on the “Caution” label if the hazard is known. For samples that are contaminated with PCB, explosives, biohazards, international solids, soils, and food use the applicable label as listed in section 5.6.1

### 5.6.1 LABELS

Figure 5.0o “Caution Label”



Figure 5.0p “PCB Label”



Figure 5.0q "Explosive Label"



Figure 5.0r "Biohazardous Label (CAM FCD-00460)"

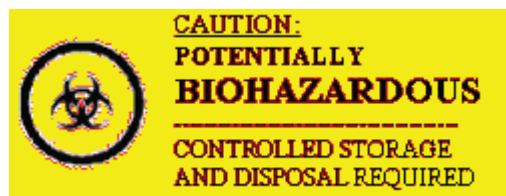


Figure 5.0s International Solid Sample Label (CAM FCD-00459)"



Figure 5.0t "International Food Label (CAM. FCD-00461)"



Any contaminated COCs due to breakage or leakage must be contained in a plastic bag to prevent spreading of the contamination to other departments. A copy is made of the original COC and the original COC together with boxes, broken glass, plastic, paper, gloves, etc. that were exposed to the spill are collected in one bag, flagged and brought to Archiving for proper disposal.

Scan the MSDS sheets, if available, under Images in JOB.

#### 5.6.2 HANDLING OF INTERNATIONAL SOILS

International soils must arrive in sturdy leak-proof containers. These soil samples are inspected as per routine procedure but cannot be mixed with other domestic samples in the same storage bin. The bench used for the inspection of these samples is to be disinfected after the process of inspection has been completed.

After the samples have been inspected and labelled with "International Solid Sample" labels, the bench area must be properly cleaned using 5% bleach as disinfectant. Bleach is prepared and supplied by the Bottle Prep. The soiled paper towels, gloves, residual soil on benches and packaging material must be disposed off in designated garbage bin and then disposed of into the biohazard totes of the micro lab for appropriate disposal. If samples are not contained, broken samples including glass must be properly labelled and handed over to Archiving staff for appropriate storage and disposal.

Under no circumstances can any quantity of international soil be disposed off in the regular garbage or down a drain, etc.

#### 5.7 VERIFICATION OF METALS PRESERVATION FOR ONTARIO DRINKING WATER SAMPLES

Ontario Ministry of Environment requires that drinking water samples submitted for metals testing be preserved with HNO<sub>3</sub> to pH < 2. Verification of sample preservation must be performed.

pH verification is to be done at Sample Reception for samples for metals analysis submitted on the Maxxam DW Chain of Custody form, CAM FCD-01101. "DW Metals Preservation Checked" will be stamped on the COC once pH verification is completed for all metals bottles submitted.

Any samples with pH ≥ 2 will be documented in LIMS Job SIF module. Use checkbox #15 (Improper preservation or headspace) and in the sample inspection comments, list sample and part # of affected sample.

- 5.7.1 Bring metals bottles to area designated for pH testing. Area must be kept clean and dust free. A container to collect waste liquid should be available.
- 5.7.2 Remove a single pH indicator strip (pH 0-14 indicator strips (EMD or equivalent) from container. Uncap metals bottle and draw some sample using a disposal pipette, and dispense sample over indicator strip. Ensure that all colored areas of pH indicator strips are thoroughly moistened.
- 5.7.3 Compare color on pH indicator strip to color chart on container. If pH indicator shows pH < 2, repeat steps 5.7.2 and 5.7.3 for all metals bottles in job.
- 5.7.4 When pH verification is completed for all samples, indicate "DW Metals Preservation Checked" on COC with a stamp.

5.7.4.

Figure 5.0u "Drinking Water Metals Preservation Checked Stamp"



5.7.5 If pH indicator shows  $\text{pH} \geq 2$ , create a SIF. Use checkbox #15 (Improper preservation or headspace) and in sample inspection comments, list sample and part # of affected sample

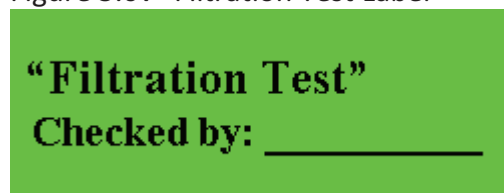
Note: Refer to CAM FCD-02110 for FLAG checkpoints for the DW samples.

## 5.8 BIOSOLIDS AND SLUDGES

If the matrix of a sample is biosolid or sludge, a filtration test must be performed to determine what test code should be used. Biosolids and sludges are categorized as liquids, sludges or solids. Biosolids and sludges can be totally liquid, totally solid or any combination in between. The following procedure is used to determine if the sample is treated as liquid, solid or sludge (mixed liquid and solid).

- 1) Shake sample. If sample can't be shaken due to lack of liquid, then book in using soil test codes.
- 2) Using 10 ml syringe, draw 10 ml of homogenized sample into syringe tube. Attach 2  $\mu\text{m}$  "acrodisk" or equivalent filter.
- 3) Visually inspect sample in syringe. If clear and colorless, book in as liquid. If cloudy or colored follow step 5.
- 4) Attempt to filter. If all 10 ml of sample filters easily, use liquid test codes. If filter clogs before all sample is filtered, then use biosolid test codes.
- 5) Attach a filtration test sticker to the COC to document that the test was performed and indicate if the sample is liquid, sludge or solid.

Figure 5.0v "Filtration Test Label"



## 5.9 SAMPLE INSPECTION

All samples received for analysis have to be inspected by Sample Reception staff.

Samples are removed from the shipping container and placed on the appropriate bench and checked for discrepancies, such as physical damage, insufficient sample volume or leakage, inappropriate sample preservation. All discrepancies are recorded in the SIF module. See section 5.2 for Discrepancy and Sample Integrity Form (SIF).

If a COC is received by Sample Reception staff but no samples have accompanied the COC, the COC must be inspected and a SIF will be created for electronic tracking.

For Inspection of IOL jobs refer to CAM FCD-00630 “Check points to process IOL jobs.”

#### 5.9.1 Samples from Other Maxxam Locations:

Samples from Maxxam Ontario and Winnipeg Labs:

Note: When samples are received at Maxxam Regional Labs in Ontario and Winnipeg, i.e., London, Waterloo, Sudbury, Ottawa, Winnipeg, Becquerel and Port Hope, and need to be inspected at the Mississauga location, the date, time and temperatures to be entered in the Sample Inspection screen (Figure 5.0a) are that of when samples were received at the original location and not when they were received in Mississauga.

If the receiving temperatures at the regional labs meet the temperature requirements but the Mississauga receiving temperatures, for inspected and non-inspected submissions exceed the temperature requirements, a SIF must be created.

To ensure samples are kept at an acceptable temperature of  $\leq 10^{\circ}\text{C}$  when shipped between regional labs, samples shall not be packed tightly; ice and ice packs shall be inserted between, under and on top of the samples. The amount of ice and ice packs that are inserted in the sample cooler shall be sufficient to keep the samples cold until the final destination.

Note: When already inspected samples arrive from the Maxxam Ontario locations using the same database, Sample Inspection staff scans the sample barcodes and move the samples to a bin location to confirm receipt. Subcontracted samples received from other Maxxam locations not using the same database, must be inspected under a new job number, refer to CAM FCD-00749, “Subcontracting From Other Maxxam Locations to Maxxam Mississauga.”

#### 5.9.2 **Subcontract Sample SAIL Approval (Samples from Shared SAIL Labs):**

Samples from Shared SAIL Labs (Samples subcontracted from other Maxxam locations sharing the same LIMS as Maxxam Campobello) need to be Sub-Approved by Sample Reception.

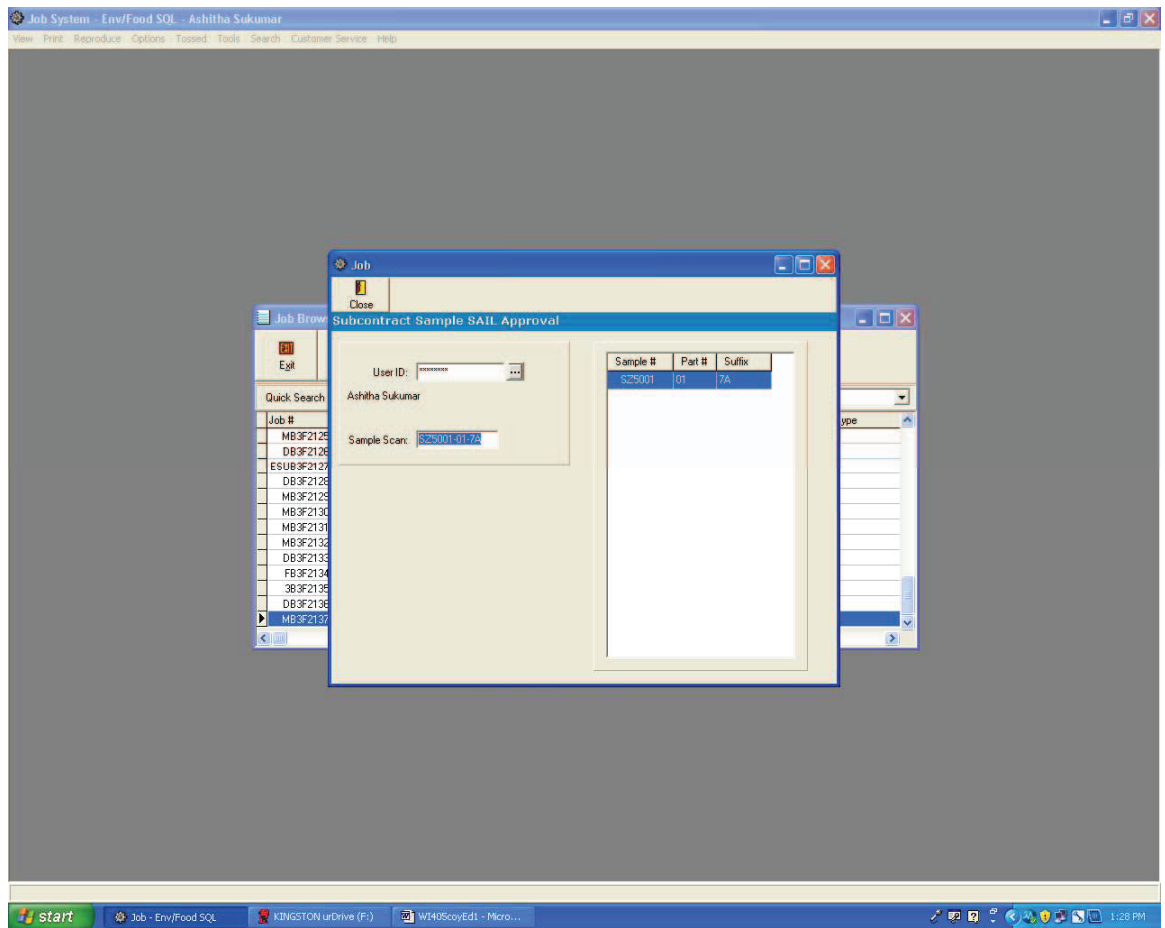
Subcontract Sample SAIL Approval Procedure:

Scan the samples into a bin location.

Scan the subcontracted label with the prefix in JOB into the SubApproval module.

If an error is encountered, investigate the problem in Progress Plan Inquiry in Operations, and print the appropriate label. Affix on the sample container and then proceed with the SubApproval process.

Figure 5.0wSub Approval Scanning



Packaging material and ice packs are removed from the empty coolers and water and ice are emptied into the sink.

Broken glass is packed up in cardboard boxes and taped up. Boxes are marked and disposed off as glass.

Empty coolers are placed on carts to be delivered to the cooler storage area by Inspection staff.

### Sorting Samples

5.9.3 Arrange samples on the bench according to the COC **sequentially streaming containers from left to right, and top to bottom**

5.9.4 Once samples have been appropriately sorted and initially inspected, they can now be assigned a Maxxam job number,



sample number and bottle type code. This is done through the Inspection module in LIMS (Figures 5.0a and 5.0z).

One person logs into a computer but others can use it, and thus it cannot be assumed that the person's initial in LIMS is the person who inspected or stored the samples. The accurate information can be retrieved from the initials on the Job label, Figure 5.0aa, affixed to the COC and from the SAIL Operations module.

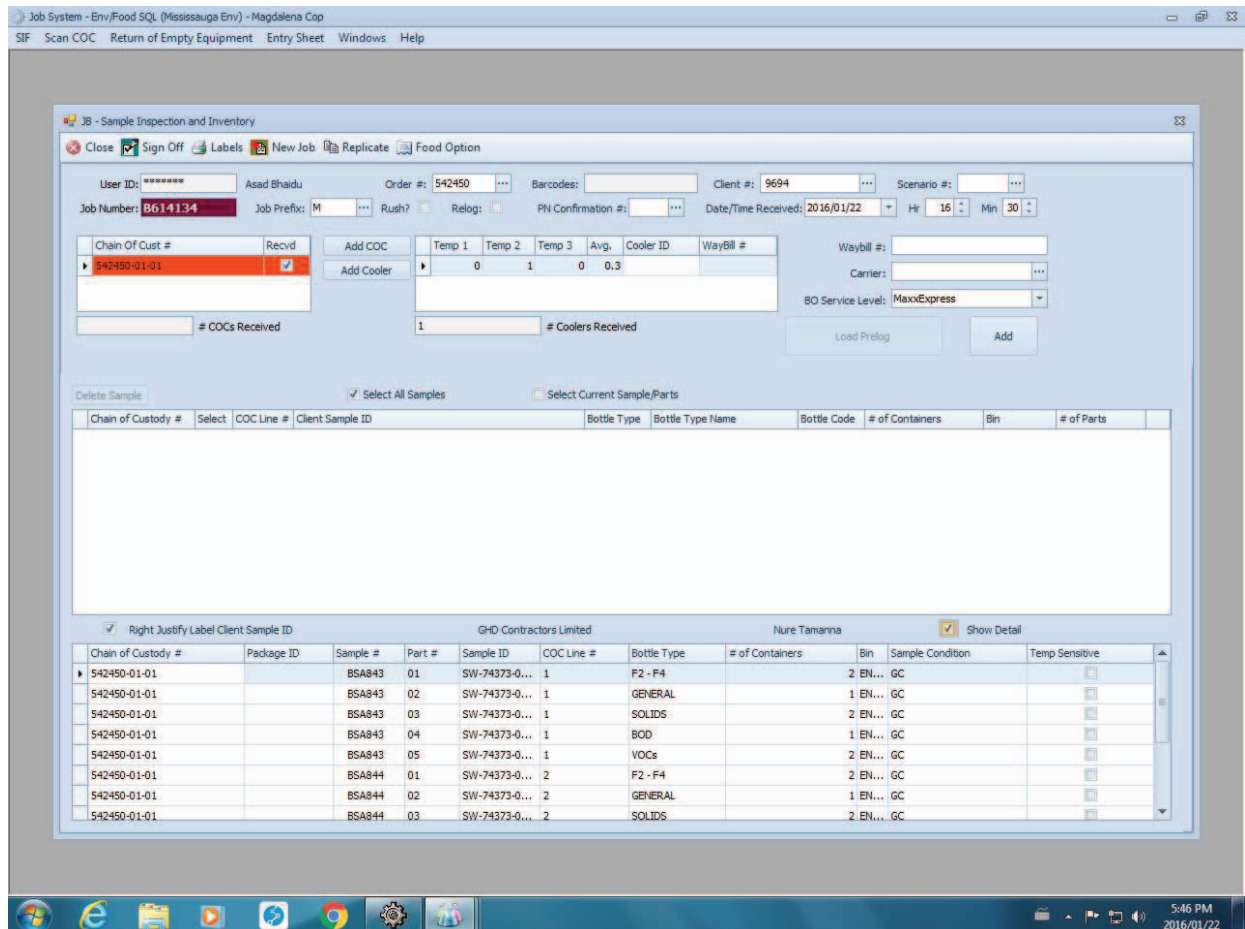
#### 5.9.5 Open the Job Browse Screen on the MaxxLIMS (Figure5.0y)

Figure 5.0y "Job Browse Screen"

Job #	Company	Facility	Date Received	TaskOrderType
MB614172	Terrapure Environmental	Stoney Creek	2016/01/22	
FB614171	Victory's Kitchen Ltd		2016/01/22	
MB614170	Terrapure Environmental	Stoney Creek	2016/01/22	
FB614169	Victory's Kitchen Ltd		2016/01/22	
MB614168	exp Services Inc	Brampton Branch	2016/01/22	
MB614167	Terrapure Environmental	Stoney Creek	2016/01/22	
FB614166	Brandt Meat Packers Ltd		2016/01/22	
FB614165	Create a Treat		2016/01/22	
FB614164	Sofina Foods Inc - Belleville	Santa Maria	2016/01/22	
FB614163	JD Siveid Foods (2013) Ltd.		2016/01/22	
FB614162	Sofina Foods Inc - Belleville	Santa Maria	2016/01/22	
MB614161	Terrapure Environmental	Stoney Creek	2016/01/22	
FB614160	Fruiton Fruits & Fills		2016/01/22	
FB614159	Victory's Kitchen Ltd		2016/01/22	
3B614158	ARYZTA LLC	Laurel Street Facility	2016/01/22	
FB614157	Belmont Meat Products Ltd		2016/01/22	
FB614156	Belmont Meat Products Ltd		2016/01/22	

5.9.6 Click on the "Inspection" button to open the Sample Inspection screen (Figures 5.0a, 5.0z) and follow the steps below:

Figure 5.0z “Sample Inspection and Inventory Screen”



**STEP 1: USER ID**

- 1) Scan or enter in user ID

**STEP 2: CLIENT AND JOB INFORMATION**

For MaxxExpress, Prelog or Bulk COC:

- 1) Scan or enter the Bottle Order # Barcode from the COC into Order # field
- 2) Scan the COC #
- 3) Toggle Rush? (if applicable)

- 4) Enter Date / Time Received corresponding to the date and time recorded on the COC

For N/A (Generic or Non-Maxxam) COC:

- 1) Pick the Client # from the drop down list, if not sure go to the Client/Quote System in ( CLINTc Sharp)
- 2) Enter Job Prefix
- 3) Toggle Rush? (if applicable)
- 4) Enter Date / Time Received corresponding to the time recorded on the COC
- 5) Click on “Add COC”
- 6) Enter in COC # in the Chain of Custody # field, including zeros.

STEP 3: ADD PREFIX:

Change prefix to location that has received the Chain of Custody forms for all Ontario Regulations:

M for COCs received in Mississauga

O for COCs received in London

T for COCs received in Ottawa

W for COCs received in Waterloo

ESU for COCs received in Sudbury

EPH for COCs received in Port Hope

STEP 4: TEMPERATURE AND COOLERS

- 1) Click on “Add Cooler”
- 2) Enter Temperatures
- 3) For additional coolers, repeat steps 1 to 2

STEP 5: WAYBILL AND CARRIER (IF APPLICABLE)

- 1) Scan or enter waybill

- 2) Enter Carrier

#### STEP 6: SAMPLE AND BOTTLE INFORMATION

- 1) Click on the “Add” button to create a new line entry on the data table. The COC number will be carried forward. Each line on the upper data table represents a line on the Chain of Custody form and a different container type.
- 2) Enter Client Sample ID, Bottle Type and # of Containers based on BO Service Level.

##### For Prelog BO Service Level:

- a) Begin entering the Client Sample ID information for the first container of the first sample on the COC form. In this case, the COC Line # field should be “1.”
- b) Choose the Bottle Type from the Order List.
- c) Enter # of Containers for that particular bottle type.

##### For Bulk or N/A BO Service Level:

- a) Begin entering the Client Sample ID information for the first container of the first sample on the COC form. In this case, the COC Line # field should be “1.”
- b) Choose the Bottle Type (CAM FCD-00463) from the Full List.
- c) Enter # of Containers for that particular bottle type.

- 3) Scan or type the bin number to be used to store the samples. All bins are pre-numbered and bar coded.

- 4) Enter number of parts.

- 5) To input multiple Parts of a sample –

E.g. Metals + Nutrients + General bottles = 3 parts

Press the Enter key once the required number of parts are typed under the “Parts” field of the sample line.

This will automatically replicate the sample line by that number. All information from that sample line will be copied as well. Change the bottle type and number of containers in each line as required.

NOTE: Do not separate/split vials for a single test code. Eg. 3 vials for VOC are inspected together as one part.

If one among a set of vials is noted to have headspace, mark the vial with a red "\*" on the barcode label and mention in the SIF that one of the vials has headspace and is indicated with a red Sharpie.

5) For multiple Samples – repeat (2) for Client Sample ID.

Click on the replicate button and indicate how many more additional samples you want to record, e.g., indicating "4" creates a total of 5 samples. Replicating samples will retain the bottle information entered for previous samples.

Modify the bottle information as it pertains to each different bottle. Typically the only information that needs modifying should be (1) Client Sample ID, (2) Bottle Type, (3) # of containers, and (4) Bin location. It may be required in some cases to store different bottle types into different bins, e.g., Microbiology samples. It is only required to enter the Client Sample ID once for the first part. It will replicate by itself when signing off the job.

- 5.9.7 At any point a sample line can be deleted using the "-" button located on the bottom left corner of the upper data table. At any point, a line can be inserted after replication by pressing the "Insert" key.
- 5.9.8 When completed, click on the "Sign Off" button to save the samples, MaxxLIMS automatically assigns the Job number.
- 5.9.9 If a job number needs to be archived, inform Supervisor the reason in writing and make the following comment in the "Remarks" field on the Job Entry Screen "Job to be archived."
- 5.9.10 Click on the "Labels" button to generate two job labels and barcode labels (Figure 5.0ab) for all the sample bottles. Attach one job label in the top right corner on the COC and the second one to one of the sample containers ensuring no information is covered. Attach unique barcode labels to each sample container.

Note: When inspecting Trip Blanks, Trip Spikes, Field Blanks, Re-logs and samples from other Maxxam locations, affix the newly generated barcodes over the bottle proofing barcodes to avoid scanning of wrong barcodes.

Note: 7 QC checks must be performed daily. Seven jobs are randomly picked and all barcodes are checked against sample and COC. CAM FCD-00696, “Sample Reception Bar Code QC Check” must be filled out as a record of check.

**Regulated** drinking water jobs are to be verified by a second person, and the entry sheet is co-signed.

5.9.11 The job labels include:

1. Receiving date and time
2. Job number
3. Inspection person initials
4. Bin location
5. Project Manager

5.9.12 Information stored on the barcode labels include:

1. Maxxam Job Number
2. Maxxam Sample Identifier
3. Line number
4. Client Sample ID
5. The bottle type code, e.g., BOD
6. Region (“E” denotes eastern region)

Figure 5.0aa “Job Label and Bottle Barcode Label”



5.9.13 Scan the COC, waybill and other accompanying information to LIMS.

5.9.14 Click on the “New Job” button to initiate a new entry.

5.9.15 Deliver inspected COCs to Data Entry.

5.10. Instructions on Filling out the Sediment Sheet/Presence of Particulates:

Use CAM FCD-01013 for recording the level of sediment in all containers for ON Reg 153 submissions:

The sediment/particulates are recorded in the rows against the client sample ID for the relevant bottle type.

TS: Trace sediment

S: Sediment that covers the bottom of the container. If sediment is greater than 1cm, then record the value on the sheet.

P: Particulate

SP: Suspended particulates.

Affix job label in the field provided on the sheet. The sheet is to be signed by the inspection staff.

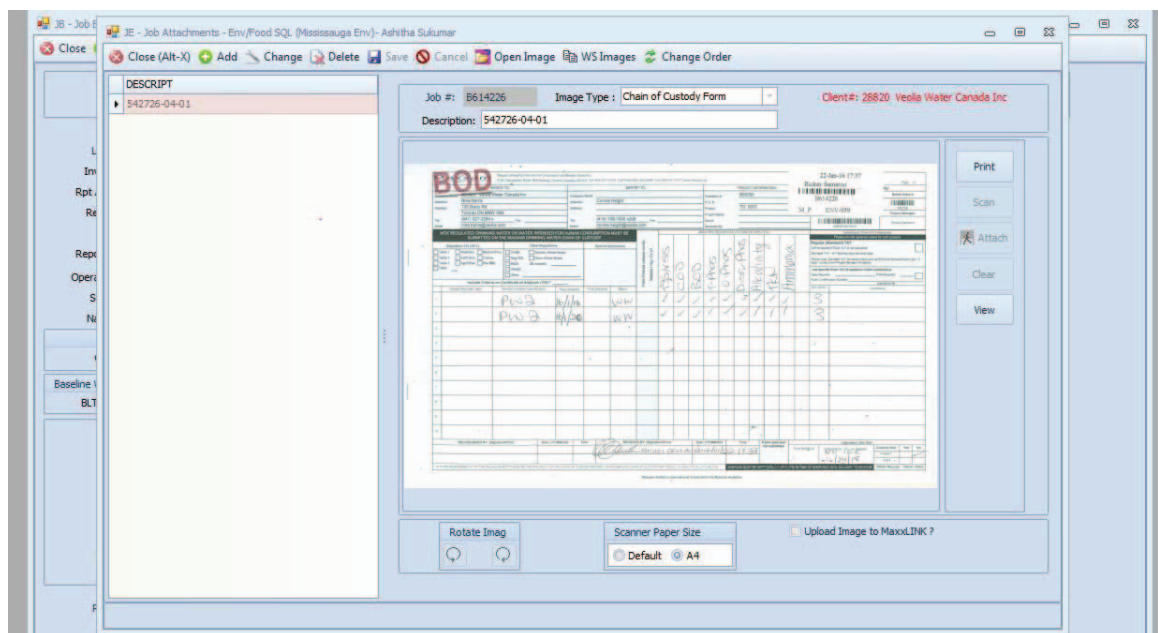
#### 5.11 INSTRUCTIONS FOR SCANNING THE COC

5.11.1 From the Sample Inspection Screen, click on "Scan COC."

5.11.2 Place COC on the scanner.

5.11.3 Select image type in the "Image Type" field.

Figure 5.0ab "Image Screen"



5.11.4 Press "Scan."

5.11.5 When scanning is completed, press "Save."

5.11.6 Click "Add" to scan additional images.

Note: Images can also be reached from the Job Entry Screen by clicking on “Images.” If a job gets cancelled and needs to be re-inspected, scan the COC to the new job number.

Note: Follow all steps in 5.10 to scan waybill documents, Incoming Additional Sample form, Field Information Forms, Sediment Level Sheet, parameter lists and MSDS. Please refer to respective images below:

Figure 5.0ac “Image Screen”

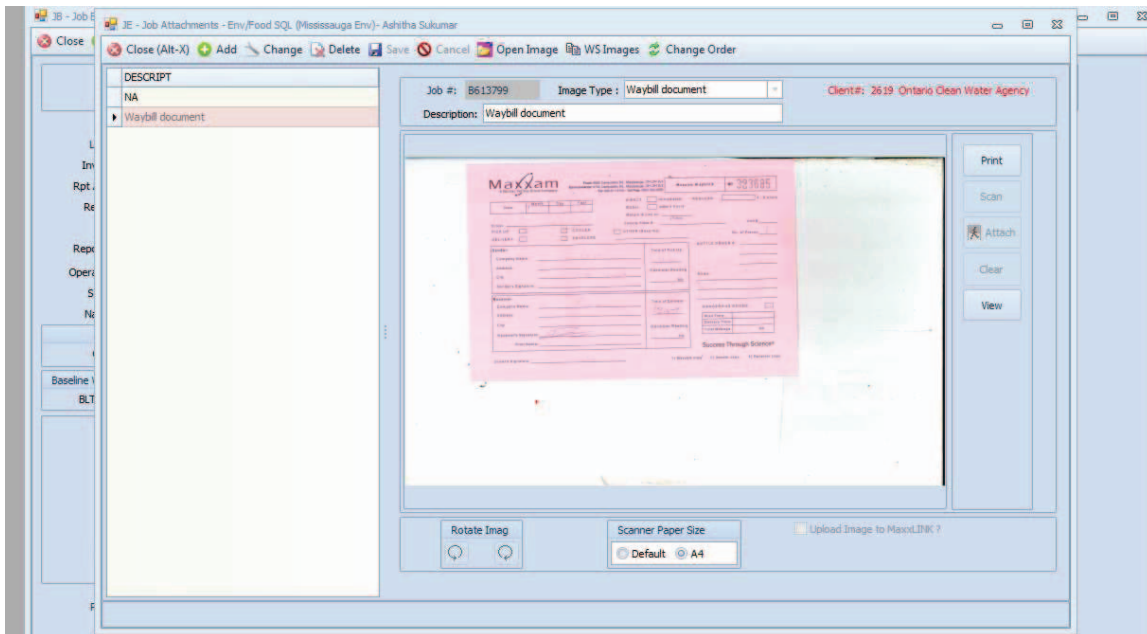




Figure 5.0ad "Image Screen"

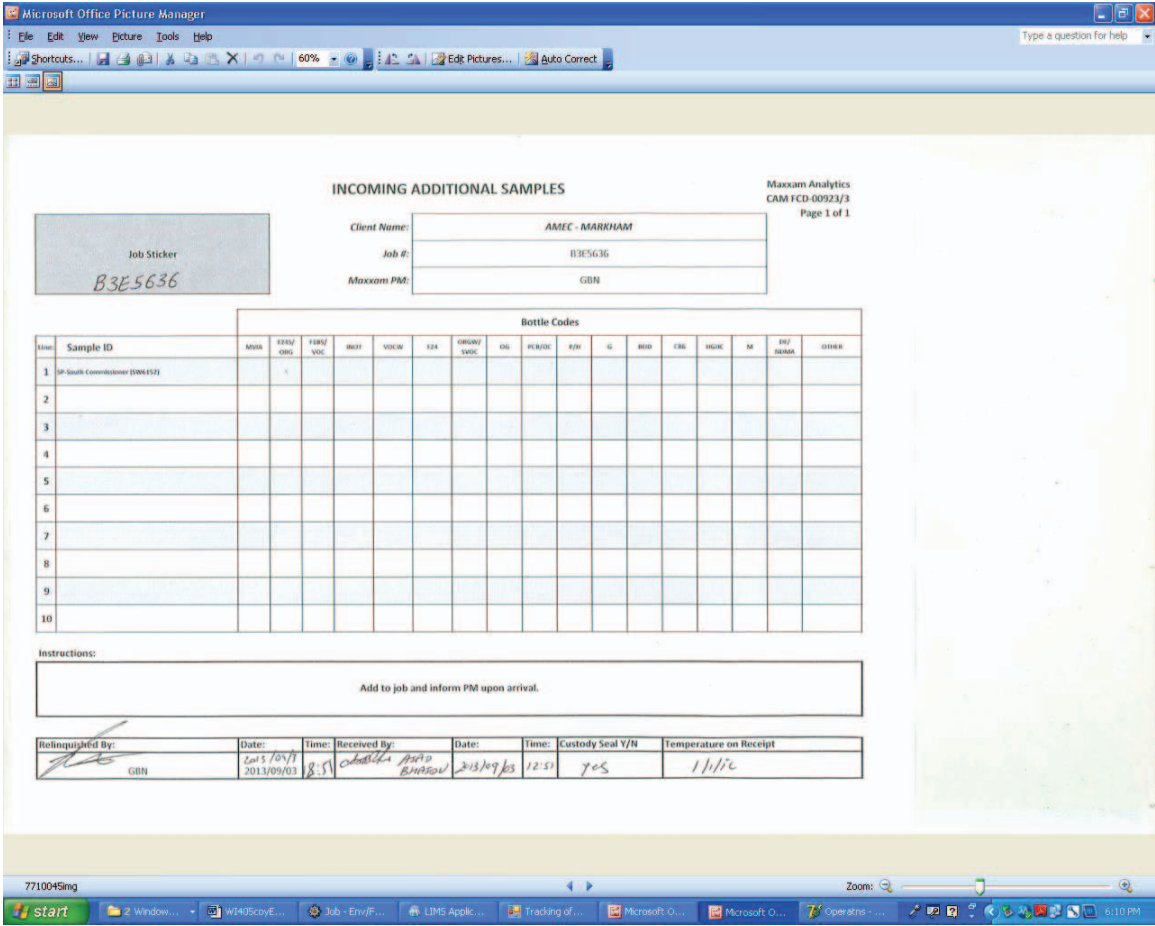


Figure 5.0ae "Image Screen"

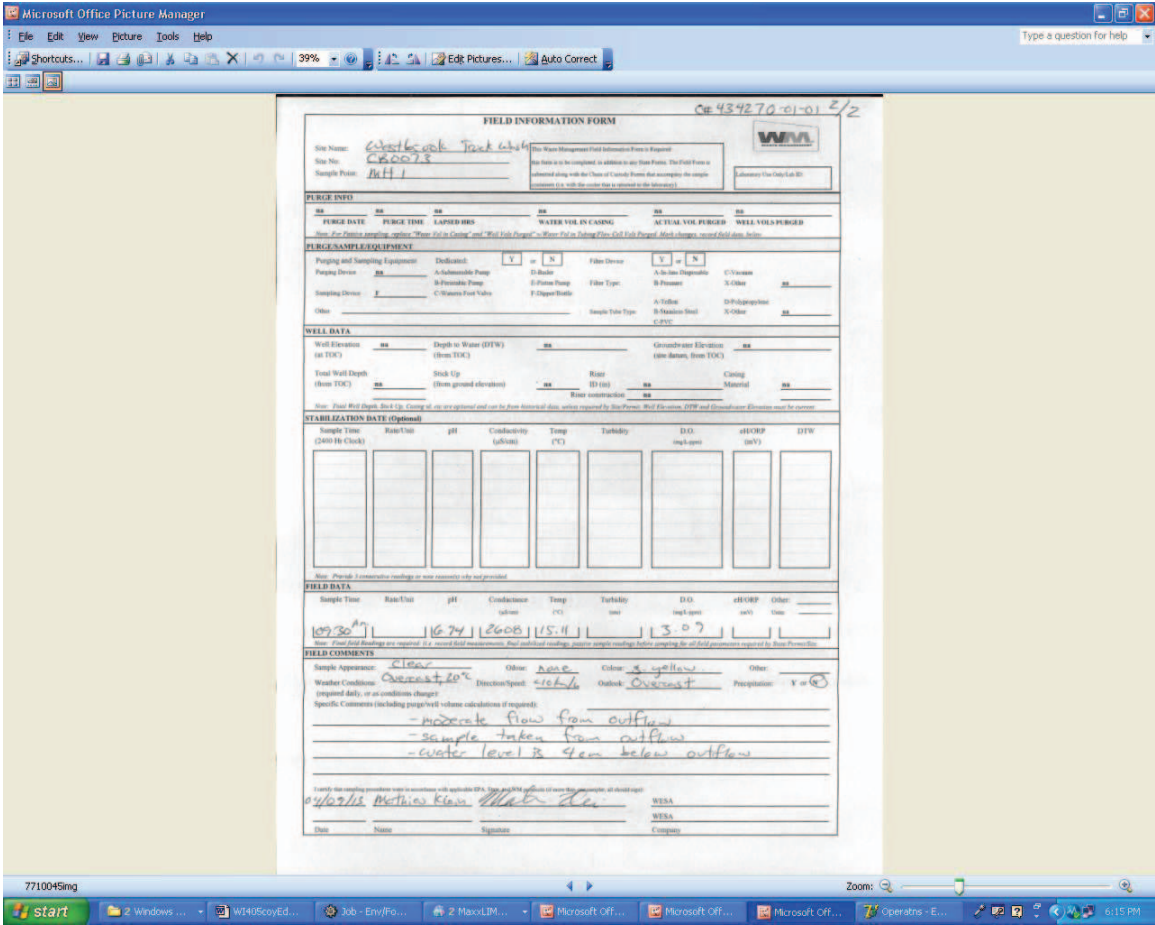
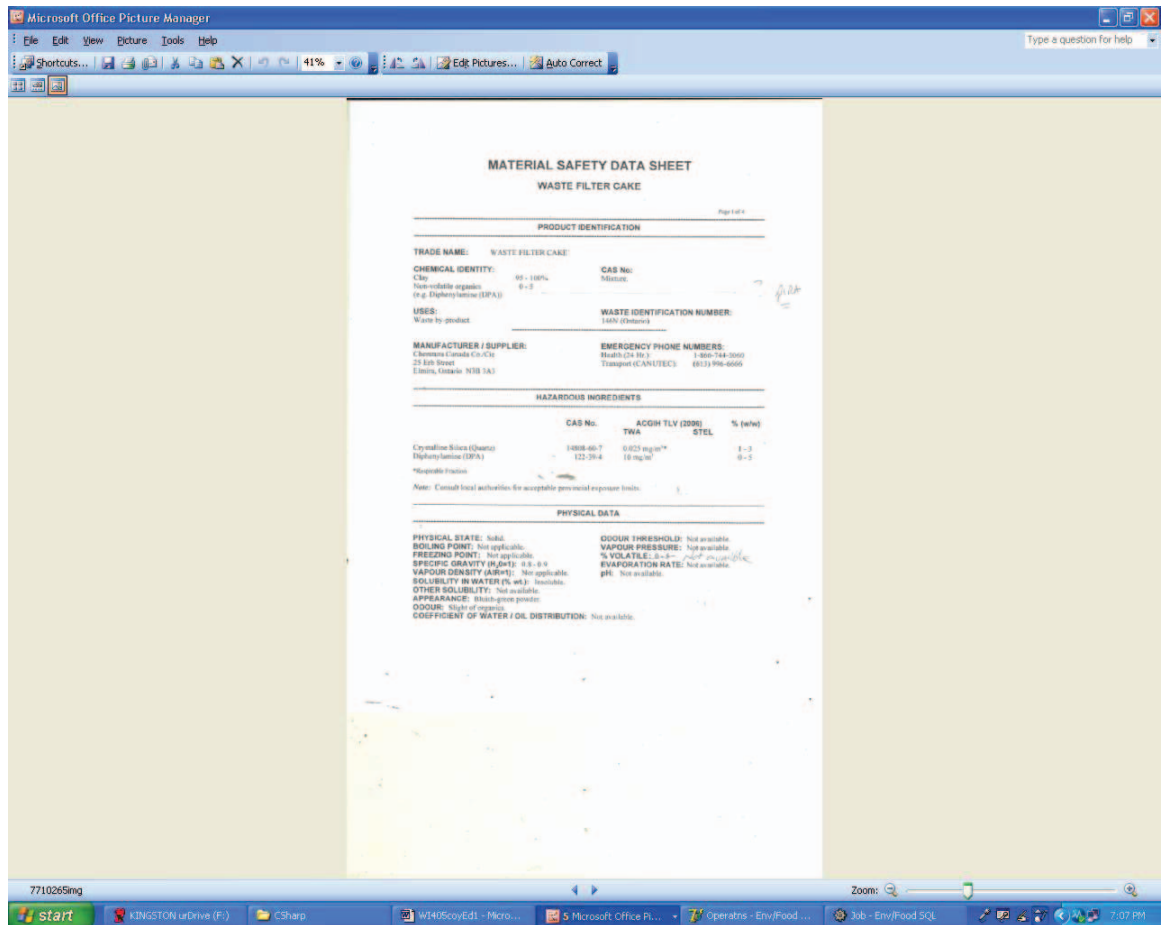


Figure 5.0a "Image Screen"



Note: Save scanned documents under the correct description. Each page of a COC is to be saved under the respective COC number as recorded on the COC (available usually at top right hand corner of page).

5.11.7. At the end of the day, all scanners must be checked for any COCs that could be left behind. CAM FCD-00464 (Sample Reception Locker, Scanner and Fume Hood Check) must be completed by the person in charge of checking the scanners and fume hood.

5.11. RE-LOGS

Re-logs are samples that have been previously on hold or the client is requesting additional tests on the samples. A sample request form CAM FCD-00454 (Sample Request Form from Archiving) must be filled out by requestor prior to sample retrieval.

- 5.12.1. Sample re-logs are retrieved by Archiving staff and delivered to Sample Inspection.
- 5.12.2. Sample re-logs are not received as regular submissions; therefore temperatures and time are not recorded.
- 5.12.3. Sample re-logs are prioritized on the inspection tables; a new job number will be assigned to each re-log request.
- 5.12.4. Toggle the Re-log box on the Sample Inspection and Inventory screen.
- 5.12.5. The "Date/Time" field should be left as defaulted and the "Temperature" field should be left blank.

#### 5.13. INCOMING ADDITIONAL SAMPLES:

Additional samples to inhouse jobs may need to be added in occasionally. Use CAM FCD-00923 to receive these samples. Samples are added by SAIL edit. Scan the Incoming Additional Sample form into job. Scan the samples into a bin location.

#### 5.14 SAMPLE STORAGE AFTER INSPECTION

All samples are stored in the fridge at a temperature set between 1°C to 6°C after sample inspection, unless otherwise specified by legal or contractual obligations. Environmental tissue samples are stored at <-10 °C. Use bin location FZ-46 for samples that are required to be kept frozen. Samples must be kept refrigerated and only be removed when processing is required. For storage of air sample media refer to Section 6.1.8.

- 5.14.1. Use blue bins for environmental samples. Store microbiology samples in red totes.
- 5.14.2. Once the bin is ready for storage, affix an "Inspection Date Label" to the bin to indicate the date of inspection.

Figure 5.0ag “Inspection Date Label”



- 5.14.3 Samples after inspection are transferred to the appropriate storage location.
- 5.14.4. All samples are initially stored in the appropriate designated storage fridge/freezer prior to being transferred to the laboratory.
- 5.14.5. Movement of the samples must be entered in SAIL Operations using the Sample Movement module.
- 5.14.6. The storage fridge contains bar coded shelves, which will ensure that location of bins containing the jobs is precisely identified for later retrieval.

5.15. SAMPLE MOVEMENT (Figure 5.0ah)

- 5.15.1 Open “Sample Movement” from the SAIL Operations module.
- 5.15.2 Enter user ID (user ID is the individual responsible for entering in the information).
- 5.15.3 Indicate whether the samples will be moving into or out of the storage location (Move In or Out).
- 5.15.4 If the samples have been previously scanned into a bin, then use the bottom grid section of the module.
- 5.15.5 In/Out Location (e.g., Shelf) – scan the shelf number that the bin is to go on or come out of.
- 5.15.6 Mobile Unit (e.g., Bin) – scan the bin number.
- 5.15.7. If the samples have not been stored in a bin and need to be stored in the bin prior to storage to the fridge, then use the top grid of the module.

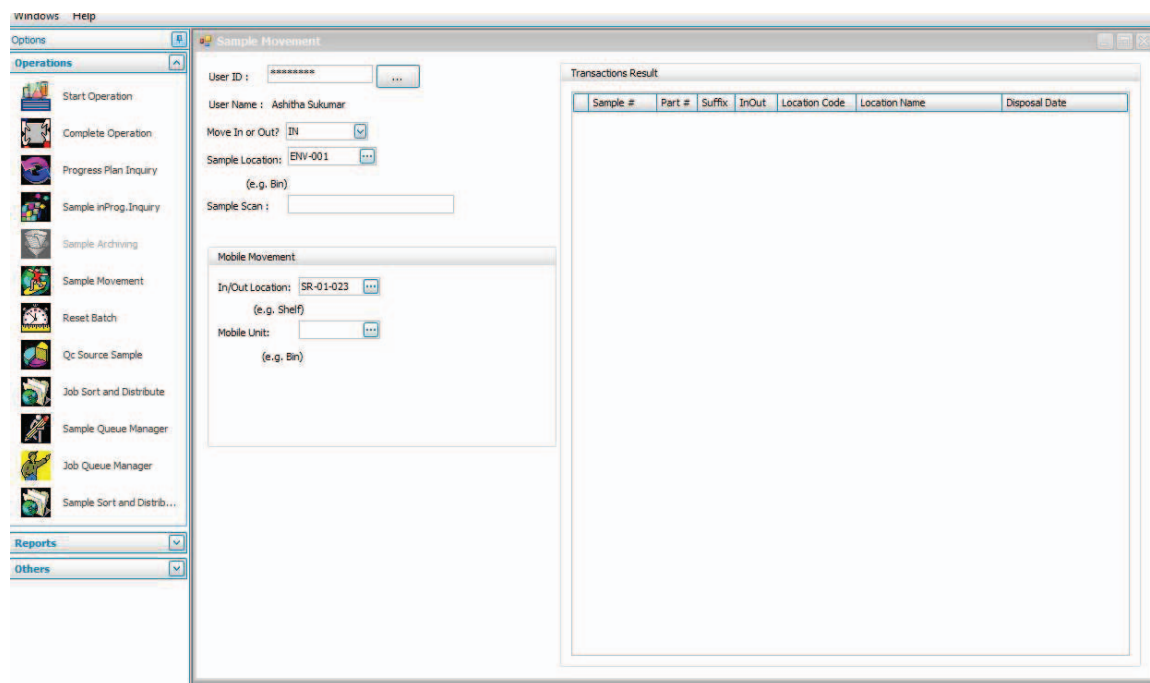
Note: Samples cannot be “Moved In” to a bin that is already scanned into a fridge location. Scan into a new bin and scan this bin into a fridge location.

5.15.8 Sample Location (e.g., Bin) – scan the bin number.

5.15.9 Sample Scan – scan each of the samples that are to go into that bin.

Note: If the movement was successful, a line indicating the action will be displayed in the data table.

Figure 5.0ah "Sample Movement Module"



## 6.0 PROCEDURE FOR INSPECTION OF AIR SAMPLES

Most air media received at Maxxam Analytics can be classified into the following four categories:

- 1) Air filters: These contain a thin disk or sheet of material that traps solid dust particles when air is forced through. Some typical air filters are PVC membrane filters, and glass fiber filters.
- 2) Adsorbent tubes: These are tubes or chambers filled with charcoal or other adsorbent material. Some examples are Thermal Desorption Tubes, Formaldehyde Tubes, Charcoal Tubes, XAD Tubes and VOST (Volatile Organic Sampling Train) Tubes.

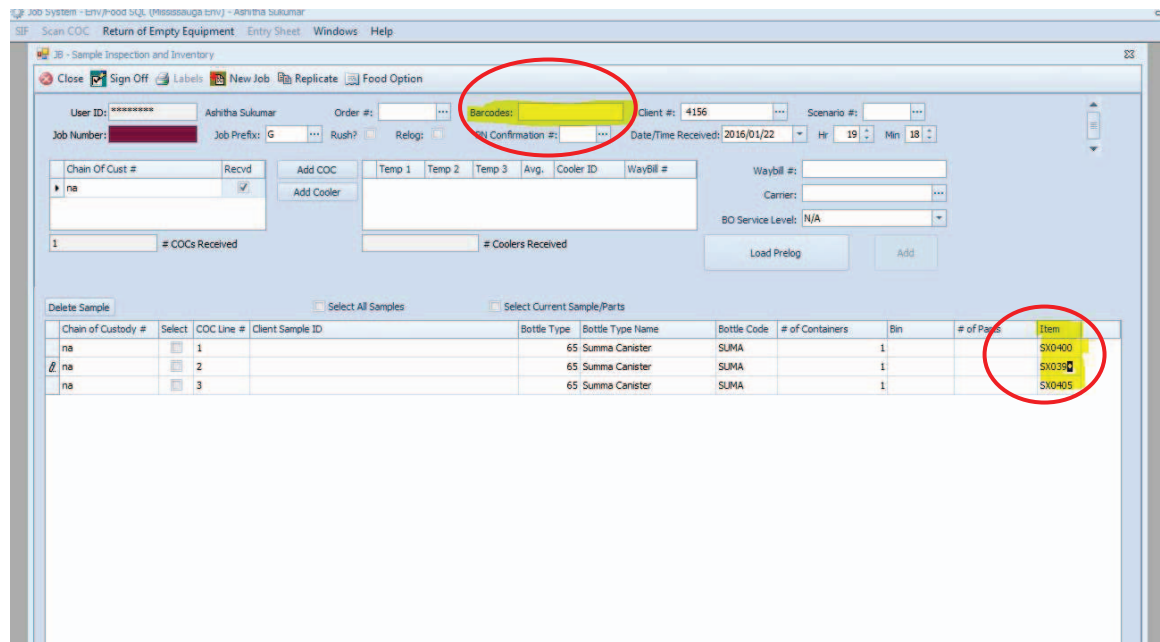
- 3) Summa Canisters and Tedlar Bags: Are examples of whole air sampling media where air is drawn into some sort of vessel.
- 4) Compressed gases: Examples of compressed gases are high pressure and low pressure compressed gas cylinders, which can be classified into compressed breathing air, medical gases, military, biomedical cylinders and aviator oxygen cylinders.

Refer to section 5.3.1 for temperature receiving requirements. Use designated bench area for air inspection.

#### 6.1 INSPECTION OF AIR SAMPLE MEDIA (EXCEPT COMPRESSED GAS CYLINDERS)

- 6.1.1 Match up samples against COC.
- 6.1.2 Folders: Use white file folders for Tedlar Bags requesting tests other than VOCs and BTEX. For VOCs and BTEX, no folders are required.
- 6.1.3 Prefix: G: For all jobs except for gases other than VOCs and BTEX requested on Tedlar Bags.  
Prefix Q: For gases other than VOCs and BTEX on Tedlar Bags, use Job Prefix Q. Use prefix M for all IOL submissions.
- 6.1.4 Inspect each Charcoal Tube as two separate IDs if test is BTEX/F1. The first one as [Sample ID FH (Front Half)] and the second one as [Sample ID BH (Back Half)]. Inspect as one ID if test is VOC.
- 6.1.5 If XAD Tubes are received together with filters, inspect as one sample ID and two containers.
- 6.1.6 Inspect PUF and filter as one sample ID and two containers, or as instructed/client specifics.
- 6.1.7 Inspect all Summa canisters received, including samples as mentioned on the Chain of Custody form, those that are Unused, those designated as "Do not analyze." Scan them into the Summa canister inventory system in MaxxLIMS and label accordingly.

Figure 6.0a "Tracking of Incoming Summa Canisters Barcode Scan"



6.1.8 Air sample media for inorganic testing should be stored in bin location AIR-RmTmp. Air sample media for organic testing should be stored in bin location AIR-FRIDGE.

6.1.9 Use bin location AIR-001 for Summa Canisters and Tedlar Bags. After inspection, Summa Canisters and Tedlar Bags are brought to Sort and Distribute.

6.1.10 Scan all related paperwork into the job, not only the COC and waybill.

## 6.2 INSPECTION OF COMPRESSED GAS CYLINDERS

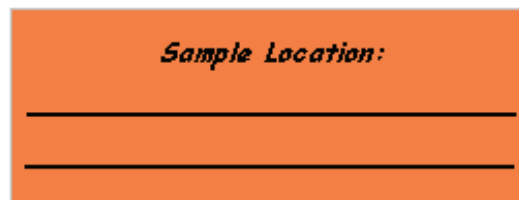
6.2.1 Remove the high and low pressure compressed gas cylinders and all sample related paperwork from the cases, except for Maxxam envelope and client sampling instructions. Cylinders with non-Maxxam packages stay in their original package as biomedical and aviator oxygen cylinders.

6.2.2 Use white folders for all cylinders except for Military. For Military, except for Spar Aerospace, use purple file folders.



- 6.2.3 Record the cylinder identification number and any readable cylinder pressure in psi (pounds per square inch) on the file folder for compressed gas cylinders.
- 6.2.4 Attach a rush sticker to the folder if rush analysis applies.
- 6.2.5 For Military cylinders, inspect one sample per file only.
- 6.2.6 For other cylinders, multiple cylinders can be inspected on the same job in numerical order as long as they are from the same equipment order.
- 6.2.7 For high and low pressure cylinders ensure the cylinder tag or the COC has the flow pressure, purge time and system pressure recorded, if not, make a comment on the file folder.
- 6.2.8 If the sample location is not recorded on the COC but on the cylinder tag, fill out the "Sample Location" label and attach to the COC.

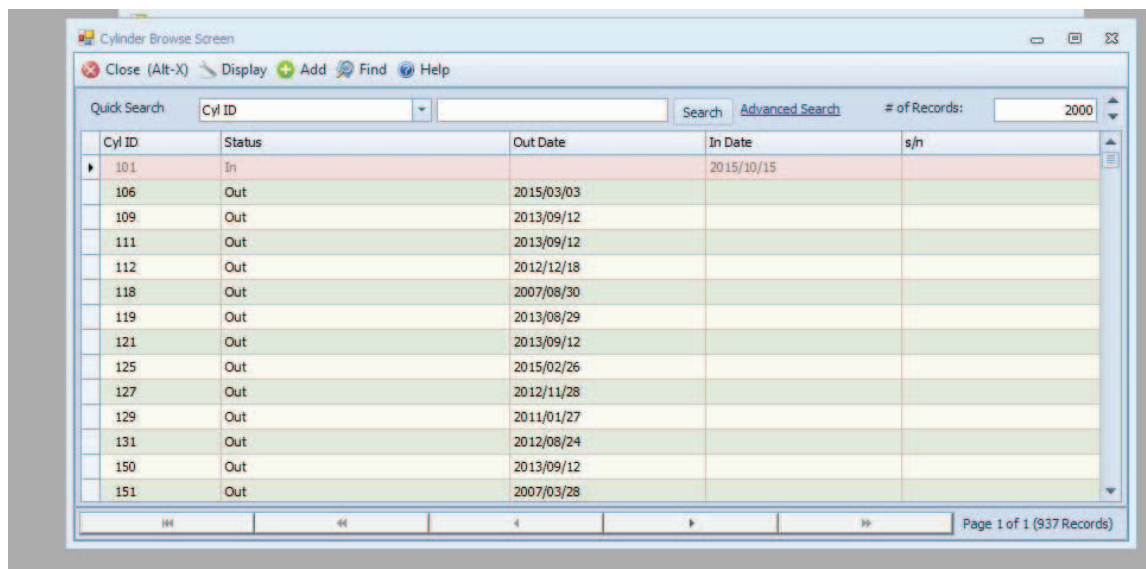
Figure 6.0b "Sample Location Label"



- 6.2.9 If the cylinder tag is blank, make a comment on the file folder.
- 6.2.10 Use Job Prefix Q for all cylinders.
- 6.2.11 For biomedical cylinders, a back up cylinder and a filter are included, inspect both.
- 6.2.12 For high and low pressure cylinders the bin location is the cylinder identification number. For other cylinders, use AIR-001 as the bin location.
- 6.2.13 For Military cylinders pick client # 99201 for DRDC (Dive), client # 50383 for Defence Construction (Other), client # 20926 for Spar Aerospace, and client # 50000 for Aviator Oxygen cylinders.
- 6.2.14 Attach one sample label to the sample tag or air case and one to the file folder on the top right corner of the inner layer of the folder for filing purposes.

- 6.2.15 Scan all related paperwork into the job, not only the COC and waybill.
- 6.2.16 After completing the inspection for high and low pressure cylinders, update cylinder status manually from “Out” to “In” in the Client Maintenance.
- a) Open “Client” database.
  - b) Click on “Equipment” pull down menu.
  - c) Click on “Individual Cylinder Info.”
  - d) Enter cylinder identification number in the “Quick Search” field.
  - e) Hit “Enter.”
  - f) Click “Display.”
  - g) Click “Change” (Figure 6.0a).
  - h) Change to “In” in the “Status” field.
  - i) Change to current date in the “In Date” field.
  - j) Click “Save.”

Figure 6.0c “Cylinder In and Out Tracking Window”



The screenshot shows a software window titled "Cylinder Browse Screen". It features a menu bar with "Close (Alt-X)", "Display", "Add", "Find", and "Help". Below the menu is a search area with a "Quick Search" field containing "Cyl ID", a "Search" button, an "Advanced Search" link, and a "# of Records:" field set to "2000". The main area is a table with the following columns: "Cyl ID", "Status", "Out Date", "In Date", and "s/n". The table contains 15 rows of data, with the first row (Cyl ID 101) highlighted in red and showing a status of "In" and an "In Date" of "2015/10/15". The other rows show "Out" status with various "Out Date" values. At the bottom right, a status bar indicates "Page 1 of 1 (937 Records)".

Cyl ID	Status	Out Date	In Date	s/n
101	In		2015/10/15	
106	Out	2015/03/03		
109	Out	2013/09/12		
111	Out	2013/09/12		
112	Out	2012/12/18		
118	Out	2007/08/30		
119	Out	2013/06/29		
121	Out	2013/09/12		
125	Out	2015/02/26		
127	Out	2012/11/28		
129	Out	2011/01/27		
131	Out	2012/06/24		
150	Out	2013/09/12		
151	Out	2007/03/28		

Note: Refer to Attachment 2 for the sample login process for environmental, summa and cylinder samples.

**7.0 E-mail Notifications:** Whenever deemed appropriate, communicate with the project managers, customer service and the lab via e-mail.

Email notifications are sent out for heads up for the following:

- PT samples
- Jobs for short holdtime analyses Tedlar bags and puf and filters
- Jobs with methanol vials with additional labels
- Missing pieces in a shipment
- Incoming additional samples

**8.0 Job Remarks:** Any communications with regard to the job /samples that may be relevant to the Operations or Customer Service, e.g., Trip Blank Lot #s are entered as Job remarks.

**9.0 Receiving and Inspection For After Hours and Emergency Work:**

Receiving information of signature, print name, date, time and temperatures (for inorganic air sampling media, compressed gas cylinders, Tedlar Bags and Summa Canisters.) are recorded on the Chain of Custody forms. Samples will then be passed to Sample Reception for generation of a job in LIMS on the next working day.

**Archiving, Retrieval and Disposal of Samples**



Maxxam Analytics International Corporation  
 Campobello Road  
 Mississauga, Ontario  
 905-817-5700

<b>Document Identity</b>			
<b>Document Status and Ownership</b>			
<b>Current Status</b>	<b>Approved - Released</b>		
<b>Approval Date</b>	September 1, 2015	<b>Release Date</b>	September 1, 2015
<b>Version Author</b>	Sue Bigg	<b>Version Manager</b>	Anita Cheema
<b>Document Categorization</b>			
<b>Campobello Departments</b>	Sample Archiving		

THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION. Its use is restricted to employees with a need to know and third parties with a need to know and who have signed a non-disclosure agreement. ANY REPRESENTATION OF THIS DOCUMENT, PRINTED OR OTHERWISE, OUTSIDE OF THE MAXXAM CompliantPro SYSTEM IS AN UNCONTROLLED COPY UNLESS STAMPED "CONTROLLED COPY" AND SIGNED AND DATED BY AN AUTHORIZED QA REPRESENTATIVE.

<b>Release and Audit Schedule</b>	
<b>Release Schedule</b>	When Approved <input type="checkbox"/> <b>Allow Administrator to Release Document Early</b>
<b>Expiration Schedule</b>	When Superseded or Obsolete
<b>Audit Schedule</b>	24 Month(s)
<b>Special Handling on Release</b>	
<input checked="" type="checkbox"/> <b>Update Completed Trainee Records</b>	

<b>Insert Text</b>	
<ul style="list-style-type: none"> <li> Critical Task Analysis</li> <li> CAM SOP-00105</li> <li> Archiving Training</li> </ul>	

<b>Associated Documents</b>
<b>Document Control Documents</b>
<ul style="list-style-type: none"> <li> Campobello FCD CAM FCD-00346 : Authorized Personnel on PCB Storage Room</li> <li> Campobello FCD CAM FCD-00347 : Record of Authorized Entry on PCB Room</li> <li> Campobello FCD CAM FCD-00348 : Monthly Inspection on PCB Room</li> <li> Campobello FCD CAM FCD-00459 : International Solid Sample Labelling</li> <li> Campobello FCD CAM FCD-00460 : Biohazardous Sample Labelling</li> <li> Campobello FCD CAM FCD-00461 : International Food Sample Labelling</li> <li> Campobello FCD CAM FCD-00785 : Hazards Sample Analysis Signing off sheet</li> <li> Campobello FCD CAM FCD-00454 : Sample Request Form</li> <li> Campobello WI CAM WI-00405 : Receiving and Inspecting Environmental and Air Samples</li> <li> Campobello WI CAM WI-00008 : Monitoring Temperatures</li> <li> Campobello FCD CAM FCD-01115 : Printing Process for Bin Labels in Archiving</li> <li> Campobello FCD CAM FCD-01112 : Sample Retrieval Process in Archiving Department</li> <li> Campobello FCD CAM FCD-01113 : Identification of Samples in the Archiving Bins</li> <li> Campobello FCD CAM FCD-01114 : Long Term Retain Job Process in Archiving</li> <li> Campobello WI CAM WI-00133 : PRTG Temperature Monitoring User Manual</li> <li> Campobello FCD CAM FCD-01211 : Dumbwaiter Basic Instructions</li> </ul>

**Reason for Change**

<p><b>Date of Change</b> October 29, 2010</p> <p><b>Section Changed</b> 7.0,7.1,7.4,Table 1.</p> <p><b>Change Made</b> Table 1:IOL Organic extracts added.Storage period in weeks added to IOL samples.Food residue taken off.IOL added to VOC &amp; CCME water vials. Section 7.0:Swab added. Section 7.1:Header A,microbiolgy samples added. Section 7.1.2 point4,"micro" added. Section 7.1.5 point 5 added. Section 7.1.7,7.4.4 and 7.4.5 modified.</p>	<b>Version 2</b>
<p><b>Date of Change</b> January 31, 2011</p> <p><b>Section Changed</b> 7.2,7.2.1,7.3,7.3.4.1,7.3.4.2,7.3.6,7.4.4,7.4.5</p> <p><b>Change Made</b> 7.2:"Hold Process" in title deleted. 7.2.1:Samples to be held longer paragraph modified. 7.3:Title has HOLD PROCESS added.Fig 9 and its explanation added. 7.3.4.1:The process using CAM FCD 00785 is obsolete,thus removed. 7.3.4.2:Renumbered Fig09 to 10. 7.3.6:Note removed."Binder SSA32:Disposal Tracking Forms Legal Jobs" added. 7.4.4:Figure 10 renumbered to 11 7.4.5:Figure 11 renumbered to 12</p> <p><b>Optional Field A</b> Whole SOP reformatted as per Corporate requirement.</p>	<b>Version 3</b>
<p><b>Date of Change</b> October 21, 2011</p> <p><b>Section Changed</b> Sections: 4.1, 6.0, 7.1, 7.2, 7.3, 7.4, 7.5,8.0,9.0,10.0</p> <p><b>Change Made</b> Section 4.1 Corporate definition added. Section 6.0 Whole section updated. Section 7.0 Figures 1,2,4,5,6,7,12 updated. Section 7.1.2 subsection 4 changed. Section 7.1.3 preexisting label added. Section 7.1.4 subsection 2 changed.Point 5 deleted. Section 7.1.5 subsection added use of blue or black marker/pen. Section 7.1.7 subsection 2 &amp; 5 modified to reflect for swabs process. Section 7.1.8 updated to current process. Section 7.1.11 added for Field preserved Methanol vials. Table 1 Storage List, Organic preserved &amp; CFIA Food added. Section 7.3.1 Contact disposal company to pick lugger bin added. Section 7.3.2 Charcoal added. Section 7.3.4.1 Hazardous sample disposal process updated to current practise. Section 7.3.4.2 PCB samples segregated are rearchived if not immediately disposed in bunker added. Section 7.3.7 Process for autoclave International waste added. Section 7.3.10 Flammable samples disposal added. Section 7.3.11 Modified,Painting in pt 1 deleted,Pt2 passing samples thru charcoal bed added,Pt 3 Glass crusher added. Section 7.3.12 Methanol vials added.Painting removed,Glass crusher added. Section 7.3.14 Correction done. Section 7.4.4 sheet for swabs added. Section 7.5 Temperature monitoring added. Section 8.0,9.0 &amp; 10.0 added. Critical Task Analysis added. Archiving Training Sheet added. Manual for Glass crusher added.</p>	<b>Version 4</b>
<p><b>Date of Change</b> November 13, 2012</p> <p><b>Section Changed</b> Sections 6.5, 7.1, Fig3, 7.2, Table1, 7.3, Fig8, Fig10, 7.3, 7.4,7.5, CTA,Some WI/FCD Added and deleted.</p> <p><b>Change Made</b> Section 6.5 Added dust masks and glass crusher.Chute deleted. Section 7.1.1 Point 5 added. Section 7.1.2 Point 4 revised. Section 7.1.3 Point 8 and Fig 3B added. Fig3 named FIG3A. Section 7.1.4 Point 2 &amp; 4 revised.Pt5 Criteria for scanning added. Section 7.1.6 Pt3 added. Section 7.1 B Corrected the WI &amp; FCD numbers. Section 7.1.7 Pts 2,3 &amp; 4 added. Pt 5 revised. Section 7.1.11 Revised. Section 7.2.1 Revised. Table 1 revised to change Micro water storage to Room temperature. Section 7.3 subsection a)revised. Figure 8 Updated. Section 7.3.1 Prodeva Model 318 added.Section 7.3.4.2 New process to run PCB report updated. Figure 10 Updated as per the new process. Section 7.3.5 Revised and additions made. Section 7.3.6 Legal sample SOP number updated. Section 7.3.7 Disposal of International samples updated as per new process. Section 7.3.11 revised. Section 7.3.13 Disposal process updated. Section 7.3.14 Cleaning bins added. Section 7.4.5 Pt 7 revised. Section 7.5 Numbering corrected, FCD number for CAM FCD-00069 corrected. CTA updated Disposing Pt 18 deleted. Disposing Pt11 revised.Addition in General section. CAM FCD-00072, COR WI-00073, COR FCD-00202,00199 added. CAM FCD-00603, CAM WI-00409 Deleted.</p>	<b>Version 5</b>
<p><b>Date of Change</b> October 28, 2013</p> <p><b>Section Changed</b> Sections 7.1.2, 7.1.3, 7.1.4, 7.1.5, 7.1.6, 7.1.7, 7.1.8, 7.3, 7.4, 7.5, 8.3, Table 1, Attachement 2&amp;5 updated.</p> <p><b>Change Made</b> Section 7.1.2 Pt1-"Both"added.Pt2-Fig5 changed to 4, Refer to CAM FCD-01115. Pt2&amp;3condensed,Pt3 bin numbers added.</p>	<b>Version 6</b>

Section 7.1.3 Deleted and reference made to CAM FCD-01115, Fig 3A, 3B deleted.  
 Section 7.1.4 Revised point 7&8, Fig4 changed to 3.  
 Section 7.1.5 & 7.1.6 Figures numbers updated.  
 Section 7.1.7 Numbering corrected, Pt 5,6 added, Pt8 revised  
 Section 7.1.8 'From lab' added.  
 Table 1 revised Chemistry food storage to 45days.  
 Section 7.3 Revised.  
 Section 7.3.4.2 PCB storage area added.  
 Section 7.3.5 Revised for micro water.  
 Section 7.3.7 & 7.3.14 Electronic location added.  
 Section 7.4.3 &, 7.4.4, 7.4.5, Fig 11&12 deleted.  
 Section 7.4 Revised.  
 Section 7.5 Revised. Attached CAM WI-00133.  
 Section 8.3 Added.  
 Section 10.0 Added four FCD(01112,01113,01114, 01115).  
 Attachement 2 & 5 latest versions updated.

**Date of Change** February 13, 2015

**Version 7**

**Section Changed** 7.1A, 7.1.2, 7.1.4, 7.2.1, 4.5, 7.3, 7.3.5, 8.4, 9.0, 10.5, CTA, FCD-01211

**Change Made** 7.1 A -Revised title to include HRMS CFIA samples.

7.1.2 Section 3, added "Residue-HRMS."  
 7.1.4 Section 6 added food residue. Section 7 added location 180 for International samples, SA-07-040 for hazardous samples and PT samples stored in white trays labelled WT-XXX.  
 7.2.1-Added 90 day retention time for CFIA samples  
 4.5-added definition for SAIL  
 7.3-revised to include HRMS CFIA samples.  
 7.3.5 Refer to section 7.3 for SAIL process.  
 Table 1-added HRMS CFIA samples. All freezer temperatures changed to <-15C.  
 8.4 Maintenance of dumbwaiter added.  
 9.0 Manual for dumbwaiter attached.  
 10.5 Included mention of FCD-01211.  
 CTA updated. Changes highlighted in yellow, dumbwaiter included.

**Date of Change** February 24, 2015

**Version 8**

**Section Changed** attachments, 8

**Change Made** removed regulations as attachments  
 8-revised maintenance requirements - added use of logbook

**Date of Change** September 1, 2015

**Version 9**

**Section Changed** 1.1, 7.3.7

**Change Made** 1.1-added 6660 Campobello Rd  
 7.3.7-added autoclave which is in use at 6660 Campobello Rd

**Approval Status Table**

Approver	Source	Role for Approvers	Parallel-Everybody	Segment
Carla Bento		Approve	August 28, 2015 10:17 AM GMT-4	
Tim Munshaw		Approve	September 1, 2015 1:31 PM GMT-4	

11/9/16 10:26 AM

## ARCHIVING, RETRIEVAL AND DISPOSAL OF SAMPLES

### 1.0 INTRODUCTION

This Standard Operating Procedure (SOP) details the archiving, storage, retrieving and disposing of environmental and food samples for the Laboratory at **Maxxam Analytix, Campobello**.

- 1.1 **Location:** Sample Archiving and Disposal area located at Maxxam Analytix, 6740 and 6660 Campobello Road, Mississauga, ON.
- 1.2 **Purpose:** The purpose of this Standard Operating Procedure (SOP) is to specify the procedure for Archiving, Storage, Retrieving and the correct and safe disposal of samples and sample preparation products (digestates, leachates, and extracts) in order to protect the public and prevent contamination of the environment.

### 2.0 SCOPE

This SOP is to be used by **Maxxam Analytix** sample custodians to ensure that samples are appropriately archived and disposed.

- 2.1 **Archiving and storage:** This is a general procedure that is applicable at all times when sample and sample preparation products are being archived and stored until they have expired.
- 2.2 **Disposal:** This is a general procedure that is applicable at all times when samples, and sample preparation products are being disposed off. This SOP will outline the requirements for the handling, storage, management and disposal of liquid and solid contaminated samples. It is imperative that all activities involving waste disposal be in compliance with Provincial and Federal applicable regulations and legislation.
- 2.3 **Retrieval:** This procedure includes the process for retrieval of samples for reworks and Sail Edits to add new tests requested by the Client.

### 3.0 RESPONSIBILITIES

- 3.1 It is the responsibility of the Department Manager and Supervisor to ensure that documents written reflect the procedures performed at Maxxam Analytix.
- 3.2 It is the responsibility of the Sample Archive and Disposal Custodians to read, understand and follow the procedures outlined in this SOP.

## 4.0 DEFINITIONS

- 4.1 **Corporate Definitions:** See COR WI-00012 for general definitions.
- 4.2 **Sample Custodian:** Person that takes possession of a sample.
- 4.3 **Hazardous waste** – means a waste that is a hazardous industrial waste, acute hazardous waste chemical, hazardous waste chemical, severely toxic waste, ignitable waste, corrosive waste, reactive waste, radioactive waste, pathological waste, leachate toxic waste, or PCB waste.
- 4.4 **PCB waste** – means materials, liquids and equipment containing PCB's at a concentration of more than fifty (50) parts per million (ppm) by weight.
- 4.5 **SAIL** – the electronic barcoding and operations monitoring program in use in the Campobello facility. The SAIL program is integrated into MaxxLIMS program.

## 5.0 REGULATORY CRITERIA

The procedures in this SOP are to be followed in compliance with applicable Federal and Provincial legislation, regulations, policies and programs.

- 5.1 A non-hazardous waste is defined by *Ontario Regulation 558/00* under the Environmental Protection Act.
- 5.2 Regulatory requirements for contaminated samples are to be those stated in *Ontario Regulation 153/04 - Record of Site Condition Regulation (Brownfield's)*. Samples are deemed contaminated if their concentration levels are higher than those listed in the regulation.
- 5.3 PCB contaminated samples are managed in accordance with *Ontario Regulation 362 – Waste Management – PCB's* under the Environmental Protection Act. Samples containing PCB's at a concentration greater than 50 parts per million (ppm), by weight, are considered PCB waste. PCB storage must be in compliance with the *Storage of PCB Material Regulations*, under the Canadian Environmental Protection Act, 1999.
- 5.4 The management of biomedical waste must be in compliance with *Guideline C-4 - The Management of Biomedical Waste in Ontario*.
- 5.5 Conditions of entry for Soil and related matter authorized by Domestic Movement Certificates and Special permits to Import and issued under Section 43 of the *Plant Protection Regulations*. CFIA D-95-26, Appendix 3.



## 6.0 SAFETY

- 6.1 Follow the safety policies and work instructions in the Maxxam Safety Manual, QSI and CBTs. Lab coats, safety glasses, and gloves must be worn all the time. Refer to attached Critical Task Analysis for potential hazards.
- 6.2 As archiving area involves lot of heavy lifting it is important that the staff uses safe lifting techniques mentioned in the Back safety CBT.
- 6.3 Samples should be treated as a potential health hazard and exposure should be reduced to the lowest possible level.
- 6.4 For further information concerning specific chemicals refer to the appropriate MSDS sheets. Refer to Maxxam Environmental Health and Safety module in QSI and on Intranet for more information.
- 6.5 Dust masks and respirators are available for use when handling dusty or hazardous samples or painting sample containers. Earplugs, dust masks and face shields are available to be used while disposing at the glass crusher.
- 6.6 All samples must be handled with care to prevent undue exposure to humans and must be disposed of in a safe, conscientious manner. See CAM WI-00018 "WASTE DISPOSAL".
- 6.7 Disposal of International Samples: International Samples, waste and PPE used to handle them, should be kept separately in properly marked bins. Appropriate heat treatment is required before disposal.
- 6.8 Hazardous samples: Samples marked with Caution, Flammable or Explosive labels should follow specific instructions for storage and disposed appropriately.
- 6.9 Due to the nature of potential hazards involved, safety to person, property, and environment is of utmost importance. All safety precautions must be considered when handling contaminated samples. These precautions include:
  - Respirator mask,
  - Flammable Safety cabinet and/or drums (grounded, ventilated)
  - Environmental Spill Kit
  - Workplace hazardous labelling (WHMIS)

## 7.0 PROCEDURE

The samples are received from different departments of the lab and are archived, stored and retrieved using SAIL for environmental and food samples. A Special excel program is used to archive Microbiology swab samples.

## 7.1 ARCHIVING

### A: Environmental/ Food Chemistry & CFIA residue/HRMS / Microbiology Sample Archiving & Disposal in SAIL

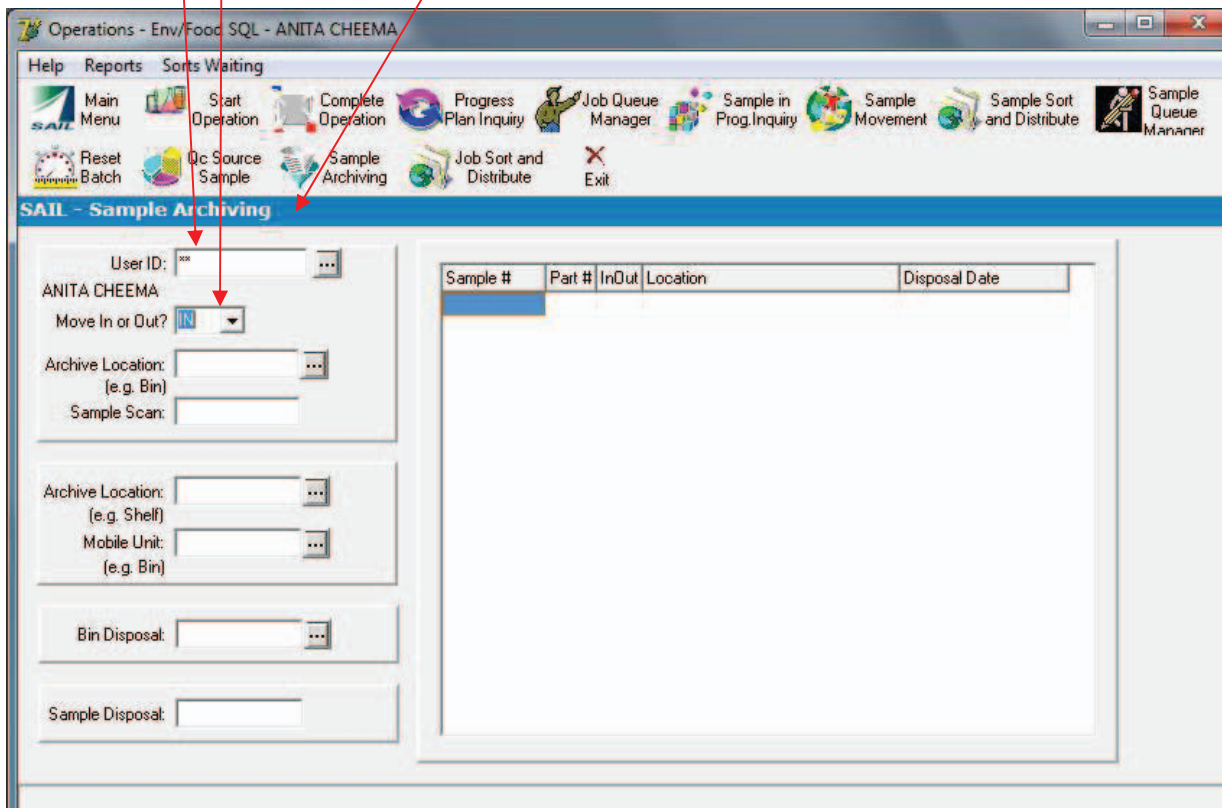
Containers with remaining sample after testing must be registered into the Sample Archiving database for retention before disposal. The process to archive and disposal of a sample or group of samples using the **Sample Archiving** Module in SAIL is outlined below.

#### 7.1.1 Scanning “IN” Process (Figure 1)

Move IN samples

1. Open Operations
2. Click on the Sample Archiving icon.
3. Log in your User ID.
4. Choose IN from the “Move In or Out” button
5. While scanning keep the bottle types the same when possible to ensure bins can be properly stacked.

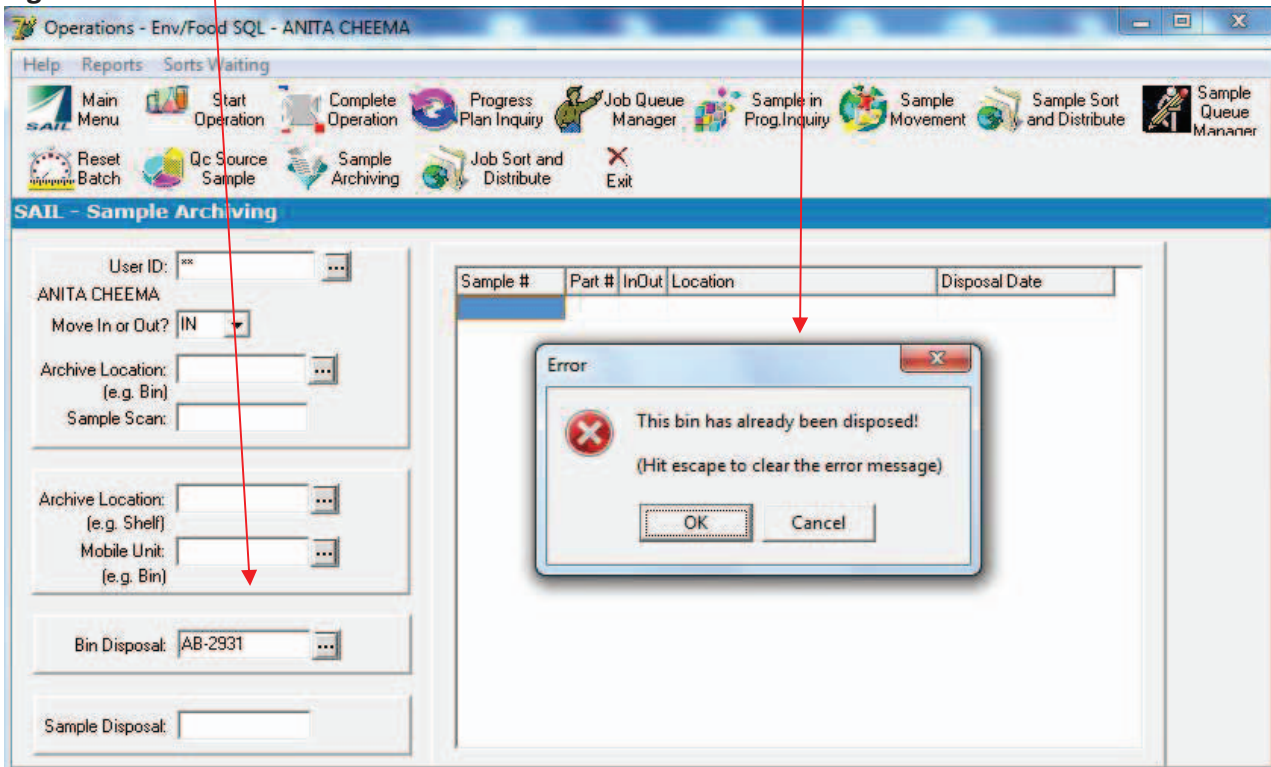
Figure 1: Sample archiving module.



#### 7.1.2 Check if Bin Already Disposed (Figure 2)

1. Scan both bin Barcodes in “Bin Disposal” to ensure that it was properly disposed previously.
2. If bin was properly disposed, an error message will appear as in Figure 2. **If bin was not previously disposed an error message will appear as in Figure 4. This bin cannot be used to archive samples.** Before archiving samples to the bin, remove old disposal date stickers **AND ANY RED DOT** from bin. Check if bin barcodes are damaged and replace with new barcodes if necessary. (Refer to CAM FCD 01115, for printing bin labels).
3. For Food Chemistry, residue-HRMS/micro bins/totes, new barcodes (OA-XXX for freezer food, FRF-XXX for fridge food, DRYF-XXX for dry food, MF-XXX for micro, MFLTR-XXX for micro long term retain etc) are used to archive samples. Barcodes are to be scanned in the Bin Disposal field to check if already in use. If the bin label is already in use, the Error messages are received as in Fig 5 or 9 and the barcode must not be used. If the barcode gets disposed when checking in the Bin Disposal field, it means that a job that was previously incomplete was disposed. That bin is to be pulled from its location and disposed before that barcode is used. Failure to do so will result in 2 bins in the location with the same barcode.

Figure 2:

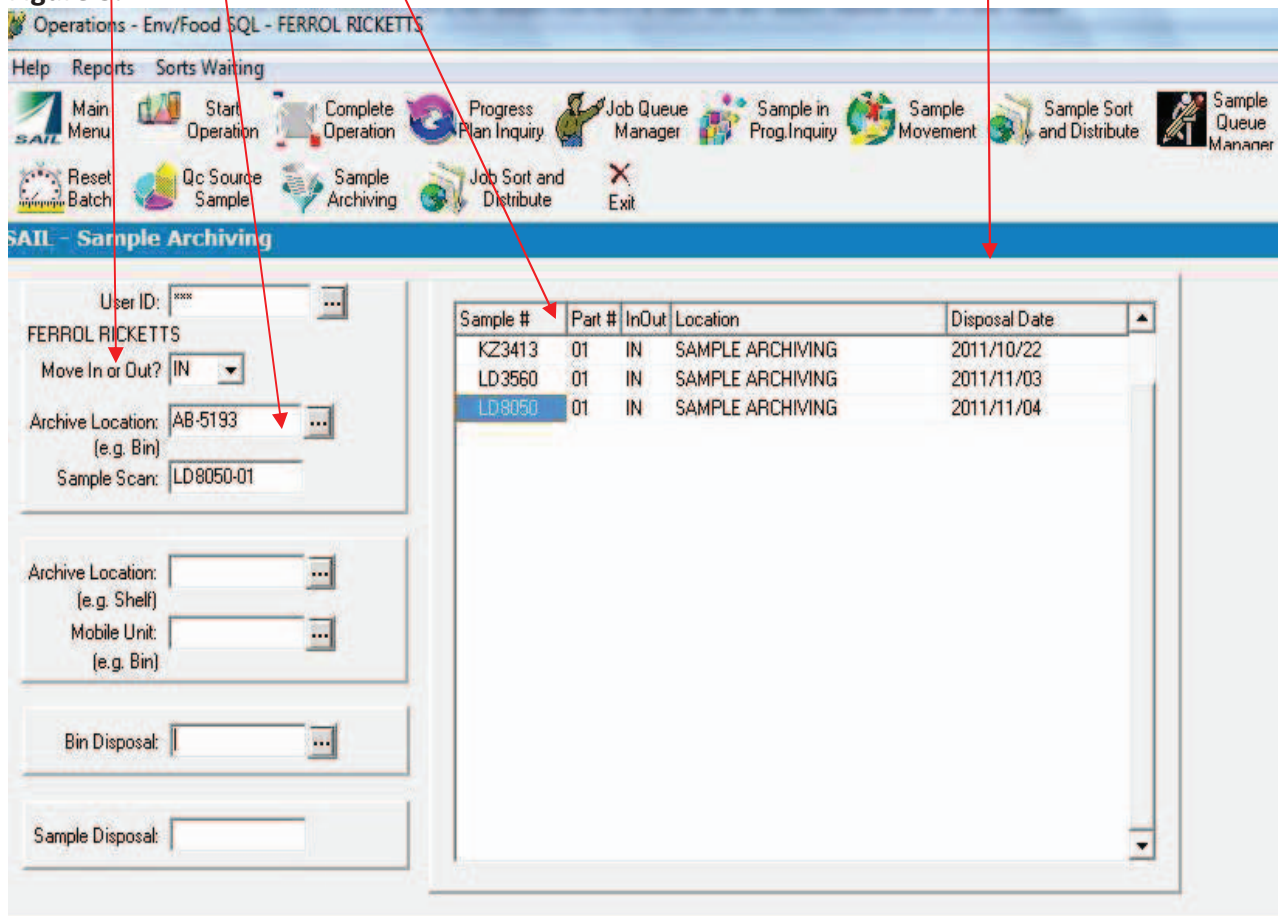


7.1.3 Refer to CAM FCD 01115 for the printing Process of Bin Labels.

7.1.4 Scanning Samples (Figure 3)

1. Scan bin barcode in the “Archive Location (e.g. Bin)” field.
2. Scan all samples into the bin. Check the Disposal date and segregate long-term (>3months) hold samples to separate bin. Ensure the sample is scanned out of the previous bin before the sample is moved to next bin.
3. The scan is successful when the samples are displayed in the data table.
4. **Food Chemistry** bins/totes should not be over packed due to the difficulty to repack on sample retrieval. Also, totes may be too heavy for one person to move. When scanning food if the package has both the original and a sub-sample label, scan the original only. Check if package has multiple original labels (different part number or sample id) and scan all.
5. When moving cart with food samples from fridge/freezer to be scanned check around on the floor for samples that may have fallen off.
6. Scan chemistry food and food residue samples for one archive location at a time so that you do not mistakenly scan freezer food to a bin with dry food label.

Figure 3:



Operations - Env/Food SQL - FERROL RICKETTS

Help Reports Sorts Waiting

Main Menu Start Operation Complete Operation Progress Plan Inquiry Job Queue Manager Sample in Prog. Inquiry Sample Movement Sample Sort and Distribute Sample Queue Manager

Reset Batch Qc Source Sample Sample Archiving Job Sort and Distribute Exit

SAIL - Sample Archiving

User ID: xxx

FERROL RICKETTS

Move In or Out? IN

Archive Location: AB-5193 (e.g. Bin)

Sample Scan: LD8050-01

Archive Location: (e.g. Shelf)

Mobile Unit: (e.g. Bin)

Bin Disposal:

Sample Disposal:

Sample #	Part #	InOut	Location	Disposal Date
KZ3413	01	IN	SAMPLE ARCHIVING	2011/10/22
LD3560	01	IN	SAMPLE ARCHIVING	2011/11/03
LD8050	01	IN	SAMPLE ARCHIVING	2011/11/04

## 7. Main Criteria in Scanning

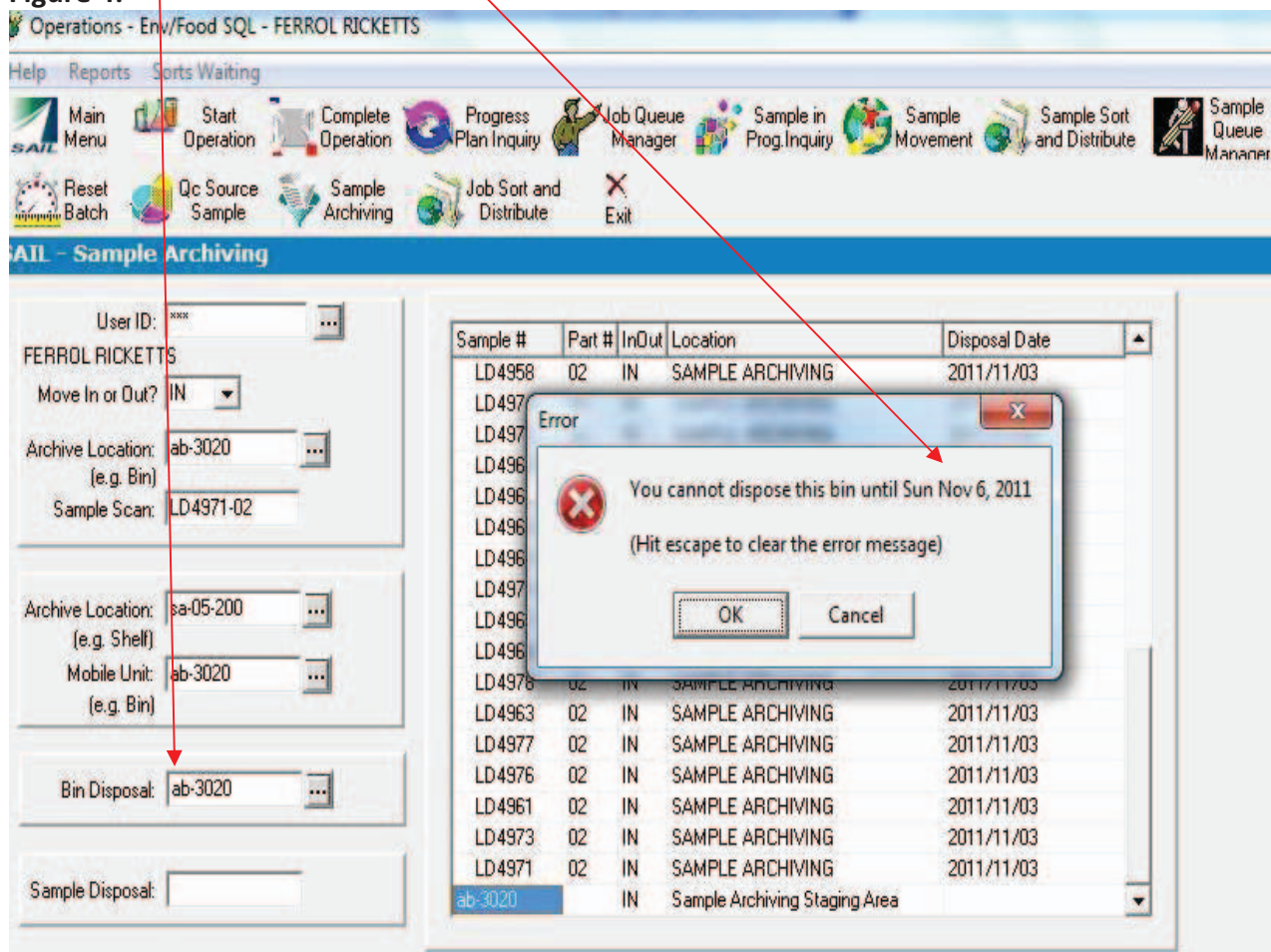
- Preserved or unpreserved/refrigerated or room temperature
- As per bottle type – so that bins can be properly stacked.
- As per waste stream –
  - Plastics: disposed at the sink
  - Glass: disposed at sink and empty containers in crusher
  - Caution: Regular (in Misc. Waste Drum), with MSDS, Flammable (In Flammable Waste Drum),
    - PCBs: Oils scanned in vial boxes with PCB-XXX labels; water and soil in regular bins and stored in SA-05-500.
    - Methanol vials: These are scanned on receipt in vial boxes with METH-XXX labels and all vial boxes are stored in FD-92-010/020/030.
    - International samples: These may be food or solid samples. These are considered biohazards and must be handled with care. Gloves must be disposed in the biohazard drum after use. International food samples must not be mixed with other samples. An international food label must be placed under/beside the disposal date sticker to easily identify these bins for disposal. Location soils: FD85/86, FD-92-170/180, International food dry is SA-04-280, Fridge food SA-06-030, Freezer food FZ-06 (Top shelves)
- For caution samples use the neon yellow disposal date stickers to easily identify those bins for disposal.
- Check monitor at all times – sometimes labels are partially scanned.
- **Hazardous samples** are to be scanned together, either in coolers (labelled CC-XXX) or grey bins. Bins/coolers scanned to ARC-150 or ARC-140 or SA-07-040 or SA-05-900 (vented cabinet). Job number(s) and disposal date to be noted on coolers if used. MSDS form if present to be placed in the bin or taped to outside of cooler. The samples with strong odor are kept in the cooler and moved to ARC-150. Record of disposal for IOL samples is to be kept. **Note: MSDS can be printed from the Job.**
- Segregate **IOL, LTR, miscellaneous, caution samples** and very dark samples to the pre-archiving rack having the respective bins to be archived together.
- Treat bottles preserved with DCM as caution. These are usually 1L amber bottles.
- First in, first out, so frequently organize the bins by moving them down on the pre-archiving shelves to make space for incoming samples.
- Start off with unpreserved 500ml plastic bottles & soils.

- At times when scanning bottles of different types are left back. Keep a bin at the workstation to receive these samples and scan them when the bin is full. Alternatively pass them to another worker who is scanning similar bottle type.
  - Keep separate the archived bin from other un-scanned sample bins once done, and place it in appropriate staging area. If there are leftover bins and **are to be scanned later place them back on the first two pre-**archiving shelves. To be cleared out frequently.
  - **PT samples** for environmental and food is to be handed off directly to team lead. These are stored in a white tray labelled WT-XXX on SA-01-010.
  - When scanning food if the package has both the original and a sub-sample label, scan the original only. Check if package has multiple original labels (different part number or sample id) and scan all.
  - Check and ensure nothing falls from the cart/bin when moving samples from micro to Archiving. Samples without labels or unscannable labels are returned to micro Problem Bin. The same applies to chemistry food these are returned to BO1 workstation.
  - When moving cart from fridge/freezer to be scanned check around on the floor for samples that may have fallen off.
  - Scan samples for one archive location at a time so that you do not mistakenly scan freezer food to a bin with dry food label.
8. **Staging area and Locations:** Archived bins are placed in a temporary staging area before being moved to final locations as follows:
- SA-05-200 for General bottles (and other unpreserved sample) and amber glass bottles – Samples to be refrigerated
  - SA-05-100 for yellow cap, white cap and mercury and phenol (preserved samples) – Samples to be stored at room temperature.
  - SA-05-300 for IOL samples.
  - Samples in red bins (from S&D are staged in SA-05-200 regardless of the bottle type or preserved).
  - Bins with preserved 1L plastic bottles (lead) can be scanned directly to the final location. Ensure that bin is placed to the shelf to which it was scanned.
  - If bins are overloaded advise the lab staff. Samples can fall from bin as a result.

### 7.1.5 Identification of Disposal Date (Figure 4)

1. Scan the bin barcode again in the Bin Disposal field.
2. The Error message will give the latest disposal date of the samples in the bin.
3. Write down on a “Disposal Date” label the date that appears on the screen with blue or black marker/pen.
4. Place a Disposal Date sticker **beneath** the Bin barcode on both sides of the bin ensuring that it adheres properly.
5. For microbiology samples the bins are labelled with the date the samples are processed in the lab. See section 7.1.7

Figure 4:

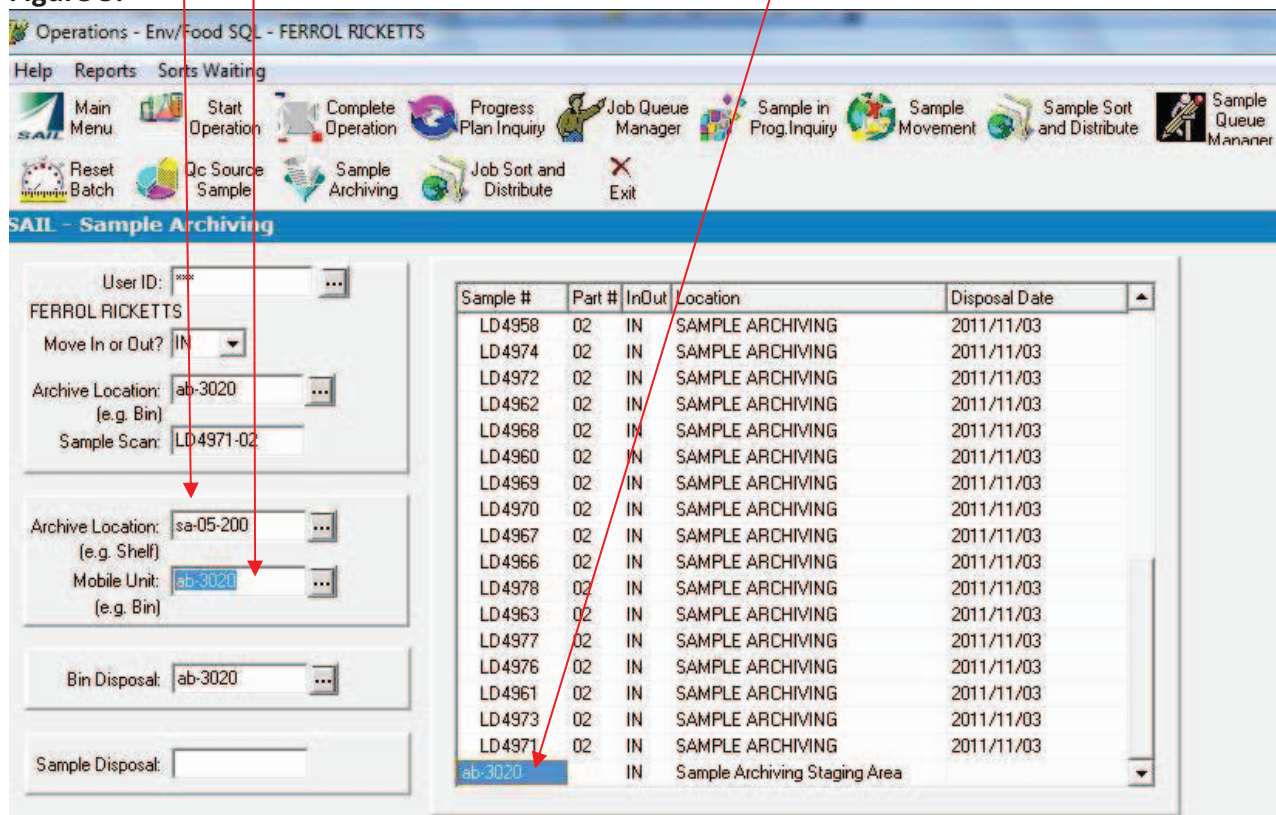


### 7.1.6 Archive Location (e.g. Shelf) (Figure 5)

Scan the shelf where the bin is to be archived in the “Archive Location:(e.g. Shelf)” field. Scan the bin barcode in the “Mobile Unit” field.

1. The scan is successful when the bin barcode is displayed in the data table.
2. Place the bin on the shelf.

**Figure 5:**



**B: Archiving Legal samples:** Refer to COR WI-00073



**C: Archiving Microbiology samples:**

**7.1.7 SWAB and FOOD**

1. Get the bins with the samples processed from Microbiology Lab fridges to Archiving Dept. for scanning. For food, proceed as in section 7.1.1 to 7.1.6.
2. Check and ensure nothing falls from the cart/bin when moving samples from micro to Archiving. If bins are overloaded inform the team leads or Supervisor.
3. High-risk samples arrive in Archiving in high-risk red bins (yellow tape on the rim). These are to be scanned to high-risk bins.
4. Micro food is scanned to large red bins. New MF-XXX barcode is used each time. These are also labeled with the processing date.
5. New MFLTR-XXX barcode is used for Long Term Retain samples. The storage period on these samples is as instructed by the Project Manager.
6. Pet food samples are not archived, only stored by dates on the totes in Archiving as delivered by the Micro Lab. While organizing the totes in the storage area if any totes are found with incorrect or no date, micro lab is to be informed via email.
7. Samples with no or damaged barcodes, multiple job swabs in same bag are put back in the problem bin in the Micro lab for relabeling/sorting.
8. For Swabs, write the bin label as SWABS and scan in excel under date processed. The bin labels affixed by lab will show the processing date of the samples in Micro. Open folder "Micro Archiving" in O drive and open the month required. Open the Excel file for the week the sample needs to be archived. Each week sheet has the individual day/date tabs at the bottom. **Figure 6**. For multiple bins, designate the bins SWABS1, SWABS2, etc.



#### **D: Archiving Inorganic Air Samples**

- 7.1.9 Lab personnel deliver bins containing inorganic air samples to Archiving. The bins are placed on the shelves and stored until the disposal dates noted on stickers on the bins. Disposal is in accordance with Section 7.3.8, *Table 2*. These samples are not archived in SAIL.

#### **E: Archiving VOC/CCME Vial Samples**

- 7.1.10 Lab personnel (VOC lab and P15 workstation) deliver boxes with samples to Archiving and place them on skids for storage/disposal. The Lab affixes the disposal dates to the boxes. The Lab personnel document and archive the samples for a month within the lab (depending on space) before delivering to Archiving. These samples are not archived in SAIL. Samples are held until the expiry dates and are disposed of in lugger bins by Archiving staff.
- 7.1.11 Vials received with Methanol in them from Sort & Distribute are archived in SAIL. Empty vial boxes bar-coded METH-XXX are used for archiving these samples.

## **7.2 STORAGE AND EXPIRY DATES**

- 7.2.1 The expiry dates of 30, 45, 60 or 90 days are automatically assigned by the LIMS. Samples are stored for that period of time from the date of receipt at sample reception. There is a manual override for microbiology samples that are held for 14 days from the date of receipt.
- At times the client requires the samples to be **held** for a longer than standard period of time. To maximize the storage capacity on the shelves, Archiving staff may pull out these specified samples from the Bins showing Disposal date greater than the standard archive period and archive it in a new bin/Shelf Location.
  - For microbiology samples, the Project Manager and Project Manager Assistant will notify Archiving staff by email requesting the extension of holding time of a specific sample. Archiving staff will pull out the specified sample and archive it in a new bin/Shelf Location.
  - For food residue HRMS CFIA samples, these are held by Maxxam for 90 days
- 7.2.2 The expiry date is indicated on the outside of each bin stuck manually using DISPOSAL DATE label, exception is Microbiology samples. The expiry date assigned will be the furthest expiry date of any of the samples or extracts in the bin. Once all desired samples have been added to the bin, the bin is transferred to a shelf inside a fridge or freezer or in room temperature as per sample type. See *Table 1*.

**Table 1: Storage List:**

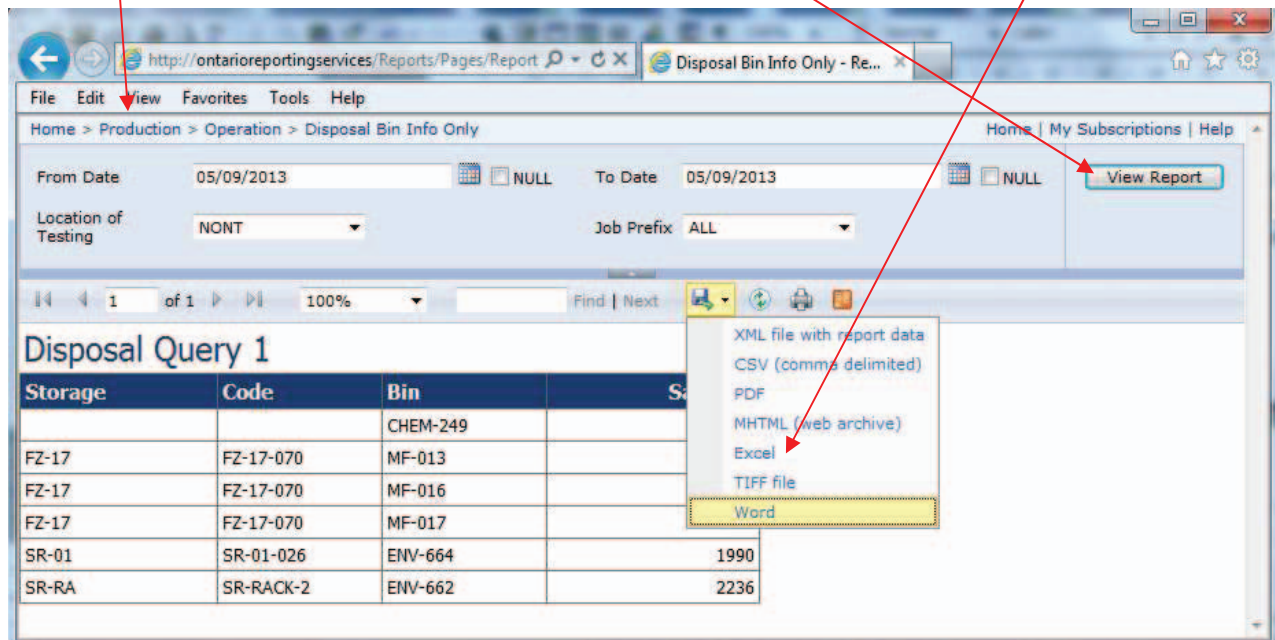
<b>SAMPLE TYPE</b>	<b>STORAGE TEMPERATURE</b>	<b>STORAGE PERIOD</b>	
<b>Organic/Inorganic water unpreserved / Organic preserved</b>	Fridge: 1-6°C	30 days	
<b>Organic/Inorganic soil</b>	Fridge: 1-6°C	30 days	
<b>IOL water</b> <b>IOL Soil</b>	Fridge: 1-6°C	3weeks past the issuance of final CoA 5weeks past the issuance of final CoA	
<b>International water/soil</b>	Fridge: 1-6°C	30 to 90 Days	
<b>PCB OIL</b>	Room temperature	30 days	
<b>Explosive</b>	Fridge: 1-6°C	30 days	
<b>HRMS samples</b> <b>Inorganic Air Lab samples</b>	Fridge: 1-6°C Room temperature	90 days 90 days	
<b>Food Residue HRMS CFIA samples</b>	Freezer: <-15°C	90 days	
<b>Drinking Water (preserved) &amp; Inorganic preserved water</b>	Room temperature	45 days & 30 days	
<b>Chemistry Food samples:</b> Original & Homogenized Retain. (Dry/fridge/freezer food)	Room-Temperature Fridge: 1-6°C Freezer: <-15°C	45 days <b>90 days</b>	
<b>CFIA Food</b> <b>Micro Food</b>	Freezer: <-15°C	14 days	
<b>Micro Water</b>	Room temperature	14 days	
<b>IOL Organic extracts</b>  <b>IOL VOC /CCME water Vials</b>	Stored by respective departments.  Fridge: 1-6°C	6weeks past the issuance of final CoA  3weeks past the issuance of final CoA	

### 7.3 DISPOSAL /HOLD PROCESS

The following are the requirement to be followed for disposal of Environmental and Food Chemistry samples (including food residue/HRMS CFIA samples).

Generate the report of the bins to be disposed on the particular day from the Disposal Query on Maxxnet (*Figure 7*). Under Maxxnet Links click on Report (ON/AtI). Click on Production then Operation. From the list click on 'Disposal Bin Info Only'. Pick NONT as location and click View Report. The report automatically runs for the same day. Option to select dates is also available. Once the report is run export to Excel. Bold the locations alternatively to make it easier to read and delete the non-archiving locations. Enter the run date on the excel file and print it. These reports are stored in the binder.

**Figure 7 Disposal Query**



Storage	Code	Bin	Sample
		CHEM-249	
FZ-17	FZ-17-070	MF-013	
FZ-17	FZ-17-070	MF-016	
FZ-17	FZ-17-070	MF-017	
SR-01	SR-01-026	ENV-664	1990
SR-RA	SR-RACK-2	ENV-662	2236

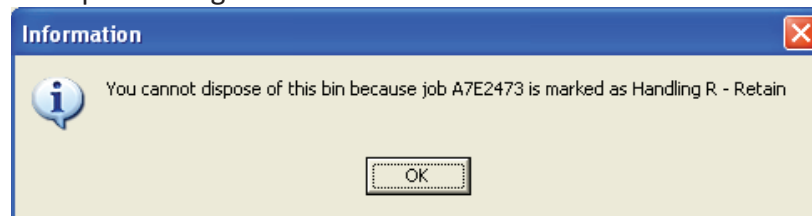
- Dispose the bins in the Bin Disposal field of Sample Archiving in SAIL. If the bin has a sample that cannot be disposed a pop up screen shows up (As in Fig: 8). Note this Job number on the query sheet and the respective bin. The bin is separated and the samples are later segregated and archived to a new bin. The previous bin is then disposed.
- Refer to 'Long Term Retain Job Process in Archiving' CAM FCD-01114 for samples requiring to be held longer.

- The Legal bins showing up in the query are not to be disposed until the disposal form has been received from the Project manager.
- Tag the bins with a coloured dot/marker to be pulled from the shelves for physical disposal in accordance with the process below.
- When the bins are ready for disposal (as per Disposal Query) are being electronically disposed, the following 3 messages can show up. In that case these samples/Jobs are pulled out of the bin and reassigned a new bin and Location in SAIL and the new disposal date stuck to the bins.

(If the Job Handling field is set to R (Retain) or C (Client), the user will be notified if this is the case as follows in SAIL).

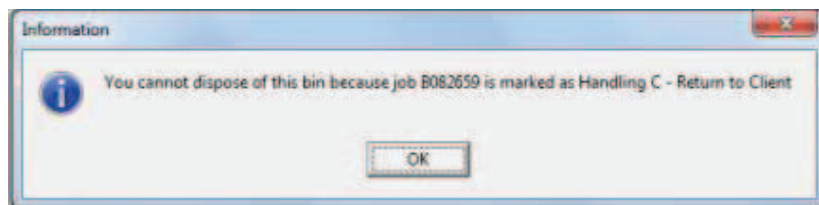
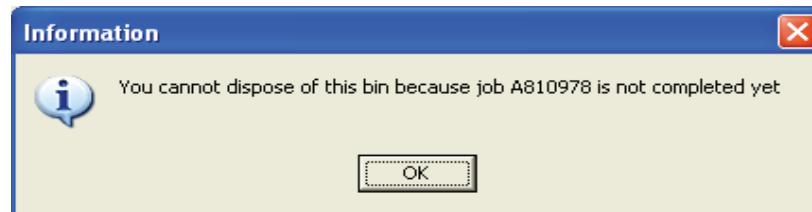
**Figure 8:**

Example message:



If the Job Status is not Complete, the sample(s) may not be disposed of.

Example message:



### 7.3.1 Non-Hazardous Soils/Solids

Non-hazardous soil/solid samples, including container, lid and label, are broken up and disposed into large lugger bins. The disposal company is contacted to remove the lugger bin once full. The Prodeva Model 318 Glass Crusher is used for breaking of the containers.

### 7.3.2 Non-Hazardous Water samples

Samples are visually screened to remove any with obvious product. These are segregated and are disposed of in Miscellaneous Waste drums that are removed by a waste disposal company, when they are full. The remaining samples are disposed of via the sanitary sewer. All water samples are passed through disposable activated charcoal filter beds approximately 2-3inches thick prior to discharge, to reduce organic/chemical loading. The charcoal bed is changed based on the quantity of samples disposed.

### 7.3.3 Caution Labelled Samples

Samples (soil/water) with “**Caution**” labels, but not classified as hazardous are disposed of in Miscellaneous Waste drums that are removed by a waste disposal company, when they are full.

### 7.3.4 Hazardous Wastes

#### 7.3.4.1 Hazardous sample

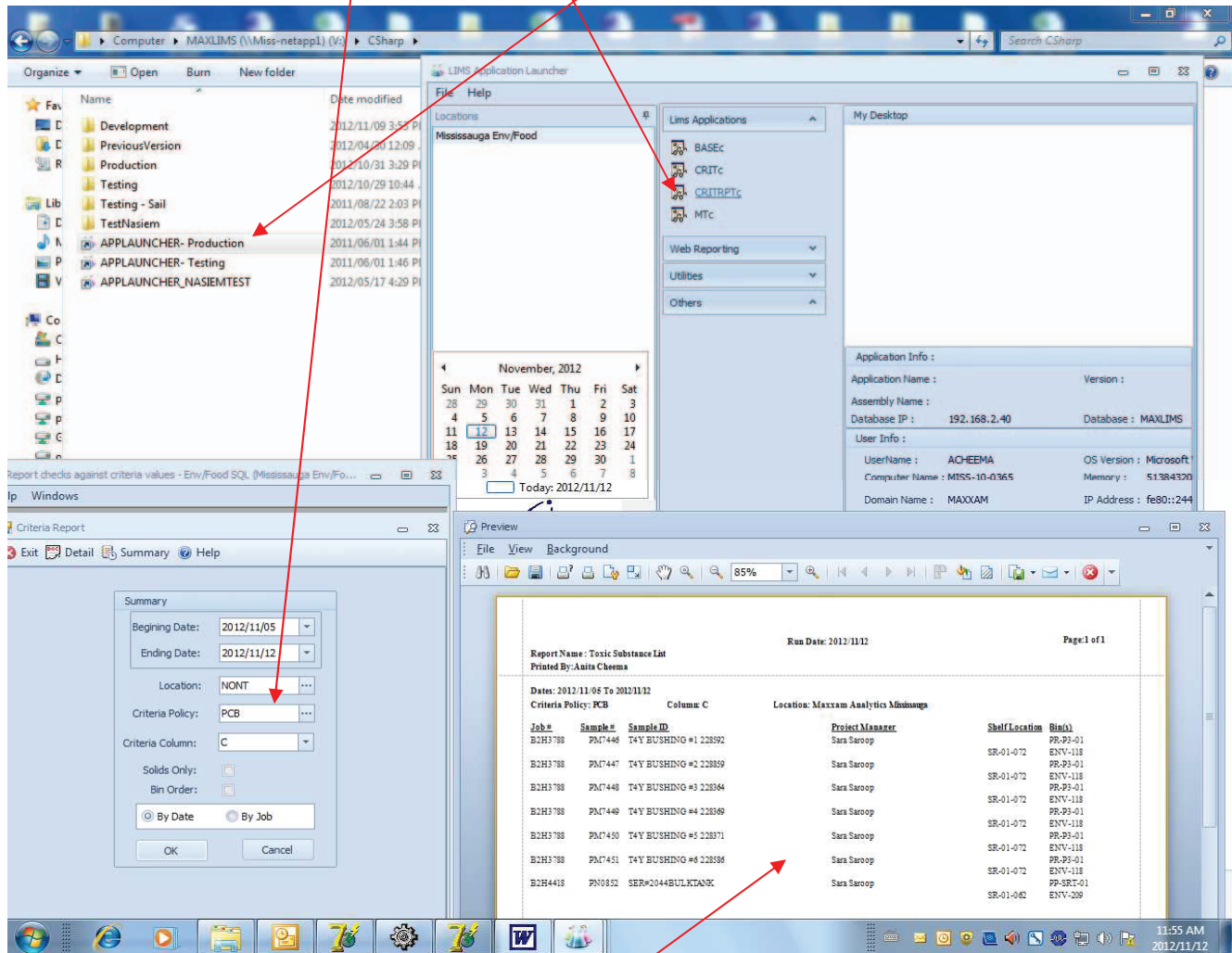
Hazardous samples are received from Sample reception with Caution labels on them. Samples with classified WHIMIS caution labels/MSDS are dealt with on a case-to-case basis. These samples are handed over to Hazardous waste room overseer for appropriate disposal.

#### 7.3.4.2 PCB waste

Samples found to contain high levels of PCB's contaminant are flagged following analysis by generating a Toxic Substance List from the MaxxLIMS (Criteria Report), on a monthly or weekly basis, to determine which samples are found to exceed the criteria of > 50 ppm set out in Ontario Regulation 362.

The report is run from V:\Csharp. Click on Applauncher Production and then CRITRPTc. Run the report by picking “Summary” and criteria policy as PCB, Criteria column as “C”. Enter the criteria as in Figure 9.

Figure 9:



- Print the report with the location of the samples (soil & water) in SAIL. Segregate these samples and either rearchive till disposal or dispose in the PCB Bunker. The report is then signed off and placed in “Binder **SSA30**: Toxic Substance List and Disposal Report” for documentation purpose. All of the PCB oil samples are disposed in the PCB Bunker.
- The segregated PCB samples (soil & water) are stored in the fridge in a bin identified with a caution and PCB label. The oil samples are stored in the cabinet 05-500 until the cabinet is full. This is



temporary storage until samples are disposed and moved to the PCB bunker.

- Maxxam Analytics, Mississauga must be registered as an interim PCB storage site under the requirements set out in Ontario Regulation 362 and the specifications outlined in “The Storage of PCB Material Regulations” under the Canadian Environmental Protection Act.

All PCB contaminated samples and laboratory wastes are stored in drums within a designated PCB bunker. When the PCB storage drums have sufficient waste, safety coordinator/Facilities is advised to contact a PCB disposal company to remove the waste. The following governs the management of the PCB bunker In keeping with the applicable regulation and Maxxam policy:

- (a) Keep the entrance to the PCB storage site under lock and key.
- (b) Permit only authorized persons to enter the PCB storage site. Maintain a register that contains the name of each person who is authorized to enter the PCB storage site and who enters the site. See **CAM FCD-00346** – "AUTHORIZED PERSONNEL ON PCB STORAGE ROOM" and **CAM FCD-00347** - "RECORD OF AUTHORIZED ENTRY ON PCB ROOM".
- (c) Have available for review, a record of all inspections conducted at the PCB storage site.
- (d) Conduct monthly maintenance and inspection of the PCB storage site. Record of the inspection must be documented using **CAM FCD-00348** " MONTHLY INSPECTION ON PCB ROOM"

### **7.3.5 Food samples and Microbiology water samples**

Food samples are disposed off in the general garbage (Compactor) Luger Bin. Food chemistry samples are disposed using SAIL (Refer to section 7.3) while food and water Micro samples are disposed manually using *monthly Calendar with disposal dates (14<sup>th</sup> day from processing samples) marked. Two staff is to pull the micro bins/pet food totes to be placed on carts for disposal the following day. The date on each bin/tote is to be independently verified by both disposing staff and on the disposal day.* All Micro water samples are passed through disposable activated charcoal filter beds approximately 2-3inches thick prior to discharge at the disposal sink in archiving.

### 7.3.6 Legal Samples

Through LIMS & SAIL, Sample Archiving will know when samples need to be disposed. Sample Archiving personnel will email the Job Numbers to the PM. Samples will be disposed off when the PM provides a copy of **COR FCD-00202** signed by the client and himself/ herself to the Sample Archiving Personnel. This copy is placed in "**Binder SSA32: Disposal Tracking Forms Legal Jobs**".

### 7.3.7 International Soil Samples

Soil samples originating from recognized biohazardous areas (USA, Newfoundland, PEI, etc.) are flagged with an "International Soil Sample – Heat Treat required" label (see CAM FCD-00459) by sample reception staff upon receipt. Upon completion of testing, the international soil samples are segregated and archived in a dedicated storage area marked "International Soil Samples - No Other Samples".

On disposal in SAIL, international soil/solid samples are placed in a designated biohazard drum for pickup by a certified contractor for disposal by heat treatment. The wastes from handling international samples such as gloves, paper towels, kimwipes, etc are also placed in the biohazard drum for disposal. The sample disposed are scanned in excel for documentation. The excel sheets are placed in "**Binder SSA31: International Sample Disposal Records**". The electronic copy of the excel sheet is saved on "O Drive: Preprocessing and Archiving folder, Archiving, International samples."

When these soil samples are handled by 6660 Campobello Road, they are autoclaved as per CFIA document D-95-26 Phytosanitary requirements for soil and soil-related matter, and for items contaminated with soil and soil-related matter. **Autoclave:** 30 minutes, 15 psi pressure, at 121°C. Soil must be moist and be placed in water permeable packages (e.g., paper bags) or in trays with soil in layers no thicker than 4.5 cm.

**NOTE:** Lab staff handling **International soil samples** should treat the samples as HIGH RISK and wear appropriate PPE. The area and tools used to handle the samples should be thoroughly cleaned with 5% Bleach and samples/worksheet labelled/tagged with the "International soil sample Labels ". The gloves, paper towels, kimwipes, aluminium tins, residual soil on benches, waste etc should be

disposed in plastic bags labelled with International soil sample labels. This is then sent to the Archiving department for disposal. Under no circumstances can any quantity of the International soil be disposed in garbage, dumpster, or down the drain etc.

### 7.3.8 Inorganic Air Samples

Inorganic air samples are disposed of in accordance with **Table 2** below:

**Table 2:**

<u>Sample Class</u>	<b>Contents</b>	<b>Disposal Methods</b>
<b>Non-Hazardous with White Labels</b>		
Wet chemistry samples	Contains dilute H <sub>2</sub> SO <sub>4</sub> , NaOH, IPA or KOH	Sanitary sewer
Ontario Hydro – KCl	Contains dilute KCl	Sanitary sewer
M29 impringers and rinses	Contains dilute HNO <sub>3</sub> or HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>	Sanitary sewer
<b>Hazardous Samples with Coloured Labels</b>		
M29- H <sub>2</sub> SO <sub>4</sub> /KMnO <sub>4</sub> Ontario Hydro - KMnO <sub>4</sub> / H <sub>2</sub> SO <sub>4</sub>	<b>Pink Caution Label</b> KMnO <sub>4</sub> / H <sub>2</sub> SO <sub>4</sub> Inorg. Air Lab	Return to Inorganic Air Lab for special disposal
M29-HCl	<b>Green Caution Label</b> Conc. HCl Inorg. Air Lab	Return to Inorganic Air Lab for special disposal
Ontario Hydro – K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	<b>Orange Caution Label</b> K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> (Hg)	Return to Inorganic Air Lab for special disposal

	Inorg. Air Lab	
HF Digests – Samples stored on pre-archiving shelves	Hazardous – Yellow Label	Return to Inorganic Air Lab for special disposal

### 7.3.9 Explosives – Soils

Soil samples that may contain traces of explosives (e.g. TNT), or have originated from a known explosives site must be flagged with an "Explosives - Do not Dry or Grind" label, by sample reception staff upon receipt. The samples must, at all times, be kept moist and cold to reduce the possibility of ignition. Upon disposal, the samples are scattered in the lugger bin or returned to the client.

**NOTE:** Soil samples with trace explosives contamination are not considered an "Explosive" under the Act as they are not intended to nor are capable of exploding, detonating or producing a pyrotechnic effect.

### 7.3.10 Flammable samples

Flammable samples/materials should be stored in the flammable cabinet until a drum can be completely filled. Pack the samples upright in the drum with layers of Vermiculite between the samples a day before designate waste company comes to pick it up. Inform the safety coordinator 2 days before the drum is ready to be picked up. The drum should not be considered safe long-term storage. Ensure the drum is grounded.

### 7.3.11 IOL Soil / Water Samples

- IOL soil/solid samples, including container, lid and label, are crushed, and/or broken and mixed into large lugger bins.
- IOL water samples are passed through a disposable activated charcoal filter beds approximately 2-3inches thick prior to discharge, to reduce organic / chemical loading. The charcoal bed is changed based on the quantity of samples disposed.
- Labels must be illegible prior to disposing

### 7.3.12 VOC Vial Samples

VOC vial samples are disposed of into the lugger bin via Glass crusher by Archiving staff after their expiry dates. VOC Field preserved methanol vials received is disposed in appropriate waste drum.

### 7.3.13 Bio-hazardous samples

Biohazardous samples are flagged with a "Biohazardous" label (CAM FCD-00460) by sample reception staff upon receipt. Upon completion of testing the samples are stored separately and disposed in the biohazard waste drum in Archiving.

### 7.3.14 International Food Samples

Food samples originating from outside of Canada must be flagged with an "International Food Sample" label (CAM FCD-00461) by sample reception staff upon receipt.

- Upon completion of testing, the international food samples are segregated and archived in a dedicated storage area/bin marked "International Food Samples".
- Upon completion of storage period the samples are disposed in Luggage bin. (Picked up by Disposal Company for burial). The sample disposed are scanned in excel for documentation and bins/totes/trays sprayed with 5% bleach and left to stand for 30mins before washing.
- The excel sheets are placed in "Binder SSA31: International Sample Disposal Records". The electronic copy of the excel sheet is saved on "O Drive: Preprocessing and Archiving folder, Archiving, International samples."

## 7.4 RETRIEVAL PROCESS

Samples for rework, relog or adding further tests are requested by emailing the Sample Request Form **CAM FCD 00454** to Archiving Disposing email account. Refer to CAM FCD 01112.

## 7.5 Temperature monitoring:

Refer to CAM WI-00015 Verification of thermometers, CAM WI-00008 Monitoring of Temperatures and CAM WI-00133 PRTG Temperature Monitoring User Manual. **The temperature monitoring of required Fridges and Freezers is conducted and documented daily by the staff starting the shift.**

## **8.0 MAINTENANCE REQUIREMENTS**

Any maintenance on any equipment is documented in the equipment maintenance logbook.

## **9.0 ATTACHMENTS**

Archiving Training Document

## Determination of Perfluorinated Compounds in Water and Soil by LC-MS-MS



Maxxam Analytics International Corporation  
Campobello Road  
Mississauga, Ontario  
905-817-5700

<b>Document Identity</b>			
<b>Document Status and Ownership</b>			
<b>Current Status</b>	<b>Approved - Released</b>		
<b>Approval Date</b>	October 20, 2016	<b>Release Date</b>	October 20, 2016
<b>Version Author / Version Manager</b>	Adam Robinson		
<b>Document Categorization</b>			
<b>Campobello Departments</b>	Environmental		

THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION. Its use is restricted to employees with a need to know and third parties with a need to know and who have signed a non-disclosure agreement. ANY REPRESENTATION OF THIS DOCUMENT, PRINTED OR OTHERWISE, OUTSIDE OF THE MAXXAM CompliantPro SYSTEM IS AN UNCONTROLLED COPY UNLESS STAMPED "CONTROLLED COPY" AND SIGNED AND DATED BY AN AUTHORIZED QA REPRESENTATIVE.

<b>Release and Audit Schedule</b>	
<b>Release Schedule</b>	When Approved <input checked="" type="checkbox"/> <b>Allow Administrator to Release Document Early</b>
<b>Expiration Schedule</b>	When Superseded or Obsolete
<b>Audit Schedule</b>	24 Month(s)
<b>Special Handling on Release</b>	
<input checked="" type="checkbox"/> <b>Update Completed Trainee Records</b>	

<b>Insert Text</b>	
<ul style="list-style-type: none"> <li><input type="checkbox"/> CAM SOP-00894</li> <li><input type="checkbox"/> CTA_CAM SOP-00894</li> <li><input type="checkbox"/> EPA Method 537</li> <li><input type="checkbox"/> ASTM D7968-14</li> <li><input type="checkbox"/> Appendix A: DoD-DOE QSM_Table 15</li> <li><input type="checkbox"/> Appendix B - mass labeled compound recovery criteria - extended parameters</li> </ul>	

<b>Associated Documents</b>
<b>Document Control Documents</b>
<ul style="list-style-type: none"> <li><input type="checkbox"/> Corporate WI Publish to All COR WI-00012 : Definitions</li> <li><input type="checkbox"/> Corporate WI Publish to All COR WI-00015 : Corporate Procedure for Balance Calibrations and Verifications</li> <li><input type="checkbox"/> Corporate WI Publish to All COR WI-00017 : Corporate Procedure for Volumetric Verification</li> <li><input type="checkbox"/> Corporate WI Publish to All COR WI-00018 : Determination of Estimation of Analytical Uncertainty of Measurement</li> <li><input type="checkbox"/> Corporate WI Publish to All COR WI-00050 : Environmental Chemistry Method Validation</li> <li><input type="checkbox"/> Corporate WI Publish to All COR WI-00055 : Corporate Procedure for Control Charting</li> <li><input type="checkbox"/> Campobello SOP CAM SOP-00101 : Disposal of Samples</li> <li><input type="checkbox"/> Campobello WI CAM WI-00008 : Monitoring Temperatures</li> <li><input type="checkbox"/> Campobello WI CAM WI-00010 : Handling of Analytical Standards</li> <li><input type="checkbox"/> Campobello WI CAM WI-00018 : Waste Disposal</li> <li><input type="checkbox"/> Campobello WI CAM WI-00095 : Environmental Method Validation (NELAC + DOD requirements)</li> <li><input type="checkbox"/> Campobello FCD CAM FCD-00328 : Bench Level Planned Deviation or Non-Conformance Form</li> <li><input type="checkbox"/> Campobello FCD CAM FCD-01126 : Worksheet Data Validation Checklist - Extractable Organics</li> <li><input type="checkbox"/> Ultra Trace Air Toxics FCD BRL FCD-00002 : Internal Data Validation Checklist</li> </ul>

- 📄 Maxxam Environment Health and Safety WIs MEHS WI-00013 : Corporate Environmental, Health and Safety Guide
- 📄 Campobello WI CAM WI-00506 : Operation and Maintenance of AB SCIEX LC/MS/MS Systems
- 📄 Campobello SOP CAM SOP-00621 : Glassware Washing
- 📄 Campobello WI CAM WI-00121 : Maxxam Lab QM Supplement for TNI-NELAC 2009 QSM and DoD QSM Version 5.0

## Reason for Change

<p><b>Date of Change</b> July 17, 2008</p> <p><b>Section Changed</b> new</p> <p><b>Change Made</b> initial release of new SOP into QSI</p>	<b>Version 1</b>
<p><b>Date of Change</b> October 22, 2009</p> <p><b>Section Changed</b> 12.5, 12.6</p> <p><b>Change Made</b> 12.5 Changed Spk 0 to Blank, corrected weight of soil 12.6 Corrected weight of soil</p>	<b>Version 2</b>
<p><b>Date of Change</b> March 18, 2010</p> <p><b>Section Changed</b> 4.1, 12.5, 12.6, 12.8, 15.2, 15, 16</p> <p><b>Change Made</b> 4.1 Added in testcodes 12.5, 12.6 Corrected QC and matrix spike concentration for soil, changed QC spike concentration 12.8 Changed expiry of mobile phase buffer 15 Updated QC requirements 16 Updated section Added Header Corrected spelling and document references throughout Added associated documents</p>	<b>Version 3</b>
<p><b>Date of Change</b> August 9, 2011</p> <p><b>Section Changed</b> Entire Document, Title, 1.0, 2.0, 3.0, 4.0, 5.0, 7.0, 8.0, 9.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0</p> <p><b>Change Made</b> Entire Document, font and format changes to reflect Maxxam's re-branding. Title, changed title to reflect inclusion of additional PFC compounds. 1.1 Scientific principle updated to describe newly validated procedure and inclusion of additional parameters. 2.3 Calibration range was modified to reflect newly validated method. 3.0 Definitions list expanded. 4.2 Primary reference changed to MOE. 4.3 Deviations to reference method updated. 4.4 Additional reference (EPA 537) added. 5.1 Regulatory criteria (Health Canada) added. 7.0 Sample containers and minimum sample size updated to reflect current practices. 8.0 Interferences were expanded upon. No glass containers was added. 9.0 Section header changed to Method Performance. 9.1 Typical detection limits in water and soil were added for all compounds. 9.2 New reporting limits for all compounds were added. 11.0 Additional apparatus and materials were added to reflect current practices. 12.1 Preparation procedure updated to include additional reagents used in current practices. 12.2 New preparation procedures added for standard preparation and quality control samples. 13.1 SPE procedure added for aqueous samples. 13.2 Direct analysis of aqueous samples modified to reflect current practices. 13.3 Extraction procedure of soil samples modified to reflect current practices. 14.0 Format changes to section. 14.1 Calibration performance criteria added. 14.2 Typical run format updated. 14.3 Chromatographic conditions modified to reflect current practices. 14.5 MRM transitions of additional compounds added. 15.0 Section reformatted. 15.2 Corporate control chart work instruction (COR WI-00055) now referenced. 16.0 Section reformatted. 16.1 Updated and clarified calculations. 16.2 Updated and clarified reporting procedures and confirmation criteria.</p>	<b>Version 4</b>
<p><b>Date of Change</b> March 14, 2014</p> <p><b>Section Changed</b> 1.0, 2.3, 3.0, 4.2, 4.3, 6, 7.2, 9, 11, 12.0, 12.1, 12.2, 12.3.4, 13.0, 13.1, 13.4, 14.0, 14.2, 14.3, 14.5, 15.2.3, 15.2.4, 15.2.5, 15.2.6, 15.2.7, 16.1</p> <p><b>Change Made</b> 1.0 Updated to include current practices (addition of leaching procedure for soil samples and 3 new compounds) 2.3 Tables added providing the calibration range for both high and low level aqueous and soil analyses 3.0 Expanded definitions list 4.2 Updated reference method to USEPA 537 4.3 Updated deviations from new reference method 6 Updated safety section 7.2 Updated minimum sample size for water based on revised method 9 Updated DLs for all parameters based on most recent validation. Added DLs for the 3 new parameters (PFDS, PFTrDA &amp; PFTeDA). Added RDLs for soils analyzed by aqueous leaching method 11 Updated materials/equipment list to reflect current practices 12.0 Changed reference document for verification of volumetric devices to COR WI. 12.1 Updated solvent/reagents list to reflect current practices 12.2 Added information on preparation of soil standards, QCs and internal standards required by aqueous leaching method, reformatted section. 12.3.4 Included preparation procedures for initial calibration standard (formally referred to as CCV) 13.0 Moved preparation procedures for QC samples to this section. Added preparation procedures for matrix spike duplicate (DoD requirement) 13.1 Identified SPE eluates as Fraction 1 &amp; Fraction 2 13.4 Added aqueous leach procedure for soil samples 14.0 Reformatted section. Moved calibration acceptance criteria to section 15 14.2 Modified typical run format 14.3 Updated chromatographic conditions to reflect current practices 14.5 Added MRM transitions for new parameters (PFDS, PFTrDA, PFTeDA &amp; 13C2PFTeDA)</p>	<b>Version 5</b>



15.0 Updated calibration and QC acceptance criteria to be consistent with DoD QSM (march 2013)  
 15.2.3 Corrected MS recovery calculation formula by addition of brackets  
 15.2.4 Added acceptance criteria for MS duplicate  
 15.2.5 Corrected RPD calculation formula by addition of brackets  
 15.2.6 Moved RRT acceptance criteria to this section  
 15.2.7 Added acceptance criteria for internal standard response (as per DoD QSM - march 2013)  
 16.1 Added formula for calculating matrix equivalent concentrations from solution concentrations  
 Attached CTA  
 Associated documents reviewed

**Date of Change** November 7, 2014 **Version 6**  
**Section Changed** 1.0, 2.3, 4.1, 4.3, 4.4, 7.0, 9.1, 9.2.1, 11.0, 11.3, 12.1, 12.2, 12.2.3, 12.3, 12.3.4, 12.4, 12.5, 13.0, 13.1.5, 13.1.6, 13.2.11, 13.2.21, 13.2.22, 13.2.23, 13.2.25, 13.2.26, 13.4.12, 14.1, 14.2, 14.4, 15.0, 15.2.6, 15.2.7, 15.2.8, 18.0  
**Change Made** Added Table of Contents  
 1.0 Updated to include addition of 7 new compounds in water  
 2.3 Updated to include calibration range for new compounds  
 4.1 Added new testcode  
 4.3 Added information to section  
 4.4 Added additional reference  
 7.0 Updated section on sample preservation  
 9.1 Updated section to include typical DLs  
 9.2.1 Updated section to include new RDLS  
 11.0 Reformatted and renumbered section to include chemicals/solvents.  
 11.3 Added information to laboratory equipment  
 12.1 Removed chemicals/solvents from section, added preparation of 20 mM TBAS, updated preparation of reconstitution solution.  
 12.2 Updated section to include new compounds  
 12.2.3 Moved procedures for preparation of calibration standards to Tables 1-6 (Section 18.0)  
 12.3 Updated section to include new compounds  
 12.3.4 Moved procedures for preparation of ICV to Tables 4-8 (Section 18.0)  
 12.4 Internal standards renamed as mass-labelled internal standards, new compounds added  
 12.5 Added section on injection internal standards  
 13.0 Updated section to include new compounds, use of LCMS (or HPLC) grade water and renaming of internal standards as mass-labeled internal standards  
 13.1.5 Changed solvent to methanol to reflect most recent method validation  
 13.1.6 Updated to include addition of injection internal standard  
 13.2.11 Modified approximate sample volume to be added to SPE cartridge  
 13.2.21 Increased drying time to reflect most recent method validation  
 13.2.22 Added step to wipe down needle guides  
 13.2.23 Updated method to include addition of 20mM TBAS to fraction 1 eluates  
 13.2.25 Added tolerance limits to drying temperature, added information on volatility of analytes  
 13.2.26 Modified reconstitution step to include addition of injection internal standards  
 13.4.12 Added tolerance limits to drying temperature  
 14.1 Renumbered section, added acquisition methods  
 14.2 Modified typical run format  
 14.4 Updated and moved information on analyte mass transitions to Table 9 (Section 18.0)  
 15.0 Summarized and moved acceptance criteria to Table 10 (Section 18.0), updated corrective actions  
 15.2.6 Added information and updated acceptance criteria for recovery of mass-labeled surrogates  
 15.2.7 Added acceptance criteria for injection internal standards  
 15.2.8 Updated relative retention time criteria  
 18.0 Added new section (Tables)  
 Associated documents reviewed

**Date of Change** August 11, 2015 **Version 7**  
**Section Changed** 1.1, 2.1, 2.3, 4.2, 4.3, 7.5, 9.2, 11, 12.1, 12.2, 12.3, 12.4, 13.2, 13.3, 14.1.3, 14.3, 18, Tables 1-3, Tables 4-6, Table 7, Table 8  
**Change Made** 1.1 Updated scientific principle  
 2.1 Added "drinking water" to applicability of method  
 2.3 Removed high level soil calibration range reference from section as it's no longer applicable  
 4.2 Added ASTM D7968-14 as reference method for soil analysis  
 4.3 Added deviations from reference method ASTM 7968-14  
 7.5 Changed hold time for waters to 14 days to be consistent with reference method  
 9.2 Updated parameter list and RDL values in section to reflect latest method validation data  
 11 Updated apparatus and materials list to reflect latest method validation data  
 12.1 Updated reagent preparation procedures to reflect current practices based on most recent validation  
 12.2 Updated standard preparation procedures to reflect current practices based on most recent validation  
 12.3 Updated second source standard preparation procedures to reflect current practices based on most recent validation  
 12.4 Updated internal standard preparation procedures to reflect current practices based on most recent validation  
 13.2 Updated low-level water sample preparation procedures to reflect current practices based on most recent validation  
 13.3 Updated soil preparation procedures to reflect current practices based on most recent validation. Removed reference to high-level soil sample preparation (no longer performed)  
 14.1.3 Updated the names of the data acquisition methods.  
 14.3 Updated chromatographic conditions to reflect current practices based on most recent validation. Included chromatographic conditions for MeFOSAA & EtFOSAA  
 18 Updated table listings  
 Tables 1-3 Updated ICAL preparation procedures to reflect current practices based on most recent validation. Removed reference to high level soil ICAL preparation (no longer performed)  
 Tables 4-6 Updated ICV preparation procedures to reflect current practices based on most recent validation. Removed reference to high level soil ICV preparation (no longer performed)  
 Table 7 Updated analytes/internal standards ions and MS settings to reflect current practices based on most recent validation  
 Table 8 Updated mass-labeled surrogate recovery acceptance criteria based on most recent validation data  
 Associated documents reviewed

**Date of Change** October 26, 2015 **Version 8**  
**Section Changed** 9, 13.2.6, 13.3.14  
**Change Made** 9 Added method performance information for EtFOSAA and MeFOSAA in soil.  
 13.2.6 Corrected internal standard spiking volume.  
 13.3.14 Updated extraction procedure to reflect most recently validated protocol.

<b>Date of Change</b>	January 26, 2016	<b>Version 9</b>
<b>Section Changed</b>	15.2.1, 15.2.8, 16.3	
<b>Change Made</b>	15.2.1 Added acceptance criteria for method blank analyses that include drinking water samples to be consistent with the reference method. 15.2.8 Added acceptance criteria for peak asymmetry factor. 16.3 Added information regarding quantitation of branched and linear isomers.	
<b>Date of Change</b>	October 20, 2016	<b>Version 10</b>
<b>Section Changed</b>	1.1, 2.3, 4.3, 4.5, 5, 7.5, 9.2, 12.2, 12.5, 13.2.1, 13.2.3, 14.4, 15.3, 16.1, 16.3, Tables 2&3, Tables 5&6, Table 7, Table 8 & Appendix B	
<b>Change Made</b>	1.1 Added reference to PFAS - perfluorinated alkylated substances 2.3 Added analytical range for "low-level" analysis. 4.3 Updated deviation section with additional justifications for deviation to the reference methods. 4.5 Included reference to Agilent LC/MS/MS instrument manuals. 5 Updated Health Canada's regulatory criteria for PFCs. 7.5 Updated hold time for water sample to 14 days to be consistent with EPA537. 9.2 Included reporting limits for "low-level" analysis in waters. 12.2 Added part number for Br-PFHxS (branched and linear PFHxS reference material). 12.5 Concentration of the composite injection internal standard solution was reduced to 100 ng/mL. This reduced concentration is still significantly significant to allow for accurate quantitation of the mass-labeled compounds. 13.2.1 Added procedures for centrifuging samples that are turbid or contain suspended particulates. 13.2.3 Included allowances for "up-front" dilutions of samples under certain conditions. 14.4 Added mass spec settings for Agilent 6470 LC/MS/MS. 15.3 Changed control chart location to the LIMS SQC control chart module. 16.1 Calculation section was updated such that sample concentrations will be calculated based on ICAL solution concentrations and corrected for initial and final sample volumes (or weight in the case of soils). This was done to support standardization of reporting protocols, in agreement with AFCEC, representing a format change only with no data impact. 16.3 Procedures for quantifying linear and branched isomers (in accordance with EPA protocols) was added. Table 2&3 ICAL concentrations were changed from matrix equivalent concentrations to solution concentrations as described in procedural changed outlined in sec 16.1 Table 5&6 ICV concentrations changed from matrix equivalent concentrations to solution concentrations as described in the procedural changed outlined in sec 16.1. Table 7 Added mass spec settings for Agilent 6470 LC/MS/MS. Table 8 Added QC criteria for low-level water analysis (PFOSLOW-W). Appendix B Attached appendix B which contains recovery criteria for additional mass-labeled compounds (aside from 13C4-PFOA, 13C4-PFOS & 13C8-PFOA). Associated documents were reviewed. No changes were required.	

Approval Status Table			
Approver	Source	Role for Approvers	Parallel-Everybody Segment
Approver	Action	Date	Comment
Carla Bento	Approve	October 19, 2016 10:01 AM GMT-4	
Rodney Major	Approve	October 19, 2016 12:21 PM GMT-4	
Salima Haniff	Approve	October 20, 2016 3:13 PM GMT-4	

10/24/16 5:25 PM

**DETERMINATION OF PERFLUORINATED COMPOUNDS IN WATER AND SOIL BY LC-MS-MS**

**TABLE OF CONTENTS:**

<b>1.0</b>	<b>Introduction</b> .....	4
1.1	Scientific Principle.....	4
<b>2.0</b>	<b>Scope</b> .....	4
2.1	Applicability.....	4
2.2	Responsibilities.....	4
2.3	Calibration Range.....	5
<b>3.0</b>	<b>Definitions</b> .....	5
<b>4.0</b>	<b>Reference Method</b> .....	6
4.1	Test Codes.....	6
4.2	Reference Methods.....	6
4.3	Reference Method Deviations.....	6
<b>5.0</b>	<b>Regulatory Criteria</b> .....	8
<b>6.0</b>	<b>Safety &amp; Disposal</b> .....	9
<b>7.0</b>	<b>Sample Handling, Preservation &amp; Hold Time</b> .....	9
7.1	Sample Containers.....	9
7.2	Minimum Sample Size.....	9
7.3	Preservation.....	10
7.4	Storage Conditions.....	10
7.5	Hold Time.....	10
<b>8.0</b>	<b>Interferences</b> .....	10
<b>9.0</b>	<b>Method Performance</b> .....	11
9.1	Method Detection Limits (MDL) / Limit of Detection (LOD).....	11
9.2	Reporting Detection Limit (RDL) / Limit of Quantification (LOQ).....	11
<b>10.0</b>	<b>Glassware Cleaning/Preparation</b> .....	14
<b>11.0</b>	<b>Apparatus &amp; Materials</b> .....	14
11.1	Chemicals / Solvents.....	14
11.2	Laboratory Supplies / Consumables.....	14
11.3	Laboratory Equipment.....	15
11.4	Analytical Equipment.....	16
<b>12.0</b>	<b>Reagents &amp; Standard Preparation</b> .....	16
12.1	Reagent Preparation.....	15
12.2	Stock Standard Preparation.....	17
	12.2.2 Preparation of Composite PFC Working Standards.....	19

12.3	Preparation of Second Source Spiking Standards.....	21
12.4	Preparation of Mass-labeled Internal Standards.....	21
12.5	Preparation of Injection Internal Standard.....	24
<b>13.0</b>	<b>Sample Preparation.....</b>	<b>24</b>
13.1	Sample Preparation – High Level Aqueous Samples.....	24
	13.1.2 Preparation of QC Samples (High Level Aqueous Analysis).....	25
13.2	Sample Preparation – Aqueous Samples.....	25
	13.2.3 Preparation of QC samples (Aqueous Analysis).....	26
13.3	Sample Preparation – Soil Samples.....	28
	13.3.1 Preparation of QC Samples (Soil Analysis).....	28
<b>14.0</b>	<b>Analytical Determination.....</b>	<b>30</b>
14.1	Analysis.....	30
14.2	Typical Run Format.....	31
14.3	Chromatographic Conditions.....	31
14.4	Mass Spectrometer Settings.....	32
<b>15.0</b>	<b>Quality Control.....</b>	<b>34</b>
15.1	Calibration.....	34
	15.1.1 Initial Calibration (ICAL).....	34
	15.1.2 Initial Calibration Verification (ICV).....	34
	15.1.3 Continuing Calibration Verification (CCV).....	35
15.2	Quality Control – Samples Preparation and Analysis.....	35
	15.2.1 Matrix / Method Blank.....	36
	15.2.2 Spiked Blank / Laboratory Control Sample.....	36
	15.2.3 Matrix Spike.....	36
	15.2.4 Matrix Spike Duplicate.....	37
	15.2.5 Laboratory Duplicate.....	37
	15.2.6 Mass-Labeled Surrogate Compound Recovery.....	37
	15.2.7 Injection Internal Standard Response.....	38
	15.2.8 Peak Asymmetry Factor.....	39
15.3	Control Charting.....	39
15.4	Non-Conformance.....	40
<b>16.0</b>	<b>Data Interpretation &amp; Calculations.....</b>	<b>40</b>
16.1	Calculations.....	40
16.2	Reporting.....	40
16.3	Linear and Branched Isomers.....	41
16.4	Data Storage and Retrieval.....	41
<b>17.0</b>	<b>Maintenance.....</b>	<b>41</b>

<b>18.0</b>	<b>Tables</b> .....	<b>41</b>
	Table 1 Initial Calibration Standard Preparation – High Level Aqueous Analysis.....	43
	Table 2 Initial Calibration Standard Preparation – Aqueous Analysis.....	43
	Table 3 Initial Calibration Standard Preparation – Soil Analysis.....	44
	Table 4 Initial Calibration Verification (ICV) Standard Preparation – High Level Aqueous Analysis..	45
	Table 5 Initial Calibration Verification (ICV) Standard Preparation – Aqueous Analysis.....	45
	Table 6 Initial Calibration Verification (ICV) Standard Preparation – Soil Analysis.....	45
	Table 7 Ions – Analytes and Internal Standards.....	46
	Table 8 QC Acceptance Criteria and Quantitation Reference.....	48

## **1.0 INTRODUCTION**

### **1.1 Scientific Principle**

The SOP describes the quantitative analysis of 25 perfluorinated compounds in water and soil by liquid chromatography-tandem mass spectrometry (LC/MS/MS).

Perfluorinated carbon compounds (PFC), also known as perfluorinated alkyl acids (PFAA) or perfluorinated alkyl substances (PFAS) are man-made chemicals that, because of their stability under extreme heat and chemical stress, as well as their surfactant properties, have been used in a variety of applications including industrial polymers, stain repellants and aqueous film forming foams (AFFF). Many of these compounds are persistent (meaning that they take a very long time to break down in the environment) and can “bioaccumulate” or build up in certain living organisms.

Isotopically labeled internal standards are added to a measured amount of sample prior to sample processing to monitor method performance and compensate for potential matrix effects.

Aqueous samples undergo cleanup and concentration using weak anion exchange solid phase extraction (SPE) cartridges. Soil samples are extracted using an organic solution before cleanup and concentration by solid phase extraction.

Chromatographic separation is achieved using a reverse phase liquid chromatography column prior to detection using tandem mass spectrometry (LC/MS/MS). Each perfluorinated compound is quantified by isotope-dilution method using a multi-point calibration curve.

## **2.0 SCOPE**

### **2.1 Applicability**

The procedure is applicable to the determination and confirmation of perfluorinated compounds (PFCs) in water (including drinking water) and soil samples.

### **2.2 Responsibilities**

It is the responsibility of the Department Managers and Supervisors to ensure that documents are written and reflect the procedures performed at Maxxam. It is the responsibility of all staff to ensure that the procedures outlined in this document are followed. The Manager or Supervisor must approve any deviations from the SOP. The procedure used, and approval is recorded as a Policy Deviation Form in Compliant Pro or on CAM FCD-00328.

2.3 Calibration Range

2.3.1 Low Level Analysis:

Matrix	Range
Aqueous	2.0 – 100 ng/L

2.3.2 Standard Analysis:

Matrix	Range
Aqueous	0.02 – 1.0 µg/L
Solids (Soils)	1.0 – 50 µg/kg

2.3.2 High Level Analysis:

Matrix	Range
Aqueous	0.80 – 50 µg/L

**3.0 DEFINITIONS**

Refer to COR WI-00012 “Definitions”. Additional definitions are listed below.

- 3.1 LC/MS/MS: Liquid chromatography – tandem mass spectrometry.
- 3.2 Precursor ion: Also synonymous with parent ion, is an electrically charged molecular moiety that may dissociate to form fragments (daughters), of which one or more may be electrically charged, and one or more neutral species.
- 3.3 Product ion: Also synonymous with daughter ion, is an electrically charged ion resulting from the collision of a precursor ion with an inert gas in the mass spectrometer.
- 3.4 MRM: Multiple reaction monitoring. The mode of operating a mass spectrometry system so that an ion of a given mass (a precursor) must fragment (dissociate) to give a product ion of a specific mass in order for a response to be detected.
- 3.5 SPE: Solid phase extraction
- 3.6 C of A: Certificate of Analysis
- 3.7 IS: Internal Standard
- 3.8 DoD: Department of Defense

3.9 HDPE: High density polyethylene plastic

3.10 PP: Polypropylene plastic

#### 4.0 REFERENCE METHOD

##### 4.1 Test Codes:

Water: PFOSALCM-W  
PFOSLOW-W (Low Level Analysis)  
Soil: PFOSALCM-S  
Leachate: PFOSLCM-LC

##### 4.2 Primary References:

###### 4.2.1 Water:

USEPA 537, Determination of selected perfluorinated alkyl acids in drinking water by solid phase extraction and liquid chromatography/tandem mass spectrometry (LC/MS/MS), version 1.1, Sept/2009.

###### 4.2.2 Soil:

ASTM D7968-14, Standard Test Method for Determination of Perfluorinated Compounds in Soil by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS), 2014.

##### 4.3 Deviations:

###### 4.3.1 Water (USEPA537):

4.3.1.1 Sample volume for SPE in the reference method is 250 mL whereas this method uses a sample volume of 125 mL. Less sample volume is required to meet the detection limits of this method.

4.3.1.2 Additional internal standards are used in this method. Native compounds are quantified by isotope dilution (ID) and isotopically mass-labeled surrogate compounds are quantified by an internal standard method whereas, EPA 537 uses the internal standard quantification method exclusively. Isotope dilution allows for built in recovery correction of the target analytes as the internal standards are stable isotopically labeled analogs of the target analytes and are added to the sample prior to extraction or other sample preparation steps such as pH adjustment, drying, or extraction solvent addition. Physical and chemical properties of each labeled compound are virtually the same as its unlabeled "native" analog. Thus, any losses of the target compound



that may occur during sample preparation or determinative steps will be mirrored by a similar loss of the labeled standard.

- 4.3.1.3 The SPE sorbent in the reference method is polystyrenedivinylbenzene (SDVB) whereas this method employs Waters WAX ion-exchange SPE sorbent. Several compounds in this method (which are not part of EPA 537) are not well retained by the SDVB sorbent resulting in low recoveries.
- 4.3.1.4 The reference method does not contain any protocols for direct analysis of aqueous samples for determining “high level” samples. The high level analysis allows for direct injection of highly impacted samples using an elevated calibration range.
- 4.3.1.5 New mass spectrometer and chromatographic conditions were optimized for use with Maxxam’s LC/MS/MS systems.

#### 4.3.2 Soil (ASTM D7968-14):

- 4.3.2.1 Sample weight in the reference method is 2 g whereas this method used a sample weight of 3 g. A larger sample size is needed to meet the detection limits required for this method.
- 4.3.2.2 Internal standards are used in this method. Native compounds are quantified by isotope dilution (ID) and isotopically mass-labeled surrogate compounds are quantified by an internal standard method whereas, ASTM D7968-14 uses external standard quantification for the quantification of both native and surrogate compounds. Refer to section 4.3.1.2 for the advantages of isotope dilution.
- 4.3.2.3 In ASTM D7968-14, samples are extracted by tumbling using a solution of methanol/water under basic conditions. This method extracts samples using a solution of methanol/water in an ultrasonic bath. Recoveries of the target analytes achieved using an ultrasonic bath are comparable to those described in ASTM D7968 (in Ottawa sand).
- 4.3.2.4 Sample extract supernatants are filtered after centrifugation in ASTM D7968-14. Sample extracts are not filtered in this method. The solid phase extraction removes particulates and other interferences that would otherwise be removed by filtering.
- 4.3.2.5 Sample extracts undergo a solid phase extraction (SPE) clean-up/concentration in this method. There is no solid phase extraction in ASTM D7968. The solid phase extraction includes clean-up and concentrations steps necessary to meet the detection limits of this method.

4.3.2.6 New mass spectrometer and chromatographic conditions were optimized for use with Maxxam's LC/MS/MS systems.

All method modifications described above have undergone an initial demonstration of capability (validation).

4.4 Additional References:

- 4.4.1 The Determination of Perfluorinated Alkyl Compounds (PFCs) in Environmental Matrices by Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS). Method code PFC-E3457A, version 1.0, Ontario Ministry of the Environment, Sept 2008.
- 4.4.2 Draft Procedure for Analysis of Perfluorinated Carboxylic Acids and Sulfonic Acids in Sewage Sludge and Biosolids by HPLC/MS/MS, USEPA, December 2011.
- 4.4.3 Quality Systems Manual for Environmental Laboratories, Version 5.0. Department of Defense, July, 2013.

4.5 Instrument Manuals:

- 4.5.1 Analyst™ DVD Manual (Contains Analyst™ Software Guide, 5500 Qtrap Hardware Guide, Turbo V Ion Source Guide and the Peripheral Devices Setup Guide).
- 4.5.2 Agilent 6470 Instrument Manual.
- 4.5.3 Agilent 1200 Infinity Series LC Hardware DVD Manual.

**5.0 REGULATORY CRITERIA**

5.1 In April, 2016, Health Canada issued the following drinking water screening values for select PFC compounds:

Compound	Screening Value (µg/L)
PFOS	0.6
PFOA	0.2
PFBA	30
PFBS	15
PFHxS	0.2
PFHxA	0.2
PFHpA	0.2

PFNA	0.2
------	-----

## 6.0 SAFETY & DISPOSAL

General Safety requirements for this SOP are provided in the attached critical task analysis (CTA). In addition to the CTA, additional guidance on Maxxam's Environment, Health and Safety (EHS) program are found in various Safe Work Procedures, Safety Policies, and the Safety Guide (See MEHS WI-00013). Chemical wastes and sample disposal protocols are outlined in the Corporate Environmental Waste Management Policy (MEHS WI-00069).

- 6.1 The use of personal protective equipment (PPE), including safety glasses and lab coats are mandatory in all Maxxam labs. It is the responsibility of the analyst to read and understand the CTA attached to this SOP and ensure that any additional identified hazard controls are used (e.g. nitrile gloves, splash goggles, fume hoods, respirators, etc).
- 6.2 Material safety data sheets for all chemical reagents are available to personnel using this method. Training on the interpretation of MSDS sheets is provided during WHMIS training upon hire. Staff performing this method shall review the associated MSDS sheets for chemicals used in this procedure and ensure they understand the associated hazards and safety controls required to work safely with each chemical.
- 6.3 General information for chemical waste and sample disposal is described in the Health and Safety work instructions. Disposal of all samples, extracts and reagents must be done in accordance with local, provincial and federal laws and regulations. Chemical wastes and sample disposal protocols are described in CAM WI-00018 "*Waste Disposal*".

## 7.0 SAMPLE HANDLING, PRESERVATION AND HOLDING TIME

### 7.1 Sample Container:

- 7.1.1 Water samples should be collected in polyethylene bottles with an unlined plastic cap.
- 7.1.2 Soil samples should be collected in polyethylene jars/bottles with an unlined plastic cap.

It is highly recommended that PFC specific sample containers from the Maxxam-Mississauga location be used for collection as they have been verified to be free of PFCs.

### 7.2 Minimum Sample Size:

- 7.2.1 The minimum sample size required for water analysis is 250 mL.

Additional bottles/sample may be required for QC (matrix spike, sample duplicate, etc.)

7.2.2 The minimum sample size required for soil is 50 g.

7.3 Preservation:

Water: Preservation is not required.

*If residual chlorine is present or suspected in the samples, they may be preserved with Trizma® (5 g/L).*

Samples should not be filtered.

Soil: Preservatives are not required.

7.4 Storage Conditions:

After samples are logged in, they are stored in a refrigerator. Samples are retained according to CAM SOP-00105 after reporting. Samples may be retained for longer periods at the client's request at an additional cost.

7.5 Hold Time:

Water - 14 days

Soil - 28 days

## 8.0 INTERFERENCES

8.1 Care should be taken when handling samples for analysis and ensuring that the compounds being tested for are not introduced into the samples during sample preparation or analysis.

8.2 No Teflon® or PTFE should be used in the collection, processing or analysis of PFCs as it is a potential source of interference.

8.3 Glass containers should also be avoided in all phases of the collection, processing and analysis, as the potential exists for loss of analyte due to adsorption.

8.4 Large amounts of organic matter or inorganic ions in samples / sample extracts may cause ion suppression in the electrospray LC/MS/MS source.

**9.0 METHOD PERFORMANCE**

9.1 Method Detection Limit (DL) / Limit of Detection (LOD):

Method detection limits are determined using COR WI-00050 (Environmental Chemistry Method Validation) and CAM WI-00095 (for DoD/NELAC requirements). Current method detection limits are maintained in Compliant Pro.

9.2 Reporting Detection Limit (RDL) / Limit of Quantification (LOQ):

Reporting Limits are defined in the test codes in MaxLIMS. Data less than these values are reported as "<" or "ND". Where applicable, the laboratory follows EPA requisites for data flagging. Sample dilution factors are applied to these values and reported accordingly.

9.2.1 Water Analysis

Parameter	Abbreviation	Low Level Analysis (ng/L)	Standard Analysis (µg/L)	High Level Analysis (µg/L)
Perfluorobutanoic acid	PFBA	2	0.02	0.8
Perfluorobutanesulfonate	PFBS	2	0.02	0.8
Perfluoropentanoic acid	PFPeA	2	0.02	0.8
Perfluorohexanoic acid	PFHxA	2	0.02	0.8
Perfluorohexanesulfonate	PFHxS	2	0.02	0.8
Perfluoroheptanoic acid	PFHpA	2	0.02	0.8
Perfluoroheptanesulfonate	PFHpS	2	0.02	0.8
Perfluorooctanoic acid	PFOA	2	0.02	0.8
Perfluorooctanesulfonate	PFOS	2	0.02	0.8
Perfluorononanoic acid	PFNA	2	0.02	0.8
Perfluorodecanoic acid	PFDA	2	0.02	0.8
Perfluorodecanesulfonate	PFDS	2	0.02	0.8
Perfluoroundecanoic acid	PFUnA	2	0.02	0.8

Perfluorododecanoic acid	PFDoA	2	0.02	0.8
Perfluorotridecanoic acid	PFTTrDA	2	0.02	0.8
Perfluorotetradecanoic acid	PFTTeDA	2	0.02	0.8
Perfluorooctanesulfonamide	PFOSA	4	0.02	0.8
N-methylperfluorooctanesulfonamide	MeFOSA	-	0.02	0.8
N-ethylperfluorooctanesulfonamide	EtFOSA	-	0.02	0.8
N-methylperfluorooctanesulfonamidoethanol	MeFOSE	-	0.02	0.8
N-ethylperfluorooctanesulfonamidoethanol	EtFOSE	-	0.02	0.8
N-methylperfluorooctanesulfonamidoacetic acid	MeFOSAA	-	0.02	0.8
N-ethylperfluorooctanesulfonamidoacetic acid	EtFOSAA	-	0.02	0.8
6:2 Fluorotelomersulfonate	6:2FTS	4	0.02	0.8
8:2 Fluorotelomersulfonate	8:2FTS	4	0.02	0.8

### 9.2.2 Soil Analysis

Parameter	Abbreviation	RDL (µg/kg)
Perfluorobutanoic acid	PFBA	1.0
Perfluorobutanesulfonate	PFBS	1.0
Perfluoropentanoic acid	PFPeA	1.0
Perfluorohexanoic acid	PFHxA	1.0
Perfluorohexanesulfonate	PFHxS	1.0
Perfluoroheptanoic acid	PFHpA	1.0
Perfluoroheptanesulfonate	PFHpS	1.0

Perfluorooctanoic acid	PFOA	1.0
Perfluorooctanesulfonate	PFOS	1.0
Perfluorononanoic acid	PFNA	1.0
Perfluorodecanoic acid	PFDA	1.0
Perfluorodecanesulfonate	PFDS	1.0
Perfluoroundecanoic acid	PFUnA	1.0
Perfluorododecanoic acid	PFDoA	1.0
Perfluorotridecanoic acid	PFTTrDA	1.0
Perfluorotetradecanoic acid	PFTeDA	1.0
Perfluorooctanesulfonamide	PFOSA	1.0
N-methylperfluorooctanesulfonamide	MeFOSA	1.0
N-ethylperfluorooctanesulfonamide	EtFOSA	1.0
N-methylperfluorooctanesulfonamidoethanol	MeFOSE	1.0
N-ethylperfluorooctanesulfonamidoethanol	EtFOSE	1.0
N-methylperfluorooctanesulfonamidoacetic acid	MeFOSAA	1.0
N-ethylperfluorooctanesulfonamidoacetic acid	EtFOSAA	1.0
6:2 Fluorotelomersulfonate	6:2FTS	1.0
8:2 Fluorotelomersulfonate	8:2FTS	1.0

### 9.3 Measurement of Uncertainty

Measurement of Uncertainty will be calculated according to COR WI-00018. The uncertainty value presents the variability of the result due to both random and systematic causes. The calculations for measurement of uncertainty will be determined on a location basis. Measurement Uncertainty must be determined only once, unless there is a major change to method or instrument.

## 10.0 GLASSWARE CLEANING/PREPARATION

10.1 Refer to procedure CAM SOP-00621.

## 11.0 APPARATUS AND MATERIALS

11.1 Chemicals / Solvents:

11.1.1 Ammonium Acetate ( $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ ), reagent grade  
(Sigma-Aldrich, p/n: A7262)

11.1.2 Ammonium hydroxide Solution ( $\text{NH}_4\text{OH}$ ), approx. 14.8M, reagent grade  
(Fisher Scientific, p/n: A669)

11.1.3 Formic Acid ( $\text{HCOOH}$ ), reagent grade  
(Sigma-Aldrich, p/n: F0507)

11.1.4 Acetonitrile ( $\text{CH}_3\text{CN}$ ), reagent grade  
(Sigma-Aldrich, p/n: 34967)

11.1.5 Methanol ( $\text{CH}_3\text{OH}$ ), reagent grade  
(Fisher Scientific, p/n: A454)

11.1.6 Trizma<sup>®</sup> Pre-set Crystals  
(Sigma-Aldrich, p/n: T7193)

11.1.7 Reagent Water, LCMS (or HPLC) Grade  
(VWR, p/n: CAWX0001-1 or Fisher p/n: W6-4)

*New lots of reagent water should be verified to be free of the target analytes prior to use.*

11.2 Laboratory Supplies / Consumables:

11.2.1 120 mL HDPE bottles with unlined caps  
(Systems Plus Ltd, p/n: WPN120)  
*(Equivalent sized bottles may be substituted)*

11.2.2 50 mL disposable screw-capped polypropylene centrifuge tubes  
(Fisher Scientific, p/n: 06-443-19)

11.2.3 15 mL disposable screw-cap polypropylene centrifuge tubes  
(Fisher Scientific, p/n: 05-539-12)

11.2.4 10 mL (17x100mm) disposable polypropylene culture tubes  
(Fisher Scientific, p/n: 351071)

11.2.5 50 mL disposable screw-cap high-speed polypropylene centrifuge tubes,  
capable of being centrifuged at 13,000rpm  
(Fisher Scientific, p/n: 05-529-1D)



- 11.2.6 Disposable polyethylene transfer pipettes, 3 mL  
(Fisher Scientific, p/n: 13-711-7M)
- 11.2.7 Pipette tips, various sizes
- 11.2.8 Waters Oasis WAX 3cc solid phase extraction cartridge, 60mg/60 $\mu$ m  
(Waters, p/n: 186002492)
- 11.2.9 Polypropylene snap top vials, 0.3 mL  
(Canadian Life Sciences, p/n: V0300P-1232)
- 11.2.10 Polyethylene vial snap caps (PVDC/Silicone Septa)  
(Canadian Life Sciences, p/n: C299-11)
- 11.2.11 pH indicator strips, pH range 0-6  
(VWR, p/n: CA1.09531.0001)
- 11.2.12 Class A glass volumetric flasks, various sizes, with glass stoppers
- 11.2.13 Ottawa Sand (Fisher Scientific, p/n: S23-3)
- 11.3 Laboratory Equipment:
  - 11.3.1 Analytical balance accurate to 0.0001g
  - 11.3.2 Top Loading Balance, electronic, 0.01 g sensitivity
  - 11.3.3 Mechanical shaking device
  - 11.3.4 Centrifuges, bench top with 50 mL tube carriers, capable of 4000 rpm and 13,000 rpm
  - 11.3.5 Vortex mixer
  - 11.3.6 Ultrasonic Bath
  - 11.3.7 Adjustable pipettes, various sizes
  - 11.3.8 Solid phase extraction sample reservoirs, polypropylene, 20 mL  
(Supelco, p/n: 57021)
  - 11.3.9 Solid phase extraction tube adaptors  
(Supelco, p/n: 57020-U)
  - 11.3.10 Solid phase extraction vacuum manifold (24 port)  
(Supelco p/n: 57250-U)
  - 11.3.11 Stainless steel solvent guide needles (for SPE manifold)  
(Supelco, p/n: 57036)
  - 11.3.12 pH Meter (Fisher Scientific Accumet AP61)

#### 11.4 Analytical Equipment:

- 11.4.1 Liquid chromatography column, Phenomenex Kinetex PFP, 2.1x100mm, 2.6  $\mu$ m (Phenomenex p/n: 00D-4477-AN)
- 11.4.2 Agilent 1290 Infinity Series Binary Pump (G4220A)
- 11.4.3 Agilent 1290 Infinity Series Autosampler (G4226A)
- 11.4.4 Agilent 1290 Infinity Series Thermostatted Column Compartment (G1316C)
- 11.4.5 Tandem Mass Spectrometer (MS/MS)
- 11.4.6 Analyst™ or MassHunter operating software

**Note: Equivalent apparatus or materials may be substituted.**

## 12.0 REAGENTS AND STANDARD PREPARATION

Reagents and standards must be prepared as specified in CAM WI-00010. They must be identified in such a way that each solution has a unique ID. This unique ID distinguishes the solution from all other solutions, even (and especially) the same solution prepared on a different day. Refer to CAM WI-00010 for reagent labeling requirements.

Solutions may be prepared in alternate volumes as long as the solute concentrations are maintained. Expiry dates for the solutions are the earliest of that included with the reagent preparation instructions below or any component expiry date. Expiry dates for purchased stock solutions are as provided by the supplier, or according to CAM WI-00010. Refer to CAM WI-00010 for expiry dates of solid and liquid chemicals. Reagents are stored at room temperature unless specified below. Temperatures of refrigerators and freezers are monitored according to CAM WI-00008.

Analytical balances (COR WI-00015) are used for weighing chemicals; pipettes & dispensers, and Class A volumetric flasks are verified according to COR WI-00017 for measuring volumes.

Certificate of Analyses (C of A) are kept for all purchased standards and reagents utilized. The C of A may be scanned and saved in Lotus Notes or a copy may be kept in a workstation binder.

#### 12.1 Reagents:

##### 12.1.1 Reagent water at pH 4-5

Add 0.2% formic acid dropwise (~ 3 mL will be required) to approximately 1 L of reagent water until a pH of 4-5 is achieved. Prepare fresh daily.

##### 12.1.2 2 % Formic acid in reagent water:

2 mL of formic acid is added to 98 mL of reagent water. Store at room temperature for up to 2 months.

- 12.1.3 0.2 % Formic acid in reagent water:  
0.2 mL of formic acid is added to 99.8 mL of reagent water. Store at room temperature for up to 2 months.
- 12.1.4 (60/40) Water/Methanol Solution:  
400 mL of methanol is added to 600 mL of reagent water. Store at room temperature for up to 2 months.
- 12.1.5 (70/30) Methanol/Water Solution:  
700 mL of methanol is added to 300 mL of reagent water. Store at room temperature for up to 2 months.
- 12.1.6 0.2% Ammonium hydroxide in methanol solution:  
0.2 mL of ammonium hydroxide solution is added to approx. 90 mL of methanol. The solution is topped up to 100 mL in a measuring cylinder. This solution is prepared fresh daily.
- 12.1.7 0.3 % Ammonium hydroxide in methanol solution:  
0.3 mL of ammonium hydroxide solution is added to approx. 90 mL of methanol. The solution is topped up to 100 mL in a measuring cylinder. This solution is prepared fresh prior to its use in the preparation of standards.
- 12.1.8 2% ammonium hydroxide in reagent water:  
2 mL of ammonium hydroxide solution is added to 99.8 mL of reagent water. Store at room temperature for up to 2 months.
- 12.1.9 20 mM ammonium acetate solution (mobile phase A):  
Dissolve 1.54 g of ammonium acetate in 1L of reagent water. Store at room temperature for up to 2 months.
- 12.1.10 (50/50) Methanol / Acetonitrile:  
Add 500 mL of acetonitrile to 500 mL of methanol. Store at room temperature for up to 2 months.
- 12.1.11 Methanol (mobile phase B): Used as received.

## 12.2 Stock Standard Preparation:

Standard solutions are prepared in glass volumetric flasks that have been scrupulously cleaned. In order to minimize the potential adsorption of PFCs to the glass surface of volumetric flasks, standard solutions should be prepared within a short length of time and transferred immediately to polypropylene screw-capped tubes for storage. Avoid the use of PTFE-coated volumetric flask stoppers by using glass stoppers instead.

Soiled volumetric flasks should be rinsed out immediately and soaked in soapy water until they can be washed.

#### 12.2.1 Stock Standard Solutions:

Stock standard solutions may be purchased from Wellington Laboratories as solutions in ampoules (or equivalent). Refer to C of A for purity specifications, storage conditions and expiration dates. All stock standards are provided as 50 µg/mL solutions. PFBS, br-PFHxS, PFHpS, br-PFOSK, PFDS, 6:2FTS and 8:2FTS stock standards require correction for either the potassium or sodium salt. The following table provides the product codes and concentrations for each anion:

Product Name	Parameter	Product Code	Concentration of Anion (µg/mL)
Perfluoro-n-butanoic acid	PFBA	PFBA	50
Potassium perfluoro-1-butanesulfonate	PFBS	L-PFBS	44.2
Perfluoro-n-pentanoic acid	PFPeA	PFPeA	50
Perfluoro-n-hexanoic acid	PFHxA	PFHxA	50
Sodium perfluoro-1-hexanesulfonate	PFHxS	br-PFHxSK	45.5
Perfluoro-n-heptanoic acid	PFHpA	PFHpA	50
Sodium perfluoro-1-heptanesulfonate	PFHpS	L-PFHpS	47.6
Perfluoro-n-octanoic acid	PFOA	PFOA	50
Potassium perfluorooctanesulfonate*	PFOS	brPFOSK	46.4
Perfluoro-n-nonanoic acid	PFNA	PFNA	50
Perfluoro-n-decanoic acid	PFDA	PFDA	50
Sodium perfluoro-1-decanesulfonate	PFDS	L-PFDS	48.2
Perfluoro-n-undecanoic acid	PFUnA	PFUdA	50
Perfluoro-n-dodecanoic acid	PFDoA	PFDoA	50

Perfluoro-n-tridecanoic acid	PFTrDA	PFTrDA	50
Perfluoro-n-tetradecanoic acid	PFTeDA	PFTeDA	50
Perfluoro-1-octanesulfonamide	PFOSA	FOSA-I	50
N-methylperfluoro-1-octanesulfonamide	MeFOSA	N-MeFOSA-M	50
N-ethylperfluoro-1-octanesulfonamide	EtFOSA	N-EtFOSA-M	50
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	MeFOSE	N-MeFOSE-M	50
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	EtFOSE	N-EtFOSE-M	50
N-methylperfluoro-1-octanesulfonamidoacetic acid	MeFOSAA	N-MeFOSAA	50
N-ethylperfluoro-1-octanesulfonamidoacetic acid	EtFOSAA	N-EtFOSAA	50
Sodium 1H, 1H, 2H, 2H-perfluorooctane sulfonate	6:2FTS	6:2FTS	47.4
Sodium 1H, 1H, 2H, 2H-perfluorodecane sulfonate	8:2FTS	8:2FTS	47.9

*\*brPFOSK and brPFHxS is a mixture of linear and branched isomers*

## 12.2.2 Preparation of Composite PFC Working Solutions:

### 12.2.2.1 Composite PFC Working Solution A (1.0 µg/mL)

Prepare the working solution from the stock standards in a 10 mL volumetric flask according to the table below. Volumes may need to be adjusted depending on the stock concentrations. Store in a freezer for up to 1 year.

Parameter	Conc. Of Stock Standard (µg/mL)	Vol. Of Stock Standard (µL)	Dilution Volume	Final Conc. (µg/mL)
PFBA	50	200	Dilute to 10 mL with 0.3% NH <sub>4</sub> OH in methanol in a volumetric flask	1
PFBS	44.2	226		1
PFPeA	50	200		1
PFHxA	50	200		1

PFHxS	45.5	211		1
PFHpA	50	200		1
PFHpS	47.6	210		1
PFOA	50	200		1
PFOS	46.4	216		1
PFNA	50	200		1
PFDA	50	200		1
PFDS	48.2	207		1
PFUnA	50	200		1
PFDoA	50	200		1
PFTTrDA	50	200		1
PFTeDA	50	200		1
PFOSA	50	200		1
MeFOSA	50	200		1
EtFOSA	50	200		1
MeFOSE	50	200		1
EtFOSE	50	200		1
MeFOSAA	50	200		1
EtFOSAA	50	200		1
6:2-FTS	47.4	211		1
8:2-FTS	47.9	209		1

12.2.2.2 Composite PFC Working Solution B (300 ng/mL)

Pipet 3.0 mL of Composite PFC Working Solution A into a 10 mL volumetric flask and dilute to volume with 0.3% NH<sub>4</sub>OH in methanol. Store in a freezer for up to 1 year.

12.2.2.3 Composite PFC Working Solution C (100 ng/mL)

Pipet 1 mL of Composite PFC Working Solution A into a 10 mL volumetric flask and dilute to volume with 0.3% NH<sub>4</sub>OH in methanol. Store in a freezer for up to 1 year.

12.2.2.4 Composite PFC Working Solution D (30 ng/mL)

Pipet 1 mL of Composite PFC Working Solution B into a 10 mL volumetric flask and dilute to volume with 0.3% NH<sub>4</sub>OH in methanol. Store in a freezer for up to 1 year.

12.2.3 Preparation of Initial Calibration Standards (ICAL):

Refer to **Tables 1-3** for Initial Calibration Standard preparation procedures.

12.3 Preparation of Second Source Standards:

Second source standards are obtained, when possible, from a different manufacturer or the same manufacturer but different lot number from those used for calibration standards. When a second source standard is not available, second source standards can be prepared from the same source as the calibration standards, but prepared by a different analyst, or the same analyst on a different day.

12.3.1 Second Source Spiking Solution A (1.0 µg/mL):

The Second Source Spiking Solution A can be prepared in a similar way as Composite PFC Working Solution A (1.0 µg/mL). Refer to Section 12.2.2.1. Store in a freezer for up to 1 year.

12.3.2 Preparation of Initial Calibration Verification Standard (ICV):

Refer to **Tables 4-6** for ICV preparation procedures.

12.4 Preparation of Mass-Labeled Internal Standards (IS):

Mass-labeled stock solutions may be purchased from Wellington Laboratories as solutions in ampoules (or equivalent). The following table provides the product codes and concentrations for each labeled internal standard. Refer to C of A for storage conditions and expiration date.

Product Name	Product Code	Concentration (µg/mL)

Perfluoro-n-[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]butanoic acid	MPFBA	50
Perfluoro-n-[ <sup>13</sup> C <sub>5</sub> ]pentanoic acid	M5PFPeA	50
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]hexanoic acid	MPFHxA	50
Sodium perfluoro-1-hexane[ <sup>18</sup> O <sub>2</sub> ]sulfonate	MPFHxS	50
Perfluoro-n-[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]heptanoic acid	M4PFHpA	50
Perfluoro-n-[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]octanoic acid	MPFOA	50
Sodium perfluoro-1-[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]octanesulfonate	MPFOS	50
Perfluoro-n-[1,2,3,4,5- <sup>13</sup> C <sub>5</sub> ]nonanoic acid	MPFNA	50
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]decanoic acid	MPFDA	50
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]undecanoic acid	MPFUdA	50
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]dodecanoic acid	MPFDoA	50
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]tetradecanoic acid	M2PFTeDA	50
Perfluoro-1-[ <sup>13</sup> C <sub>8</sub> ]octanesulfonamide	M8FOSA-M	50
N-methyl-d <sub>3</sub> -perfluoro-1-octanesulfonamide	d-N-MeFOSA-M	50
N-ethyl-d <sub>5</sub> -perfluoro-1-octanesulfonamide	d-N-EtFOSA-M	50
2-(N-methyl-d <sub>3</sub> -perfluoro-1-octanesulfonamido)ethan-d <sub>4</sub> -ol	d7-N-MeFOSE-M	50
2-(N-ethyl-d <sub>5</sub> -perfluoro-1-octanesulfonamido)-ethan-d <sub>4</sub> -ol	d9-N-EtFOSE-M	50
N-methyl-d <sub>3</sub> -perfluoro-1-octanesulfonamidoacetic acid	d3-N-MeFOSAA	50
N-ethyl-d <sub>5</sub> -perfluoro-1-octanesulfonamidoacetic acid	d5-N-EtFOSAA	50
Sodium 1H,1H,2H,2H-perfluoro-1-(1,2- <sup>13</sup> C <sub>2</sub> )-octane sulfonate	M2-6:2FTS	50
Sodium 1H,1H,2H,2H-perfluoro-1-(1,2- <sup>13</sup> C <sub>2</sub> )-decane sulfonate	M2-8:2FTS	50

#### 12.4.1 Preparation of Mass-Labeled IS Spiking Solution:



Prepare the mass-labeled IS solution using the mass-labeled stock standards in a 50 mL volumetric flask according to the table below. Store in the freezer for up to 5 years.

Parameter	Conc. Of Stock Standard (µg/mL)	Vol. Of Stock Standard (µL)	Dilution Volume	Final Conc. (ng/mL)
MPFBA	50	50	Dilute to 50 mL with 0.3% NH <sub>4</sub> OH in methanol in a volumetric flask	50
MPFPeA	50	50		50
MPFHxA	50	50		50
MPFHxS	50	50		50
MPFHpA	50	50		50
MPFOA	50	50		50
MPFOS	50	50		50
MPFNA	50	50		50
MPFDA	50	50		50
MPFUdA	50	50		50
MPFDoA	50	50		50
MPFTeDA	50	50		50
MPFOSA	50	50		50
D3-MeFOSA	50	125		125
D5-EtFOSA	50	125		125
D7-MeFOSE	50	125		125
D9-EtFOSE	50	125		125
D3-MeFOSAA	50	50		50
D5-EtFOSAA	50	50		50

M2-6:2FTS	50	125		125
M2-8:2FTS	50	125		125

### 12.5 Preparation of Injection Internal Standard:

Injection internal standard stock solutions may be purchased from Cambridge Isotope Laboratories (CIL) as solutions in ampoules (or equivalent). The following table provides the catalogue numbers and concentration. Refer to C of A for storage conditions and expiry date.

Compound Name	Abbreviation	Cat. No.	Concentration (µg/mL)
<sup>13</sup> C <sub>6</sub> -Perfluorohexanoic acid	13C6-PFHxA	CLM-8340-1.2	50
<sup>13</sup> C <sub>9</sub> -Perfluorodecanoic acid	13C9-PFDA	CLM-8172-1.2	50

#### 12.5.1 Preparation of Composite Injection Internal Standard Solution (100 ng/mL):

Prepare a composite injection internal standard solution according to the table below in a 10 mL volumetric flask. Store in the freezer for up to 1 year.

Parameter	Conc. Of Stock Standard (µg/mL)	Vol. Of Stock Standard (µL)	Dilution Volume (mL)	Final Conc. (ng/mL)
13C6-PFHxA	50	20	Dilute to 10 mL with 0.3% NH <sub>4</sub> OH in methanol in a volumetric flask	100
13C9-PFDA	50	20		100

## 13.0 SAMPLE PREPARATION

### 13.1 Aqueous Sample Preparation (High Level Analysis):

13.1.1 Homogenize each sample by gently mixing the sample bottle by hand.

13.1.2 Prepare the following Quality Control Samples and extract along with the unknown field samples:

13.1.2.1 Matrix (Method) Blank:

Aliquot 750  $\mu$ L of reagent water into a 15 mL polypropylene tube.

13.1.2.2 Spiked Blank (Laboratory Control Sample - LCS):

Aliquot 750  $\mu$ L of reagent water into a 15 mL polypropylene tube. Fortify the sample with 21  $\mu$ L of PFC Spiking Solution A (1.0  $\mu$ g/mL) to give a final concentration of 28  $\mu$ g/L.

13.1.2.3 Matrix Spike:

Select an unknown field sample and transfer a 750  $\mu$ L aliquot into a 15 mL polypropylene tube. Fortify the sample with 21  $\mu$ L of PFC Spiking Solution A (1.0  $\mu$ g/mL) to give a final concentration of 28  $\mu$ g/L.

13.1.2.4 Matrix Spike Duplicate (if required):

Transfer an additional 750  $\mu$ L of the unknown field sample selected as the matrix spike above into a 15 mL polypropylene tube. Fortify the duplicate sample with 21  $\mu$ L of PFC Spiking Solution A (1.0  $\mu$ g/mL) to give a final concentration of 28  $\mu$ g/L. If insufficient volume exists for a MSD, a Spike Duplicate can be prepared in its place.

13.1.3 Aliquot 750  $\mu$ L of each field sample into labeled 15 mL disposable polypropylene culture tubes. Select one sample and perform an additional 750  $\mu$ L aliquot for duplicate analysis.

*Note: A sample duplicate is not required if a Matrix Spike Duplicate has been prepared, unless specified by the client.*

13.1.4 Add 100  $\mu$ L of Mass-Labeled IS Solution to all QCs and field samples.

13.1.5 Pipet 500  $\mu$ L of methanol to all QC and field samples and vortex carefully.

13.1.6 Pipet 180  $\mu$ L of each sample to 0.3 mL polypropylene vials and add 20  $\mu$ L of Injection Internal Standard solution. Cap with polyethylene snap caps. Vortex to mix.

13.2 Aqueous Sample Preparation (Low Level Analysis):

13.2.1 Homogenize each sample by gently mixing the sample bottle by hand. Any water sample containing visible turbidity, visible particulates, or may cause the SPE to become plugged must be centrifuged to separate particulates from

the clear aqueous portion before extraction and analysis. The clear aqueous portion of the sample should then be decanted, extracted using SPE, and analyzed. Any associated particulates will not be analyzed. Sample description before and after centrifuging (e.g., clear, opalescent, weakly turbid, strongly turbid, opaque) should be documented on the worksheet (and the associated case narrative where applicable). If centrifuging the samples does not separate the particulates from the clear aqueous portion or if SPEs still become plugged, the laboratory should notify the Project Manager.

13.2.2 Prepare the following Quality Control samples and extract along with the unknown field samples:

13.2.2.1 Matrix (Method) Blank:

Transfer 125 mL of reagent water (adjusted to pH 4-5) to a HDPE bottle.

13.2.2.2 Spiked Blank (Laboratory Control Sample – LCS):

Transfer 125 mL of reagent water (adjusted to pH 4-5) to a HDPE bottle. Fortify the sample with 62.5  $\mu\text{L}$  of PFC Spiking Solution A (1.0  $\mu\text{g}/\text{mL}$ ) to give a final concentration of 0.5  $\mu\text{g}/\text{L}$ .

13.2.2.3 Matrix Spike:

Select an unknown field sample and transfer 125 mL to a pre-calibrated HDPE bottle. Fortify the sample with 62.5  $\mu\text{L}$  of PFC Spiking Solution A (1.0  $\mu\text{g}/\text{mL}$ ) to give a final concentration of 0.5  $\mu\text{g}/\text{L}$ .

13.2.2.4 Matrix Spike Duplicate (if required):

Transfer an additional 125 mL of the field sample selected as the matrix spike above to a pre-calibrated HDPE bottle. Fortify the matrix spike duplicate with 62.5  $\mu\text{L}$  of PFC Spiking Solution A (1.0  $\mu\text{g}/\text{mL}$ ) to give a final concentration of 0.5  $\mu\text{g}/\text{L}$ .

13.2.3 Transfer 125 mL of each field sample to pre-calibrated HDPE.

*In some instances (e.g. suspected high concentrations as noted by the client or based on site history, the nature of the matrix, etc.) dilutions may be performed on samples by taking a smaller initial sample aliquot.*

13.2.4 Select one sample for duplicate analysis and transfer an additional 125 mL to a pre-calibrated HDPE bottle.

*Note: A sample duplicate is not required if a Matrix Spike Duplicate has been prepared, unless specified by the client.*

- 13.2.5 Add 150  $\mu$ L of Mass-Labeled IS Solution to all QCs and field samples and swirl gently to mix.
- 13.2.6 Adjust the pH of the unknown field samples (and the Matrix Spike and duplicate) to between pH 4-5 using 0.2% formic acid, 2% formic acid and/or 2% ammonium hydroxide. *(To prevent cross contamination, the use of disposable pH indicator strips is recommended)*
- 13.2.7 Prepare the SPE manifold by labeling and attaching 3cc/60mg/60 $\mu$ m Oasis WAX SPE cartridges to every other flow valve.
- 13.2.8 Install stainless steel solvent guide needles on to the SPE manifold.
- 13.2.9 Condition each cartridge with:
- 3 mL of 0.2% Ammonium hydroxide in methanol
  - 3 mL of methanol
  - 3 mL of reagent water
- Elute each to waste by gravity.
- 13.2.10 Close the SPE manifold flow control valves.
- 13.2.11 Add approximately 3 mL of reagent water (pH 4-5) to each SPE cartridge.
- 13.2.12 Attach an SPE tube adaptor and 20 mL reservoir to the top of each SPE cartridge.
- 13.2.13 Transfer the samples to the sample reservoirs then open the SPE manifold control valve. Allow the samples to pass to waste by gravity. For difficult samples, a low vacuum (~1 mL/min) may be used to pass these samples through the cartridges. *Retain the sample bottles for rinsing in Step 13.2.16.*
- 13.2.14 Once the samples have passed through the SPE cartridges, remove the reservoirs *(retain for rinsing in step 13.2.16)* and tube adaptors and wash each cartridge with:
- 3 mL of 2% formic acid solution
  - 3 mL of (60/40) water/methanol solution
- Elute each to waste by gravity then dry the cartridges under maximum vacuum for approximately 5 minutes.
- 13.2.15 Place labeled polypropylene tubes, pre-calibrated to 3 mL, into the manifold rack to collect the eluate. If necessary, use clean laboratory tissues to wipe any liquid droplets off each stainless steel needle guide (do not cross-contaminate samples).
- 13.2.16 Add 3 mL of 0.2% ammonium hydroxide in methanol to each retained 125 mL sample bottle and rinse the inner walls of the bottles using disposable

transfer pipets. Using the same rinsate, rinse the inner walls of retained reservoirs, collecting the rinsate in the corresponding 125 mL sample bottle.

13.2.17 Transfer the 0.2% ammonium hydroxide rinsate to the corresponding SPE cartridges, rinsing the walls of the SPE cartridges in the process. Ensure all of the solution is transferred to the SPE cartridge. Allow to elute by gravity. A low vacuum may be used to elute the last drops.

13.2.18 Remove the sample extracts from the extraction manifold. If necessary, top up the sample extracts to the 3 mL calibration mark with 0.2% ammonium hydroxide in methanol.

13.2.18.1 *For low level analysis (PFOSLOW-W), dry the sample extracts under a steady stream of nitrogen at approximately 45°C (± 10°C). Once dryness has been achieved, reconstitute the samples with 0.3 mL of methanol. Proceed to step 13.2.19.*

13.2.19 Gently vortex the collection tubes to mix and pipet 180 µL of each eluate to 0.3 mL polypropylene vials. Add 20 µL of injection internal standard solution to each vial and cap with polyethylene snap caps. Vortex to mix.

**Note:** *Reservoirs, adaptors and stainless steel guide needles should be soaked in soapy water immediately after the extraction until they can be washed.*

### 13.3 Soil Sample Preparation:

**Note:** *Homogenize approx. 50 g of sample using a stainless steel spatula or scoopula before weighing out.*

13.3.1 Prepare the following Quality Control Samples:

13.3.1.1 Matrix (Method) Blank:

Weigh 3–4 g of Ottawa Sand into a 50 mL polypropylene centrifuge tube.

13.3.1.2 Spiked Blank (Laboratory Control Sample – LCS):

Weigh 3-4 g of Ottawa Sand into a 50 mL polypropylene centrifuge tube. Fortify the sample with 75 µL of PFC Spiking Solution A (1.0 µg/mL) to yield a matrix equivalent concentration of 25 µg/kg.

13.3.1.3 Matrix Spike:

Weigh 3-4 g of an unknown field sample into a 50 mL polypropylene centrifuge tube. Fortify the sample with 75 µL of PFC Spiking Solution A (1.0 µg/mL) to yield a matrix equivalent concentration of 25 µg/kg.

13.3.1.4 Matrix Spike Duplicate (if required):

Weigh an additional 3-4 g of the unknown field sample selected as the matrix spike into a 50 mL polypropylene centrifuge tube. Fortify the sample with 75  $\mu$ L of PFC Spiking Solution A (1.0  $\mu$ g/mL) to yield a matrix equivalent concentration of 25  $\mu$ g/kg.

- 13.3.2 Weigh 3-4 g of each field sample into labeled 50 mL polypropylene centrifuge tubes. Select one sample and perform an additional weighing for duplicate analysis.

*Note: A sample duplicate is not required if a Matrix Spike Duplicate has been prepared, unless specified by the client.*

- 13.3.3 Add 200  $\mu$ L of Mass-Labeled IS Solution to all QCs and field samples.
- 13.3.4 Add 8 mL of (70/30) methanol/water solution to each sample tube. Cap and vortex to mix.
- 13.3.5 Place QC and sample tubes in an ultrasonic bath at ambient temperature for 30 minutes. After 30 minutes, vortex the samples briefly to mix.
- 13.3.6 Centrifuge the tubes for 10 minutes at 4000 rpm (ambient temperature).
- 13.3.7 Transfer 4 mL of each supernatant into new 50 mL polypropylene centrifuge tubes. *Retain the remaining sample extract in case dilutions are necessary.*
- 13.3.8 Add 16 mL of reagent water to the supernatant aliquots. Adjust to pH 4-5 using 0.2% formic acid solution (and/or 2% formic acid / 2% ammonium hydroxide solution). *(To prevent cross contamination, the use of disposable pH indicator strips is recommended)*
- 13.3.9 Prepare the SPE manifold by labeling and attaching 3cc/60mg/60 $\mu$ m Oasis WAX SPE cartridges to the flow valves.
- 13.3.10 Install stainless steel solvent guide needles on to the SPE manifold.
- 13.3.11 Condition each cartridge with:
- 3 mL of 0.2% ammonium hydroxide in methanol
  - 3 mL of methanol
  - 3 mL of reagent water
- Elute each to waste by gravity.
- 13.3.12 Load the QCs and samples into the corresponding SPE cartridges by carefully pouring or transferring using a polyethylene transfer pipet. Allow to pass by gravity. For difficult samples, a low vacuum (~1 mL/min) may be used to pass these samples through the cartridges. Retain the 50 mL sample tubes and transfer pipets for rinsing in Step 13.3.15.

- 13.3.13 Wash the cartridges with:
- 3 mL of 2% formic acid solution
  - 3 mL of (60/40) water/methanol
- Elute each to waste by gravity. Once both have passed, dry cartridges under a high vacuum for approximately 5 minutes.
- 13.3.14 Place labeled polypropylene tubes, pre-calibrated to 2 mL, into the manifold rack to collect the eluate. Using clean laboratory tissues, wipe any liquid droplets off each stainless steel needle guide (do not cross-contaminate samples).
- 13.3.15 Pipet 2 mL of 0.2% ammonium hydroxide in methanol solution to each of the retained 50 mL sample tubes.
- 13.3.16 Cap the tubes and rinse the walls and cap by briefly vortexing.
- 13.3.17 Using the corresponding retained transfer pipets; transfer the 0.2% ammonium hydroxide rinsate to each SPE cartridge, rinsing the walls of the SPE cartridge in the process. Ensure all of the solution is transferred to the SPE cartridge.
- 13.3.18 Allow to elute by gravity, using vacuum to elute the last drops.
- 13.3.19 Remove the sample extracts from the extraction manifold. If necessary, top up the sample extracts to the 2 mL calibration mark with 0.2% ammonium hydroxide in methanol.
- 13.3.20 Gently vortex the collection tubes to mix and pipet 180  $\mu$ L of each eluate to 0.3 mL polypropylene vials. Add 20  $\mu$ L of injection internal standard solution to each vial and cap with polyethylene snap caps. Vortex to mix.

## 14.0 ANALYTICAL DETERMINATION

### 14.1 Analysis:

14.1.1 Configure the LC/MS/MS for PFC analysis according to the chromatographic and mass spectrometer conditions below (Sec 14.2-14.5). Refer to CAM WI-00506 for LC/MS/MS start up procedure, system performance check(s) and performance optimization.

#### 14.1.2 Calibration Frequency:

An initial calibration is performed daily, prior to the analysis of test samples. Refer to Sec 15.1 for acceptance criteria.

#### 14.1.3 Acquisition Methods:

PFC\_Water\_Low.dam



PFC\_Water\_High.dam  
 PFC\_Water\_Low\_FOSAA.dam  
 PFC\_Water\_High\_FOSAA.dam  
 PFC\_Soil.dam  
 PFC\_Soil\_FOSAA.dam

14.2 Typical Run Format:

1. Solvent (optional, typically methanol)
2. Matrix (Method) Blank
3. Initial Calibration (Cal Stds 1-6, in ascending order)
4. Initial Calibration Verification Standard (ICV)
5. Continuing Calibration Verification (CCV) Standard (i.e. Std 4)
6. Matrix Spike
7. Matrix Spike Duplicate (if applicable)
8. Spiked Blank/LCS
9. Test samples 1-20 (including sample duplicate, if applicable)
10. End analysis with Continuous Calibration Verification (CCV) Std (i.e Std 4)

*Note: For DoD Jobs, the CCV must be analyzed after every tenth field sample and at the end of the analysis*

14.3 Chromatographic Conditions:

Mobile phase A (MPA): 20 mM Ammonium Acetate Solution  
 Mobile phase B (MPB): Methanol  
 Elution mode: Gradient (refer to profile below)

Time (min)	% A	% B
0.0	60	40
0.3	60	40
2.0	10	90
3.5	10	90
3.6	60	40
4.5	60	40

Flow rate: 0.58 mL/min  
 Column: Phenomenex Kinetex PFP, 2.1x100mm, 2.6 µm

Column Temperature: 35°C  
 Run time: 4.5 minutes  
 Typical injection volume: 3.0 µL

MeFOSAA & EtFOSAA (*All FOSAA.dam acquisition methods*):

Mobile phase A (MPA): 20 mM Ammonium Acetate Solution  
 Mobile phase B (MPB): (50/50) Methanol / Acetonitrile  
 Elution mode: Gradient (refer to profile below)

Time (min)	% A	% B
0.0	40	60
0.5	40	60
1.0	10	90
1.5	10	90
1.6	40	60
2.0	40	60

Flow rate: 0.6 mL/min  
 Column: Phenomenex Kinetex PFP, 2.1x100mm, 2.6 µm  
 Column Temperature: 35°C  
 Run time: 2 minutes  
 Typical injection volume: 3.0 µL

14.4 Mass Spectrometer Settings:

14.4.1 Agilent 6470 Mass Spectrometer

Mass analyzer	Tandem Mass Spectrometer (MS/MS)
Ion source	Electro spray ionization (ESI)
Polarity	Negative
Scan type	MRM
Capillary voltage	3500
Nebulizer pressure (psi)	55
Gas temperature	300
Gas flow (L/min)	11

Sheath gas heater temperature	325
Sheath gas flow	11
Cell accelerator voltage	4
Fragmentor voltage	Compound dependent, refer to Table 7
Collision energy (CE)	Compound dependent, refer to Table 7

#### 14.4.2 Sciex QTrap 5500 Mass Spectrometer

Mass analyzer	Tandem Mass Spectrometer (MS/MS)
Ion source	Electro spray ionization (ESI)
Polarity	Negative
Scan type	MRM
Curtain gas (CUR)	20
Collision gas thickness (CAD)	Medium
IonSpray voltage (ISV)	-4000
Ion source gas (GS1)	50.0
Ion source gas (GS2)	50.0
Temperature (TEM)	575
Entrance potential (EP)	-10
Declustering potential (DP)	Compound dependent, refer to Table 7
Collision energy (CE)	Compound dependent, refer to Table 7
Collision cell exit potential (CXP)	Compound dependent, refer to Table 7

#### 14.3 MS/MS Method Ions:

Refer to **Table 7** for Ions.

***Mass spectrometer conditions should be used as guidelines and may be adjusted for the purpose of optimizing mass resolution, sensitivity and may differ slightly for each individual instrument.***

## 15.0 QUALITY CONTROL REQUIREMENTS

### 15.1 Calibration:

#### 15.1.1 Initial Calibration:

Establish the initial calibration curve (Sec 12.2.3) by plotting the area ratio (response ratio) for each standard against the concentration using an isotope dilution calibration method.

A first-order linear regression calibration model (i.e.,  $y = mx + b$  function) is used.

$y = \text{Standard peak area ratio (peak area of native analyte / peak area of mass-labeled IS compound)}$

$x = \text{Standard concentration (ng/mL)}$

$m = \text{Slope}$

$b = \text{Intercept}$

#### **Acceptance Criteria: Refer to Table 8**

A minimum of 5 calibration standards are used to generate the curve and should be analyzed with each analytical sequence.

#### Corrective Action(s):

- If the acceptance criteria cannot be met and the problem appears to be associated with a single standard, that standard may be re-analyzed (once). Replacing the standard may be necessary in some cases.
- Re-prepare and re-analyze the initial calibration (if a new calibration is prepared, all of the results from the original analysis should be discarded).
- Narrowing the calibration range by removing data points from either extreme ends of the range is permissible. There must still be a minimum of five standards remaining for establishing linearity.

#### 15.1.2 Initial Calibration Verification (ICV):

After the calibration standards have been analyzed and prior to analyzing test samples, the accuracy of the calibration must be verified by the analysis of an ICV standard (Sec 12.3.2).

**Acceptance Criteria: Refer to Table 8**

Corrective Action(s):

- Re-analyze the ICV.
- Prepare and analyze a new ICV.
- Evaluate the initial calibration.

15.1.3 Continuing Calibration Verification (CCV):

Once the calibration curve has been established, the continuing accuracy must be verified by analysis of a CCV (i.e STD 4) at the end of the analytical sequence (maximum of 20 samples).

*Note: For DoD samples, the continuing accuracy of the calibration should be verified after every tenth field sample and at the end of the sequence.*

**Acceptance Criteria: Refer to Table 8**

Corrective Action(s):

- Correct the problem and re-establish continuing calibration. Samples that are not bracketed by acceptable CCV runs must be re-analyzed.
- If a CCV fails, the laboratory can immediately analyze two additional consecutive CCVs (immediately is defined as starting a consecutive pair within one hour; no samples can be run between the failed CCV and the two additional CCVs). This approach allows for spurious failures of analytes to be reported without reanalysis of samples. Any corrective actions that change the dynamics of the system requires that all samples since the last acceptable CCV are reanalyzed. Both of these CCVs must meet acceptance criteria in order for the samples to be reported without reanalysis. If either of these two CCVs fail or if the laboratory cannot immediately analyze two CCVs, the associated samples cannot be reported and must be reanalyzed. Corrective action(s) and recalibration must occur if the above scenario fails. All affected samples since the last acceptable CCV must be reanalyzed. Flagging of data for a failed CCV is only appropriate when the affected samples cannot be reanalyzed. The laboratory must notify the client prior to reporting data associated with a failed CCV

15.2 Quality Control - Sample Preparation and Analysis:

The effect of the matrix on method performance (precision, accuracy, method sensitivity and interference) is evaluated through the analysis of QC samples (including a method blank, spiked blank, matrix spike and matrix spike duplicate or sample

duplicate) in each analytical batch of 20 samples or less. The QC samples are subjected to the same analytical procedures (Sec 13) as those used on field samples.

*For Department of Defense (DoD) related projects, refer to Appendix A for QC requirements and acceptance criteria.*

#### 15.2.1 Method Blank:

**Acceptance Criteria: Analyte concentration < ½ RDL**

*For analyses containing drinking water samples, the analyte concentration(s) in the blank must be < 1/3 RDL*

Corrective Action(s):

- A potential contamination may exist. The analysis should be terminated, the problem corrected and the samples re-extracted and analyzed. If sufficient sample is not available for re-analysis, any positive sample data must be flagged as possibly contaminated to the level found in the method blank.

#### 15.2.2 Spiked Blank (SPK) / Laboratory Control Sample (LCS):

$$\text{Spike Recovery (\%)} = \frac{\text{Measured amount in spiked blank} \times 100}{\text{Amount of spike added}}$$

**Acceptance Criteria: Refer to Table 8**

Corrective Action(s):

- Check for calculation errors.
- Re-analyze the spike.
- Flag the data in Tester's comments.

#### 15.2.3 Matrix Spike (MS):

$$\text{MS Recovery (\%)} = \frac{(\text{Spiked sample result} - \text{Native sample result}) \times 100}{\text{Amount of spike added}}$$

**Acceptance Criteria: Refer to Table 8**

Corrective Action(s):

- Check for calculation errors.

- If % recovery is outside the control limits and all other QC data is within limits, a matrix effect is suspected. Flag the associated data in the Tester's comments.
- If the % recovery cannot be calculated due to high analyte concentration (Concentration of the unknown sample used in the preparation of the matrix spike is > 1/2 the fortification level of the matrix spike) the matrix spike is reported as NC (Not Calculated) and the data is flagged in Tester's comments.

#### 15.2.4 Matrix Spike Duplicate (MSD):

$$RPD (\%) = \frac{(MS \text{ result} - MSD \text{ result})}{(MS \text{ result} + MSD \text{ result})/2} \times 100$$

#### **Acceptance Criteria: Refer to Table 8**

#### Corrective Action(s):

- The corrective actions listed for the matrix spike are also applicable to the matrix spike duplicate.
- Check samples for homogeneity, if not homogeneous, flag the data in Tester's comments.

#### 15.2.5 Laboratory Duplicate:

$$RPD (\%) = \frac{(\text{sample result} - \text{duplicate result})}{(\text{sample result} + \text{duplicate result})/2} \times 100$$

#### **Acceptance Criteria: Refer to Table 8**

#### Corrective Action(s):

- Check for calculation errors.
- Check samples for homogeneity, if not homogeneous, flag the data in Tester's comments.

#### 15.2.6 Mass-Labeled Surrogate Compound Recovery:

Recoveries of following mass-labeled internal standard compounds are calculated according to the procedure below and reported as surrogate recoveries:

13C4-Perfluorooctanoic acid (13C4-PFOA)

13C4-Perfluorooctane sulfonate (13C4-PFOS)

### 13C8-Perfluorooctane sulfonamide (13C8-PFOSA)

*Recoveries of additional mass-labeled compounds may be reported as specified by project requirements. Refer to appendix B*

Using the ICAL, regress the area ratio for each applicable mass-labeled surrogate against its concentration using the injection internal standard as the quantitation reference as indicated in Table 8. Mass-labeled surrogate compounds and injection internal standards are in each calibrator at a constant concentration. The regression will simplify to a single point calibration (linear through zero) because the concentrations are constant.

#### **Acceptance Criteria: Refer to Table 8**

##### Corrective Action(s):

- If an injection error is suspected, re-inject suspect sample(s). If the re-injection produces an acceptable recovery, report the re-injected sample results.
- If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Flag the associated data in the Tester's comments.

#### 15.2.7 Injection Internal Standard Response:

The injection internal standards are quantified by external standard. Regress the area against the concentration of the injection internal standards. The injection internal standards are in each calibrator at a constant concentration. The regression will simplify to a single point calibration (linear through zero) because the concentrations are constant.

#### **Acceptance Criteria: Refer to Table 8**

##### Corrective Action(s):

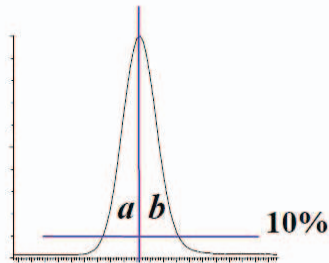
- Re-inject suspect sample(s). If the re-injection produces an acceptable response, report the re-injected sample results.
- If responses are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Flag the associated data in the Tester's comments.
- For failed QC samples, re-prepare and re-analyze the entire batch. If sufficient sample is not available for re-analysis, flag the data in Tester's comments.



### 15.2.8 Peak Asymmetry Factor:

A peak asymmetry factor must be calculated using the equation below every time a calibration curve is generated. The peak asymmetry factor for the first two eluting peaks (PFBA & PFPeA) in a midlevel CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5.

$$As = b/a$$



Where:

As = peak asymmetry factor

b = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex.

a = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

Corrective Action(s):

- Ensure the correct chromatographic conditions are being used (Section 14.3).
- Replace the analytical column and reanalyze the batch.
- Perform instrument maintenance.

### 15.3 Control Charting:

Control charts are generated according to COR WI-00055. Each time a Spiked Blank is analyzed, the % recoveries of PFOS, PFOA and PFOSA in the spiked blank are plotted manually on the control charts. The charts are monitored for out of control points and/or the development of trends. Take action, if necessary, and document on the control charts.

PFC control charts can be found in the LIMS SQC Chart module

#### 15.4 Non Conformance:

All method non-conformances, QC failures or method deviations due to unusual sample matrix, are documented on the worksheet data validation checklist (CAM FCD-01126 or BRL FCD-00002 for DoD Jobs).

### 16.0 DATA INTERPRETATION AND CALCULATIONS

#### 16.1 Calculations

Instrument software calculates concentrations from the calibration curve.

$$\text{Water: Concentration } (\mu\text{g/L}) = \frac{C_s \times V_f}{V_i}$$

$$\text{Soil: Concentration } (\mu\text{g/kg}) = \frac{C_s \times V_f \times A_f}{W}$$

Where:  $C_s$  = Instrument concentration (ng/mL)  
 $V_i$  = Initial sample volume (mL)  
 $V_f$  = Final sample volume (mL)  
 $A_f$  = Aliquot factor  
 $W$  = Dry sample weight (the weight of the sample after moisture has been calculated (g)). Moisture determination is conducted per CAM SOP-00445.

A concentration factor (CF) may be applied to the instrument software in the form of a dilution factor to reflect the value reported with respect to the concentration steps taken.

Examples:

$$\text{Water CF} = (V_f = 3 \text{ mL}) / (V_i = 125 \text{ mL}) = 0.024$$

$$\text{Soil CF} = (V_f = 2 \text{ mL} \times A_f) / (\text{sample dry weight} = 3 \text{ g}) = 1.33$$

#### 16.2 Reporting:

The quantitative values shall be reported in appropriate units, microgram per liter ( $\mu\text{g/L}$ ) for standard water samples, nanogram per liter for (ng/L) low-level water samples and microgram per kilogram ( $\mu\text{g/kg}$ ) for soil samples. Data must be reported to 3 significant figures. The analyst must not extrapolate beyond the established calibration range.

The results for a positive sample can be reported if the following conditions are met:

16.2.1 The supervisor/manager or a qualified designate approves the instrument and analysis performance.

16.2.2 The calibration (Sec. 15.1) and quality control (Sec. 15.2) performance criteria have been satisfied.

16.2.3 All DoD submissions are reported in accordance with appendix A of DoD-ELAP QSM 5.0.

Refer to CAM SOP-00102 for data verification, approval and validation procedures.

### 16.3 Linear and Branched Isomers:

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). As certified quantitative reference material(s) containing both linear and branched isomer become available commercially, they will be incorporated into the method.

### 16.4 Data Storage and Retrieval:

16.4.1 Paper Records: Raw and calculated data, including LIMS work sheet, calibrations and QC results are stored numerically, by worksheet number, in folders in the laboratory as space permits. These files are archived off-site for long-term storage.

16.4.2 Electronic Media: Acquired data is stored on the local hard drive and will be backed up on the network drive as needed. The acquired data stored on the network drive will be archived on CD at a later date or when required.

## 17.0 MAINTENANCE

For maintenance requirements and additional instrument information, refer to CAM WI-00506.

## 18.0 TABLES

Table 1: Initial Calibration Standard Preparation – High Level Aqueous Analysis

Table 2: Initial Calibration Standard Preparation – Aqueous Analysis

Table 3: Initial Calibration Standard Preparation – Soil Analysis

Table 4: Initial Calibration Verification (ICV) Standard Preparation – High Level Aqueous Analysis

Table 5: Initial Calibration Verification (ICV) Standard Preparation – Aqueous Analysis

Table 6: Initial Calibration Verification (ICV) Standard Preparation – Soil Analysis

Table 7: Ions – Analytes and Internal Standards

Table 8: QC Acceptance Criteria and Quantitation References

**Table 1:** Initial Calibration Standard Preparation – High Level Aqueous Analysis

Calibration Standards are prepared in polypropylene tubes according to the following table:

	<b>CS1</b>	<b>CS2</b>	<b>CS3</b>	<b>CS4</b>	<b>CS5</b>	<b>CS6</b>
	0.8 µg/L	1.5 µg/L	6.0 µg/L	15 µg/L	30 µg/L	50 µg/L
	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)
Reagent Water	750	750	750	750	750	750
PFC Working Standard <b>A</b> (1.0 µg/mL)	-	-	-	-	22.5	37.5
PFC Working Standard <b>B</b> (300 ng/mL)	-	-	15	37.5	-	-
PFC Working Standard <b>D</b> (30 ng/mL)	20	37.5	-	-	-	-
Mass-Labeled IS Solution	100	100	100	100	100	100
Methanol	480	463	485	463	478	463

Vortex the calibration standards to mix then pipet 180 µL of each to 0.3 mL polypropylene vials. Add 20 µL of Injection Internal Standard Solution (400 ng/mL) to each vial, cap with polyethylene snap caps and vortex to mix.

**Table 2:** Initial Calibration Standard Preparation – Aqueous Analysis

Calibration Standards are prepared in polypropylene tubes according to the following table:

	<b>CS1</b>	<b>CS2</b>	<b>CS3</b>	<b>CS4</b>	<b>CS5</b>	<b>CS6</b>
	0.83 ng/mL	1.7 ng/mL	5.0 ng/mL	12.5 ng/mL	25 ng/mL	41.7 ng/mL
	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)
PFC Working Standard <b>A</b> (1.0 µg/mL)	-	-	-	37.5	75	125
PFC Working Standard <b>C</b> (100 ng/mL)	25	50	150	-	-	-
Mass-Labeled IS Solution	150	150	150	150	150	150
Methanol	2825	2800	2700	2813	2775	2725

Vortex the calibration standards to mix then pipet 180 µL of each to 0.3 mL polypropylene vials. Add 20 µL of Injection Internal Standard Solution (400 ng/mL) to each vial, cap with polyethylene snap caps and vortex to mix.

**Table 3:** Initial Calibration Standard Preparation – Soil Analysis

Calibration Standards are prepared in polypropylene tubes according to the following table:

	<b>CS1</b>	<b>CS2</b>	<b>CS3</b>	<b>CS4</b>	<b>CS5</b>	<b>CS6</b>
	0.75 ng/mL	1.5 ng/mL	4.5 ng/mL	11.3 ng/mL	22.5 ng/mL	37.5 ng/mL
	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)	Vol Req'd (µL)
PFC Working Standard <b>A</b> (1.0 µg/mL)	-	-	-	22.5	45	75
PFC Working Standard <b>C</b> (100 ng/mL)	15	30	90	-	-	-
Mass-Labeled IS Solution	100	100	100	100	100	100
Methanol	1885	1870	1810	1878	1855	1825

Vortex the calibration standards to mix then pipet 180 µL of each to 0.3 mL polypropylene vials. Add 20 µL of Injection Internal Standard Solution (400 ng/mL) to each vial, cap with polyethylene snap caps and vortex to mix.

**Table 4:** Initial Calibration Verification (ICV) Standard Preparation – High Level Aqueous Analysis

The ICV is prepared in a polypropylene tube according to the following table:

ICV (28 µg/L)	Vol Req'd (µL)
Reagent Water	750
Second Source Spiking Standard <b>A</b> (1.0 µg/mL)	21
Mass-Labeled IS Solution	100
Methanol	500

Vortex the ICV standard to mix then pipet 180 µL of each to 0.3 mL polypropylene vials. Add 20 µL of Injection Internal Standard Solution (400 ng/mL) to each vial, cap with polyethylene snap caps and vortex to mix.

**Table 5:** Initial Calibration Verification (ICV) Standard Preparation – Aqueous Analysis

The ICV is prepared in a polypropylene tube according to the following table:

ICV (20.8 ng/mL)	Vol Req'd (µL)
Second Source Spiking Standard <b>A</b> (1.0 µg/mL)	62.5
Mass-Labeled IS Solution	150
Methanol	2788

Vortex the ICV standard to mix then pipet 180 µL of each to 0.3 mL polypropylene vials. Add 20 µL of Injection Internal Standard Solution (400 ng/mL) to each vial, cap with polyethylene snap caps and vortex to mix.

**Table 6:** Initial Calibration Verification (ICV) Standard Preparation – Soil Analysis

The ICV is prepared in a polypropylene tube according to the following table:

ICV (18.8 ng/mL)	Vol Req'd (µL)
Second Source Spiking Standard <b>A</b> (1.0 µg/mL)	37.5
Mass-Labeled IS Solution	100
Methanol	1863

Vortex the ICV standard to mix then pipet 180 µL of each to 0.3 mL polypropylene vials. Add 20 µL of Injection Internal Standard Solution (400 ng/mL) to each vial, cap with polyethylene snap caps and vortex to mix.

**Table 7:** Ions – Analytes and Internal Standards

Compound	Abbreviation	Precursor Ion (m/z)	Product Ion (m/z)	Sciex 5500			Agilent 6470	
				Declustering Potential (DP)	Collision Energy (CE)	Collision Cell Exit Potential (CXP)	Fragmentor Voltage	Collision Energy
<b>Native PFCs</b>								
Perfluorobutanoic acid	PFBA	212.9	169.0	-30	-14	-13	65	8
Perfluorobutanesulfonate	PFBS	298.9	79.9	-140	-65	-12	141	40
Perfluoropentanoic acid	PFPeA	262.9	218.9	-37	-12	-18	70	4
Perfluorohexanoic acid	PFHxA	313.0	269.0	-35	-13	-13	77	4
Perfluorohexanesulfonate	PFHxS	398.9	79.9	-150	-80	-12	166	48
Perfluoroheptanoic acid	PFHpA	363.0	319.0	-37	-14	-14	80	8
Perfluoroheptanesulfonate	PFHpS	448.9	79.9	-150	-100	-12	173	50
Perfluorooctanoic acid	PFOA	413.1	369.0	-35	-15	-17	77	8
Perfluorooctanesulfonate	PFOS	498.8	79.9	-150	-80	-8	193	50
Perfluorononanoic acid	PFNA	462.9	419.0	-35	-15	-19	87	8
Perfluorodecanoic acid	PFDA	513.0	469.1	-35	-16	-21	92	8
Perfluorodecanesulfonate	PFDS	598.9	79.9	-90	-100	-12	225	50
Perfluoroundecanoic acid	PFUnA	562.9	519.0	-44	-17	-24	97	8
Perfluorododecanoic acid	PFDoA	612.9	569.0	-44	-18	-25	102	8
Perfluorotridecanoic acid	PFTTrDA	663.0	619.0	-45	-18	-27	107	12
Perfluorotetradecanoic acid	PFTeDA	713.0	669.0	-50	-20	-30	109	12
Perfluorooctane sulfonamide	PFOSA	497.9	78.0	-150	-70	-8	166	36
N-methylperfluorooctane sulfonamide	MeFOSA	511.9	169.0	-110	-35	-13	161	28
N-ethylperfluorooctane sulfonamide	EtFOSA	526.0	169.0	-120	-35	-13	161	28
N-methylperfluorooctane sulfonamidoethanol	MeFOSE	616.0	59.0	-50	-71	-9	105	16
N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	630.0	59.0	-33	-71	-9	110	12
N-methylperfluorooctanesulfonamidoacetic acid	MeFOSAA	570.1	419.1	-30	-29	-20	146	20
N-ethylperfluorooctanesulfonamidoacetic acid	EtFOSAA	584.1	419.1	-30	-29	-20	129	20
6:2 Fluorotelomersulfonate	6:2FTS	427.0	407.0	-70	-32	-18	166	24
8:2 Fluorotelomersulfonate	8:2FTS	526.9	507.0	-35	-38	-21	99	28
<b>Mass-Labeled Internal Standards</b>								
<sup>13</sup> C <sub>4</sub> -Perfluorobutanoic acid	MPFBA	216.9	172.0	-35	-13	-16	65	8
<sup>13</sup> C <sub>5</sub> -Perfluoropentanoic acid	MPFPeA	267.9	223.0	-30	-12	-16	70	4
<sup>13</sup> C <sub>2</sub> -Perfluorohexanoic acid	MPFHxA	314.9	270.0	-35	-13	-13	75	4



<sup>18</sup> O <sub>2</sub> -Perfluorohexanesulfonate	MPFHxS	402.9	84.0	-105	-60	-8	161	50
<sup>13</sup> C <sub>4</sub> -Perfluoroheptanoic acid	MPFHpA	366.9	322.0	-37	-14	-14	72	8
<sup>13</sup> C <sub>4</sub> -Perfluorooctanoic acid	MPFOA	416.9	372.0	-35	-15	-17	80	8
<sup>13</sup> C <sub>4</sub> -Perfluorooctanesulfonate	MPFOS	502.9	79.9	-150	-80	-8	180	52
<sup>13</sup> C <sub>5</sub> -Perfluorononanoic acid	MPFNA	467.9	423.0	-35	-15	-19	85	8
<sup>13</sup> C <sub>2</sub> -Perfluorodecanoic acid	MPFDA	514.9	470.0	-35	-16	-21	105	8
<sup>13</sup> C <sub>2</sub> -Perfluoroundecanoic acid	MPFUnA	564.9	520.0	-44	-17	-24	95	8
<sup>13</sup> C <sub>2</sub> -Perfluorododecanoic acid	MPFDoA	614.9	570.0	-44	-18	-25	100	8
<sup>13</sup> C <sub>2</sub> -Perfluorotetradecanoic acid	MPFTeDA	714.9	669.9	-50	-20	-30	105	12
<sup>13</sup> C <sub>8</sub> -Perfluorooctane sulfonamide	MPFOSA	505.8	77.9	-95	-90	-12	165	36
N-methyl-d <sub>3</sub> -perfluorooctanesulfonamide	D3-MeFOSA IS	514.9	168.9	-110	-37	-16	100	28
N-ethyl-d <sub>5</sub> -perfluorooctanesulfonamide	D5-EtFOSA IS	531.0	168.9	-120	-38	-16	145	32
N-methyl-d <sub>3</sub> -perfluorooctanesulfonamidoethanol-d <sub>4</sub>	D7-MeFOSE IS	623.1	59.0	-50	-71	-9	110	12
N-ethyl-d <sub>5</sub> -perfluorooctanesulfonamidoethanol-d <sub>4</sub>	D9-EtFOSE IS	639.1	59.0	-33	-75	-9	105	12
N-methyl-d <sub>3</sub> -perfluorooctanesulfonamidoacetic acid	D3-MeFOSAA	573.1	419.1	-30	-30	-20	125	20
N-ethyl-d <sub>5</sub> -perfluorooctanesulfonamidoacetic acid	D5-EtFOSAA	589.2	419.0	-30	-29	-20	135	20
<sup>13</sup> C <sub>2</sub> -Fluorotelomersulfonate (6:2)	M2-6:2FTS	429.0	80.9	-70	-73	-9	155	40
<sup>13</sup> C <sub>2</sub> -Fluorotelomersulfonate (8:2)	M2-8:2FTS	528.9	80.9	-35	-85	-10	190	40
<b>Mass-Labeled Injection Internal Standards</b>								
<sup>13</sup> C <sub>6</sub> -Perfluorohexanoic acid	13C6-PFHxA	318.9	274.0	-34	-13	-23	75	4
<sup>13</sup> C <sub>9</sub> -Perfluorodecanoic acid	13C9-PFDA	521.9	477.1	-28	-17	-23	90	8

**Table 8:** QC Acceptance Criteria and Quantitation Reference

Compound	Abbreviation	Quant Type	ICAL <sup>1</sup> , ICV & CCV (% of true value)		Recovery (%) QCs & Samples									Quantitation Reference
					Aqueous - High		Aqueous - Standard		Aqueous - Low		Soil		%RPD	
			Low	High	Low	High	Low	High	Low	High	Low	High		
<b>Native PFCs</b>														
Perfluorobutanoic acid	PFBA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFBA
Perfluorobutanesulfonate	PFBS	ID	75	125	70	130	70	130	70	130	70	130	30	MPFHxS
Perfluoropentanoic acid	PFPeA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFPeA
Perfluorohexanoic acid	PFHxA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFHxA
Perfluorohexanesulfonate	PFHxS	ID	75	125	70	130	70	130	70	130	70	130	30	MPFHxS
Perfluoroheptanoic acid	PFHpA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFHpA
Perfluoroheptanesulfonate	PFHpS	ID	75	125	70	130	70	130	70	130	70	130	30	MPFHpA
Perfluorooctanoic acid	PFOA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFOA
Perfluorooctanesulfonate	PFOS	ID	75	125	70	130	70	130	70	130	70	130	30	MPFOS
Perfluorononanoic acid	PFNA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFNA
Perfluorodecanoic acid	PFDA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFDA
Perfluorodecanesulfonate	PFDS	ID	75	125	70	130	70	130	70	130	70	130	30	MPFDA
Perfluoroundecanoic acid	PFUnA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFUnA
Perfluorododecanoic acid	PFDoA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFDoA
Perfluorotridecanoic acid	PFTTrDA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFTTrDA
Perfluorotetradecanoic acid	PFTTeDA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFTTeDA
Perfluorooctane sulfonamide	PFOSA	ID	75	125	70	130	70	130	70	130	70	130	30	MPFOSA
N-methylperfluorooctane sulfonamide	MeFOSA	ID	75	125	70	130	70	130	70	130	70	130	30	D3-MeFOSA IS
N-ethylperfluorooctane sulfonamide	EtFOSA	ID	75	125	70	130	70	130	70	130	70	130	30	D5-EtFOSA IS
N-methylperfluorooctane sulfonamidoethanol	MeFOSE	ID	75	125	70	130	70	130	70	130	70	130	30	D7-MeFOSE IS
N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	ID	75	125	70	130	70	130	70	130	70	130	30	D9-EtFOSE IS
N-methylperfluorooctanesulfonamidoacetic acid	MeFOSAA	ID	75	125	70	130	70	130	70	130	70	130	30	D3-MeFOSAA
N-ethylperfluorooctanesulfonamidoacetic acid	EtFOSAA	ID	75	125	70	130	70	130	70	130	70	130	30	D5-EtFOSAA
6:2 Fluorotelomersulfonate	6:2FTS	ID	75	125	70	130	70	130	70	130	70	130	30	M2-6:2FTS
8:2 Fluorotelomersulfonate	8:2FTS	ID	75	125	70	130	70	130	70	130	70	130	30	M2-8:2FTS
<b>Mass-Labeled Surrogate Compounds<sup>2</sup></b>														
<sup>13</sup> C <sub>4</sub> -Perfluorooctanoic acid	13C4PFOA	IS	75	125	70	130	70	130	50	130	50	130	30	13C6-PFHxA

<sup>13</sup> C <sub>4</sub> -Perfluorooctanesulfonate	13C4PFOS	IS	75	125	70	130	70	130	50	130	50	130	30	13C6-PFHxA
<sup>13</sup> C <sub>8</sub> -Perfluorooctane sulfonamide	13C8PFOSA	IS	75	125	70	130	60	120	50	130	N/A		30	13C9-PFDA
<b>Mass-Labeled Injection Internal Standards</b>														
<sup>13</sup> C <sub>6</sub> -Perfluorohexanoic acid	13C6-PFHxA	ES	50	150	50	150	50	150	50	150	50	150	30	
<sup>13</sup> C <sub>9</sub> -Perfluorodecanoic acid	13C9-PFDA	ES	50	150	50	150	50	150	50	150	50	150	30	

Quantitation Methods:

ID = Isotope Dilution

IS = Internal Standard

ES = External Standard

<sup>1</sup> Recovery criteria of unlabeled (native) compounds in lowest calibration standard is 70-130%

<sup>2</sup> In-house established surrogate recovery control limits will be reviewed and adjusted as required.

**ATTACHMENT E**

**AMEC FOSTER WHEELER STANDARD OPERATING PROCEDURES**

**FIELD SAMPLING PROTOCOLS TO AVOID CROSS-CONTAMINATION OF  
PERFLUORINATED COMPOUNDS (PFCs)  
SOP AFW-01 (PFCs)**

**1.0 PURPOSE**

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures/considerations when collecting soil, sediment, surface water, and groundwater samples at potential perfluorinated compound (PFC) release areas. This SOP also describes a tiered approach that should be used to assist with field decisions. Sampling specific SOPs should also be reviewed prior to conducting field sampling activities at PFC areas. The information contained within this SOP is included within sampling specific SOPs as applicable.

**2.0 SCOPE**

This procedure applies to all Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) personnel and subcontractors who collect or otherwise handle samples of soil, sediment, surface water, and groundwater for analysis of PFCs. This SOP should be reviewed by all on-site personnel prior to implementation of field activities.

**3.0 REFERENCES**

Transport Canada, 2013. *Perfluorochemical (PFC) Field Sampling Protocol*. May.

Delta Consultants, 2010. *Report of Investigation Activities at Select Firefighting Foam Training Areas and Foam Discharge Sites in Minnesota*. February. MPCA, 2008. *Closed Landfill Program Sampling Protocol for Monitoring Wells*. October.

**4.0 GENERAL**

Given the low detection limits associated with laboratory PFC analysis, and the many potential sources of trace levels of PFCs, field personnel are advised to act on the side of caution by strictly following the subject protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFCs. Specific items related to field sampling are discussed below.

**5.0 PROCEDURES**

This section contains both the responsibilities and procedures involved with field sampling for analysis of PFCs. Proper procedures are necessary to insure the quality and integrity of the

samples. The details within this SOP should be used in conjunction with installation-specific work plans. The installation-specific work plans will generally provide the following information:

- Sample collection objectives;
- Locations to be sampled;
- Number and volume of samples to be collected at each location;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control (QC) procedures and sampling required;
- Any additional sampling requirements or procedures beyond those covered in this SOP, as necessary; and,
- At a minimum, the procedures outlined in this SOP for field sampling will be followed.

## **5.1 RESPONSIBILITIES**

### ***Base Lead***

The Base Lead shall provide the Quality Project Plan (QPP), and installation-specific work plan to the Field Lead, which shall include the sampling requirements for each investigation area. The Base Lead will report deviations to the procedure provided in this SOP to the QC Manager and the Air Force Civil Engineer Center Contracting Office Representative.

### ***Field Lead***

The Field Lead shall ensure that samples are collected using procedures that are in accordance with the QPP, installation-specific work plans, and applicable SOPs. The Field Lead shall also be required to make rational and justifiable decisions when deviations from these procedures are necessary because of field conditions or unforeseen issues and report the deviations to the Base Lead.

### ***Quality Control Manager***

The QC Manager will be responsible for conducting field audits during selected sampling activities. During these audits, the QC Manager will ensure that field crews are adhering to the procedures provided in the QPP and in the installation-specific work plans, including, but not limited to, sampling techniques, field documentation, decontamination, sample packaging, chain of custody documentation procedures, and equipment calibration.

### ***Field Personnel***

Field personnel assigned to sampling activities are responsible for completing their tasks according to specifications outlined in the QPP, installation-specific work plans, applicable SOPs, and other appropriate procedures. Field personnel are responsible for reporting deviations from procedures to the Field Lead.

## **5.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures/considerations to be made during field activities at potential PFC release areas. A summary of the prohibited and acceptable items for PFC investigation areas is included in Table 1. A checklist, provided as Attachment 1, shall be used by the Field Manager daily prior to the commencement of fieldwork to ensure the field team is in compliance with this protocol.

### ***Field Equipment***

- **Do not use Teflon®-containing materials** (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) since Teflon® contains fluorinated compounds.
- High-density polyethylene (HDPE), low-density polyethylene (LDPE), and silicon materials are acceptable for sampling. Samples should not be stored in containers made of LDPE materials.
- Amec Foster Wheeler will use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. Amec Foster Wheeler will use ProActive SS Pumps with polyvinyl chloride (PVC) leads or Geotech SS Geosub pumps for groundwater sample collection at depths greater than 25 feet. These pumps are constructed with stainless steel and will minimize introductions of PFCs. However, for groundwater sample depths greater than 150 feet, a Grundfos RediFlo pump (or similar) may be used due to the pumping limitations of stainless steel pumps.
- When using liners to collect soil samples during direct-push technology or during conventional drilling and sampling methodologies, acetate liners are to be used.
- **Rite in the Rain products are the only waterproof field books that may be used.** To avoid plastic coating or glue materials, do not use other brands of waterproof field books. If Rite in the Rain products are not available, field reports will be documented on loose paper secured on masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable) using a pen or pencil. Sharpies®/markers may also be used.
- **Post-It Notes are not allowed** on project sites.

- **Do not use markers other than Sharpies® markers.** Pens will be used when documenting field activities in the field log and on field forms as well as labeling sample containers and preparing the Chain of Custody.
- **Do not use chemical (blue) ice packs** during the sampling program. This includes the use of ice packs for the storage of food and/or samples.

### ***Field Clothing and Personal Protective Equipment***

- **Do not wear water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener. Preferably, field gear should be cotton construction and well laundered (i.e., washed a minimum of 6 prior to use after purchase). New clothing may contain PFC related treatments. **Do not use new clothing** while sampling or sample handling.
- **Do not wear clothing or boots containing Gore-Tex™** during the sampling program as it contains a PFC membrane.
- Safety footwear will consist of steel-toed boots made with polyurethane and PVC, untreated leather boots, or well-worn leather boots. Newer leather boots may be worn if they are covered with polypropylene, polyethane, or PVC boot covers.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:
  - Decontamination of re-usable sampling equipment;
  - Prior to contact with sample bottles or water containers;
  - Insertion of anything into the well (e.g., HDPE tubing, HydraSleeve bailer, etc.);
  - Insertion of silicon tubing into the peristaltic pump;
  - Completion of monitor well purging, prior to sample collection;
  - Handling of any quality assurance/quality control samples including field blanks and equipment blanks; and,
  - After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

### ***Sample Containers***

- Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). All samples should be collected in polypropylene or HDPE bottles. The screw cap will be made of polypropylene



or HDPE and may be lined or unlined. However, if lined, the liner may not be made of Teflon® or contain PFCs.

- Container labels will be completed using pen after the caps have been placed back on each bottle.
- Glass sample containers are not to be used due to potential loss of analyte through adsorption.

### ***Wet Weather***

- Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination. Teams will avoid synthetic gear that has been treated with water-repellant finishes containing PFCs. Use rain gear made from polyurethane, vinyl, and wax or rubber-coated materials.
- Teams should consider the use of a gazebo tent, which can be erected overtop of the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be handled as such; therefore, gloves should be worn when setting up and moving the tent, changed immediately afterwards and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

### ***Equipment Decontamination***

- Field sampling equipment, including oil/water interface meters and water level indicators, and other downhole equipment used at each sample location, will require cleaning between uses. Alconox® and Liquinox® soap is acceptable for use since the Safety Data Sheets do not list fluoro-surfactants as an ingredient. However, Decon 90 will not be used during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified “PFC-free” water.
- For larger equipment (e.g., drill rig and large downhole drilling and sampling equipment), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water.

### ***Personnel Hygiene***

- Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, unless the products are applied to a part of the body that will be covered

by clothing. These products may contain surfactants and represent a potential source of PFCs.

- Many manufactured sunblock and insect repellants contain PFCs and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural ingredients, unless previously vetted by the project chemist. A list of acceptable sunscreens and insect repellents is provided in Table 1.
- For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

### ***Food Considerations***

- No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (i.e., Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

### ***Visitors***

- Visitors to the investigation area are asked to remain outside of the exclusion zone during sampling activities.

## **6.0 TIERED APPROACH TO ASSIST WITH FIELD DECISIONS**

In evaluating whether products contain PFCs and are suitable for use in the field, the tiered approach presented in Table 2 will be used to assist with field decisions. Any member of the field team should contact the Project Manager, Regional Lead, or Project Chemists with questions.

**Table 1. Summary of Prohibited and Acceptable Items for PFC Sampling**

Prohibited Items	Acceptable Items
<b>Field Equipment</b>	
Teflon® containing materials	High-density polyethylene (HDPE) and Low density polyethylene (LDPE) materials
Storage of samples in containers made of LDPE materials	Acetate liners
Teflon® tubing	Silicon tubing
Waterproof field books not manufactured by Rite in the Rain	Rite in the Rain products or Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies®, pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Excel Purity Paste TFW Multipurpose Thread Sealant Vibra-Tite Thread Sealant	Gascoils NT Non-PTFE Thread Sealant Bentonite
Equipment with Viton Components (need to be evaluated on a case by case basis, Viton contains PTFE, but may be acceptable if used in gaskets or O-rings that are sealed away and will not come into contact with sample or sampling equipment.)	
<b>Field Clothing and PPE</b>	
New clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of synthetic or natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and PVC, well-worn or untreated leather boots, leather boots with boot covers
	Reflective safety vests, Cotton Clothing, synthetic under clothing, body braces
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling, unless the products are applied to body parts that will be covered by clothing.	<b>Sunscreens</b> - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are “free” or “natural” <b>Insect Repellents</b> - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, Deep Woods Off <b>Sunscreen and insect repellent</b> - Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion

**Table 1. Summary of Prohibited and Acceptable Items for PFC Sampling (continued)**

Prohibited Items	Acceptable Items
<b>Sample Containers</b>	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Lined or unlined HDPE or polypropylene caps
<b>Rain Events</b>	
Waterproof or resistant rain gear	Polyurethane, vinyl, wax or rubber-coated rain gear. Gazebo tent that is only touched or moved prior to and following sampling activities
<b>Equipment Decontamination</b>	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
<b>Food Considerations</b>	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

**Table 2. Tiered Approach**

Tier and Description	Action
Tier 1: Products that <i>will come into direct contact</i> with field samples include, but are not limited to, drilling grease, sampling equipment, sample containers, and well construction materials	These products will undergo the greatest scrutiny and requires chemist's input to help evaluate the materials as a possible source of contamination <sup>A</sup> and as possible sampling or storage materials or both
Tier 2: Products that <i>will not come into direct contact</i> with samples, but could be <i>reasonably expected to contain PFCs</i> , such as waterproof or nonstick products	Project team/affected person can review the Safety Data Sheet (SDS) <sup>B</sup> and if it shows PFCs, product should not be used. If product SDS does not indicate PFCs, confirm with chemist before use
Tier 3: Products that <i>will not come into direct contact</i> with samples and are <i>not expected to contain PFCs</i> , such as ballpoint pens, zipper bags, and body braces	Project team/affected person can review SDS and if no PFCs, then appropriate to use

<sup>A</sup> Tier 1 products will undergo the closest scrutiny. It may be necessary to have Tier 1 products analyzed for PFCs to confirm that a specific batch or lot number does not contain PFCs. Alternate products will need to be evaluated/used if PFCs are identified in the product.

<sup>B</sup> SDS Check: To evaluate product SDS and/or manufacturing specs, check if the product contains anything with "fluoro" in the name or the acronyms TPE, FEP, ETFE, and/or PFA. If fluorinated compounds are not listed in the manufacturing specs and/or on the SDSs, product can be used.

## SOIL SAMPLING SOP AFW-02 (PFCs)

### 1.0 PURPOSE

The purpose of this technical procedure is to describe the methodology for collecting soil samples in order to document the areal and vertical extent of contaminated soil and to determine the geotechnical, physical, and chemical properties of the soil while conducting perfluorinated compound (PFC) investigation sampling.

### 2.0 SCOPE

This procedure applies to all Amec Foster Wheeler personnel and subcontractors who collect or otherwise handle samples of surficial or subsurface soil during PFC investigations.

### 3.0 REFERENCES

ASTM International (ASTM), *Standard Practice for Clarification of Soils for Engineering Purposes (Unified Soil Classification System), Method D-2487-11*,

(ASTM), 1999, *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*, Method D-1586-99, Philadelphia, Pennsylvania.

ASTM International (ASTM), 1994, *Standard Practice for Thin-Walled Tube Sampling of Soils*, Method D-1587-94, Philadelphia, Pennsylvania. International (ASTM), 1995, *Standard Practice for Ring-Lined Barrel Sampling of Soils*, Method D-3550-84 (1995)e1, Philadelphia, Pennsylvania.

Barth, D.S. and B.J. Mason. 1984. *Soil Sampling Quality Assurance User's Guide*. EPA-600/4-84-043.

Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual, Available Sampling Methods*. Volume II, 2nd Edition. EPA-600/4-84-076.

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Techniques and Strategies*. EPA-600/4-83-020.

Hewitt, Alan D., et al. 2007. *Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents*. U.S. Army Corps of Engineers. ERDC/CRREL TR-07-10.

#### 4.0 DEFINITIONS

**Borehole** - Any hole drilled or hydraulically driven into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing monitoring wells.

**Composite soil sample** – a combination of soil aliquots collected at various locations, or at various depths at a single location. Analysis of composite samples yields a value representing an average over the various sampled sites or depths from which individual samples were collected.

**Core Sampler** – A metal tube (probe rod), generally 4- to 5-feet long by 2.25- to 3.25-inch OD, typically utilized along with drive rods and a polyvinyl chloride (PVC) or acetate or equivalent liner that is used to collect soil cores utilizing a direct-push rig. Inside the probe rods are smaller diameter, center rods affixed with a solid drive tip that seals the lower end of the probe rods during pushing. After reaching the target depth, advancement is halted and the center rods and drive tip are removed, which opens the bottom end of the probe rods. A sample liner is attached to the rod string and is lowered to the bottom of the push rods, and the assembly is then advanced to collect the soil sample within the liner. The center rod string is withdrawn from the probe rods, and the liner is removed to access the recovered soil core. The process of direct-pushing and soil core recovery may be repeated within the same boring until reaching total boring depth.

**Discrete soil sample** – a discrete aliquot from a distinct sampling interval (of a specific sample size) that is representative of one specific location at a specific point in time.

**Drilling Jars** – A set pair of linked, heat-treated steel bars. The jars may be attached to a wireline sampling string incorporating a split spoon or other impact sampler. The jars are used to drive the sampler into the soil ahead of the bottom of the borehole

**Shelby Tube Sampler** – A thin-walled metal tube used to recover relatively undisturbed samples. These tubes are available in various sizes, ranging from 2 to 5 inches in outside diameter and 18 to 54 inches in length. A stationary piston device is included in the sampler to reduce sampling disturbance and increase sample recovery.

**Split-Spoon Sampler** – A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. This device can be driven into resistant (semiconsolidated) materials using a drive weight or drilling jars mounted in the drilling rig. A standard split-spoon sampler (used for performing standard penetration tests) is 2 inches in outside diameter and 1-3/8 inches in inside diameter. This standard spoon typically is available in two common lengths, providing either 20-inch or 26-inch internal longitudinal clearance for obtaining 18-inch or 24-inch long samples, respectively. Six-inch long sleeves (tubes) of brass,

stainless steel, or plastic are commonly placed inside the sampler to collect and retain soil samples. A five-foot long split-spoon sampler is also available. A California modified split-spoon sampler is also commonly used. The design is similar to the standard split-spoon except the outside diameter is 2 1/2 inches and the inside diameter is 2 inches.

## **5.0 PROCEDURES**

This section contains both the responsibilities and procedures involved with soil sampling for analysis of PFCs. Proper procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with installation-specific work plans. The installation-specific work plans will generally provide the following information:

- Sample collection objectives;
- Locations to be sampled;
- Number and volume of samples to be collected at each location;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control procedures and sampling required;
- Any additional sampling requirements or procedures beyond those covered in this SOP, as necessary; and
- At a minimum, the procedures outlined in this SOP for field sampling will be followed.

### **5.1 RESPONSIBILITIES**

#### ***Base Lead***

The Base Lead shall provide installation-specific work plan to the Field Lead, which shall include the sampling requirements, locations and depths for the project.

#### ***Field Lead***

The Field Lead shall ensure that soil samples are collected according to this technical procedure. The Field Lead shall also be required to make rational and justifiable decisions when deviations from this procedure are necessary because of field conditions or unforeseen problems.

#### ***Field Personnel***

Field personnel assigned to subsurface soil sampling activities during drilling or probing are responsible for completing their tasks according to specifications outlined in this SOP and other

appropriate procedures. All staff are responsible for reporting deviations from procedures to the Base Lead or the Field Lead.

## 5.2 FIELD PROCEDURES/CONSIDERATIONS

Collecting soil samples is an important site characterization activity. Soil samples are used to determine the nature and extent of contamination, to identify hazardous substance source areas, and to determine the geotechnical, hydrogeologic, physical, and chemical properties of a site. Soil sampling strategies will be determined and documented before initiating sampling. Field conditions at the investigation area may preclude collection at one or more predetermined sampling locations. Additional soil sampling may be required if unexpected subsurface conditions are observed during the course of the sampling. Proper sampling techniques, proper selection of sampling equipment, and proper decontamination procedures will eliminate cross-contamination and the introduction of contaminants from external sources. Soil conditions can vary widely at a hazardous waste site. Such variations can affect the rate of contaminant migration through the soil. Therefore, it is important that detailed records be maintained during sampling, particularly with respect to the sample location, depth, color, odor, lithology, hydrogeology, and readings derived from field monitoring equipment. Surface and shallow subsurface soil samples shall be described utilizing the Unified Soil Classification System and / or ASTM guidance D2487 Standard Practices for Classification of Soils for Engineering Purposes (Unified Soil Classification System), unless otherwise specified by the work plan.

The following are procedures/considerations to be made during field activities at potential PFC release areas.

### 5.2.1 FIELD EQUIPMENT

Equipment and supplies used to collect, document, and package surface or subsurface soil samples may include, but is not limited to, the following items:

- Nitrile gloves;
- Stainless steel spoons/trowels;
- Stainless steel hand auger;
- Stainless steel split spoon, split barrel, or continuous sampler;
- Stainless steel bowls/pans;
- Field logbook and boring log (**Not** “write in the rain” © or other water resistant paper);
- Pens;
- Paper towels;
- Aluminum foil;



- Appropriate decontamination equipment;
- Appropriate personnel protective equipment and safety equipment as specified in the Health and Safety Plan and in other SOPs;
- Sample cooler with ice (no blue ice);
- Sample jars (i.e., no glass) and labels;
- Bubble wrap;
- Chain-of-Custody forms;
- Munsell Soil Color charts;
- Grain size charts;
- Hand lens;
- Brass sleeves;
- Brass caps;
- Acetate liners;
- Ziplock freezer bags;
- Stainless steel deionized water spraying devices;
- Non PFC plastic sheeting; and
- Non PFC tape.

### **5.2.2 DECONTAMINATION**

Before collecting any soil samples, all sampling devices shall be decontaminated. If dedicated or disposable equipment is used, it will be rinsed with deionized water where applicable. Mobile decontamination supplies will be provided so that equipment can be decontaminated in the field. Each piece of sampling equipment shall be decontaminated before initiation of sampling operations and between each sample location and interval. Decontamination solutions shall be replenished between sampling locations as needed. Spent decontamination fluids will be containerized, properly labeled and appropriately disposed of according to the investigation derived waste (IDW) plans addressed in the installation-specific work plan.

### **5.2.3 SURFACE SOIL SAMPLING**

Any surface vegetation will be removed before sampling with a decontaminated shovel or sampling spoon. Surface soil samples may be collected as either discrete or composite samples. Each surface soil sample will be collected using either a stainless steel spoon or trowel. The sampler, wearing clean disposable nitrile gloves, will remove pebbles, roots, etc. from the mixture as the sample is collected. Each sample will be collected by thoroughly homogenizing material from the zero (i.e., zero is considered ground surface where no vegetation is present,

and/or the surface directly below where vegetation must be removed) to 6-inch below ground surface depth interval (unless other depth intervals are specified in the work plan). A decontaminated stainless steel scoop or trowel will be used to remove a thin layer of soil from the area that comes into contact with the shovel (if used to gain a specific sampling depth). A second decontaminated stainless steel spoon or trowel will then be used to collect the soil sample.

Each soil sample fraction collected will be thoroughly mixed (i.e., homogenized) using the sampling spoon or trowel. The homogenized material will then be divided among the appropriate sample containers. The sample containers will then be sealed tightly. Care should be taken to ensure the container (bowl, pan, etc.) used for homogenization and the sampling utensils do not interfere with the analytes of interest (e.g., an aluminum pan should not be used for soil samples submitted for inorganic analyses; only stainless steel bowls are allowed).

All personnel who collect or handle the soil samples will wear disposable nitrile gloves to prevent cross-contamination and provide personal protection. New gloves shall be donned for sample collection at each sampling location (i.e., at each new vertical or horizontal position), or whenever gloves are torn or otherwise compromised.

If collecting a composite sample, each aliquot will be collected by placing equal amounts of soil collected from multiple locations into a decontaminated collection container. The aliquots will then be combined (i.e. homogenized) using a spoon or trowel. The homogenized material will then be divided equally among the appropriate sample containers.

#### **5.2.4 SUBSURFACE SOIL SAMPLING**

##### ***Split-Spoon Sampling***

Split-spoon samples for chemical analysis are usually obtained in brass, plastic, or stainless steel sleeves. The type of sleeve to be used if applicable, along with the length and type of sampler, will be stated in the project work plans. The split-spoon sampler is connected to the drill rod string or a wireline sampling string and is driven by a drive hammer (140 or 340 pound, depending on the size of the sampler) or drilling jars into the undisturbed soil ahead of the bottom of the borehole. The procedure for collecting samples from the split-spoon sampler will be outlined in the project work plans. The standard procedure is described below.

- Calibrate all field analytical and health and safety monitoring equipment according to the instrument manufacturer's specifications. Calibration results will be recorded on the appropriate form(s) as specified by the project-specific work plans. Instruments that

cannot be calibrated according to the manufacturer's specifications will be removed from service and tagged.

- Wear the appropriate personal protective equipment as specified in the project work plans and the applicable drilling method SOP.
- Between each sampling location and prior to each sampling run, decontaminate the sampler, sleeves, and other nondisposable sampling equipment as described in SOP AFW-10.
- Advance the borehole to the desired depth or target horizon where the sampling run is to begin.
- When the desired sampling depth or target horizon is reached, remove the drill bit or plug from inside the drive casing or augers.
- Insert the sleeves into the split-spoon sampler (if determined necessary), connect the halves, and screw together the rear threaded collar and front drive shoe. Attach the split-spoon sampler to the bottom end of the drill rod string or wireline sampling string. Set up and attach the specified weight hammer, if used.
- Drive the sampler into the soil at the bottom of the borehole. Record the type of sampler assembly and hammer weight on the Boring Log and/or other appropriate form(s), as specified in the project work plans. To minimize off-gassing of the volatiles, the sampler should not be driven until the sampling team is ready to process the sample.
- Pull the drill rod or wireline sampling string up from the bottom of the borehole and remove the sampler.
- Remove the drive shoe and rear collar from the sampler and open the split barrel.
- If sleeves are used, remove the sleeves one at a time, starting with the sleeve adjoining the drive shoe. Observe and record the amount of sample recovery on the Boring Log. Any observed field problems associated with the sampling attempt (e.g., refusal) or lack of recovery should be noted on the Boring Log.
- If sleeves are used, select sleeve(s) to be submitted for laboratory analysis. Sample sleeve selection should be based on four factors: judgment that the sample represents relatively undisturbed intact material, not slough; proximity to the drive shoe; minimal exposure to air; lithology; and obvious evidence of contamination. The soil core should also be visually recorded on a Boring Log.
- Appropriately label and number each sleeve or soil sample container to be submitted for analysis. The label will contain, at a minimum, the following information:
  - Project number;

- Location ID;
  - Boring number;
  - Sample number;
  - Bottom depth of sleeve, if applicable;
  - Date and time of sample collection;
  - Parameters for analysis; and,
  - Sampler's initials.
- Document the sampling event on the Soil Sample Collection Field Sheet or an equivalent form as specified in the project work plans. At a minimum, this log will contain:
    - Project name and number;
    - Location ID
    - Date and time of the sampling event;
    - Drilling and sampling methods;
    - Sample number;
    - Sample location;
    - Boring number;
    - Sample depth;
    - Sample description;
    - Unusual events; and,
    - Signature or initials of the sampler.
  - Appropriately preserve (no blue ice permitted to cool samples), package, handle, and ship the sample in accordance with the procedures outlined in SOP AFW-11 and the project work plans. The samples shall also be maintained under proper chain of custody. Samples stored on-site will be subject to the provisions of SOP AFW-11.
  - Repeat this sampling procedure at the intervals specified in the project work plans until the bottom of the borehole is reached and/or last sample collected.

### ***Core Sampling using Direct Push Technology (DPT)***

A core sampler may be used to collect subsurface soil samples. The procedure for collecting soil samples using a core sampler should be outlined in the project work plans. The standard procedure is described below.

- Calibrate all field analytical and health and safety monitoring equipment.
- Wear the appropriate personal protective equipment.

- Between each sampling location and prior to each sampling run, decontaminate the sampler and other sampling equipment as described in SOP AFW-10.
- Advance the probe rods equipped with a solid drive tip to the desired depth or target horizon where the sampling run is to begin. After reaching the target depth, the center rods and drive tip are removed and a new acetate liner is attached to the center rod string.
- Once the liner and center rods are inserted into the probe rods, the assembly is advanced to collect the soil sample within the liner. The assembly is pushed about 4 to 5 feet into the soil with a continuous, rapid motion. At shallow depths and/or in soft soils, the assembly may be advanced without impact from the drive hammer. At greater depths and in harder substrates impact from the drive hammer is likely required to advance the sampling assembly. The liner and center rods are withdrawn from the probe rods, noting which end of the liner is up.
- The DPT contractor will cut the liner and present it to the geologist/engineer for inspection and sample collection. Upon receiving the liner, the field geologist/engineer will observe and record the amount of sample recovery and any associated problems.
- Sample selection should be based on five factors: judgment that the sample represents relatively undisturbed intact material, not slough; proximity to the drive shoe; minimal exposure to air; lithology; and obvious evidence of contamination. The soil core should also be visually recorded on a soil Boring Log.
- Appropriately label and number each soil sample container to be submitted for analysis. The label will contain, at a minimum, the following information:
  - Project number;
  - Location ID;
  - Boring number;
  - Sample number;
  - Date and time of sample collection;
  - Parameters for analysis; and,
  - Sampler's initials.
- Document the sampling event on the soil sample collection field sheet or an equivalent form as specified in the project work plans. At a minimum, this log will contain:
  - Project name and number;
  - Location ID;
  - Date and time of the sampling event;
  - Drilling and sampling methods;
  - Sample number;

- Sample location;
  - Boring number;
  - Sample depth;
  - Sample description;
  - Unusual events; and,
  - Signature or initials of the sampler.
- Appropriately preserve (no blue ice permitted to cool samples), package, handle, and ship the sample in accordance with the procedures outlined in SOP AFW-11 and the project work plans. The samples shall also be maintained under proper chain of custody. Samples stored on-site will be subject to the provisions of SOP AFW-11.
  - Repeat this sampling procedure at the intervals specified in the project work plans until the bottom of the borehole is reached and/or last sample collected.



## GROUNDWATER SAMPLING SOP AFW-03 (PFCs)

### 1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of groundwater samples for chemical analysis. Proper collection procedures are necessary to assure the quality and integrity of all groundwater samples. Additional specific procedures and requirements will be provided in the installation-specific work plans, as necessary.

### 2.0 SCOPE

This procedure applies to all Amec Foster Wheeler personnel and subcontractors who collect or otherwise handle groundwater samples during perfluorinated compound (PFC) investigations.

### 3.0 REFERENCES

ASTM International, 2007, *Standard Guide for Sampling Ground-Water Monitoring Wells*, D 4448-01 (Reapproved 2007).

Barcelona et al, 1985, *Practical Guide for Groundwater Sampling*, Illinois State Water Survey, Champaign, Illinois, ISWS Contract Report 374, November.

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

EPA, 1992, *EPA RCRA Groundwater Monitoring: Draft Technical Guidance*, November.

### 4.0 DEFINITIONS

**Bailer** – A bailer is an enclosed cylindrical tube containing a floating ball check-valve at the bottom. Lowering the bailer into water causes the ball to float allowing water to enter the



cylinder. Raising the bailer through the water column causes the ball to settle, creating a seal to trap the water so that it can be brought to the surface.

**Bladder Pump** – A bladder pump is an enclosed cylindrical tube containing a flexible membrane bladder. Well water enters the bladder through a one-way check-valve at the bottom. Gas is forced into the annular space (positive displacement) surrounding the bladder through a gas supply line. The gas displaces the well water through a one-way check-valve at the top. The water is brought to the surface through a water discharge line. Gas (air or nitrogen) is provided by compressors or cylinders.

**Dedicated Groundwater Monitoring Equipment** – Dedicated groundwater monitoring equipment is used to purge and sample only one well. The equipment is commonly installed within, and remains in the well, for the duration of the monitoring program. Dedicated equipment does not need to be decontaminated between sampling events.

**Electric Submersible Pump** – An electric submersible pump is an enclosed cylindrical tube containing a motor with rotary attachments. Well water enters the cylinder through a one-way check valve. Electrical power to the motor causes rotors or impellers to turn and displace the groundwater.

**Peristaltic Pump** – A peristaltic pump is a self-priming, low volume pump consisting of a rotor and ball bearing rollers. Tubing placed around the rotors is squeezed by the rotors as they revolve. The squeezing produces a wavelike contractual movement that causes water to be drawn through the tubing. During purging and sampling, only the tubing is placed down the well. All of the mechanical systems of the pump remain above ground during purging and sampling activities. The peristaltic pump is typically limited to sampling at depths of less than 25 feet. Operating two or more peristaltic pumps in parallel can increase operational depths slightly.

## 5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with groundwater sampling. Proper groundwater sampling procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with





installation-specific work plans. The work plans will generally provide the following information:

- Sample collection objectives;
- Locations of groundwater samples to be collected;
- Numbers and volumes of samples to be collected;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control (QC) procedures and sampling required;
- Management procedures for groundwater investigation derived waste (IDW); and
- Any additional groundwater sampling requirements or procedures beyond those covered in this SOP, as necessary.
- At a minimum, the procedures outlined in this SOP for groundwater sampling will be followed.

## **5.1 RESPONSIBILITIES**

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the installation-specific work plans should be reviewed before performing groundwater sampling at the project investigation area.

### ***Base Lead***

The Base Lead is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and with any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

### ***Field Lead***

The Field Lead is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Lead is also responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing nonconformances, etc.) if problems occur.

### ***Field Personnel***



Field personnel assigned to groundwater sampling activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the Base Lead or Field Lead.

## **5.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures/considerations to be made during field activities at potential PFC release areas.

### **5.2.1 FIELD EQUIPMENT**

Purging and sampling equipment is constructed from a variety of materials. The most inert material (e.g., silicone and high-density polyethylene), with respect to known or anticipated contaminants in the well(s), will be used whenever possible. The various types of purging and sampling equipment available for groundwater sampling are described in *ASTM Standard Guide for Sampling Ground-Water Monitoring Wells, D 4448-01* (ASTM, 2007) or *Collection of Groundwater Samples at Known or Suspected Groundwater Contaminated Sites* or *Compendium of Superfund Field Operations Methods* (EPA, 1987).

If non-dedicated sampling equipment is to be used, and the contaminant histories of the wells are known, it is advisable to establish a sampling order starting with the least contaminated well and progressing to the most contaminated well last.

### **5.2.2 DECONTAMINATION**

Before collecting any groundwater samples, all sampling devices shall be decontaminated. If dedicated or disposable equipment is used, it will be rinsed with deionized water where applicable. Mobile decontamination supplies will be provided so that equipment can be decontaminated in the field. Each piece of sampling equipment shall be decontaminated daily before initiation of sampling operations and between each sample location and interval. Decontamination solutions shall be replenished between sampling locations as needed. Spent decontamination fluids will be containerized, properly labeled and appropriately disposed of according to the investigation derived waste (IDW) plans addressed in the installation-specific work plan.

### 5.2.3 GROUNDWATER PURGING AND SAMPLING

#### ***Groundwater Purging and Sampling with a Bladder Pump***

Pre-sample purging and sampling should be conducted in accordance with the installation-specific work plans. The standard procedure for purging and sampling using a bladder pump is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and will be conducted as described below.

- Inspect the equipment to ensure that it is in good working order.
- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.
- An exception to the daily calibration requirements will be made in the case of the water level meters. These instruments will be calibrated at the beginning of the project and then every six months using a steel surveyors tape.
- If non-dedicated equipment is being used, decontaminate the equipment as described in SOP AFW-10. During decontamination, the equipment should again be inspected for damage and, if present, repaired or replaced with undamaged equipment.
- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Log and brought to the attention of the Field Lead.
- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Groundwater Sample Collection Form.
- Obtain a static depth to water level measurement. If the total well depth has not been verified within the past year, obtain a total well depth measurement. Calculate the volume of water in the well (cased well volume) as follows:

$$\pi \left( \frac{d}{2} \right)^2 (h_1 - h_2) \times 7.48 = \text{cased well volume (in gallons)}$$

Where:

d = inside diameter of well casing (in feet)

$h_1$  = depth of well from top of casing (in feet)

$h_2$  = depth to water from top of casing (in feet)

- Record static water level, total well depth, and volume calculations on the sample collection field sheet.
- If using non-dedicated equipment, lower the pump and associated tubing and/or lines into the well. The pump intake should be located near the middle of the saturated portion of the screened interval and the depth of the pump intake will be recorded on the Groundwater Sample Collection Form. For low yielding wells it may be necessary to gently lower the pump during purging to follow the declining water level in the well.
- Attach the compressor or cylinder to the controller and the controller to the gas supply line, making sure that the compressor is downwind of the monitoring well. Attach the sampling tube to the discharge supply line. Adjust the pressure/discharge cycle on the controller.
- Begin purging. Collect and dispose of purge water in accordance with the criteria specified by the project work plans.
- Physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) of the purge water will be measured when purging begins, after each well casing volume, and then periodically throughout the purging procedure. These measurements will be recorded on Groundwater Sample Collection Forms. Purging is considered complete when water quality indicator parameters have stabilized (i.e., three consecutive readings are within tolerances specified in Table 4-1) (ASTM, 2007; EPA, 1992 and Barcelona et al, 1985). If stability is not reached within the removal of three well casing volumes, then purging is continued until stability is attained, up to a maximum purging period of one hour. If parameters have not stabilized after the additional hour of purging, the sample may be collected.

**Table 4-1**

Parameter	Units	Requirement
pH	Standard Units	± 0.1
Specific Conductivity	Micromhos/centimeter (umho/cm, or μS/cm)	± 3 percent
Temperature	Degrees Celcius (°C)	± 0.5 °C
Oxidation-Reduction Potential (ORP)	Millivolts (mV)	± 10 percent
Dissolved Oxygen	Milligrams/liter (mg/L)	± 10 percent
Turbidity	Nephelometric Turbidity Units (NTUs)	± 10 percent, but less than 10 NTUs

- For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow purging rates. In this case, purging will be considered complete when one well volume (i.e., well casing plus filter pack volume) has been purged from the well and the well goes dry.
- The well will then be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completely filled following a single recharge event. The date and time of each sample collection will be recorded.
- Inspect the sample bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.
- Turn on the pump and adjust the pressure/discharge cycle on the pump controller so that the water will flow smoothly and without agitation into the sample containers.



- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analysis should be filled to the base of the bottleneck.
- The samples should be collected in the order of volatility, collecting the samples for the analysis of the most volatile parameters first, followed by the samples for the least volatile parameters. The samples for volatiles analysis should be collected during one full discharge cycle. Do not partially fill a container for volatile parameter analysis during one cycle and complete the filling during the next cycle.
- Document the sampling event on the Groundwater Sample Collection Form.
- As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.
- Handle and ship the sample according to the procedures outlined in SOP AFW-11, following appropriate chain of custody procedures. Samples stored temporarily on-site will be maintained per SOP AFW-10.

### ***Groundwater Purging and Sampling with a Peristaltic Pump***

Purging and sampling will be conducted per the project work plans. The standard procedure for groundwater purging and sampling using a peristaltic pump is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and will be conducted as described below.

- Inspect the equipment to ensure that it is in good working order.
- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity, and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.
- An exception to the daily calibration requirements will be made in the case of the water level meters. These instruments will be calibrated at the beginning of the project and then every six months using a steel surveyors tape.

- Conduct equipment decontamination; however, the old silicone tubing used in the pump head should not be decontaminated. New tubing should be used for each well.
- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Log and brought to the attention of the Field Manager.
- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Groundwater Sample Collection Form.
- Obtain a static water level measurement and calculate the cased well volume as described in Section 4.2.2 of this SOP.
- Connect new silicone tubing to the rotor head of the pump motor and tighten until snug.
- Run a short section of the tubing from the discharge side of the pump head to a collection vessel.
- Insert the free end of the influent tubing into the well and lower it to the middle of the saturated portion of the well screen. The depth of the tubing intake will be recorded on the Groundwater Sample Collection Form. For low yielding wells, it may be necessary to gently lower the tubing intake during purging to follow the declining water level in the well.
- Begin purging. Collect and dispose of purge water in accordance with the criteria specified by the installation-specific work plan.
- Physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) of the purge water will be measured when purging begins, after each well casing volume, and then periodically throughout the purging procedure. These measurements will be recorded on Groundwater Sample Collection Forms. Purging is considered complete when water quality indicator parameters have stabilized (i.e., three consecutive readings are within tolerances specified in Table 4-1) (ASTM, 2007; EPA, 1992 and Barcelona et al, 1985). If stability is not reached within the removal of three well casing volumes, then purging is continued until stability is attained, up to a maximum purging period of one hour. If parameters have not stabilized after the additional hour of purging, the sample may be collected.



- For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow purging rates. In this case, purging will be considered complete when one well volume (i.e., well casing plus filter pack volume) has been purged from the well and the well goes dry.
- The well will then be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completely filled following a single recharge event. The date and time of each sample collection will be recorded.
- Inspect the sample bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.
- Turn on and adjust the rotor speed of the pump so that the water will flow smoothly and without agitation into the sample containers.
- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.
- The samples should be collected in the order of volatility, collecting the samples for the analysis of the most volatile parameters first, followed by the samples for the least volatile parameters. The samples for volatiles analysis should be collected during one full discharge cycle. Do not partially fill a container for volatile parameter analysis during one cycle and complete the filling during the next cycle.
- Document the sampling event on the Groundwater Sample Collection Form.
- As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.





- Handle and ship the sample according to the procedures outlined in SOP AFW-11 following appropriate chain of custody procedures. Samples stored temporarily on-site will be maintained per SOP AFW-10.

### **Groundwater Purging and Sampling with an Electric Submersible Pump**

Purging and sampling will be conducted in accordance with the project work plans. The standard procedure for purging and sampling using a submersible pump is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and is described below.

- Inspect the equipment to ensure that it is in good working order.
- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.
- An exception to the daily calibration requirements will be made in the case of the water level meters. These instruments will be calibrated at the beginning of the project and then every six months using a steel surveyors tape.
- If non-dedicated equipment is being used, decontaminate the equipment as described in SOP AFW-10. During decontamination, the equipment should again be inspected for damage and, if present, repaired or replaced with undamaged equipment.
- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Log and brought to the attention of the Field Manager.
- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Groundwater Sample Collection Form.
- Obtain a static water level measurement and calculate the cased well volume as described in Section 4.2.2 of this SOP.
- If using non-dedicated equipment, lower the pump and associated lines into the well. The pump intake should be located near the middle of the saturated portion of the



screened interval and the depth of the pump intake will be recorded on the field form. For low yielding wells it may be necessary to gently lower the pump during purging to follow the declining water level in the well.

- Place the generator downwind of the well. Start the generator, and then plug the pump into the generator.
- Begin purging. Collect and dispose of purge water in accordance with the criteria specified by the project work plans.
- Physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity, and temperature) of the purge water will be measured when purging begins, after each well casing volume, and then periodically throughout the purging procedure. These measurements will be recorded on Groundwater Sample Collection Forms. Purging is considered complete when water quality indicator parameters have stabilized (i.e., three consecutive readings are within tolerances specified in Table 4-1) (ASTM, 2007; EPA, 1992 and Barcelona et al, 1985). If stability is not reached within the removal of three well casing volumes, then purging is continued until stability is attained, up to a maximum purging period of one hour. If parameters have not stabilized after the additional hour of purging, the sample may be collected.
- For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow purging rates. In this case, purging will be considered complete when one well volume (i.e., well casing plus filter pack volume) has been purged from the well and the well goes dry.
- The well will then be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completely filled following a single recharge event. The date and time of each sample collection will be recorded.
- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of

preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.

- Turn on and adjust the flow rate of the pump by using the check-valve on the discharge line so that the water will flow smoothly and without agitation into the sample bottles.
- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.
- The samples should be collected in the order of volatility, collecting the samples for the analysis of the most volatile parameters first, followed by the samples for the least volatile parameters. The samples for volatiles analysis should be collected during one full discharge cycle. Do not partially fill a container for volatile parameter analysis during one cycle and complete the filling during the next cycle.
- Document the sampling event on the Groundwater Sample Collection Form.
- As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.
- Handle and ship the sample according to the procedures outlined in SOP AFW-11, following appropriate chain of custody procedures. Samples stored temporarily on-site will be maintained per SOP AFW-10.

### ***Groundwater Purging and Sampling with a Bailer***

Purging and sampling will be conducted in accordance with the project work plans. The standard procedure for purging and sampling with a bailer is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and is described below.

- Inspect the equipment to ensure that it is in good working order.
- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.

- An exception to the daily calibration requirements will be made in the case of the water level meters. These instruments will be calibrated at the beginning of the project and then every six months using a steel surveyors tape.
- If non-dedicated equipment is being used, decontaminate the equipment as described in SOP AFW-10. During decontamination, the equipment should again be inspected for damage and, if present, repaired or replaced with undamaged equipment.
- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Activity Daily Log and brought to the attention of the Field Manager.
- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Groundwater Sample Collection Form.
- Obtain a static water level measurement and calculate the cased well volume as described in Section 4.2.2 of this SOP.
- Secure the bailer to a five foot length of stainless bailer wire with a bowline knot or clip. Attach the bailer wire to bailing line or chain.
- Begin purging by slowly lowering the bailer into the groundwater. Allow the floating ball valve to seat, and slowly retrieve the bailer. Repeat this procedure to purge the well. Collect, transport, and dispose of purge water in accordance with the criteria specified in the project work plans.
- During purging, the descent of the bailer should be controlled to prevent freefall inside the well. In the event the bailer encounters an obstruction inside the well, no attempts should be made to push the bailer beyond the obstruction. If the bailer becomes lodged in the well, the line should not be pulled with such force that it would part from the bailer. Such conditions should also be noted on the Groundwater Sampling Form and brought to the immediate attention of the Field Manager.
- The well will then be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA



8330) must be concurrently and completed filled following a single recharge event. The date and time of each sample collection will be recorded.

- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.
- Lower the sample collection bailer and submerge into the water column as above. Retrieve the bailer and insert a bottom-emptying device into the bailer so that the water will flow smoothly and without agitation into the sample bottles.
- Collect the sample water directly into the provided sample bottles (containers), allowing the discharge to flow gently down the inside of the bottles, minimizing aeration of the sample. Completely fill the bottles; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.
- Document the sampling event on the Groundwater Sample Collection Form.
- As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.
- Handle and ship the sample according to the procedures outlined in SOP AFW-11, following appropriate chain of custody procedures. Samples stored temporarily on-site will be maintained per SOP AFW-10.

### ***Groundwater Sampling using Inflatable Packers***

Inflatable Packers are used to isolate portions of an open-hole bedrock well for sampling or other hydrogeological assessment purposes. Expandable rubber bladders are positioned one above the other on a metal pipe. Their configuration permits discharge and power supply lines to pass through the packers with a pump sandwiched in between. The packers are inflated with compressed air to hydraulically isolate water-bearing fractures identified through borehole geophysical logging or core samples.

Pumping of water from within a packed interval can be used to estimate yield of the selected zone, and for the analysis of samples collected from a targeted zone, facilitating the assessment of the vertical extent of groundwater contamination. If samples are to be collected for field screening or laboratory analysis, low-flow sampling techniques would be employed before



sample collection. The resolution of the groundwater quantity and quality within the borehole is based on the length of the bedrock borehole interval tested and usually does not exceed 20 feet in length. The steps for collecting groundwater samples using inflatable packers are outlined below:

- If packers are not seated properly, water will leak around the system during the sampling event. To determine if leakage around the packer is occurring, the water level above the top packer is monitored to see if the level drops while the target interval is being pumped. If the water level drops, the packers will be re-seated by deflating and re-inflating the packers. A dropping water level does not necessarily mean the packers have a poor seal. Another possibility is that there are vertical fractures that connect fractures within the sampling zone to fractures above the top packer.
- Packers are assembled at the surface with the selected pump sandwiched between individual bladders.
- Assembled unit is lowered to a predetermined depth.
- Bladders are inflated from air-lines originating at the surface. Bladder pressures are determined accordingly:

G = Inflation  
pressure at gauge  
(PSI)

DP = Depth to top  
of packer (feet)

DW = Depth to static  
water level in well (feet)

Sp = Unconfined packer pressure  
rating for the well size (PSI)

PP = Injection pump  
pressure (PSI)

To calculate Packer Inflation Pressure for  
sampling (i.e., pump out):

$$G = [ (DP - DW) \times .43 ] + Sp + [ (DP - DW) \times .43 \times .2 ]$$

- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.
- Turn on and adjust the flow rate of the pump so that the water will flow smoothly and without agitation into the sample bottles.
- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.
- The samples should be collected in the order of volatility, collecting the samples for the analysis of the most volatile parameters first, followed by the samples for the least volatile parameters. The samples for volatiles analysis should be collected during one full discharge cycle. Do not partially fill a container for volatile parameter analysis during one cycle and complete the filling during the next cycle.
- Document the sampling event on the Groundwater Sample Collection Form.
- As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.
- Handle and ship the sample according to the procedures outlined in SOP AFW-11, following appropriate chain of custody procedures. Samples stored temporarily on-site will be maintained per SOP AFW-10.



## MONITORING WELL INSTALLATION SOP AFW-04 (PFCs)

### 1.0 PURPOSE

This Standard Operating Procedure (SOP) provides procedures and requirements for the installation of monitoring wells using various drilling techniques, including but not limited to, direct push technology (DPT), hollow-stem auger, rotary, sonic, or dual-tube percussion. The details within this SOP should be used in conjunction with installation-specific work plans.

### 2.0 SCOPE

These procedures apply to all Amec Foster Wheeler personnel and subcontractors who perform monitoring well installation activities during perfluorinated compound (PFC) investigations.

### 3.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1986, *Resource Conservation and Recovery Act (RCRA) Ground Water Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, U.S. Government Printing Office, Washington D.C.

EPA, 1987, *A Compendium of Superfund Field Operations Methods*, EPA-500/P-87/001, U.S. Government Printing Office, Washington D.C.

### 4.0 DEFINITIONS

**Air Rotary Casing Hammer Drilling** – A drilling method using a non-rotating drive casing that is advanced simultaneously with a slightly smaller diameter rotary bit attached to a string of drill pipe. The drive casing is a heavy-walled, threaded pipe that allows for pass-through of the rotary drill bit inside the center of the casing. Air is forced down through the center drill pipe to the bit, and then upward through the space between the drive casing and the drill pipe. The upward return stream of air removes cuttings from the bottom of the borehole.

**Annular Space** – The space between:

- Concentric drill pipes;





- An inner drill pipe and outer drive casing;
- Drill pipe or drive casing and the borehole wall; or,
- Well screen or casing and the borehole wall.

**Borehole** – Any hole drilled into the subsurface for the purpose of identifying lithology, collecting soil or rock samples, and/or installing groundwater wells.

**Cuttings** – Pieces of soil, sediment, or rock cut by a bit in the process of drilling borings.

**Direct Push Drilling** – For the purposes of this monitoring well installation SOP, the term “direct push drilling” refers to using DPT to push or drive hollow rods into the ground for the purpose of installing monitoring wells with a maximum inside diameter of 1 inch when using 2.625 inch inside diameter DPT rods. Direct push drilling uses an expendable drive point that is fitted to the lower end of a string of drive rods that are advanced into the ground using percussive hammering. No cuttings are brought to the surface during drilling, although soil cores may be retrieved using various sampling tools.

**Dual-Tube Percussion Drilling** – A drilling method using non-rotating drive casing with a bit on the bottom of the casing string. A smaller diameter tube or drill pipe is positioned inside the drive casing. The drive casing is advanced by the use of a percussion hammer, thereby causing the bit to cut or break up the sediment or soil at the bottom of the boring. Air is forced down the annular space between the drive casing and inner drill pipe and cuttings are forced upward with the return stream of air within the center of the inner drill pipe.

**Filter Pack** – Granular filter material (sand, gravel, etc.) placed in the annular space between the well screen and the borehole wall to increase the effective diameter of the well and to minimize the movement of fine-grained material into the well.

**Grout** – For the purposes of this SOP, the term “grout” consists of a neat cement grout mixture generally containing five to six gallons of clean water mixed with each 94 pound bag of Portland cement. The grout is emplaced within a borehole as a slurry, and once properly set and cured, is capable of restricting movement of water.



**Hollow-Stem Auger Drilling** – A drilling method using augers with open centers. The augers are advanced with a screwing or rotating motion into the ground. Cuttings are brought to the surface by the rotating action of the augers, thereby clearing the borehole.

**Monitoring Well** – A well that provides for the collection of representative groundwater samples, the detection and collection of representative light and dense non-aqueous phase organic liquids, the measurement of fluid levels, and the assessment of hydrogeologic characteristics of saturated materials in the vicinity of the well.

**Mud Rotary Drilling** – For the purposes of this monitoring well installation SOP, the term “mud rotary drilling” refers to direct circulation (as opposed to reverse circulation) mud rotary drilling. Mud rotary drilling uses a rotating drill bit which is attached to the lower end of a string of drill pipe. Drilling mud is pumped down through the inside of the drill pipe and out through the bit. The mud then flows upward in the annular space between the borehole and the drill pipe, carrying the cuttings in suspension, within the drilling mud, to the surface.

**Sonic Drilling** – Sonic drilling uses a combination of rotary motion, oscillation/vibration, and hydraulic downward force to advance a drill bit and drive casing. Soil or rock cores are retrieved using a core barrel as the drive casing is advanced.

**Tremie** – A tubular device or pipe used to place grout, bentonite, or filter pack in the annular space of a borehole.

**Well Screen** – A commercially available, factory-perforated, wire wound, continuous wrap, or slotted casing segment used in a well to maximize the entry of groundwater from the producing zone and to minimize the entrance of sand.

## 5.0 PROCEDURES

This section contains both the main project team responsibilities and the procedures for monitoring well installation activities. The procedures described herein are applicable as requirements for monitoring well installations using DPT, hollow-stem auger, mud rotary, air rotary, air rotary casing hammer, sonic, or dual tube percussion drilling techniques. Site-specific factors need to be considered in the selection of well construction and completion materials, specification of well designs, and choosing borehole drilling methods. These factors



will be incorporated in project planning activities and the compilation of installation-specific work plans. The work plans will contain the following information related to monitoring well installation:

- Objectives of the monitoring well;
- Specific location of the well to be installed;
- Zone or depth well is to be installed;
- Drilling method(s) to be used;
- Well construction materials to be used;
- Specification of well design(s) including Well Construction Diagrams; and,
- Additional procedures or requirements beyond the scope of this SOP.

## **5.1 RESPONSIBILITIES**

### ***Base Lead***

The Base Lead is responsible for ensuring that all monitoring well installation activities are conducted and documented in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by quality assurance/quality control (QA/QC) monitoring activities.

### ***Field Lead***

The Field Lead is responsible for periodic observation of well installation activities to assure implementation of this SOP. The Field Lead is also responsible for the review and approval of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to monitoring well installation requirements, issuing nonconformances, etc.) identified during the performance of these activities.

### ***Field Personnel***

Field personnel assigned to monitoring well installation activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. Field staff are responsible for reporting deviations from the procedures to the Base Lead or the Field Lead.



## **5.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures/considerations to be made during field activities at potential PFC release areas.

### **5.2.1 FIELD PREPARATION**

Before mobilization of a rig to the well site, ensure that the monitoring well location has been appropriately cleared of all underground utilities, buried objects, and overhead utilities, and that drill permits (e.g., FAA permits) have been issued per the project work plans. Review all forms and diagrams documenting the location of the cleared monitoring well site and the location of any identified underground utility lines, other buried objects, and overhead utilities.

Decontaminate drill rig and drilling equipment, including down-hole equipment and well construction materials, before borehole drilling and monitoring well installation.

Clear the work area of brush and minor obstructions and then mobilize the rig to the planned monitoring well location. The responsible field personnel (e.g., rig geologist or engineer) should then review with the driller the proposed borehole and well design and the details of the monitoring well installation plan, including any potential drilling or completion problems.

Calibrate field equipment according to the instrument manufacturer's specifications. Document the calibration results on the appropriate form(s). Instruments that cannot be calibrated according to the manufacturer's specifications will be removed from service and tagged.

Workers will be provided with, and don, the appropriate personal protective equipment as specified by the installation-specific work plans. Typically, the minimum personal protection will include a hard hat, safety glasses, gloves and steel-toed boots.

### **5.2.2 BOREHOLE DRILLING**

Commence drilling and advance the borehole while conducting health and safety air monitoring according to the work plans. Perform air monitoring as often as necessary to ensure the safety of workers. Record all measurements in the field log and/or other appropriate form(s) as



specified in the installation-specific work plans. Record other pertinent information (date, investigation area, well or boring number, and location) in the field log and/or on other appropriate form(s) as specified by the work plans. In addition, note and record observed field conditions, any unusual circumstances, and weather conditions.

During drilling, collect representative cutting and/or soil samples as required by the installation-specific work plans. Compile a Boring Log or lithologic log from the cuttings and samples.

At total depth, remove soil cuttings through circulation or by rapidly spinning the augers as applicable, prior to constructing the well. Review logs and notes with the driller for any zones or depths exhibiting drilling problems that may affect the planned well installation. Condition the hole or take other actions mutually agreed upon by the rig geologist (or engineer), lead technical personnel, and the driller to ensure or aid in the well development.

Remove the drill pipe and bit if using sonic or rotary techniques, remove the center bit plug if using the hollow-stem auger technique, or disengage the expendable drive point if using DPT. The well construction materials will then be installed inside the open borehole or through the center of the drive casing or augers.

Measure the total depth of the completed boring using a weighted sounding line. The borehole depth is checked to assure that formation material has not collapsed or heaved to fill the borehole. If heaving has taken place or the borehole has collapsed, options for cleaning, re-drilling, or installation in the open section of the boring should be discussed with lead technical personnel.

In the event that the borehole was over-drilled, bentonite pellets, or bentonite chips (as specified in the installation-specific work plans) may be added to the boring to raise the bottom of the borehole to the desired depth. The bentonite should be installed through a tremie pipe to fill the borehole from the bottom of the boring upward. During installation, the tremie pipe should be submerged below the top of the bentonite column in the borehole to prevent free-fall and bridging. Bentonite should be added gradually to the borehole to prevent bridging. Bentonite addition will stop when its level has reached approximately one foot below the desired base of the well string (i.e., casing, screen, end plug or sump, etc.). The bentonite plug will be hydrated for at least one hour before installation of a well string and filter pack.

### 5.2.3 WELL INSTALLATION

Calculate volumes of filter pack, bentonite pellets/slurry, and grout required, based on borehole and well casing dimensions. If required by the installation-specific work plans, determine the filter pack and well screen slot size for the monitoring well. For most monitoring well installations, the filter pack and well screen slot size will be determined prior to the start of the installation activities.

Inspect the casing, screen, and any other well construction materials prior to installation to assure that no damage has occurred during shipment and decontamination activities. Measure and record the length of each section of well screen, blank casing, and the end cap in order to determine the actual total length of well string and screen interval, and to calculate desired stickup.

Connect and carefully lower the well string through the open borehole, drive rods or casing, or inside of the augers until the well string is at the desired depth. The well string should be suspended by the installation rig and should not rest on the bottom of the boring. In the event the well string was dropped, lowered abruptly, or for any other reason suspected of being damaged during placement, the string should be removed from the boring and inspected. In certain instances, the well string may rise after being placed in the borehole due to heaving sands. If this occurs, the driller must not place any drilling equipment on the well string (drill pipe, hammers, etc.) to prevent the casing from rising. The amount of rise should be noted by the rig geologist or engineer who should then consult lead technical personnel for an appropriate course of action.

Record, at a minimum, the following information on the appropriate forms per the installation-specific work plans:

- Total length of well string;
- Actual calculated length between top of blank casing and top of screen interval;
- Total measured length of screen interval;
- Total measured length between bottom of screen interval and end cap or sump;
- Total depth of boring;
- Depth from ground surface to top of grout or bentonite backfill in bottom of borehole (if present);

- Installed depth to base of well string (i.e. bottom of end cap or sump); and,
- Installed depth to top and bottom of well screen.

When using the mud rotary drilling technique, tremie the filter pack into the annular space around the screen. Clean, potable water may be used to assist with the filter pack tremie operation. For all other drilling techniques, the filter pack may be allowed to free fall or be tremied per the installation-specific work plans. If using DPT rods, drive casing, or augers, the drive rods, casing, or augers should be pulled slowly during filter pack installation in increments no greater than 5 feet. For DPT-installed wells, a pre-pack filter may be attached to or fitted around the screen and placed concurrently with the well string.

Filter pack settlement should be monitored by initially measuring the sand level before beginning to withdraw the drive casing/augers. In addition, depth soundings using a weighted tape shall be taken repeatedly to continually monitor the level of the sand. The top of the well casing shall also be monitored to detect any movement due to settlement or from drive casing/auger removal. If the top of the well casing moves upwards at any time during the well installation process, the driller should not be allowed to set drilling equipment (e.g., downhole hammers, drill pipe, etc.) on the top of the casing to prevent further movement.

Filter pack should be added until its height is approximately 2 feet above the top of the screen (unless otherwise specified in the installation-specific work plans), and verification of its placement (by sounding) should be conducted. The filter pack should then be gently surged using a surge block or swab in order to settle the pack material and reduce the possibility of bridging. Surging is completed by lowering a surge block or swab into the well casing and alternately lowering and raising it within the saturated portion of the screen.

The height of the filter pack will then be re-sounded and additional filter pack placed as necessary. Once the placement of the filter pack is completed, the depth to the top of the pack is measured and recorded on the appropriate forms per the work plans.

A 3-foot thick (unless otherwise specified in the installation-specific work plans) bentonite seal is then installed on top of the filter pack. If pellets or chips are used, they should be added gradually to avoid bridging. Repeated depth readings will be taken using a weighted tape to ascertain the top of the bentonite seal. Bentonite chips and pellets will not hydrate properly if they are not continually submerged in water and must be allowed to hydrate for a minimum of



12 hours prior to grout installation. Granular bentonite must be used if the seal is to be placed above the water table.

After hydration of the bentonite seal, grout (or cement bentonite grout, as specified in the installation-specific work plans) is then pumped through a side-discharging tremie pipe and filled from the top of the bentonite seal upward. The bottom of the tremie pipe should be maintained below the top of the grout column to prevent free fall and bridging. When using drive casing or hollow-stem auger techniques, the drive casing/augers should be raised in incremental intervals, keeping the bottom of the drive casing/augers below the top of the grout. Grouting will cease when the grout level has risen to within approximately 1 to 2 feet of the ground surface, depending on the surface completion type (flush mount or aboveground). Grout levels should be monitored to assure that grout taken into the formation is replaced by additional grout. If settling of the grout occurs, additional topping off of the grout may be necessary.

Record, at a minimum, the following information on the appropriate forms per the installation-specific work plans:

- Type and total volume of filter pack material installed;
- Total surging time and amount of settlement;
- Final measured depth to top of filter pack;
- Type and total volume of bentonite seal material installed;
- Amount of water added to hydrate bentonite seal;
- Amount of time bentonite seal hydrated;
- Final measured depth to top of bentonite seal;
- Type and mixture of grout material(s) used;
- Total volume of grout installed;
- Total number of lifts used to install grout;
- Final measured depth to top of grout seal;
- Final top of casing measurement after installation completion (feet below ground surface or feet above ground surface); and
- Type of well cap (lockable hinged or expansion plug) used to secure well.



#### 5.2.4 SURFACE COMPLETION

For aboveground completions, the protective steel casing will be centered on the well casing and inserted into the grouted annulus. Prior to installation, a 2-inch deep temporary spacer shall be placed between the PVC well cap and the bottom of the protective casing cover to keep the protective casing from settling onto the well cap. After the protective casing has set, a drainage hole may be drilled into the protective casing if required by the installation-specific work plans. The drainage hole is positioned approximately 2 inches above ground surface. The protective casing will be painted with a rust-preventive colored paint. The well head will be labeled to identify, at a minimum, the well identification, total depth, and date of installation. A minimum of 24 hours after grouting should elapse before installation of the concrete pad and steel guard posts for aboveground completions, or street boxes or vaults for flush mount completions.

For aboveground completions, a concrete pad, a minimum of 2-foot by 2-foot by 4-inch thick, is constructed at ground surface around the protective steel casing. The concrete pad is sloped away from the protective casing to promote surface drainage from the well. If traffic conditions warrant extra protection, three steel bucking posts will be embedded to a depth approximately 2 feet below the top of the concrete pad. The posts will be installed in concrete filled post holes spaced equally around the well at a distance of approximately 2 feet from the protective steel casing. Where removal of bucking posts is required for well access, mounting sleeves should be imbedded into the concrete.

For flush mount (or subgrade) completions, a street box or vault is set and cemented in position. The top of the street box or vault will be raised slightly above grade and the cement sloped to grade to promote surface drainage away from the well.

Record, at a minimum, the following information on the appropriate forms per the installation-specific work plans:

- Type and dimensions of surface completion installed;
- Dimensions of concrete pad installed (for above ground completions);
- Number and position of steel bucking posts (if applicable); and
- Number, type and size of bolts (for flush mount completions).



### **5.2.5 DEMOBILIZATION**

Following well completion and demobilization of the rig, the well site should be cleared of all debris and trash and restored to a neat and clean appearance per the installation-specific work plans. All investigation-derived waste generated at the well site should be appropriately contained and managed per the work plans.



## **MONITORING WELL DEVELOPMENT**

### **SOP AFW-05 (PFCs)**

#### **1.0 PURPOSE**

This Standard Operating Procedure (SOP) establishes general guidelines for developing new groundwater monitoring wells and redeveloping existing monitoring wells. Additional site-specific well development procedures and requirements may be provided in the installation-specific work plans.

#### **2.0 SCOPE**

These procedures apply to all Amec Foster Wheeler personnel and subcontractors who perform monitoring well development activities during perfluorinated compound (PFC) investigations.

#### **3.0 REFERENCES**

U.S. Environmental Protection Agency (EPA), 1992, *Monitoring Well Development Guidelines For Superfund Project Managers*, OSWER-9950.1, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Ground Water Forum, April.

#### **4.0 DEFINITIONS**

**Surge Block** – A plunger-like tool, consisting of leather or rubber discs sandwiched between steel or wooden disks that may be solid or valved, that is used in well development.

**Surging** – A well development technique where the surge block is alternately lifted and dropped within the well casing above or adjacent to the screen to create a strong inward and outward movement of water through the well intake.

**Well Development** – The act of stressing the formation around the well screen so that mobile, artifact particulates are removed from the well, filter pack, and formation in the immediate vicinity of the monitoring well. The purpose of development is to try to ensure proper hydraulic connection between the well and the geologic materials in the vicinity of the well, produce a well capable to yielding groundwater samples of acceptably low turbidity, and to obtain groundwater samples as similar as possible to in situ conditions.



## **5.0 PROCEDURES**

This section contains both the main project team responsibilities and the procedures for monitoring well development activities. The procedures described herein are applicable as requirements for monitoring well development methods including surging and bailing, surging and pumping, or combinations of these processes. Site-specific factors need to be considered in the selection of well development methods. These factors will be incorporated in project planning activities and the compilation of installation-specific work plans. The standard procedure for field personnel to use in assessing and documenting well development is described below and is intended only for development methods listed above.

### **5.1 RESPONSIBILITIES**

#### ***Base Lead***

The Base Lead is responsible for ensuring that monitoring wells are properly developed and that the development process is properly documented. This will be accomplished by staff training and by maintaining quality assurance/quality control (QA/QC).

#### ***Field Lead***

The Field Lead is responsible for periodic inspections and review of field generated documentation associated with well development. If deviations from project requirements occur, the Field Lead is also responsible for issuing nonconformance reports and requests for corrective action.

#### ***Field Personnel***

Field personnel are responsible for conducting monitoring well development and documentation in accordance with the specifications outlined in this SOP and with the project work plans. All field staff are responsible for reporting deviations from procedures to the Base Lead or Field Lead.

### **5.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures/considerations to be made during field activities at potential PFC release areas.



### 5.2.1 FIELD PREPARATION

Decontaminate the rig and development equipment. For a newly installed monitoring well, allow the grout to cure for a minimum of 24 hours prior to development.

Calibrate all field analytical test equipment (e.g., pH, temperature, conductivity, oxidation and reduction potential, and turbidity) according to the instrument manufacturer's specifications and the project-specific work plan or sampling and analysis plan. Specific test equipment to be used should be identified in the project-specific work plans. Instruments that cannot be calibrated according to the manufacturer's specifications will be removed from service and tagged.

An exception to the daily calibration requirements will be made in the case of the water level meters. The tape of these instruments will be checked prior to the beginning of the project, and each succeeding six months, using a steel surveyor's tape.

Workers will be provided with, and don, the appropriate personal protective equipment as specified by the installation-specific work plans. Typically, the minimum personal protection will include a hard hat, safety glasses, gloves and steel-toed boots.

### 5.2.2 WELL DEVELOPMENT/REDEVELOPMENT

Visually inspect the well to ensure that it is undamaged, properly labeled and secured. Any observed problems with the well head should be noted in the field log and reported to the Field Manager.

Unlock the well and obtain a depth to water level measurement. Calculate the volume of water in the well (cased well volume) as follows:

$$\pi \left( \frac{d}{2} \right)^2 (h_1 - h_2) \times 7.48 = \text{gallons per cased well volume}$$

Where:

d = inside diameter of well casing, ft

h<sub>1</sub> = depth of well from top of casing, ft

h<sub>2</sub> = depth to water from top of casing, ft.



The depth to the bottom of the well should be measured and then compared to the well completion form or diagram for the well. If sand or sediment is present inside the well, it should first be removed by bailing. Do not insert bailers, pumps, or surge blocks into the well if obstructions, parting of the casing, or other damage to the well is suspected. Report such conditions to the Field Manager and obtain approval to continue or cease well development activities.

Begin development by first gently surging the well with a surge block, followed by bailing or pumping. This is then continued with alternate surging and bailing or pumping. At no time should the surge block be forced down the well if excessive resistance is encountered. During development, the surge block or bailer should not be allowed to free-fall or descend rapidly such that it becomes lodged in the casing or damages the end cap or sediment trap at the bottom of the well.

Use of a surge block may not be required in the development of certain wells, particularly small diameter wells (i.e., 2-inches or less). Equipment typically used to develop small diameter wells (e.g., bladder pumps, electric submersible pumps, bailers, and tubing with check valve, may be raised and lowered in the water column to effectively surge the well during the development process.

While developing, take periodic water level measurements (at least one every five minutes) to determine if drawdown is occurring and record the measurements on the well development record. If a well is pumped or bailed to dryness, then development will cease and not resume until the water level in the well recovers to approximately 80 percent of static, pre-development water level conditions.

While developing, calculate the rate at which water is being removed from the well. Record the volume on the Well Development Form.

While developing, water is also periodically collected and readings taken of the indicator parameters: pH, specific conductance, oxidation/reduction potential, dissolved oxygen, turbidity, and temperature. Development is considered complete when the indicator parameters have stabilized (i.e., three consecutive pH, specific conductance, and temperature readings are within tolerances specified in the project work plans or within 10% if not otherwise specified) and the maximum turbidity is 50 NTUs or less, or the well develops dry. Additionally,



three times the amount of water used during drilling and well installation activities will be removed during development of newly installed wells. In certain instances, for slow recharging wells or small-diameter wells, the parameters may not stabilize. In this case, well development is considered complete upon the removal of three times the amount of water used during drilling and well installation activities (if used) or when the best achievable water quality has been attained (i.e. no further improvement observed) using a combination of surging and pumping as described above.

Obtain a water level and turbidity measurement at the completion of development.

Complete documentation of the well development event on the Well Development Form. At a minimum this record must contain:

- Project name and number;
- Well identification number;
- Well depth, casing size, and completion date;
- Method of development;
- Volume of water removed;
- Water levels (including the time of measurement);
- Physical description of the water (e.g., discoloration, turbidity, odor, etc.) and solids removed from the well;
- Test equipment readings for pH, conductivity, temperature and turbidity (including the time of collection); and,
- Signature of the well development observer.

Collect and appropriately dispose of water removed from the well in accordance with criteria listed in the project-specific work plans and regulatory requirements.

Allow the well to recover for at least 24 hours prior to sampling.



## **BOREHOLE ABANDONMENT**

### **SOP AFW-06 (PFCs)**

#### **1.0 PURPOSE**

This Standard Operating Procedure (SOP) establishes guidelines and procedures for field personnel to use in the supervision of borehole or soil boring abandonment and groundwater monitoring well abandonment activities. Additional specific borehole and well abandonment procedures and requirements will be provided in the project work plans.

#### **2.0 SCOPE**

These procedures apply to all Amec Foster Wheeler personnel and subcontractors who perform soil boring or monitoring well abandonment activities during perfluorinated compound (PFC) investigations.

#### **3.0 REFERENCES**

U.S. Environmental Protection Agency (EPA), 1991, *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*, EPA/600/4-89/034, U.S. Environmental Protection Agency, Office of Research and Development, March.

#### **4.0 DEFINITIONS**

**Borehole Abandonment** – The process whereby boreholes or soil borings are grouted or sealed following completion of drilling, sampling and/or logging.

#### **5.0 PROCEDURES**

This section contains responsibilities, procedures and requirements for borehole abandonment. Abandonment procedures to be used at a particular investigation area must incorporate project-specific regulatory requirements. Consequently, the installation-specific work plans will identify the following:

- Abandonment objectives,
- Boreholes to be abandoned,





- Specific procedures for borehole abandonment beyond those covered in this SOP (e.g., state-specific procedures); and,
- Applicable site-specific regulatory requirements for borehole abandonment.

## **5.1 RESPONSIBILITIES**

### ***Base Lead***

The Base Lead is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and with any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

### ***Field Lead***

The Field Lead is responsible for periodically observing field activities and review of field generated documentation associated with this SOP. The Field Lead is also responsible for the implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to the abandonment requirements, issuing nonconformances, etc.) if problems occur.

### ***Field Personnel***

Field personnel assigned to borehole and well abandonment activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from the procedures to the Base Lead or Field Lead.

## **5.2 FIELD PROCEDURES/CONSIDERATIONS**

After drilling, logging and/or sampling, boreholes should be backfilled by the method required by the applicable regulatory agency and described in the installation-specific work plans. This typically consists of backfilling to the surface with bentonite chips, pellets or bentonite-cement grout. If bentonite chips or pellets are used, they should be added to the borehole in 2-foot lifts and hydrated with water from a potable water supply. This process should be repeated



until the entire borehole is plugged using no less than 5 gallons water per ten feet of borehole. If bentonite grout is used the following guidelines should be followed:

- Bentonite should be thoroughly mixed into the grout and within the percentage range specified in the work plans. If not otherwise specified in the work plans, the cement-bentonite grout mixture should be of the following proportions: 94 pounds of Portland cement, 5 pounds of powdered bentonite and a maximum of 8 gallons of water. The grout is usually tremied into the hole; however, for selected boreholes (e.g., shallow borings well above the water table) at certain sites, the grout may be allowed to free fall. In either case, care must be taken to ensure the grout does not bridge, forming gaps or voids in the grout column.
- The volume of the borehole prior to sealing should be calculated and compared to the grout volume used during abandonment to aid in verifying that bridging did not occur.
- When using a tremie pipe to place grout in the borehole, the bottom of the tremie should be submerged into the grout column and withdrawn slowly as the hole fills with grout. If allowing the grout to free fall (and not using a tremie), the grout should be poured slowly into the boring. The rise of the grout column should also be visually monitored or sounded with a weighted tape.
- If the method used to drill the boring utilized a drive casing, the casing should be slowly extracted during grouting such that the bottom of the casing does not come above the top of the grout column.
- During the grouting process, the drilling hands performing the task should be supervised to assure that potentially contaminating material (oil, grease, or fuels from gloves, pumps, hoses, et. al) does not enter the grout mix and that personnel are properly wearing personal protective equipment as specified in the project Health and Safety Plan.
- Following grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to “top off” the hole.
- The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the installation-specific work plans.



## **SEDIMENT SAMPLING**

### **SOP AFW-07 (PFCs)**

#### **1.0 PURPOSE**

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of sediment samples for chemical and physical analysis. This SOP does not include the procedures and equipment selection for sediment sampling to support biological analysis, which is very specific to the aquatic environment and type of analysis (e.g., toxicological and bioaccumulation tests, benthic community analysis, etc.), and would be covered in the project work plan. This SOP is only applicable to bedload sediment sampling, and does not include suspended load sampling.

#### **2.0 SCOPE**

These procedures apply to all Amec Foster Wheeler personnel and subcontractors who perform sediment sampling activities during perfluorinated compound (PFC) investigations.

#### **3.0 REFERENCES**

American Society for Testing and Materials (ASTM), 1995, *Standard Guide for Core Sampling Submerged, Unconsolidated Sediments*, ASTM D 4823-95, reapproved October 1, 2008.

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

EPA, 2001, *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*, Office of Water, EPA 823-B-01-002.

EPA, 2007, *Sediment Sampling*, Region 4 Science and Ecosystem Support Division (SESD), Operating Procedure, Number SESDPROC-200-R1, November.

## 4.0 DEFINITIONS

**Composite Samples** – Composite samples are comprised from at least two grab samples that are thoroughly mixed in a decontaminated bowl to be representative of an area, transect, or vertical section. The resulting data typically is considered an average concentration of the area or column of sediment sampled. Compositing samples are NOT acceptable for VOC analysis.

There are two types of composite samples: horizontal and vertical. Horizontal composites are obtained by collecting multiple grab samples over an area (such as over the surface of a point bar) or across the channel or basin as a transect. Vertical composites are obtained by collecting multiple short (1-foot) core samples at different depths or one long core at the same location, and are collected when the sediment deposit is deep and a surficial sample would not represent historical conditions.

**Disturbed Sediment Sample** – A sediment sample whose in situ physical structure and fabric has been disturbed as the direct result of the sample collection procedure. Disturbed sediment samples can be collected using hand augers, spoons, or scoops as described in Section 4.2.

**Grab Samples** – A disturbed sediment sample that is collected by using such devices as the sample container (e.g., wide-mouth jar), or a stainless steel spoon, scoop, or hand auger, and is representative of the current conditions at the location sampled.

**Sediment** – Sediment is generally considered as those unconsolidated mineral and organic deposits found underwater, such as on the bottom of rivers, streams, creeks, ponds, lakes, lagoons, and estuaries; however, with constant changes in stream channel morphology, fluvial sediment deposits often emerge above base flow level and are sometimes abandoned as the flow channel migrates, leaving dry to saturated point bars and islands. Broadly speaking, sediment is “eroded material which lies below surface water the majority of the time where the surface water is capable of providing for an aquatic biota habitat.” Bedload sediment lies on top of, and is transported along, the surface of the channel or basin floor, that can be comprised of soil or bedrock. The inorganic particles of sediment range from clay to gravel size. Many contaminants in sediment are trapped in the interstitial water, while other contaminants are adsorbed onto the organic matter. Therefore, coarse sand- to gravel-size sediment is usually not a good candidate sample for chemical analysis, as the water and organic content is usually low.



**Sediment Sample** – Environmental samples of sediment can be collected as a single grab sample or as a composite sample, and as a surficial sample (top 6 inches of bedload sediment) or along a vertical profile. Surficial grab samples of bedload sediment (single or composited) are preferred when: the source of contamination is recent; the sedimentation rate is low; the surface water is known to have been a contaminant migration pathway; and the horizontal distribution of the contamination is being assessed. Vertical profile samples of bedload sediment (discrete depths or composited) are preferred when the source of contamination is historical and it is not known whether the surface water was a contaminant migration pathway, and therefore any contamination present in the sediment may be buried by recent sedimentation and is most likely stratified within the deposit. The method and type of sampling conducted will depend on the project and data quality objectives as defined in the installation-specific work plans.

**Undisturbed Sediment Sample** – A sediment sample whose in situ physical structure and fabric has not been disturbed as the result of sample collection. Undisturbed sediment samples can be collected using the core samplers described in Section 4.2.

## 5.0 PROCEDURES

This section contains both the team member responsibilities and procedures involved with sediment sampling. Proper sediment sampling procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with installation-specific work plans. The installation-specific work plans will generally provide the following information:

- Sample collection objectives;
- Approximate locations and depths of sediment samples to be collected;
- Numbers and volumes of sediment samples to be collected;
- Types of analyses to be conducted for the samples;
- Specific quality control procedures required; and,
- Any additional sediment sampling requirements or procedures beyond those covered in this SOP, as necessary.



- 

## **5.1 RESPONSIBILITIES**

### ***Base Lead***

The Base Lead is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and with any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

### ***Field Lead***

The Field Lead is responsible for observing sampling activities and periodic review of field generated documentation. The Field Lead is responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to quality control sampling requirements, issuing nonconformances, etc.) if problems occur.

### ***Field Personnel***

Field personnel assigned to sediment sampling activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff members are responsible for reporting deviations from procedures to the Base Lead or Field Lead.

## **5.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures/considerations to be made during field activities at potential PFC release areas.

### **5.2.1 SEDIMENT SAMPLING EQUIPMENT**

A number of devices are available for the collection of sediment samples, the proper selection of which is dependent on the sampling objectives, whether the sediment is above or below water, the sediment thickness, the depth of water above the sediment, the accessibility and conditions of the sampling locations, and the analytical requirements. Therefore, it is prudent to conduct a site visit of the sampling locations before the development of the work plan. Two types of sediment sampling devices will typically be used: core samplers and grab samplers.



Most of these devices are constructed of stainless steel, and some core samplers allow a sleeve (should be made of HDPE) to be inserted into the core barrel to retain the sample.

### **Core Samplers**

The collection of submerged sediment samples, and most sediment deposits above water, may be conducted with a core sampler (i.e., both grab and composite samples). The advantage of a core sampler over a grab sampler is that discrete and less disturbed samples can be collected if needed, a complete vertical profile may be collected for deposits up to several feet thick, and when sampling submerged sediment, there is no loss of fines as the sample is raised to the surface (ASTM, 2008). The simplest core sampler is a hand-driven, hollow, stainless steel or polycarbonate core barrel, with a beveled edge on the head assembly at the leading end and a check valve or flapper valve at the opposite end to keep the sample in the barrel by partial vacuum (end-filling type). The trailing end has a T-handle to push and/or twist the core barrel into the soft sediment. Core barrels are typically 1- to 2-inches in diameter and are available in 2- and 4-foot lengths; however, core barrels are available in lengths up to 8 feet (for deeply submerged sediment sampling). For deeper submerged sediments (> 2 feet below the water surface), usually collected from a boat, handle extensions can be added to the top of the hand core sampler.

A sample sleeve, or core liner can be inserted into some core samplers to obtain discrete samples that are handled and shipped in the sleeve. Upon extrusion from the core barrel, cores can be subsampled or homogenized. One disadvantage to core samplers is that the volume of sediment retrieved in one core barrel may be insufficient if full suites of analyses are needed, thus requiring multiple cores to be collected at each location.

### **Grab Samplers**

Grab samplers will disturb the sediment during collection, which may be a limiting factor for some sampling parameters and objectives. If sampling dry to moist surficial sediments is the sampling objective, then a sample can be collected by using grab samplers such as stainless steel hand augers, spoons, scoops, or the sample containers themselves (wide-mouth jar). If sampling shallow submerged sediment (< 6 inches below the water surface), then the sample container may be used as the preferred collection device to minimize loss of fines upon raising the sample to the surface. The lid of the sample container may be used to cover the mouth of the sample container before raising it to the surface.

For deeper submerged sediments (>2 feet below the water surface), usually collected from a boat, a Ponar grab sampler is an option for surficial deposits. This type of sampler has a jaw-type mechanism that is tripped from above in order to close the jaws and collect the sample. The dredge is lowered slowly through the water to the sediment with the jaws in the open position. As the dredge is retrieved, the jaws close and the isolated sediment is brought to the surface. The disadvantage to using these types of grab samplers is that a pebble or stick can often prevent the jaws from shutting completely, and the sample will be washed or lost upon raising the sampler to the surface. If sample collection at depth is not successful using a grab sampler, then use of a core sampler may be required.

## 5.2.2 FIELD PREPARATION

### Pre-Sample Planning

- Review carefully the Health and Safety Plan and/or the Hazard Assessment.
- If current information is not available, conduct a reconnaissance of all sediment sampling locations to determine accessibility to the water body, depth of water, dangerous conditions (e.g., strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.), sediment accumulation points to flag for sampling (e.g., pools, convex side of meanders, mid-channel islands, downstream side of boulders, deltas, etc.), and sampling and personal protection equipment selection criteria. Access to water bodies such as streams may be hampered by thick vegetation, and lakes and ponds that will require the use of a boat may not be accessible by road. Therefore, the logistics of getting the sampling equipment and containers to and from the sampling sites must be considered before attempting to sample.
- The total depth of the sediment column should be determined prior to sampling when conducting vertical profile sampling to ensure that the proposed sampling location is an accumulation point, and to determine the total depth in which samples will be collected. This may be done using one of several methods, which may include: 1) shovel 2) post-hole digger 3) push probe or 4) core sampler. A field geologist or environmental scientist will be on-site to determine the preferred depth for biased samples, if needed. Depth measurements will be recorded in the field log.
- The timing of sediment sampling relative to stream flow is critical, even when fluctuation in stream flow is not a variable of concern in the project objectives. Avoid sampling during high water or flood conditions, not only for safety reasons, but also



because most sediment deposits will be submerged under deeper water, will be eroding due to turbulent flow, and will be migrating and/or in suspension. If the same locations are being sampled on a periodic basis (e.g., quarterly, semi-annually, yearly), it is critical to sample under the same flow conditions (e.g., base flow) during each periodic event.

- Plan to collect sediment (and co-located surface water) samples along a water body in the upstream direction, starting from the most downstream sampling location. This procedure will insure that any mobilized contaminants or fine particles resulting from sampling activities, which will migrate downstream, do not affect the representativeness of the subsequent samples. This procedure must be followed even in lakes or ponds that are stream fed.
- Select biased locations where sediment occurs. Transects may have to be diagonal to stream flow instead of perpendicular to include point bars on opposite sides. For establishing a grid or transects in a lake, placing buoys at the nodes/sampling locations works well. At small ponds, transects can be marked by stretching a cord or cable between stakes on opposing shores, using turn-buckles to provide tautness and flagging tape to mark sampling locations.
- If accessing and reaching the sampling locations is difficult, taking a portable global positioning system (GPS) instrument to obtain X-Y coordinates during sampling is recommended, to avoid repeating trips. Such difficult locations will be costly to land survey. If a GPS is ineffective due to the terrain or tree canopy, marking the locations on a topographic map or aerial photograph at the time of sampling is the next best alternative.
- When surface water samples are collected at sediment sampling locations, collect the surface water sample prior to the sediment sample (i.e., sediment sampling will suspend the fines), no more than 1 foot above the top of the sediment, unless samples are to be collected in a stratified water column as specified in the facility-specific work plans.
- When selecting a boat to access sampling locations on lakes, ponds, or rivers, make sure the hull design will not disturb the bottom and is stable enough to haul loaded samplers to the surface (flat vs V-shaped). Jon boats or small pontoons work well in most situations. Care must be given to avoid disturbing the bottom near the sampling locations with oars, a motor's propeller, or boat anchors. If necessary, use two anchors to anchor both ends of the boat to prevent rotation during sampling.
- Prior to sampling, decontaminate nondisposable sample equipment according to SOP AFW-10 and procedures outlined in the installation-specific work plan.

### 5.2.3 GENERAL SAMPLING PROCEDURES

- Review carefully the Health and Safety Plan and/or the Hazard Assessment.
- Don appropriate personal protection equipment, such as tall rubber boots or waders and personal floatation devices, as specified in the installation-specific work plan, prior to entering the water. Rubber boots or waders also serve as good protection (against snake bites and abrasion) when traversing through woods, marsh, or thick vegetation to access the sampling locations. Hats, with or without mosquito netting, may also be needed to protect against exposure to prolonged sunlight and to insects. A walking stick or trekking pole is often needed when wading in unclear water, to probe the bottom for sure footing and depth of water.
- Due to uneven terrain, water hazards (e.g., currents, holes, ice, drowning, etc.), hazardous biota (e.g., snakes, spiders, stinging nettles, etc.), remoteness, and the hauling of equipment, gear, and sample containers, always sample sediments as a team of at least two personnel, with one team member as a site health and safety officer.
- Approach submerged sampling locations from downstream and collect the sample facing upstream. Wading disturbs the sediment bottom and the suspended fines migrate downstream.
- Never wade in water deeper than 2 feet, and generally no deeper than the top of the knee. Instability increases in deeper water, especially in a current, and it becomes more hazardous, and difficult, to sample. If the water is not clear (unable to see the bottom), proceed with extreme caution, probing the bottom ahead with a walking stick for depth and unevenness. One of the team members should stay on or close to shore to hand equipment and supplies back and forth. If deemed necessary, the sampler may need to don a seat harness and be on a safety rope that is controlled by the other team member.
- When using a hand coring device, slowly push the corer into the sediment until there is a noticeable resistance (usually indicating the channel or basin floor), or until the trailing end of the core barrel is at the sediment surface.
- For sediment sampling using a boat, gently lower all grab and core samplers to the bottom so as not to create a bow wave and disturb the fine sediment on the surface. After the sample is collected at a given location, measure the depth of water with a weighted fiberglass tape and record this information on the sample collection log. These data are useful for profiling the lake or pond bottom.



- Retrieve the sampling device slowly through the water to avoid washout by creating turbulent flow. Immediately extrude (for core samplers) or directly transfer (for grab samplers) the sample to a stainless steel bowl (depending on the analytical parameters), and check to see that sediment recovery is acceptable (no visible signs of sediment loss or washing). If sediment recovery is unacceptable or the volume is insufficient, collect another sample close to, but upstream of, the previous attempt.
- When using a core sampler and collecting discrete samples for a vertical profile, extrude individual segments of sediment into separate labeled bowls for homogenizing.
- Thoroughly homogenize the collected sediment sample in a mixing bowl (due to the stratified nature of sediment deposits), whether from a grab or core sampler, after removing excess water (being careful not to lose the fines in the process), rocks, sticks, leaves, and other organic debris. Then transfer the sediment into the sample containers using a stainless steel spoon or spatula. Fill the sample container such that little to no headspace exists.
- If using core sleeves to transport the samples directly to the lab, place tape over each end of the sleeve and seal each end with plastic end caps. With a pen, write a “T” for top on the trailing end and a “B” for bottom on the leading end of the sleeve.
- Collect X-Y coordinates of the sample location using a portable GPS instrument. If a GPS is ineffective due to the terrain or tree canopy, mark the location in the field with a stake or flag.
- Appropriately label and number the sample containers. The label will be filled out with a pen and will contain, at a minimum, the following information:
  - Project number
  - Sample number
  - Sample location
  - Sample depth
  - Sample type
  - Date and time of collection
  - Parameters for analysis
  - Sampler’s initials
- Document the sampling event on a Sediment Sample Collection Log or an equivalent form as specified in the installation-specific work plan. Note any pertinent field observations, conditions, or problems on the Sediment Sample Collection Log. Any



encountered problems (i.e., access issues, flooding by beaver dams, etc.) or unusual conditions should also be immediately brought to the attention of the Field Manager.

- Appropriately preserve, handle, package, and ship the samples per SOP AFW-11, or the installation-specific work plan.



## **SURFACE WATER SAMPLING**

### **SOP AFW-08 (PFCs)**

#### **1.0 PURPOSE**

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of surface water samples for laboratory analyses and water quality measurements. Proper collection procedures are necessary to assure the quality and integrity of all surface water samples. Additional specific procedures and requirements will be provided in the installation-specific work plan, as necessary.

#### **2.0 SCOPE**

This procedure applies to all Amec Foster Wheeler personnel and subcontractors with the responsibility for determining water quality in the field and for the collection, preparation, preservation, and submittal of surface water samples for laboratory analyses.

#### **3.0 REFERENCES**

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

De Vera, E.R., B.P. Simians, R.D. Stephens, and D.L. Storm. 1990. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

Korte, N. and P. Kearl. 1984. *Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells*. U.S. Department of Energy, Grand Junction, Colorado.

#### **4.0 DEFINITIONS**

**Surface water** – Includes all water on the surface of the ground directly exposed to the atmosphere, including, but not limited to, lakes, ponds, reservoirs, artificial impoundments, streams, rivers, springs, seeps, and wetlands.



**Vernal pool** – Temporary small, shallow bodies of freshwater that support communities of amphibians and invertebrates.

## **5.0 PROCEDURES**

This section contains both the team member responsibilities and procedures involved with surface water sampling. Proper surface water sampling procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with installation-specific work plans. The installation-specific work plans will generally provide the following information:

- Sample collection objectives;
- Approximate locations and depths of surface water samples to be collected;
- Numbers and volumes of surface water samples to be collected;
- Types of analyses to be conducted for the samples;
- Specific quality control procedures required; and,
- Any additional surface water sampling requirements or procedures beyond those covered in this SOP, as necessary.

### **5.1 RESPONSIBILITIES**

#### ***Base Lead***

The Base Lead is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and with any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

#### ***Field Lead***

The Field Lead is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Lead is also responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing nonconformances, etc.) if problems occur.

#### ***Field Personnel***

Field personnel assigned to surface water sampling activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the Base Lead or the Field Lead.

## **5.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures/considerations to be made during field activities at potential PFC release areas.

### **5.2.1 EQUIPMENT SELECTION**

For most investigation areas, a decontaminated bottle sampler attached to a pole (e.g., PVC pipe) can be used as the sampling device, or the sample container itself can serve as the sampling device.

There are several more sophisticated sampling devices that can be used to collect water at discrete depths in deep bodies of water (e.g., Van Dorn and Kemmerer samplers). However, for most routine area investigations of shallow lakes, ponds, and streams, this equipment is not necessary.

The following equipment will typically be used during surface water sampling events:

- Water Quality Meter;
- Laboratory-provided sample containers;
- Self-adhesive sample bottle labels;
- High-density polyethylene (HDPE), stainless-steel, or glass beakers, dippers, bailers or other sampling device;
- Appropriate health and safety equipment specified in the Health and Safety Plan;
- Field notes and data sheets (e.g., sample collection form and Chain of Custody);
- Pen;
- Plastic bags;
- Cooler with ice; and,
- GPS receiver.

Laboratory-provided sample containers will be used to directly collect water samples if sample containers do not contain preservatives. Where required by site conditions, remote sampling into sample containers will be allowed by clamping the container onto the end of a clean

extension rod. The extension rod must be made of material that does not include contaminants of interest.

Beakers or dippers (i.e., transfer containers), which may be attached to extension rods, may be used if sample containers have preservatives or remote sampling site conditions prevent sampling by direct sample container immersion. The beakers or dippers will be obtained from a scientific instrument supplier so that the material composition of such a sampling container may be documented. The selected type of transfer device, the composition of this device, and the volume of the device will be recorded on the sample log. Bailers may be used if direct access to the sampling point can be reached. Sample transfer containers must be disposable or decontaminated prior to each use. Discrete depth sampling devices may be used when the installation-specific work plan directs that specific depth intervals be sampled.

## **5.2.2 FIELD PREPARATION**

### ***Pre-Sample Planning***

In general, surface water sample locations may include shallow or deep lakes, ponds and other types of impoundments, creeks and streams, ditches, low-lying areas, and intermittently wet drainage areas. These bodies of water may receive contaminant input from surface runoff; groundwater; or from direct discharge through a sluice, ditch, or pipe.

If up-to-date information is not available, conduct a reconnaissance of all planned surface water sample locations to determine accessibility to the water body, depth of water, dangerous conditions (e.g., strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.), and sampling and personal protection equipment selection criteria. Access to water bodies such as streams may be hampered by thick vegetation, and lakes and ponds that will require the use of a boat may not be accessible by road. Therefore, the logistics of getting sampling equipment and containers to and from the investigation areas must be considered before attempting to sample.

As a general rule, samples should not be collected after heavy rains or during storm events because they will not be representative samples reflecting normal (i.e., baseline) conditions.

When surface water samples are collected at sediment sample locations, the surface water sample should be collected prior to the sediment sample (i.e., the sediment sample will suspend



the fines), and the surface water sample should be collected no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column. If samples are to be collected in a stratified water column, the sample depths will be specified in the installation-specific work plans.

The number of sample points, and the specific analytes to be measured, are provided in the installation-specific work plans. Sample locations and the number of samples collected will vary with the size of the water body and the nature of the source input.

### ***Streams, Tributaries, and Creeks***

In moving water bodies such as streams, tributaries, and creeks, sample points should be located where the water is homogeneous both horizontally and vertically. Samples should be taken far enough downstream from the source input for the discharge to be completely mixed. Locations immediately below riffle areas will be vertically mixed and narrow channel areas promote horizontal or cross-channel mixing. Sampling should take place downstream of riffle areas and narrow channel areas where low flow and minimal turbulence conditions are present. The selection of strategically located sample sites may depend on several factors, such as homogeneity, accessibility, intake points for water supplies, stream velocity, and geomorphology.

In general, a single grab sample collected at mid-depth in the center of the channel is adequate to represent the entire mixed cross-section of small streams less than 20 feet wide. The installation-specific work plan will designate whether a single mid-point sample, vertical profile samples, or discrete depth samples are required. If vertical profile samples are specified in the installation-specific work plan for larger and deeper streams or creeks, these samples should be taken from mid-stream just below the surface, at mid-depth, and just above the bottom and composited. If discrete depth samples are specified by the installation-specific work plan, these samples should be taken at the desired depths, if possible. The pH, temperature, specific conductivity, and dissolved oxygen should be measured for each sample point when vertical composite samples are collected. The number of vertical composites and the depths sampled are determined in the installation-specific work plan. Water depth can either be measured with a graduated staff (e.g., yardstick) at shallow depths or with one of various manual or electronic devices available for deeper depths.

Stagnated areas or pools in a stream or creek could contain different contaminant concentrations than those from the flowing areas, depending on the physical and chemical properties of the contaminant and the proximity of these areas to the source. A sample may be taken at mid-depth to determine if these areas represent contaminant sinks.

### ***Lakes, Lagoons, Ponds, and Impoundments***

The selection of representative sample points in standing bodies of water depends on the size, shape, and depth of the basin, and will be specified in the installation-specific work plan. Samples can be collected along a vertical transect and/or horizontal grid. The installation-specific work plan will designate whether a single mid-point sample, vertical profile samples, or discrete depth samples are required. In larger basins, stratification may inhibit uniform vertical mixing. In these instances, discrete depth samples may be collected at each stratification layer. In smaller basins, such as ponds, lagoons, and impoundments, the entire water column is generally uniformly mixed and one sample at the deepest point may be adequate. The deepest point is usually in the center of small ponds and other containment catch basins. For impoundments with a dam, the deepest point is generally near the base of the dam. Water depth can either be measured with a graduated staff (e.g., yardstick) at shallow depths or with one of various manual or electronic devices for deeper depths.

Wading into the water body to collect samples is not recommended in shallow lakes and ponds. Wading will disturb bottom sediments, which may contaminate the water column resulting in a false positive parameter result. Therefore, a boat is typically used to collect representative water samples in lakes, lagoons, ponds, and impoundments.

### ***Equipment Decontamination***

Before sampling begins, sampling devices (e.g., bailers, beakers, dippers, etc.) shall be decontaminated. Mobile decontamination supplies may be utilized so that equipment can be decontaminated on-site. Each piece of sampling equipment shall be decontaminated before sampling operations and between sampling locations. Decontamination of field equipment will be performed in accordance with SOP AFW-10.

### 5.2.3 GENERAL SAMPLING PROCEDURES

- Samples will be collected first from areas that are suspected of being the least contaminated to minimize the risk of sample cross-contamination. In flowing water bodies, sampling shall progress from downstream to upstream to avoid sediment disturbance affecting subsequent samples.
- Prior to sampling, the water body characteristics (e.g., size and depth) should be observed and described in the field logbook.
- Collect X-Y coordinates of the sample location using a portable GPS instrument. If a GPS is ineffective due to the terrain or tree canopy, mark the location in the field with a stake or flag after sampling is complete.
- Don a clean pair of nitrile gloves.
- Surface debris (i.e., sticks, leaves, vegetation) will be cleared from the sample location prior to sample collection, taking care not to disturb bottom or attached sediments.
- Measure water quality parameters (pH, dissolved oxygen, specific conductivity, and temperature) at each sample location prior to collecting a water sample. Samples for water quality parameters will be collected in a separate container at a like location and depth as the samples for laboratory analysis.
- Collect the sample in accordance with the appropriate method-specific procedures in Section 5.2.4.
- Document the sampling event on the sample collection form. As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.
- Handle and ship the sample according to the procedures outlined in SOP AFW-11, following appropriate chain of custody procedures. Samples stored temporarily on-site will be maintained per SOP AFW-10.

**Note:** Collection of surface water samples in deep-water areas may require the use of a boat. The Base Lead and Health and Safety Manager shall be consulted for additional health and safety requirements.

### 5.2.4 METHOD SPECIFIC SAMPLE COLLECTION PROCEDURES

#### ***Samples Collected by Container Immersion***

Surface water sample collection by container immersion will be done in accordance with the following procedures:

- The outside of all capped sample containers shall be triple rinsed with the surface water being sampled before filling the containers with the sample to be analyzed.
- Submerge the sample container or transfer container below the water surface with minimal surface disturbance and with the open end pointed upstream.
- If possible, the sample container or transfer container will be lowered no closer than 3 to 6 inches above the bottom sediments.

#### ***Samples Collected by Bailer***

Surface water sample collection with a bailer will be done in accordance with the following procedures:

- A disposable HDPE bailer or equivalent will be used;
- Depth of water at each sampling site will be measured and the bailer will be lowered to the appropriate sampling location in accordance with the sampling plan;
- If possible, the bailer will be lowered no closer than 3 to 6 inches above the bottom sediments;
- The bailer will be inserted facing downstream and withdrawn very slowly and carefully to avoid agitation of the bottom sediments; and,
- Transfer the sample from the bailer directly into the sample container. Minimize aeration of the sample as much as possible.

#### ***Samples Collected by Discrete Depth Sampling Devices***

Surface water sample collection with a discrete depth sampling device will be done in accordance with the following procedure:

- A Van Dorn sampler, Kemmerer sampler, or equivalent will be used.
- Depth of water at each sampling site will be measured and the sampling device will be lowered to the appropriate sampling depth in accordance with the installation-specific work plan.
- If possible, the sampling device will be lowered no closer than 3 to 6 inches above the bottom sediments.

- The sampling device will be lowered facing upstream and opened once at the desired sampling depth. The device will be withdrawn very slowly and carefully to avoid agitation of the bottom sediments.
- Transfer the sample from the device directly into the sample container. Minimize aeration of the sample as much as possible.

## 6.0 RECORDS

Field notes shall be recorded on the Daily Field Record and Surface Water Sampling Form. The following information is required according to the sampling method performed:

- GPS coordinates, or distance to two fixed objects, or distance and compass bearing from at least one fixed object;
- Distance of sample collection point from right or left edge of water;
- Water depth;
- Estimate of surface area of water body;
- Sample depth interval;
- Sample collection method (grab, discrete);
- Surface water and investigation area conditions (e.g., floating oil or debris, gassing, etc.);
- Location of any discharge pipes, sewers, or tributaries;
- Instrument calibration;
- Required investigation area maps (If a staff gauge is measured and not co-located with surface water location it must be included in the investigation area map).; and,
- Weather observations (e.g., wind speed, is it sunny or cloudy, and approximate wave height).



## **GROUNDWATER TREATMENT SYSTEM INFLUENT AND EFFLUENT SAMPLING**

### **SOP AFW-09 (PFCs)**

#### **1.0 PURPOSE**

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of the collection of, influent and effluent samples from groundwater treatment systems for perfluorinated compound (PFC) chemical analysis. Proper collection procedures are necessary to assure the quality and integrity of all samples. Additional investigation area specific information or procedures and applicable area and system specific requirements will be provided in the installation-specific work plans, as necessary.

#### **2.0 SCOPE**

This procedure applies to all Amec Foster Wheeler personnel involved in the sampling of groundwater treatment systems. Construction and operation of systems will vary; therefore, this SOP may not be applicable to all situations.

This procedure has been developed to serve as management-approved professional guidance for the Amec Foster Wheeler Program. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in planning or in the execution of planned activities must be approved by the Base Lead.

#### **3.0 REFERENCES**

Barcelona et al, 1985, *Practical Guide for Groundwater Sampling, Illinois State Water Survey, Champaign, Illinois, ISWS Contract Report 374*, November.

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations, Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01*, August.

EPA, 1992, *EPA RCRA Groundwater Monitoring: Draft Technical Guidance*, November.

#### 4.0 DEFINITIONS

**Effluent** – Treated groundwater exiting a groundwater treatment system.

**Influent** - Un-treated groundwater entering into a groundwater treatment system.

#### 5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with groundwater treatment system sampling. Proper groundwater treatment system sampling procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with installation specific work plan addendums. The installation specific work plan addendums will generally provide the following information:

- Sample collection objectives;
- Locations of groundwater treatment system samples to be collected;
- Numbers and volumes of samples to be collected;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control (QC) procedures and sampling required;
- Any additional groundwater treatment system sampling requirements or procedures beyond those covered in this SOP, as necessary; and,
- At a minimum, the procedures outlined in this SOP for groundwater treatment system sampling will be followed.

#### 5.1 RESPONSIBILITIES

##### ***Base Lead***

The Base Lead is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

##### ***Field Lead***

The Field Lead is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Lead is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing nonconformances, etc.) if problems occur.

### ***Field Personnel***

Field personnel assigned to groundwater sampling activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the Base Lead or Field Lead.

## **5.2 METHOD SUMMARY**

The basic procedures for sampling groundwater treatment systems are similar to those for sampling of groundwater monitoring wells, as specified in Groundwater Sampling SOP AFW-03 (PFCs), and sampling of private and public supply wells, as specified in Private And Public Water Supply Well Sampling SOP AFW-13 (PFCs). The procedure can be summarized as follows.

- Decontaminate any equipment that will come into contact with water inside the well and/or sampled water as specified in SOP AFW-10 (PFCs);
- Purge water until specific parameters have stabilized, toward ensuring formation water (as opposed to stagnant well water) will be sampled;
- Collect samples in laboratory-supplied containers; and
- Follow standard sample handling and custody procedures to contain and transport samples to the off-site laboratory.

## **5.3 FIELD PROCEDURES**

Field procedures will incorporate other applicable project-specific SOPs, particularly SOP AFW-01 (PFCs), *Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Compounds (PFCs) Sites*.

### ***Treatment Plant Access***

Contact treatment plant personnel prior to sampling to procure access and to confirm applicable site specific and system specific health and safety requirements.

### ***Influent and Effluent Sampling Considerations***

Upon arriving at treatment plant, the treatment plant operator will inform the sampler if the treatment system is operating or if it is off. The operator will also show the sampler the location of the sampling ports. If the treatment system is off, the sampler will wait until the operator



starts the system. Once the system is operating, sampling will be performed as described below. If the treatment plant is operating upon arrival, perform the minimum one minute purge and sample as described below.

- Inspect the laboratory provided sampling bottles prior to sampling to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the installation specific work plan addendums.
- Open the sampling port.
- Purge for a minimum of 1 minute, a high flow volume into a bucket to flush the sampling port tube.
  - During the purge, collect one set of physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature).

**Table 4-1**

<b>Parameter</b>	<b>Units</b>
pH	Standard Units
Specific Conductivity	Micromhos/centimeter (umho/cm, or $\mu\text{S}/\text{cm}$ )
Temperature	Degrees Celcius ( $^{\circ}\text{C}$ )
Oxidation-Reduction Potential (ORP)	Millivolts (mV)
Dissolved Oxygen	Milligrams/liter (mg/L)
Turbidity	Nephelometric Turbidity Units (NTUs)

- Upon completion of the one minute purge, adjust the flow rate downward prior to filling the laboratory supplied sample bottles.
- Collect the sample directly into the provided sample bottle(s) (containers), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the

sample. Completely fill the bottle where applicable; however, samples collected for metals and general water chemistry analyses should be filled only to the base of the bottleneck.

- The samples should be collected in the order of volatility, collecting the most volatile samples first, followed by the least volatile samples.
- Document the sampling event on the Groundwater Sample Collection Form.
- Appropriately seal, store, handle, and ship the samples per SOP AFW-11.
- Sample both the effluent and influent ports following the same procedures.
- Upon completion of sampling, empty the purge water from the bucket into a location determined by the treatment plant operator.

As the sample is collected directly into the laboratory provided container and directly from the system itself, there is no decontamination required, though fresh gloves should be donned prior to each sampling event at each port.



## EQUIPMENT DECONTAMINATION SOP AFW-10 (PFCs)

### 1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines for use by field personnel in the decontamination of drilling, sampling, development, and heavy equipment. The details within this SOP are applicable as general requirements for drilling and heavy equipment decontamination, and should also be used in conjunction with installation-specific work plans.

### 2.0 SCOPE

These procedures apply to all Amec Foster Wheeler personnel and subcontractors who prepare equipment for use during investigation at potential perfluorinated compound (PFC) release areas. This SOP should be reviewed by all on-site personnel prior to implementation of field activities.

### 3.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

EPA, 1991, *Management of Investigation Derived Wastes During Site Inspections*, EPA 540/G-191/009, May.

### 4.0 DEFINITIONS

**Heavy Equipment** – Drill rigs, excavators, dozers, back-hoes, trucks, or other similar type machinery used to drill soil borings, break concrete, excavate soil or other similar type activity.

**Laboratory Grade Detergent** – A standard brand of laboratory-grade detergent, such as “Alconox” or “Liquinox.”



**Potable Water** – Water dispensed from a municipal water system or a water supply well used and approved for drinking.

## 5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with equipment decontamination. Proper decontamination procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with installation-specific work plans. The work plans will generally provide the following information:

- Sample collection objectives;
- Specific quality control (QC) procedures and sampling required; and
- Management procedures for investigation derived waste (IDW).

At a minimum, the procedures outlined in this SOP for equipment decontamination will be followed.

### 5.1 RESPONSIBILITIES

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the installation-specific work plans should be reviewed before implementing drilling, sampling, development, and heavy equipment decontamination at the project investigation area.

#### ***Base Lead***

The Base Lead is responsible for ensuring that decontamination of drilling, sampling, development and heavy equipment is conducted in accordance with this SOP and with any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

#### ***Field Lead***

The Field Lead has the responsibility for periodic review of procedures and documentation associated with the decontamination of equipment. The Field Lead is also responsible for



implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing nonconformances, etc.) if problems occur.

### ***Field Personnel***

Field personnel assigned to monitor the subject decontamination activities are responsible for ensuring these tasks are completed according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the Base Lead or the Field Lead.

## **5.2 GENERAL**

This section provides requirements for the construction of a temporary decontamination facility for drilling, development, and heavy equipment and the decontamination procedures to be followed. The installation-specific work plans will provide detailed information regarding:

- Types of equipment requiring decontamination under this SOP;
- Location of the decontamination station;
- Types and/or specifications on materials to be used in the fabrication of the decontamination station; and,
- Types of materials and additional details on the procedures to be used in the decontamination process.

Field personnel associated with construction of the decontamination station or decontamination of drilling or heavy equipment must read both this SOP and the installation-specific work plans prior to implementation of related decontamination activities.

## **5.3 DECONTAMINATION FACILITY**

A decontamination facility will be set up in an area exclusively for decontamination of drilling, sampling, well development, and/or heavy equipment. Decontamination of equipment will be conducted within the station.

At a minimum, the station will be constructed such that all rinsates, liquid spray, soil, debris, and other decontamination wastes are fully contained and may be collected for appropriate



waste management and disposal. The facility may be as simple as a bermed pad lined with polyethylene sheeting with an impermeable sump for collecting rinse water. More sophisticated designs involving self-contained metal decontamination pads in combination with bermed polyethylene sheeting may also be used, depending on project-specific requirements. These requirements along with specific equipment and construction specifications for the decontamination facility will be provided in the installation-specific work plans.

## **5.4 DECONTAMINATION PROCEDURES**

Each piece of drilling and sampling equipment shall be decontaminated daily before initiation of sampling operations and between each sample location and interval. Decontamination solutions shall be replenished between sampling locations as needed. Spent decontamination fluids will be containerized, properly labeled and appropriately disposed of according to the investigation derived waste (IDW) plans addressed in the installation-specific work plan.

### **5.4.1 DOWNHOLE EQUIPMENT**

Downhole drilling, sampling, and development equipment (including but not limited to drill pipe, drive casing, drill rods, bits, tools, nondisposable bailers, etc.) will be thoroughly decontaminated before mobilization to each investigation area and between borings or wells at each investigation area or as required in the installation-specific work plans. The standard procedure will be performed as described below.

- Appropriate personal protective equipment (as specified in the installation-specific work plans) must be worn by all personnel involved with the subject task to limit personal exposure.
- Equipment caked with drill cuttings, soil, or other material will initially be scraped or brushed. The scrapings will be containerized and appropriately disposed.
- Equipment will then be sprayed with potable water using a high-pressure washer.
- Washed equipment will then be rinsed with “PFC-free” water.
- Decontaminated downhole equipment (e.g., drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean plastic sheeting to prevent contact with contaminated soil and allowed to air dry. If equipment is not used immediately, it will be covered or wrapped in plastic sheeting to minimize airborne contamination (i.e., dust).



- Field sampling equipment and other downhole equipment used multiple times at each sample location will require cleaning between uses utilizing a four stage decontamination process. The equipment will first be rinsed in a bucket containing a mixture of potable water and soap. Alconox® and Liquinox® soap is acceptable for use since the Material Safety Data Sheets do not list fluoro-surfactants as an ingredient. The equipment will then be rinsed in each of two buckets of clean potable water. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified “PFC-free” water.
- Decontamination activities will be documented by the Field Lead, lead geologist, or lead engineer in the field log and/or appropriate form(s), as specified in the installation-specific work plans.

#### **5.4.2 HEAVY EQUIPMENT**

Heavy equipment (e.g., drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling locations and at the decontamination facility upon entering and prior to leaving the installation. Decontamination will be performed in accordance with the installation-specific work plans. The standard procedure will be performed as described below.

- Appropriate personal protective equipment will be worn by all personnel involved in the task, in order to limit personal exposure.
- Heavy equipment caked with drill cuttings, soil, or other material will be initially scraped or brushed to remove bulk soil and containerized in accordance with the installation-specific work plan.
- Heavy equipment will then be moved to the decontamination pad and sprayed with potable water using a high pressure washer.
- Heavy equipment will then be rinsed with “PFC-free” water.
- During the decontamination effort, fluid collection and containment systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the investigation area, thereby contributing to the volume of waste or contamination. Any identified problems should be immediately repaired and documented.



- Decontamination activities will be documented in the field log and/or appropriate form(s), as specified in the installation-specific work plans.
- Between boreholes at the same location the back-end of the drilling rigs will be washed with potable water until surfaces are visibly free of soil buildup.





## SAMPLE HANDLING AND CUSTODY SOP AFW-11 (PFCs)

### 1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the handling and custody procedures for environmental samples. Proper sample handling and collection procedures are necessary to assure the quality and integrity of media samples. Additional specific procedures and requirements will be provided in the installation-specific work plan, as necessary.

### 2.0 SCOPE

This procedure applies to all Amec Foster Wheeler personnel and subcontractors collecting environmental PFC samples.

### 3.0 REFERENCES

U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, EPA/540/R-96/0, Dec 96 -*Sampler's Guide to the Contract Laboratory Program*.

EPA, Office of Emergency and Remedial Response, EPA/540/R-941/013, Feb 94 - *User's Guide to the Contract Laboratory Program*.

AFCEE (U.S. Air Force Center for Environmental Excellence. 2000 (September). Quality Program Plan. AFC-J23-35Q85101-M3-0002. Prepared by Jacobs Engineering Group Inc. for AFCEE/MMR Installation Restoration Program, Otis Air National Guard Base, MA.

American Society for Testing and Materials. 1996. *Standard Guide for Sampling Chain-of-Custody Procedures*. D 4840-95.

### 4.0 DEFINITIONS

**Chain-of-Custody Record** – legal documentation of custody of sample materials and instructions for analytical laboratory.

**Custody** – physical possession or control. A sample is under custody if it is in possession or under control so as to prevent tampering or alteration of its characteristics.

**Sample Label** – a record attached to samples to ensure legal documentation of traceability.

## 5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with sample handling and chain of custody. An essential part of the sampling activities of any environmental project is assuring the integrity of the sample from collection to data reporting. Sample labels and chain-of-custody forms are used to document identification and handling of samples from the time of collection through the completion of chemical analysis. In some projects, analytical data may be used in litigation. Accountability of the history of a sample must be available to demonstrate that the data are a true representation of the media sampled. The chain-of-custody record is used as evidence in legal proceedings to demonstrate that a sample was not tampered with or altered in any way that may bias the analytical accuracy of the laboratory results. It is extremely important that chain-of-custody records be complete, accurate and consistent. At a minimum, the procedures outlined in this SOP for sample handling and chain of custody will be followed.

### 5.1 RESPONSIBILITIES

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the installation-specific work plans should be reviewed before sample handling at the project investigation area.

#### ***Base Lead***

The Base Lead is responsible for ensuring that sample handling and custody activities are conducted in accordance with this SOP and with any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

#### ***Field Lead***

The Field Lead shall ensure that the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the shipper or laboratory (i.e., on-site or off-site).

#### ***Field Personnel***

##### ***Sample Collector***

The Sample Collector shall ensure the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the Sample Shipper or laboratory (i.e. on-site or off-site). The Sample Collector shall maintain custody of the samples until they are

relinquished to the Sample Shipper or laboratory. The Sample Collector shall be responsible for informing the Sample Shipper of sampling conditions and if any of the samples are potentially hazardous. (NOTE: The Sample Collector and Sample Shipper can be the same person.)

### **Sample Shipper**

The Sample Shipper shall pack the sample shipping coolers, ensure that the chain-of-custody forms are correct, and ship and/or deliver the samples to the laboratory. The Sample Shipper shall determine which samples are potentially hazardous and ship them accordingly.

## **5.2 SAMPLE CUSTODY**

Sample custody procedures are designed to ensure that sample integrity is maintained from collection to final disposition. A critical aspect of sound sample collection and analysis protocols is the maintenance of strict chain-of-custody procedures as described in this technical procedure. Chain-of-custody procedures include tracking and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if it is: (1) in the physical possession of the responsible party; (2) in view of the responsible party after being in their possession (3) secured to prevent tampering; or (4) placed in a designated, secure area that is controlled and restricted by the responsible party.

Custody will be documented throughout all sampling activities on the chain-of-custody record for each day of sampling. This record will accompany the samples from the investigation area to the laboratory. All personnel with sample custody are required to sign, date, and note on the record the time when receiving and relinquishing samples from their immediate custody. Any discrepancies will be noted at this time. Samples will be shipped to subcontract laboratories via overnight air courier. Bills of lading will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. In some cases, samples may be hand delivered to the laboratory; hand delivery will be noted on the chain-of-custody form. The subcontractor laboratory is responsible for sample custody once samples are received.

## **5.3 SAMPLE LABELS**

A label will be attached to all sample containers at the time of sample collection. The label will contain the following information:

- Unique chain-of-custody control number;

- Sample identification
- Analyses requested; and,
- Preservative used.

When sample collection is complete; the Sample Collector fills in the following information in ink:

- Date and time of sample collection; and,
- Sampler's initials.

#### **5.4 CHAIN-OF-CUSTODY RECORDS**

Chain-of-custody forms will be used to document the integrity of all samples to maintain a record of sample collection, transfer of samples between personnel, shipment of samples, and receipt of samples at the laboratory. Each sample/analysis at each sampling location will be logged onto a chain-of-custody form. The chain-of-custody forms shall include the following information:

- Project name and project number if applicable;
- Name and address of laboratory to receive the samples;
- Chain-of-custody control number;
- Sample type, sample method;
- Location ID, sample ID;
- Matrix code;
- Analyses requested;
- Field QC for matrix spike (MS)/matrix spike duplicate (MSD), if applicable;
- Container type, size and number;
- Preservatives used;
- Turn-around-time for laboratory analysis; and,
- Comments to Laboratory or Sample Collector, if applicable.

The Sample Collector will enter the following information using black or blue ink:

- Sampler's initials;
- Date of collection;
- Time of collection (24-hour format);
- Depths, if applicable;
- Pump/equipment number, if applicable; and,
- Void reason, if applicable.



The Sample Collector shall verify the chain-of-custody record is complete, accurate in all aspects, and consistent with all other sample documentation (e.g. number of samples, sample labels, field logs). The Sample Collector will sign the "Sampled By" and "Relinquished By" fields on the chain-of-custody record, marking the date and time custody is transferred to the Sample Shipper or other authorized person.

The Sample Shipper will perform the following duties:

- Obtain the signature of the Sample Collector, on the chain-of-custody form, to transfer sample custody;
- Record the carrier service and airbill number on the chain-of-custody;
- Sign and enter the date and time relinquished to the shipper; and,
- Prepare the samples for shipment from the field to the laboratory.

The Sample Shipper will sign the "Received By" box, marking the date and time of receipt of the samples from the Sample Collector or other sample custodian. Every transfer of physical custody shall be documented on the chain-of-custody record.

Any corrections to the chain-of-custody form entries will be made by a single-line strike mark through the incorrect item, and then entering the correct entry adjacent to the strikeout item. Corrections will be initialed and dated by the person making the change. After the form has been inspected and determined to be complete, the sample shipper will sign, date, and note the time of transfer and will reference a shipper tracking number on the form. The chain-of-custody form will be placed inside the cooler after the sample packer has detached or made an appropriate copy of the form. Field copies of the completed chain of custody forms maintained in project files.

## **5.5 SAMPLE STORAGE**

In some cases, samples that cannot be shipped immediately to a laboratory must be temporarily stored in an Amec Foster Wheeler controlled sample refrigerator until arrangements can be made for delivery. The Sample Collector or Shipper shall place samples in the refrigerator [samples and signed chain of custody record(s)] and secure the refrigerator with a unique, keyed lock, restricting access to one field personnel at a time. A temperature blank must accompany samples overnight.

Samples temporarily stored in the refrigerator must be received by the field personnel that



placed them in storage, and in turn, may be “relinquished to” the appropriate laboratory, the Sample Shipper or another sample custodian. Each transfer of custody shall be recorded on the appropriate chain-of-custody form(s).

## **6.0 RECORDS**

Distribution of the chain-of-custody record:

- Original form sealed in a plastic bag and taped inside the top of the shipping container; and,
- Copies to the Base Lead.



**PROTOCOL TO PROVIDE WATER FREE OF PERFLUORINATED COMPOUNDS FOR COLLECTION  
OF FIELD BLANKS AND EQUIPMENT BLANKS  
SOP AFW-12 (PFCs)**

**1.0 PURPOSE**

The purpose of this Standard Operating Procedure (SOP) is to identify and limit trace perfluorinated compound (PFC) detections introduced through low-level PFC contamination in the laboratory-supplied water used for field blanks, equipment blanks, and decontamination of sampling equipment; ambient PFC contamination from atmospheric conditions or sample containers; or decontamination procedures. The following procedures will be used to provide traceable PFC-free water for equipment decontamination, field blanks, and equipment blanks.

**2.0 SCOPE**

This procedure applies to all Amec Foster Wheeler personnel and subcontractors who use or provide PFC-free water for field blanks, equipment blanks, and equipment decontamination.

**3.0 REFERENCE**

Department of Defense, 2013. *Quality Systems Manual for Environmental Laboratories, Version 5.0*. July.

**4.0 DEFINITIONS**

Per the Department of Defense Quality Systems Manual for Environmental Laboratories Version 5.0, water will be defined as being PFC-free if there are no target analyte detections at concentrations equal to or greater than half the limits of quantification (LOQs) specified in the Table 1. Target analyte detections at or greater than half the LOQ will disqualify all the water in the associated batch from being used for equipment decontamination, field blanks, or equipment blanks.

**Table 1. Perfluorinated Compounds, Limits of Detection, Limits of Quantification, and Action Limits**

Analytes	Synonym	LOD (ng/L)	LOQ (ng/L)	Action Limits (ng/L)
Perfluorohexanoic acid	PFHXa	16	20	-
Perfluoroheptanoic acid	PfHpA	16	20	-
Perfluorooctanoic acid	PFOA	16	20	400
Perfluorononanoic acid	PFNA	16	20	-
Perfluorodecanoic acid	PFDA	16	20	-
Perfluorobutanesulfonic acid	PFBS	16	20	-
Perfluorohexanesulfonic acid	PFHxS	16	20	-
Perfluoroheptanesulfonic acid	PFHpS	16	20	-
Perfluorooctanesulfonic acid	PFOS	16	20	200
Perfluorodecanesulfonic acid	PFDS	16	20	-

Notes:

- No defined action limit

LOD limit of detection

ng/L nanograms per liter

## 5.0 GENERAL

Given the low detection limits associated with PFC analysis and the many potential sources of trace levels of PFCs, laboratory and field personnel are advised to act on the side of caution by strictly following these protocols.

## 6.0 RESPONSIBILITIES

### *Analytical Laboratories*

The analytical laboratories will be responsible for providing Amec Foster Wheeler with PFC-free water to use for field and equipment blanks. The laboratories must certify that each batch of deionized water is PFC-free following the procedures specified below before shipment to the field. Procedures to be used for certification of the PFC-free water are:

- 1) If the laboratory provides water from its internal ultrapure water system, that water must be used for the routine preparation of method blanks for PFC analysis, and the laboratory must:
  - a. Provide copies of their control charts showing that PFC concentrations in the method blanks are consistently less than the concentrations specified in Section 7 below with each shipment of water;



- b. Fill a bottle from each “manufacturers lot” of bottles/caps with the laboratory’s PFC-free water, and analyze an aliquot of water from that bottle to show that the water in the bottle meets the requirements of Section 7 below; and,
  - c. Assign a unique Batch Number to each shipment of PFC-free water to Amec Foster Wheeler, and maintain a record of the preparation date and bottle/cap lot number used to prepare that PFC-free water batch. If multiple bottle types (e.g. cubitainers for large volumes and 125 ml bottles for rinsate blanks) are used, separate batch numbers should be used for each bottle type.
- 2) If the laboratory provides purchased ultra pure water to Amec Foster Wheeler for equipment decontamination and blanks, the laboratory must analyze an aliquot of each manufacturer’s batch before the water is shipped to Amec Foster Wheeler. If target analytes are detected in the water at concentrations equal to or greater than half the LOQs specified in Table 1 the water must be considered contaminated, and it will not be shipped to Amec Foster Wheeler. The manufacturer name and batch or lot number will be used for purposes of maintaining traceability of purchased water.

If target analytes are not detected at concentrations equal to or greater than half the LOQs specified in Table 1, the water is suitable to be shipped to Amec Foster Wheeler. The laboratory must provide a certificate of analysis with results for the water batch to the Amec Foster Wheeler’s Project Chemist, or designee, before the water is shipped to the field. Each batch of PFC-free water must be clearly marked with a unique batch identification number.

### ***Amec Foster Wheeler***

Prior to use, the field crew will collect a field blank from each batch of PFC-free water by pouring an aliquot of the water into a sample container. Before sample collection, field crews will decontaminate the equipment and will using the PFC-free water as a final rinse. During sampling, field crews will collect equipment blanks at a frequency of 1 per 10 samples collected using the same sampling equipment.

Amec Foster Wheeler field crews will clearly associate field blanks and equipment blanks with both the associated laboratory water batch identification number and associated field samples on daily field forms and/or in an electronic sample tracker. The Amec Foster Wheeler Chemist will maintain records and will chart results of the source water, equipment blank, and field blank analytical data. Amec Foster Wheeler will evaluate the data to identify any trends or anomalies that warrant a change of this or field sampling procedures.

## 7.0 EVALUATION

This procedure will provide documentation that the source water used for equipment rinsing and blanks is PFC-free, with PFC levels less than 1/40 the project action limit for perfluorooctanoic acid (PFOA), less than 1/20 the project action limit for perfluorooctanesulfonic acid (PFOS), or less than half the LOQ for analytes without project action limits. Amec Foster Wheeler will track analyte concentrations in the water from shipment from the laboratories, to the field, and ultimately to the water's use to rinse sampling equipment. This will eliminate concern about the PFC-free water itself as a source of contamination, and facilitate evaluation and identification of sources or actions that contribute to cross-contamination, so that the project team can adjust procedures if needed. The blanks dataset will be used as part of Amec Foster Wheeler's overall quality control assessment of ambient sources of PFC contamination relative to sample concentrations.



## ELECTRONIC FIELD FORMS SOP AFW-13 (PFCs)

### 1.0 PURPOSE

This Standard Operating Procedure (SOP) provides procedures and requirements for the use of mobile devices for the purposes of electronic data collection (EDC) during perfluorinated compound (PFC) investigations. Mobile devices utilized for EDC during field sampling programs are primarily used for data capture and documentation purposes. As the use of field devices for EDC is expected to increase, additional specific procedures and requirements may be provided in installation-specific work plans, as applicable.

*Note: This document is not intended to serve as a “user’s manual” for Mobile Devices/forms. Appropriate training shall be done by the Mobile Device Programming/Field Form Development Team or someone with adequate experience using the devices.*

### 2.0 SCOPE

These procedures apply to all Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) personnel using Mobile Devices during PFC investigations.

### 3.0 DEFINITIONS

**Mobile Device** – An electronic device such as a tablet or smartphone running either Android or iOS operating systems. Manufacturers include, but are not limited to Apple, Samsung, HTC and LG. For the purposes of this document, unless otherwise specified Mobile Devices refers to tablets.

**Field Forms** – Hard-copy or electronic field data records used to capture and document information and observations during field sampling events. For the purposes of this document, unless otherwise specified, Field Forms refers to the electronic format used to collect data using Mobile Devices.

**doForms®** – a third-party form-building software package used to create electronic versions of field forms for use on Mobile Devices.



**Base Lead Review** – This electronic field form review is conducted by the Base Lead within the first 2 days after receipt of field forms from Field Personnel. The Base Lead Review identifies deviations from the work plan and other site-specific details that would otherwise not be caught by the Quality Assurance/Quality Control (QA/QC) Lead.

**QA/QC Review** – This electronic field form review is conducted by the QA/QC Lead. The QA/QC Review checks format, reasonableness of data, and overall completeness of field forms. The QA/QC Review is completed within 1 week of receipt of field forms from Base Lead.

#### **4.0 PROCEDURES**

This section provides both the responsibilities of Amec Foster Wheeler personnel and SOPs as they relate to using electronic field forms on Mobile Devices on PFC projects. Each PFC project team member plays a role with respect to Mobile Device use; in order to maximize the benefit gained from the use of mobile devices for EDC, it is important that the following procedures are followed as closely as possible.

Handling and care procedures for Mobile Devices, creation of new electronic field forms, revision to existing electronic forms, and transmittal and archiving of captured data prior to, during, and subsequent to field sampling events are also detailed in the sections below.

#### **4.1 RESPONSIBILITIES**

##### ***Mobile Device Programming/Field Form Development Team***

The responsibilities of this Team are as follows:

- Ensuring that electronic field forms/applications required for each PFC project are loaded on designated Mobile Devices prior to each field event;
- Ensuring newly developed and existing electronic field forms/applications developed for field sampling, documentation, and observations meet current PFC program QA/QC guidelines;
- Ensuring data captured using developed electronic field forms meet current PFC program QA/QC guidelines;



- Downloading collected original submitted (unaltered) data routinely in both .csv and excel formats, and coordinating with the Data Manager to store raw data files for archival purposes;
- Notifying Base Leads when payment/renewal of licensing fees associated with electronic forms used on the Mobile Devices is required;
- Testing (alpha/beta) all newly developed field forms to the maximum extent practical prior to distributing for field use, reducing the likelihood that Field Personnel or the Field Lead will have to troubleshoot a faulty field form;
- Notifying field sampling teams in advance when new forms/form revisions are available for use; and,
- Providing technical support to Field Personnel or the Field Lead during field events should assistance be needed over the phone or via email (e.g., recovering a lost document in the event of a Mobile Device crash).

Lucas J. Benedict is the Mobile Device Programming/Field Form Development Team Lead. He may be reached by email at [lucas.benedict@amecfw.com](mailto:lucas.benedict@amecfw.com), or by phone at 207-828-3599 (direct) or 207-712-1655 (cell).

### ***Field Personnel***

Field Personnel are responsible for the following:

- Understanding the basic operation of Mobile Devices and how to navigate the various field forms/application;
- Adhering to security/care requirements associated with the use of Mobile Devices;
- Alerting the Field Lead and, if needed, the Mobile Device Programming/Field Form Development Team of issues/problems with Mobile Devices as soon as they occur; and,
- Ensuring field forms are completely populated and signed prior to daily submittal to Base Lead and QA/QC Lead.



### ***Field Lead***

The Field Lead is responsible for the following:

- Ensuring the required number of Mobile Devices are prepared for the upcoming field event(s);
- Ensuring all Field Personnel understand and follow security/care requirements associated with the use of mobile devices;
- Coordinating with the Mobile Device Programming/Field Form Development Team for troubleshooting purposes in the event it is needed in the field; and,
- Ensuring that field forms are completely populated and signed by Field Personnel prior to daily submittal to Base Lead and QA/QC Lead.

### ***Base Lead***

The Base Lead is responsible for the following:

- Acquiring the required number of mobile devices prior to field events;
- Ensuring that the Mobile Device Programming/Field Form Development Team has loaded the required forms/applications onto each device required for the field event and the previous project's data and files have been cleared from the Mobile Device;
- Ensuring that Field Personnel have been adequately trained to use the mobile devices and field forms/applications;
- Potentially delegating any of these responsibilities to the Field Lead;
- Receiving field forms on a daily basis from Field Personnel to track progress and perform the Base Lead Review for content; and,
- Submitting field forms to the QA/QC Lead following the Base Lead Review (within 2 working days).

### ***QA/QC Lead***

The QA/QC Lead is responsible for the following:

- Receiving electronic field forms via email from Base Lead and performing a formal QA/QC Review on each form;
- Filing a copy of all original submitted (unaltered) forms;



- Providing immediate feedback to Field Personnel and Base Lead should field forms require attention to clarify an entry or correct an error;
- Communicating with the Mobile Device Programming/Field Form Development Team should field forms require attention;
- Documenting all significant changes made to field form entries by emailing proposed changes to Base Lead and receiving authorization to make proposed change; and,
- Inserting signature and date on field forms once the content and format meet the expectations of the project.

Tom Hensel serves as the QA/QC Lead. Field forms are required to be submitted to Tom following Base Lead Review. He can be reached at [thomas.hensel@amecfw.com](mailto:thomas.hensel@amecfw.com) or 865-671-6774.

### ***Data Manager***

The Data Manager is responsible for the following:

- Assisting the Mobile Device Programming/Field Form Development Team Lead with developing the field forms to be compatible with Environmental Resources Program Information Management System (ERPIMS) data format and valid value requirements;
- Performing data loading duties to the ERPIMS database for data stored in the Groundwater and Surface Water Sampling forms, and Screened Well and Open Hole Bedrock Construction Forms. Data relating to water levels and groundwater parameters is uploaded to the database following QA/QC Review; and,
- Informing the Mobile Device Programming/Field Form Development Team Lead of any ERPIMS database changes that may affect the forms and adjusting as necessary.

Andrew Nelson serves as the Data Manager. Final field forms and associated data required for ERPIMS upload are required to be submitted to Andrew no greater than one week after the associated field event. He can be reached at [andrew.nelson@amecfw.com](mailto:andrew.nelson@amecfw.com) or 978-392-5354.

## **4.2 FIELD PROCEDURES/CONSIDERATIONS**

The following are procedures for Mobile Devices usage at different stages of the project. Timeframes for each of the submittals are summarized in **Table 1** and included in the sections below.



#### **4.2.1 FIELD PREPARATION**

Any Mobile Device training needed for Field Personnel shall be conducted in the office prior to field mobilization. The Base Lead should consider all potential forms/applications that are anticipated to be used during an upcoming field event. The Base Lead confirms with the Mobile Device Programming/Field Form Development Team that the anticipated forms/applications are available for use, and are loaded on the mobile devices prior to field mobilization. Once the Base Lead/Field Lead has all Mobile Devices in hand for the field effort, the devices shall be fully charged. Hard copies of field forms from the Quality Program Plan (QPP) will be taken to the field as backup to the digital field forms.

#### **4.2.2 SECURITY/CARE**

Mobile Device Security Guidelines:

- Never share security passcode with someone other than Amec Foster Wheeler employees;
- Do not leave devices unattended. Devices must be secured at all times when not in use; and,
- If the device cannot be secured, keep it with you.

Mobile Device Care Guidelines

- Keep protective cases on the devices at all times while in the field;
- When traveling, keep devices in carry-on baggage, if possible. If device must be kept in checked baggage, ensure that adequate cushion (clothing, towels, etc.) is surrounding devices in bags;
- Operate the Mobile Devices within the operating range temperatures recommended by the manufacturer (32 to 95 degrees Fahrenheit [°F]). Do not store the Mobile Devices in temperatures less than -4°F or greater than 113°F.
- Report damage and discontinue use if protective case is compromised; and,
- Avoid long-term direct exposure to sunlight for the screen.





### 4.2.3 FIELD USE STEPS

1. **Prepare** - The Field Lead (or designee) will discuss with the Field Personnel the use of Mobile Devices for EDC, photographic documentation, or other relevant applications at the pre-job meeting on the first day of each field event.
2. **Complete** - Field Personnel complete electronic field form entries and verify no blank entries remain. Each question/field/cell is to be populated with relevant information, or a predetermined acceptable value before submitting forms. Field Personnel may use terms such as “NA”, “TBD”, etc. if a particular field is not applicable or cannot be determined. Field Personnel are to complete the Field Form entries during the field event and must be fully completed prior to submittal.
  - a. Save as Incomplete - If additional time is needed to completely fill out forms in the evening before submitting.
  - b. Save as Complete - This allows completed forms to remain on the device for later upload if internet access is unavailable.
3. **Submit** – Field Personnel submit all field forms daily to the Base Lead for review.
4. **Delete** - Electronic Field Forms shall not be deleted from electronic devices before confirming with the Base Lead that completed forms were received. Once the Base Lead confirms receipt of Field Forms, those forms can be deleted from the Mobile Device. In the event a Field Form is inadvertently deleted or the Mobile Device crashes, the Mobile Device Programming/Field Form Development Team may be able to recover the lost form, and should be contacted ASAP.

### 4.2.4 QA/QC PROCESS

#### Base Lead Review

Field Forms shall be submitted daily to the Base Lead. The Base Lead Review identifies content errors that the QA/QC Lead may not catch, as the Base Lead is expected to have a better working knowledge of the site investigation. The Base Lead shall perform the review, make corrections and forward field forms to the QA/QC Lead within two working days of receipt. The QA/QC Lead has the primary role of reviewing each field form generated in the field.



### QA/QC Review

The QA/QC Lead will conduct a formalized review (QA/QC Review) and sign-off on each form if no edits/changes are necessary. If minor changes are required on field forms, the QA/QC Lead will confirm those changes are needed with the Base Lead/Field Lead and finalize forms him/herself. Field forms requiring more significant changes may be sent back to the project team for edits and then resubmitted back to the QA/QC Lead. Field forms will be sent back to the Base Lead once finalized and within one week of receipt, to be incorporated into site investigation reports.

### **4.2.5 POST-JOB**

#### Mobile Devices

Mobile Devices shall be returned to the owning office immediately after downloading photos and other items/files removed. This shall be done in the first couple of days back in the office. Shipping shall be done via FedEx.

#### Electronic Field Forms

Finalized field forms should be submitted to the Data Manager by the Base Lead within 1 week following the field effort. This provides adequate time for the most recent field forms to go through both Base Lead Review and QA/QC Review.

### **4.2.6 MOBILE DEVICE/FIELD FORM UPDATES AND MODIFICATIONS**

Field forms may be modified by the Mobile Device Programming/Field Form Development Team remotely. If a Field Form modification is required, the Field Personnel and/or Field Lead will be notified by the Mobile Device Programming/Field Form Development Team. Once field form revision/modification is complete, each mobile device must be updated manually in the field or in the office using the "Update" button/icon within the doForms® application. If a problem is noted with a field form while Field Personnel are using it during a sampling event, the Mobile Device Programming/Field Form Development Team can make quick corrections or changes and push it out to Field Personnel, pending internet access needed to update the device(s). Field Personnel will use the "Update" feature to receive the changes.



If changes are required or requested, the user submits a Mobile Form Support Request (located on each Mobile Device) to the Mobile Device Programming/Field Form Development Team. The formalized request allows new ideas to be tracked. This support request form is one of the options in doForms®. Once these changes are made to field forms by the Mobile Device Programming/Field Form Development Team, each device will need to go through the “Update” process.

**Table 1. Summary of Timeframes for Submittals**

Submittal Schedule	
Task	Timeframe
Field Forms from Field Personnel to Base Lead	Daily
Field Forms from Base Lead to QA/QC Lead	2 working days following receipt
QA/QC Lead completes review, finalizes Field Forms and returns to Base Lead	1 week following receipt of Field Forms from Base Lead
Base Lead submits Field Forms to Data Manager (Andrew Nelson)	1 week following field effort completion
Return Mobile Devices to owning office	2 days following field effort completion

**ATTACHMENT F**  
**AMEC FOSTER WHEELER FIELD FORMS**



**ATTACHMENT 1 TO SOP AFW-01  
DAILY PFC PROTOCOL CHECKLIST**



<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>		<b>Weather (temp./precipitation):</b>	
<b>Site Name:</b>		<b>Date and Time:</b>	
<b>Field Manager:</b>			

<p><b>Field Clothing and PPE (as applicable):</b></p> <p><input type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01</p> <p><input type="checkbox"/> Field crew has not used fabric softener on clothing</p> <p><input type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning</p> <p><input type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent</p> <p><b>Field Equipment:</b></p> <p><input type="checkbox"/> No Teflon® containing materials on-site</p> <p><input type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene</p> <p><input type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products</p> <p><input type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site</p> <p><input type="checkbox"/> No adhesives (Post-it® Notes) on-site</p> <p><input type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession</p>	<p><b>Sample Containers:</b></p> <p><input type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE</p> <p><input type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene</p> <p><b>Wet Weather (as applicable):</b></p> <p><input type="checkbox"/> For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p><b>Equipment Decontamination:</b></p> <p><input type="checkbox"/> "PFC-free" water on-site for decontamination of sample equipment</p> <p><input type="checkbox"/> Alconox and Liquinox to be used as decontamination materials</p> <p><b>Food Considerations:</b></p> <p><input type="checkbox"/> No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area</p>
--	---

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:	<p><b>Field Manager Signature:</b></p>    <p><b>Field Manager Name (print):</b></p>
--	---

<b>QA/QC'd by:</b>	<b>QA/QC Date:</b>
--------------------	--------------------





**GROUNDWATER SAMPLING RECORD**

<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>		<b>Sample Technician:</b>	
<b>Well ID:</b>		<b>Date:</b>	
<b>Initial Depth to Water (ft):</b>		<b>Well Diameter (in):</b>	
<b>Total Depth of Well (ft):</b>		<b>1 Casing Volume (gal):</b>	
<b>Method of Purging:</b>		<b>3 Casing Volumes (gal):</b>	
<b>Measuring Point (toc, tor, etc.):</b>		<b>Pump Intake Depth (feet):</b>	

Time	Water Level (feet)	Flow Rate	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	

Stability Reached (Y/N): \_\_\_\_\_ If No, Provide Explanation \_\_\_\_\_

<b>Final Values:</b>									

<b>Sample ID:</b> _____ <b>QA/QC Samples (Yes/No):</b> _____ <b>Duplicate ID:</b> _____ <b>Sample Container Type(s):</b> _____ <b>Preservative(s):</b> _____ <b>Analysis/Method(s):</b> _____	<b>Method of Sampling:</b> _____ <b>Sample Date:</b> _____ <b>Sample Collection Time:</b> _____ <b>Total Volume Purged (gal):</b> _____ <b>Sample Depth (ft):</b> _____ <b>Depth to Water After Sampling (ft):</b> _____
--	---

**Instruments (Manufacturer, Model, and Serial No.):**  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>Calculations:</b> <b>Saturated well casing volume:</b> $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$  V = Volume (gal/ft) $\pi = 3.14$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2 H = height of water column (ft)	<b>Technician Signature:</b>    
--	--

<b>Notes:</b>   	<b>Technician Name (print):</b>  
---------------------------	---

QA/QC'd by: _____	QA/QC Date: _____
-------------------	-------------------





# OPEN HOLE BEDROCK WELL CONSTRUCTION FORM

**Project Name:** Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations

**Contract Number:** W9133L-14-D-0002

**Installation:** \_\_\_\_\_

**Drilling Subcontractor:** \_\_\_\_\_

**Drilling Personnel:** \_\_\_\_\_

**Technician Name:** \_\_\_\_\_

**Other Amec Foster Wheeler Representatives:** \_\_\_\_\_

**Project Number:** 291330006

**Task Order:** 0006

**Location ID:** \_\_\_\_\_

**Well ID:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Drilling Method:** \_\_\_\_\_

**Type of Well:** \_\_\_\_\_

**Measuring Point:** \_\_\_\_\_

**TOC/TOR Difference (in):** \_\_\_\_\_

**Approximate Diameter of Borehole (in):** \_\_\_\_\_

**Depth to Water (ft):** \_\_\_\_\_

**During Drilling:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Post Development:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Water added during drilling (gal):** \_\_\_\_\_

**Water removed during development (gal):** \_\_\_\_\_

**Borehole Yield (gpm):** \_\_\_\_\_

**Bottom of Overburden / Top of Bedrock (ft):** \_\_\_\_\_

**Casing Depth (ft):** \_\_\_\_\_

**Bottom Depth (ft):** \_\_\_\_\_

**Surface Pad:**

**Type:** \_\_\_\_\_

**Length (ft):** \_\_\_\_\_

**Width (ft):** \_\_\_\_\_

**Thickness (in):** \_\_\_\_\_

**Well Casing:**

**Manufacturer:** \_\_\_\_\_

**Type/Material:** \_\_\_\_\_

**Diameter (in):** \_\_\_\_\_

**Annular Seal (above BRx):**

**Manufacturer:** \_\_\_\_\_

**Type:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Annular Seal (below BRx):**

**Manufacturer:** \_\_\_\_\_

**Type:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Notes:**

\_\_\_\_\_

**Technician Signature:** \_\_\_\_\_

**Technician Name (print):** \_\_\_\_\_

Depths and heights are referenced to ground surface unless specified TOC.  
All elevations are referenced to MSL (NAVD 88).

**QA/QC'd by:** \_\_\_\_\_ **QA/QC Date:** \_\_\_\_\_





# SCREENED WELL CONSTRUCTION FORM

**Project Name:** Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations

**Contract Number:** W9133L-14-D-0002

**Installation:** \_\_\_\_\_

**Drilling Subcontractor:** \_\_\_\_\_

**Drilling Personnel:** \_\_\_\_\_

**Technician Name:** \_\_\_\_\_

**Other Amec Foster Wheeler Representatives:** \_\_\_\_\_

**Project Number:** 291330006

**Task Order:** 0006

**Location ID:** \_\_\_\_\_

**Well ID:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Drilling Method:** \_\_\_\_\_

**Type of Well:** \_\_\_\_\_

**Measuring Point:** \_\_\_\_\_

**TOC/TOR Difference (in):** \_\_\_\_\_

**Approximate Diameter of Borehole (in):** \_\_\_\_\_

**Depth to Water (ft):** \_\_\_\_\_

**During Drilling:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Post Development:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Hydrologic Unit:**      Unknown              Unsaturated Zone

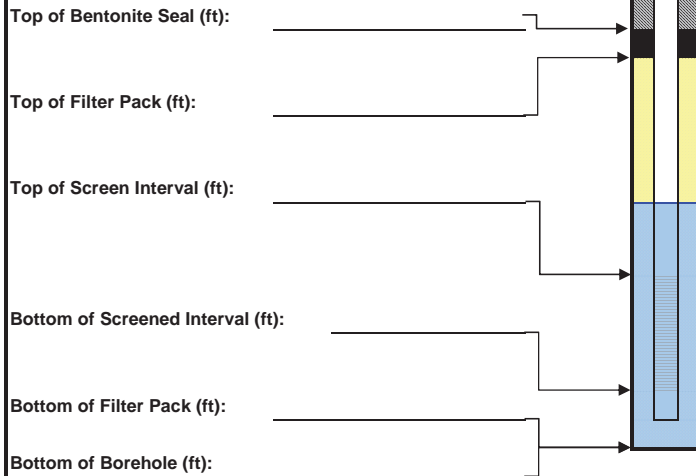
(circle one):            Aquifer                      Water Table Aquifer

                                 Bedrock Aquifer            Confining Layer/Aquiclude

                                 Perched Aquifer            Lower/Confined Aquifer

**Water added during drilling (gal):** \_\_\_\_\_

**Water removed during development (gal):** \_\_\_\_\_



**Protective Casing:**

**Type:** \_\_\_\_\_

**Dimensions (in):** \_\_\_\_\_

**Stickup (ft):** \_\_\_\_\_

**Length (ft):** \_\_\_\_\_

**Guard Post:** \_\_\_\_\_

**Surface Pad:**

**Type:** \_\_\_\_\_

**Length (ft):** \_\_\_\_\_

**Width (ft):** \_\_\_\_\_

**Thickness (in):** \_\_\_\_\_

**Annular Seal (grout above well seal):**

**Material:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Bentonite Seal:**

**Manufacturer:** \_\_\_\_\_

**Material:** \_\_\_\_\_

**Type:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Hydration time (hrs):** \_\_\_\_\_

**Filter Pack Material:**

**Manufacturer:** \_\_\_\_\_

**Material:** \_\_\_\_\_

**Size:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Surging time:** \_\_\_\_\_

**Well Casing (Riser):**

**Manufacturer:** \_\_\_\_\_

**Type/Material:** \_\_\_\_\_

**Length:** \_\_\_\_\_

**Diameter (in):** \_\_\_\_\_

**Well Screen:**

**Manufacturer:** \_\_\_\_\_

**Type/Material:** \_\_\_\_\_

**Diameter (in):** \_\_\_\_\_

**Slot Size (in):** \_\_\_\_\_

**Slot Type:** \_\_\_\_\_

**Sump/End Cap:** \_\_\_\_\_

**Notes:**

\_\_\_\_\_

**Technician Signature:** \_\_\_\_\_

Depths and heights are referenced to ground surface unless specified TOC.  
All elevations are referenced to MSL (NAVD 88).

**Technician Name (print):** \_\_\_\_\_

**QA/QC'd by:** \_\_\_\_\_

**QA/QC Date:** \_\_\_\_\_



## SOIL SAMPLE COLLECTION LOG

<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>	_____	<b>Date:</b>	_____
<b>Location ID:</b>	_____	<b>Technician:</b>	_____

**Other Amec Foster Wheeler Representatives:**

Sample ID	Sample Time	Sample Depth (ft)	USCS Symbol	Comments/Observations

<b>Sample Collection Method:</b> _____	<b>Analysis/Method(s):</b> _____
<b>Sample Container Type(s):</b> _____	<b>Preservative(s):</b> _____

<p><b>Notes:</b></p>          	<p style="text-align: center;"><b>Technician Signature:</b></p>     <hr/> <p style="text-align: center;"><b>Technician Name (print):</b></p>
--	---

<b>QA/QC'd by:</b> _____	<b>QA/QC Date:</b> _____
--------------------------	--------------------------



## SAMPLE COLLECTION LOG

### SEDIMENT / SURFACE SOIL / SURFACE WATER

<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>	_____	<b>Date:</b>	_____
<b>Location ID:</b>	_____	<b>Sample Technician:</b>	_____
<b>Northing:</b>	_____	<b>Easting:</b>	_____

#### SEDIMENT SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
<b>Sample Depth (ft):</b> _____	<b>Sample ID:</b> _____
<b>MS/MSD Collected:</b> _____	<b>Sample Date:</b> _____
<b>Duplicate ID:</b> _____	<b>Sample Collection Time:</b> _____
<b>Sample Container Type(s):</b> _____	<b>Sample Collection Methods:</b> _____
<b>Preservative(s):</b> _____	<b>Analysis/Method(s):</b> _____

#### SURFACE SOIL SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
<b>Sample Depth (ft):</b> _____	<b>Sample ID:</b> _____
<b>MS/MSD Collected:</b> _____	<b>Sample Date:</b> _____
<b>Duplicate ID:</b> _____	<b>Sample Collection Time:</b> _____
<b>Sample Container Type(s):</b> _____	<b>Sample Collection Methods:</b> _____
<b>Preservative(s):</b> _____	<b>Analysis/Method(s):</b> _____

#### SURFACE WATER SAMPLE

Time	Intake Depth (feet)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)

<b>Sample Depth (ft):</b> _____	<b>Sample Date:</b> _____
<b>Sample ID:</b> _____	<b>Sample Collection Time:</b> _____
<b>MS/MSD Collected:</b> _____	<b>Sample Collection Methods:</b> _____
<b>Duplicate ID:</b> _____	<b>Surface Water Depth (ft):</b> _____
<b>Sample Container Type(s):</b> _____	<b>Water Body and Water Quality Characteristics</b> (circle all that apply):
<b>Preservative(s):</b> _____	River      Stream      Pond      Flowing      Stagnant Clear      Cloudy      Turbid      Other:
<b>Analysis/Method(s):</b> _____	

<b>Location Sketch:</b>	<b>Instruments (Manufacturer, Model, and Serial No.):</b>  <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;"><b>Notes:</b></td> <td style="width: 30%;"><b>Technician Signature:</b></td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td><b>Technician Name (print):</b></td> </tr> <tr> <td> </td> <td> </td> </tr> </table>	<b>Notes:</b>	<b>Technician Signature:</b>				<b>Technician Name (print):</b>		
<b>Notes:</b>	<b>Technician Signature:</b>								
	<b>Technician Name (print):</b>								

<b>QA/QC'd by:</b> _____	<b>QA/QC Date:</b> _____
--------------------------	--------------------------

# TAILGATE SAFETY MEETING REPORT



**Project Name:** Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations     
 **Project Number:** 291330006  
**Contract:** W9133L-14-D-0002     
 **Task Order:** 0006  
**Installation:** \_\_\_\_\_     
 **Date and Time:** \_\_\_\_\_  
**Field Manager Name:** \_\_\_\_\_     
 **Site Health and Safety Officer (HSO):** \_\_\_\_\_  
**Safety Meeting Type (circle one):**     
 Initial Kickoff Safety Meeting     
 Regular/Daily Tailgate Safety Meeting     
 Unscheduled Tailgate Safety Meeting

## Order of Business

**Topics Discussed (check all that apply):**

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences

- Engineering Controls
- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)

Safety suggestions by site workers: \_\_\_\_\_

Action taken on previous suggestions: \_\_\_\_\_

Injuries/accidents/personnel changes since previous meeting: \_\_\_\_\_

Observations of unsafe work practices/conditions that have developed since previous meeting: \_\_\_\_\_

Location of (or changes in the locations of) evacuation routes/safe refuge areas: \_\_\_\_\_

Other Safety Topics: \_\_\_\_\_

Additional comments: \_\_\_\_\_

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature

<b>Meeting Conducted By (print):</b>	<b>Company and Title</b>	<b>Signature</b>

**QA/QC'd by:** \_\_\_\_\_ **QA/QC Date:** \_\_\_\_\_

# WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>	_____	<b>Calibration Start Time:</b>	_____
<b>Sample Technician:</b>	_____	<b>Calibration End Time:</b>	_____

### Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (% mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments

### Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (% mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments

#### Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	_____	_____	Spec. Conductance	_____	_____	10	_____	_____
pH (7)	_____	_____	Salinity	_____	_____	20	_____	_____
pH (10)	_____	_____	D.O.	_____	_____	100	_____	_____
			ORP	_____	_____	800	_____	_____

<b>Instruments (Manufacturer, Model, and Serial No.):</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 60%; border: none;">Manufacturer/Model</td> <td style="width: 40%; border: none;">Serial No</td> </tr> </table> <b>Water Quality Meter:</b> _____ <b>Turbidity Meter:</b> _____ Calibrated Within Acceptance Criteria (Y/N): _____ If No, Provide Explanation: _____	Manufacturer/Model	Serial No	<b>Notes:</b> _____ _____ _____	<b>Technician Signature:</b> <div style="text-align: center; height: 40px;">(Signature)</div> <b>Technician Name (print):</b> _____
Manufacturer/Model	Serial No			

<b>QA/QC'd by:</b> _____	<b>QA/QC Date:</b> _____
--------------------------	--------------------------



**WELL DEVELOPMENT LOG**

<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>	_____	<b>Sample Technician:</b>	_____
<b>Well ID:</b>	_____	<b>Date Started/Date Completed:</b>	_____
<b>Measuring Point:</b>	_____	<b>Initial Depth to Water (ft):</b>	_____
<b>Development Method:</b>	_____	<b>Total Depth of Well (ft):</b>	_____
<b>Pump Start Date/Time:</b>	_____	<b>Depth to Water After Purging (ft):</b>	_____
<b>Pump Start Rate:</b>	_____	<b>1 Casing Volume (gal):</b>	_____
<b>Total Volume Purged (gal):</b>	_____	<b>3 Casing Volumes (gal):</b>	_____

Time	Intake Depth (feet)	Water Level (feet)	Rate	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)

**Instruments (Manufacturer, Model, and Serial No.):**

\_\_\_\_\_

<b>Calculations:</b> <b>Saturated well casing volume:</b> $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$  <small>V = Volume (gal/ft)          π = 3.14          R = well radius (ft) = (well diameter (in)/12 (in/ft))/2          H = height of water column (ft)</small>	<b>Technician Signature:</b>      
---	--

<b>Notes:</b>   	<b>Technician Name (print):</b>   
---------------------------	---

<b>QA/QC'd by:</b> _____	<b>QA/QC Date:</b> _____
--------------------------	--------------------------



**ATTACHMENT G**  
**HEALTH AND SAFETY PLAN**



**GENERAL HEALTH AND SAFETY PLAN  
FY16 PHASE 1 REGIONAL SITE INSPECTIONS  
FOR PER-FLUORINATED COMPOUNDS**

**MULTIPLE AIR NATIONAL GUARD  
INSTALLATIONS**

Contract #: W9133L-14-D-0002  
Delivery Order 0006

Amec Foster Wheeler Project #: 2-9133-0006

December 1, 2016

# NGB/A7OR

## Site Health and Safety Plan Site Investigation

### General Information

Project Name: FY16 Phase 1 Regional Site Inspections for Per-fluorinated Compounds

Location: Multiple Air National Guard Installations

Client: Air National Guard

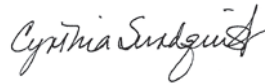
Plan Prepared By: Lauren Bugdalski

Plan Reviewed By: TBD

Plan Approved By: Cynthia Sundquist, CIH, CSP

Health and Safety Manager: Cynthia Sundquist, CIH, CSP

CIH/CSP Signature:



CIH Number: 5221

Project Start Date:

### Emergency Contacts

Ambulance	911
Fire	911
Police	911
Poison Control Center	1-800-222-1222
Hospital	See Site Specific HASP
HAZMAT	1-800-424-8802
Amec Foster Wheeler Health and Safety Officer	Kendra Bavor: (207) 828-775-5401 (207) 650-8671 (cell)
Amec Foster Wheeler Project Principal	Jay Mullet, PE: (248) 926-4008 x 3669 (office) (810) 333-0892 (cell)
Amec Foster Wheeler Senior Project Manager	Rob Singer: (207) 828-2643 (office) (207) 272-0989 (cell)
Amec Foster Wheeler Field Manager	See Site Specific WP
Amec Foster Wheeler Site Health and Safety Manager	See Site Specific HASP

# NGB/A7OR

---

Amec Foster Wheeler HSE Manager	Cindy Sundquist (207) 828-3309 (office) (207) 650-7593 (cell)
ANG Contracting Officer Representative	Stephanie MacKay: (703) 607-1661

## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION</b>	<b>1-1</b>
1.1	PURPOSE AND POLICY	1-1
1.2	APPLICABILITY	1-1
1.2.1	<i>Modification Plan</i>	1-1
1.2.2	<i>Subcontractor Responsibilities</i>	1-2
1.3	SITE LOCATION	1-2
1.4	SCOPE OF WORK	1-3
1.5	HEALTH AND SAFETY PLANNING	1-3
1.6	PROJECT ORGANIZATION AND RESPONSIBILITIES	1-3
1.6.1	<i>Project Manager</i>	1-3
1.6.2	<i>Field Manager</i>	1-4
1.6.3	<i>Health, Safety, and Environment Group Manager</i>	1-4
1.6.4	<i>Site Health and Safety Officer</i>	1-4
1.6.5	<i>Project Field Team</i>	1-4
1.6.6	<i>Subcontractor's Safety Representative</i>	1-4
<b>2.0</b>	<b>TRAINING</b>	<b>2-1</b>
2.1	GENERAL TRAINING	2-1
2.2	SAFETY MEETINGS	2-1
2.3	INSTALLATION-SPECIFIC TRAINING	2-1
2.4	HAZARD COMMUNICATION	2-2
2.5	FIRST AID AND CARDIOPULMONARY RESUSCITATION	2-2
2.6	CONFINED SPACE TRAINING	2-2
2.6.1	<i>Training for Entry Supervisor</i>	2-3
2.6.2	<i>Training for the Authorized Attendants</i>	2-3
2.6.3	<i>Authorized Entrants</i>	2-3
2.7	MANDATORY TRAINING AND CERTIFICATIONS	2-3
2.8	OTHER TRAINING	2-4
<b>3.0</b>	<b>SAFETY AND HEALTH RISK ANALYSIS</b>	<b>3-1</b>
3.1	CHEMICAL HAZARDS	3-1
3.2	PHYSICAL HAZARDS	3-2
3.2.1	<i>Slips, Trips, and Falls</i>	3-2
3.2.2	<i>Falling Objects</i>	3-3
3.2.3	<i>Use of Tools and Machinery</i>	3-3
3.2.4	<i>Noise Hazards</i>	3-3
3.2.5	<i>Construction Hazards and Heavy Equipment</i>	3-3
3.2.6	<i>Traffic Hazards</i>	3-3
3.2.7	<i>Fire/Explosions</i>	3-4
3.2.8	<i>Oxygen-Deficient Atmospheres</i>	3-4
3.2.9	<i>Heat/Cold-Related Stress/Illness</i>	3-4
3.2.10	<i>Working on Private Property</i>	3-5
3.2.11	<i>Night-Time Work</i>	3-5
3.3	BIOLOGICAL HAZARDS	3-6
3.4	CONFINED SPACE ENTRY	3-6
<b>4.0</b>	<b>PERSONNEL PROTECTION AND MONITORING</b>	<b>4-1</b>
4.1	MEDICAL SURVEILLANCE	4-1
4.2	PERSONAL PROTECTIVE EQUIPMENT AND ACTION LEVELS	4-1
4.2.1	<i>Work Practices</i>	4-2
4.3	MONITORING REQUIREMENTS	4-3

# NGB/A70R

4.3.1	Exposure/Air Monitoring .....	4-3
4.3.2	Routine Monitoring for Explosive Environments.....	4-3
4.4	PHYSICAL MONITORING .....	4-3
4.4.1	Heat Stress Monitoring.....	4-4
4.4.2	Cold Stress Monitoring.....	4-5
4.4.3	Illumination Monitoring.....	4-8
<b>5.0</b>	<b>SITE CONTROLS, MEASURES, ACCIDENT PREVENTION, AND CONTINGENCY PLAN .....</b>	<b>5-1</b>
5.1	SITE CONTROL MEASURES .....	5-1
5.2	WORK ZONE.....	5-1
5.3	SAFE WORK PRACTICES .....	5-1
5.4	HEALTH AND SAFETY EQUIPMENT CHECKLIST .....	5-2
5.5	ACCIDENT PREVENTION .....	5-2
5.5.1	Slips, Trips, and Falls .....	5-2
5.5.2	Use of Tools and Machinery.....	5-3
5.5.3	Noise .....	5-4
5.5.4	Severe Weather.....	5-4
5.5.5	Heavy Equipment .....	5-5
5.6	UTILITIES.....	5-6
5.7	SITE SECURITY.....	5-7
5.8	COMMUNICATION.....	5-7
5.9	CONTINGENCY PLAN.....	5-8
5.9.1	Fire .....	5-9
5.9.2	Chemical Exposure.....	5-9
5.9.3	Spill or Hazardous Materials Release .....	5-9
5.9.4	Confined Space Emergency Response .....	5-9
5.9.5	Incident Reporting Procedures.....	5-11
5.9.6	Evacuation Procedures .....	5-12
5.10	RECORDKEEPING.....	5-12
<b>6.0</b>	<b>REFERENCES.....</b>	<b>6-1</b>

## Tables

Table 3-1	Toxicity Assessment .....	3-1
Table 3-2	Minimum Illumination Intensities In Foot-Candles.....	3-6
Table 4-1	Summary Of Prohibited And Acceptable Items For Sampling Of PFAS.....	4-2
Table 4-2	Summary Of Heat-Related Illnesses .....	4-4
Table 4-3	Summary Of Cold-Related Illnesses .....	4-5
Table 5-1	Minimum Clearance From Energized Overhead Electrical Lines .....	5-6

## Appendices

- Appendix A Field Forms
- Appendix B Job Hazard Analysis (Jhas)
- Appendix C Safety Data Sheets (Sdss)

# NGB/A7OR

---

## Appendix D Confined Space Entry Permit

## LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AFB	Air Force Base
AFS	Air Force Station
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
ANG	Air National Guard
ANSI	American National Standards Institute
ARB	Air Reserve Base
CFR	Code of Federal Regulations
CIH	certified industrial hygienist
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
CPR	cardiopulmonary resuscitation
dBA	decibels on A-weighted scale
DoD	Department of Defense
DRI	direct reading instrument
°F	degrees Fahrenheit
FM	Field Manager
ft/sec	feet per second
GFCI	ground fault circuit interrupter
HASP	Health and Safety Plan
HAZCOM	hazardous communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSE	Health, Safety, and Environment
IDW	investigation derived waste
ISWP	Installation-Specific Work Plan
JBA	Joint Base Andrews
JHA	job hazard analysis
kV	kilovolt
LEL	lower explosive limit
mg/m <sup>3</sup>	milligrams per cubic meter
mph	miles per hour
NIOSH	National Institute for Occupational Safety and Health
NRR	noise reduction rating
NWS	National Weather Service
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PFAS	perfluorinated alkyl substances
PFC	perfluorinated compounds
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride



# NGB/A7OR

---

QCP	Quality Control Plan
SAP	Sampling and Analysis Plan
SCBA	self-contained breathing apparatus
SDS	safety data sheet
SHSO	Site Health and Safety Officer
TLV	threshold limit value
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance

# NGB/A7OR

---

## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) has prepared this general Health and Safety Plan (HASP) for safety and health requirements concerning potential chemical exposures and other hazards that may be encountered during implementation of the FY16 Phase 1 Regional Site Inspections for Per-fluorinated Compounds at Multiple Air National Guard (ANG) Installations. SIs will be performed at twenty (20) ANG installations. Installation-specific health and safety information will be included in the Installation-Specific Work Plans (ISWPs) prior to beginning fieldwork.

### 1.1 Purpose and Policy

The purpose of this HASP is to present the general health and safety policies, responsibilities, procedures, and controls that will be implemented during field activities at each of the 20 installations. This HASP presents the minimum requirements for health and safety that must be met by Amec Foster Wheeler and other contractor personnel. Field and contractor personnel shall read, understand, and comply with the requirements of this HASP and the installation-specific HASP for each installation. Visitors shall also be required to review, sign, and comply with this HASP to gain site entry.

This HASP is in compliance with applicable federal, state, and local health and safety requirements. Specific references consulted in assembling the HASP include:

- 29 Code of Federal Regulations (CFR) 1910 and 1926 (Occupational Safety and Health Administration [OSHA] General Industry and Construction Standards, respectively); and,
- Amec Foster Wheeler Health, Safety, and Environment (HSE) program and field operating procedures.

### 1.2 Applicability

This HASP is structured to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that might arise while project-related operations are being conducted at each installation. The provisions of the plan are mandatory for on-site employees engaged in hazardous material management activities, including but not limited to, hydrogeologic and soil investigation, construction activities; installation of monitoring wells; development of monitoring wells; collection of soil, sediment, surface water, and groundwater samples; management of investigation derived waste (IDW); mobilization; project operations; and demobilization. Copies of all field forms to be used during site inspection (SI) activities are provided in **Appendix A**.

#### 1.2.1 Modification Plan

Changing and/or unanticipated site conditions might require modification of this plan to

# NGB/A7OR

---

maintain a safe and healthy work environment. Any proposed change must be reviewed by the Project Manager (PM) and HSE Group Manager prior to implementation of the change. Under no circumstances will modifications to this plan conflict with federal, state, or local health and safety regulations.

## 1.2.2 Subcontractor Responsibilities

Team members or subcontractors who perform work for Amec Foster Wheeler under this HASP are responsible for the health and safety of their employees. Each teaming partner and/or subcontractor is responsible for compliance with applicable federal, state, local, and Amec Foster Wheeler safety requirements, including but not limited to:

- 29 CFR 1910.120 (OSHA) guidelines regarding 40-hour Hazardous Waste Operations and/or 24-hour awareness training;
- Medical monitoring, medical examination for fitness to work including respirator use pursuant to 29 CFR 1910.134, if required;
- Supplying personal protective equipment (PPE) (coveralls, respirators, boots, gloves, etc.) as required by site conditions; and,
- 29 CFR 1926 (OSHA Construction Standard).

Copies documenting the above training and programs will be kept on-site by all individual contractors.

## 1.3 Site Location

Work conducted under this HASP will be performed at the following 20 installations:

- 1) Stewart International Airport (IAP), New Windsor, New York;
- 2) New Castle County Airport (NCCA), Wilmington, Delaware;
- 3) Joe Foss Field, Sioux Falls, South Dakota;
- 4) Harrisburg IAP (HIA), Harrisburg, Pennsylvania;
- 5) Stanly County Air Guard Station (AGS), Stanly County, North Carolina;
- 6) Pittsburgh IAP (Air Force Reserve Command (AFRC) and ANG), Pittsburgh, Pennsylvania;
- 7) Richmond IAP Byrd Field, Richmond, Virginia;
- 8) Martin State Airport, Middle River, Maryland;
- 9) Eastern West Virginia Regional Airport (EWRVA) Shepherd Field, Martinsburg, West Virginia;
- 10) Barnes MAP, Westfield, Massachusetts;
- 11) Yeager Airport, Charleston, West Virginia;
- 12) Minneapolis-St. Paul MAP (MSPIA) (AFRC and ANG), Hennepin County, Minnesota;
- 13) Bradley IAP, East Granby, Connecticut;
- 14) Bangor IAP, Bangor, Maine;
- 15) Quonset State Airport, North Kingstown, Rhode Island;

# NGB/A7OR

---

- 16) Greater Peoria Airport, Peoria, Illinois;
- 17) General Mitchell IAP, Milwaukee, Wisconsin;
- 18) Forbes Field, Topeka, Kansas;
- 19) Truax Field, Madison, Wisconsin; and
- 20) Capital MAP, Springfield, Illinois.

## 1.4 Scope of Work

The scope of work to be conducted under this HASP is based upon the technical approach presented in the general Quality Program Plan (QPP) and 20 ISWPs. Planned site inspection (SI) activities include the following:

- Soil sample collection;
- Monitoring well installation;
- Monitoring well development and rehabilitation of existing wells;
- Groundwater sample collection;
- Confined space entry into an extraction well vault to collect groundwater samples;
- Sediment and surface water sample collection; and,
- Management of IDW.

## 1.5 Health and Safety Planning

Identifying and evaluating potential health and safety hazards prior to beginning and during field activities are an integral part of HASP development. A formal site characterization must be completed by the Site Health and Safety Officer (SHSO) per OSHA standard for hazardous waste sites in 29 CFR 1910.120. The SHSO will perform a hazard assessment at each of the sites to collect information concerning the types and degrees of hazards and risks that may be present. Based upon the information collected, the project team can assess additional hazards and identify additional safety requirements not initially addressed in this HASP or in the installation-specific HASP. The hazard assessment will allow the project team to verify that the proper hazard control measures such as PPE, training requirements, permits, procedures, and engineering controls are being used.

## 1.6 Project Organization and Responsibilities

Personnel shall be aware of the site organization and the responsibilities and qualifications of each organization member. The general responsibilities of each are discussed below. Refer to page iii for emergency contact information.

### 1.6.1 Project Manager

The PM has overall health and safety responsibility for the work performed at each installation. The PM is responsible for regulatory compliance and the health and safety of employees working on the project. The PM has the authority to direct response

# NGB/A7OR

---

operations, if necessary.

## **1.6.2 Field Manager**

The Field Manager (FM) is responsible for ensuring that field operations are performed in accordance with the SAP and this HASP as well as protecting the health and safety of the workers and the public. The FM may delegate responsibilities for health and safety to the SHSO or other appropriate team personnel. The FM is also responsible for reviewing field reports, and interfacing with the Project's Certified Industrial Hygienist (CIH) and/or the SHSO regarding resolution of health and safety problems/concerns. The FM reports to the PM who has the authority to make the appropriate changes or cease work.

## **1.6.3 Health, Safety, and Environment Group Manager**

The Amec Foster Wheeler HSE Group Manager will be a primary point of contact for any incidents that arise during work activities.

## **1.6.4 Site Health and Safety Officer**

One SHSO will be assigned to each field team. The SHSO reports to the FM and is responsible for implementing this HASP plan in the field. The SHSO advises both the FM and PM on all aspects of on-site health and safety and advises the FM of conditions that may require work to be ceased or of any changes in operations in the event that worker or public health or safety is threatened. The SHSO will control visitor access to the work zone. The SHSO will conduct daily tailgate safety meetings and is responsible for updating the HASP (field changes) to ensure it adequately identifies all tasks and significant hazards at the Site and notifying project personnel, the FM, and PM of changes. The FM may serve as the SHSO.

## **1.6.5 Project Field Team**

The Project Field Team is responsible for the completion of various site tasks, complying with the HASP, notifying the SHSO of suspected unsafe conditions, and reporting any accidents or injuries through the appropriate chain of command.

## **1.6.6 Subcontractor's Safety Representative**

Team members or subcontractor's safety representative will oversee the field activities of his/her employees and is responsible for enforcing the field requirements of this HASP.

# NGB/A7OR

---

## 2.0 TRAINING

### 2.1 General Training

The FM and SHSO are responsible for informing site personnel and visitors of the contents of this HASP and ensuring that each person signs the Health and Safety Plan Acceptance Form included at the end of this plan) prior to working on site. Training documentation will be reviewed by the SHSO and filed on site.

Authorized visitors shall receive a safety briefing from the designated SHSO prior to accessing the site. The safety briefing will inform visitors of the potential hazards and installation-specific procedures appropriate to site areas they intend to visit. The briefing shall also include emergency action plan procedures.

### 2.2 Safety Meetings

Personnel shall be provided continuous health and safety training, as appropriate, to ensure that work is being performed in a safe manner. The SHSO shall conduct a daily safety meeting to discuss health and safety considerations for each day's activities, pertinent aspects of Job Hazard Analyses (JHAs), necessary PPE, problems encountered during the previous day, and new operations. Attendance records and meeting notes will be maintained for each day's meeting and will be filed on site.

### 2.3 Installation-Specific Training

Prior to beginning fieldwork, personnel (e.g., field personnel, subcontractors, authorized visitors, etc.) shall attend the pre-entry briefing covering the contents of this HASP and the appropriate installation-specific HASP. The briefing shall be conducted by the SHSO or designated representative. Attendance shall be documented on the Health and Safety Plan Acceptance Form. By signing the acceptance form, personnel acknowledge that they have attended the briefing, understand the potential safety and health hazards as described in this HASP, and agree to perform work according to the requirements outlined in this HASP and the installation-specific HASP. During the HASP review, the FM/SHSO will discuss specific tasks to be performed and the objectives of the project. This initial review will be supplemented, as needed, with daily, pre-task reviews, which will include the review of pertinent JHAs (**Appendix B**); Safety Data Sheets (SDSs) (**Appendix C**), and other applicable documents with intended task participants. The following topics will be addressed during the briefing:

- Names of the SHSO and the designated alternate;
- Safety, health, and other potential hazards;
- Task activities to be performed;
- Hazardous chemicals that may be encountered;
- Monitoring instrumentation;

# NGB/A7OR

---

- Hazard Communication (HAZCOM) Program;
- Physical hazards that may be encountered;
- PPE requirements;
- Proper use of assigned PPE, including respiratory protection if required;
- Action levels requiring upgrades/downgrades;
- Site controls and safety rules;
- Special training requirements and safe work practices;
- Emergency communication signals, codes, and location of telephone numbers;
- Emergency procedures for injuries, fires, and hazardous materials incidents; and,
- Emergency routes.

## 2.4 Hazard Communication

Employees working with hazardous materials shall receive training in accordance with the HAZCOM Standard, 29 CFR 1926.59. The HAZCOM program elements are addressed in Section 5.8 of this HASP.

## 2.5 First Aid and Cardiopulmonary Resuscitation

At least two field personnel at each installation will be currently certified in both basic first aid and cardiopulmonary resuscitation (CPR) by the American Red Cross, American Heart Association, or recognized equivalent organization. The designated first aid/CPR-trained personnel will also have the required blood-borne pathogen training.

## 2.6 Confined Space Training

Personnel responsible for supervising, planning, entering, or participating in confined space entry and rescue shall be adequately trained and demonstrate proficiency in their functional duties prior to any confined space entry. Training shall be provided before the employee is assigned their functional duties or whenever there is a change in operations or procedures. The training shall be certified by the employer, and the certification shall be documented and maintained on site. The training shall include:

- An explanation of the general hazards associated with confined spaces;
- A discussion of specific confined space hazards associated with the facility location;
- The reason for, proper use and limitations of PPE, and other safety equipment required for entry into confined spaces;
- An explanation of the permit system and other procedural requirements for conducting confined space entry;
- How to respond to emergencies;
- Duties and responsibilities as a member of the confined space entry team; and,
- A description of how to recognize probable air contaminant over-exposure and/or oxygen deficiency symptoms in themselves and their coworkers, and methods for alerting attendants.

# NGB/A7OR

---

## 2.6.1 Training for Entry Supervisor

The supervisor authorizing or in charge of entry shall receive the training in Section 2.6 above, and additional training on:

- Recognizing the effects of exposure to chemical hazards known to be in the confined space;
- The use of air monitoring equipment and the interpretation of results; and,
- The use and selection of PPE.

## 2.6.2 Training for the Authorized Attendants

Authorized attendants shall receive the training in Section 2.6.1, and additional training on:

- Practical exercises;
- Special rescue equipment;
- Radio operations;
- Lifelines and safety harnesses;
- Procedures for summoning rescue service;
- First aid; and,
- Cardiopulmonary resuscitation.

## 2.6.3 Authorized Entrants

Authorized entrants shall receive the training in Section 2.6.1, and additional training on:

- Respiratory fit-test for each type of respirator they will wear in a confined space;
- Detection of a prohibited condition;
- Proper exit techniques during evacuation;
- The requirements of the confined space entry permit; and,
- Communication techniques and equipment.

## 2.7 Mandatory Training and Certifications

In addition to the training and certification detailed above, the following will also be required:

- Personnel operating motor vehicles shall hold a valid operator's license from the state in which they reside.
- Following the completion of the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, all personnel are required to complete an annual 8-hour HAZWOPER refresher training. Copies of personnel training certificates shall be provided to the SHSO for inclusion and retention in the project's



# NGB/A7OR

---

records.

- In addition to the initial 40-hour HAZWOPER training, the PM and SHSO will have completed the 8-hour Supervisor/Manager HAZWOPER training. The course provides managers with specific safety and health responsibilities in accordance with the requirements of 29 CFR 1910.120(e)(4).

## 2.8 Other Training

Since work may be conducted within areas used by commercial and/or Department of Defense (DoD) aircraft, personnel should determine whether special training is required in areas adjacent to and near aprons, taxiways, and runways. This instruction (e.g., Flightline Training) establishes the responsibilities, procedures, and training requirements for the safe control of vehicles and pedestrians on and near airfield operations. Training requirements should be determined prior to work plan development and fieldwork activities and will be followed by all personnel working in areas where required.

## 3.0 SAFETY AND HEALTH RISK ANALYSIS

Personnel shall be made aware of chemical and physical hazards of concern associated with the project. The potential hazards for tasks associated with this project are discussed below. Protective measures and proper PPE are discussed in Section 4.2.

### 3.1 CHEMICAL HAZARDS

Field activities conducted under this HASP are associated with site investigations for releases of PFAS at 20 installations. Personnel shall be aware of site control measures designed to minimize potential exposure from any PFAS found during the assessment and characterization activities.

The chemical toxicological properties and permissible exposure limits (PELs) for constituents that may be encountered during sampling and drilling activities are shown in Table 3-1. Other potential hazards include Liquinox® or equivalent, isobutylene gas (equipment calibration), and methanol and nitric acid (sample preservatives). Safety Data Sheet (SDS) information including Liquinox® is included in **Appendix C**.

**TABLE 3-1  
TOXICITY ASSESSMENT**

Constituent	IDLH Level	PEL/REL	Acute Toxicological Symptoms for Relevant Exposure Pathway (oral, dermal, inhalation)
Gasoline	Carcinogen	See Benzene	Irritant to the eyes, skin, and mucous membrane; dermatitis; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsion; chemical pneumonia; possible liver and kidney damage
Petroleum Products (diesel fuel)	1,100 ppm (LEL)	REL TWA 350 mg/m <sup>3</sup> REL-C 1800 mg/m <sup>3</sup> * * 15-min	Irritant to the eyes, nose, and throat; dizziness; drowsiness; headache; nausea; dry cracked skin; chemical pneumonia
Benzene	Carcinogen (500 ppm)	TWA 0.5 ppm STEL 2.5 ppm	Irritation to the eyes, skin, nose, respiratory system; dizziness; headache; nausea; staggered gait; anorexia; lassitude (weakness, exhaustion); dermatitis; bone marrow depression

**Notes:**

\* Information obtained from ACGIH Guide to Occupational Exposure Values, 2013 and NIOSH Publications  
IDLH – immediately dangerous to life or health

# NGB/A7OR

---

LEL – lower explosive limit

mg/m<sup>3</sup> – milligrams per cubic meter

min – minute

PEL – Occupational Safety and Health Administration permissible exposure limits

ppm – parts per million

REL – National Institute for Occupational Safety and Health recommended exposure limits

TWA – time-weighted average (8-hour workday, 40-hour work week)

STEL – short-term exposure limit (15-minute time-weighted average)

REL-C – ceiling level concentration that should not be exceeded during any part of the working exposure

## 3.2 PHYSICAL HAZARDS

Potential physical hazards anticipated for this project include, but are not limited to:

- Uneven terrain and slips/trips/falls;
- Crushing injuries from unstable equipment;
- Injuries from the use of hand and power tools;
- Elevated noise levels;
- Exposure to the sun/sunburn;
- Sharp objects such as nails, broken glass, etc.;
- Weather related (heat/cold stress, inclement weather/electrical storms);
- Underground and aboveground utilities;
- Heavy equipment operation (including drill rigs); and,
- Vehicle and/or airport related traffic.

Control or protective measures for these physical hazards will be addressed during initial review of this HASP, during mandatory daily job safety meetings, and through the use of engineering controls (where applicable). Communications with other contractors shall be established and maintained during site activities. This will ensure that all contractors are provided with the appropriate hazard information. A telephone or cellular phone shall be available and easily accessible to site personnel.

Prior to beginning any intrusive activities the proper authorities will be contacted to provide a utility mark-out. All known utilities will be located, marked and avoided during intrusive activities. In addition, a review of all available utility maps will be conducted for the vicinity of the proposed sampling locations and proper dig permits will be acquired as applicable. In the event that any of the planned sampling locations are found to interfere with buried utilities or are located in an area subject to frequent flooding, the locations will be relocated as closely as practical to the original location. Relocated drilling locations will be approved by the FM. In the event that gas, water, or sewer utilities are damaged during field activities, Amec Foster Wheeler will immediately contact the appropriate authorities to coordinate response/repair activities.

### 3.2.1 Slips, Trips, and Falls

Slips, trips, and falls are the primary physical hazard that site personnel may encounter.

# NGB/A7OR

---

Therefore, personnel shall adhere to the following preventative measures. Supervisors will remind personnel and subcontractors to maintain sure footing on all surfaces. Sure footing includes safety boots with treaded soles to minimize slipping on surfaces. The supervisor and/or the SHSO will inspect all work areas prior to the start of work to look for hazards.

## **3.2.2 Falling Objects**

Falling or overhead objects are a potential hazard during all activities with heavy equipment. Personnel should be aware of overhead hazards, especially with heavy equipment. Personnel will be required to wear hard hats during activities involving heavy equipment and any other activities where falling or overhead objects are a hazard. Hard hats meeting American National Standards Institute (ANSI) Z89.1 standard will be provided.

## **3.2.3 Use of Tools and Machinery**

The use of hand and power tools is anticipated during field activities. Personnel should be familiar with each piece of equipment that they intend to use and be familiar with manufacturer's instructions and recommendations for the use and maintenance of each piece of equipment.

## **3.2.4 Noise Hazards**

Noise hazards at the sites may include the use of heavy equipment and power tools as well as airplanes arriving at and departing from nearby runways. Personnel within 25 feet of operating equipment shall wear hearing protection. The FM or SHSO will determine and enforce any other noise protection requirements if necessary.

## **3.2.5 Construction Hazards and Heavy Equipment**

While working on site, employees must be aware of other physical hazards that might exist from drilling and sampling activities, including risk of injury while working in or around heavy equipment such as drill rigs. Care will be exercised in the use of and while working near equipment. Heavy equipment will be inspected and documented throughout environmental service activities. Operators of equipment shall be qualified and licensed to operate the specific heavy equipment. Before equipment is placed into use, it will be inspected by the operator to ensure that it is in safe operating condition. Construction activity will vary among sites, so site-specific hazards and safety protocols will be included in site-specific HASPs.

## **3.2.6 Traffic Hazards**

Driving a vehicle and working in areas of vehicle and/or aircraft traffic both present hazards to employees. Safe driving rules and speed limits must be followed at all times, both on base and off base. When working or driving in an area shared by aircraft,

personnel should obtain and follow area-specific driving and work regulations/instructions (e.g., Flightline Training) prior to entering and working in the area. Cell phone use is prohibited while driving at all times. High visibility traffic vests must be worn if working in areas with vehicle and/or aircraft traffic or heavy equipment operation.

### 3.2.7 Fire/Explosions

The primary fire hazards at the project consist of fueling operations, storage of fuels, and other flammable liquids at the project site. The significant ignition sources at the project include smoking materials, vehicle/equipment exhaust, catalytic converters, and engine block surfaces. Personnel shall also be alert for other ignition sources such as static electricity, lightning, and electrical equipment.

### 3.2.8 Oxygen-Deficient Atmospheres

During on-site activities, no confined spaces will be entered; therefore, oxygen-deficient atmospheres will not be encountered during sampling activities.

### 3.2.9 Heat/Cold-Related Stress/Illness

Field activities conducted at the Site in either the winter or summer months may present a potential hazard to personnel for heat/cold stress injuries.

The potential for a heat stress injury rises considerably when workers are required to perform physical activities in impermeable PPE and outdoor temperatures are above 70 degrees Fahrenheit (°F), particularly in humid weather. This type of exposure can result in health effects ranging from heat fatigue to serious illness or death. Signs and symptoms of heat related injuries include the following:

- Heat cramps – muscle spasms during or after work shift;
- Heat exhaustion – fatigue, clammy skin, nausea, profuse sweating; and,
- Heat stroke – confusion, hot and dry skin, absence of sweating (life threatening).

The potential for cold stress injury rises when workers are exposed to extreme cold or work in cold environments. Extreme cold weather is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter, outdoor workers, and those who work in an area that is poorly insulated or without heat. What constitutes cold stress and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered factors for "cold stress." Whenever temperatures drop decidedly below normal, heat can more rapidly leave your body, especially as the wind speed increases. These weather-related conditions may lead to serious health problems.

- Hypothermia
  - Early symptoms: shivering, fatigue, confusion and disorientation;

- Late symptoms: no shivering, blue skin, dilated pupils, slowed pulse and breathing, loss of consciousness; and,
- Frostbite – reduced blood flow to hands and feet, numbness, tingling, bluish or pale waxy skin.

### 3.2.10 Working on Private Property

The scope of work for this task order may include the collection of groundwater samples on private property. Many private property owners do not like strangers on their property; therefore, the following practices should be followed when conducting work on private property:

- Contact the property owner prior to field activities to (1) discuss the scope of work, (2) obtain permission to conduct the activities and (3) schedule a date and time that suites the property owner to perform the work;
- All work conducted on private property must be completed by two field staff;
- Contact the property owner the day before conducting the work to confirm the activities;
- When arriving at the property inform the property owner that you are on site; and,
- Prior to commencing activities, perform a hazard analysis by walking the areas where you will be working to evaluate the presence of potential safety hazards (e.g., slip, trip, falls; dogs; etc.).

### 3.2.11 Night-Time Work

The scope of work for this task order may include completion of investigation activities including drilling and/or sampling overnight. All potential night work and associated requirements must first be coordinated with Airfield Managers to ensure that any proposed night time activities including temporary illumination of work areas will not interfere with airfield operation or other installation requirements. If night time work is required at any installation, the following practices should be followed:

- Discussion with Airfield Manager regarding any installation specific requirements;
- Night work must be scheduled prior to the onset of investigation activities and a staffing plan should be developed and approved by the SHSO. The staffing plan should outline the field schedule and shift rotation that will be developed to prevent fatigue of field staff. Night time shift work should be limited to a maximum of 8 hours per employee;
- All night time investigation activities must be completed by two field staff;
- Staff conducting night work must familiarize themselves with the work area prior to onset of any night work (i.e., during day light) to identify and become familiar with access and emergency evacuation routes;
- At the start of each shift, a tailgate safety briefing including a review of night-time specific hazards should be reviewed;

- High-visibility Class III PPE should be worn at all times;
- Work area should be sufficiently illuminated in accordance with the OSHA requirements for lighting controls outlined Table 3-2. The illumination values presented in Table 3-2 are minimum requirements that should be followed while any work is in progress;
- Light intensity should be measured using a photometer and recorded on tailgate safety forms.

**TABLE 3-2  
MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES  
(MODIFIED FROM OSHA 1926.56[A])**

Foot-Candles	Area of Operation
5	General construction area lighting
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
30	First Aid Stations, Offices.

**Notes:**

OSHA minimum illumination intensities obtained from 29 CFR Subpart D 1926.56 (a); Safety and Health Regulations for Construction.

### 3.3 Biological Hazards

Working outdoors presents many potential biological hazards. These include, but are not limited to insect bites or stings, contact with poisonous plants or the oil from these plants, and encounters with animals. Biological hazards endemic to certain geographic areas will be described in detail in the site-specific HASPs.

### 3.4 Confined Space Entry

A confined space is defined as a space that has one or more of the following characteristics (29 CFR 1910.146):

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Is configured such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a small cross section; and,
- Contains any other recognized serious safety hazard.

Due to the nature of confined spaces, they can be further classified as Permit Required

# NGB/A7OR

---

Confined Spaces if they meet one of the following conditions:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or,
- Contains any other recognized serious safety or health hazard.

Before personnel may enter a confined space, the SHSO or designee must survey the premises and perform a job task analysis to identify chemical and physical hazards and evaluate whether the confined space is a Permit Required Confined Space. In identifying possible hazards, the SHSO or designee will evaluate if:

- Atmospheres that are oxygen-deficient or -enriched, flammable, or toxic for single or multigas environments;
- Possible physical, mechanical, electrical, or biological hazards;
- The possibility of liquids, gases, or solids being admitted during occupancy;
- Past and current uses of the confined space that may have adversely affected the atmosphere of the confined space;
- Any hazards that might be created by the physical characteristics, configuration, and location of the confined space; and,
- Activities or facilities in the area (particularly in interconnected spaces) that could adversely affect the confined space, such as traffic, running vehicles (exhaust fumes), gas lines, sewers, fuel or chemical tank vents

The presence of one or more of the following conditions would indicate that the confined space contains a high hazard(s); thus, would represent a Permit Required Confined Space:

- Atmospheric oxygen concentration below 19.5% or above 23.5%;
- Flammable atmosphere greater than 10% of the lower explosive limit (LEL);
- Atmospheric hydrogen sulfide concentration above 10 parts per million (ppm);
- Atmospheric carbon monoxide (CO) concentration above 25 ppm;
- Atmospheric carbon dioxide (CO<sub>2</sub>) concentration above 5,000 ppm;
- Atmospheric concentration of any toxic substance above the OSHA PEL or the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) (whichever is lower);
- Any atmospheric or physical condition recognized as dangerous;
- Conditions that limit access or egress; or,
- Mechanical energy.
- 

If a site is determined to be a Permit Required Confined Space, a Confined Space Entry



# NGB/A7OR

---

Permit must be completed (**Appendix D**).

## 4.0 PERSONNEL PROTECTION AND MONITORING

Initial safety and health indoctrination, visitor safety and health awareness, and any additional training shall be the responsibility of the SHSO. The SHSO shall maintain a record of training attendance in the Safety and Health Logbook.

Employees working on-site (such as but not limited to equipment operators, general laborers, and others) potentially exposed to hazardous substances, health hazards, or safety hazards shall be trained in accordance with the requirements of 29 CFR 1910.120 (HAZWOPER) and 29 CFR 1910.1200 (HAZCOM). Personnel shall provide written certification to the SHSO that the required training has been received prior to engaging in on-site activities. Documentation of training will be maintained on site and managed by the SHSO. Specific training requirements are discussed below.

### 4.1 Medical Surveillance

Personnel requiring access to controlled work areas will have a baseline medical examination and a periodic (usually annual) update examination prior to assignment, in accordance with OSHA 29 CFR 1910.120(f). The exam must be performed by an Occupational Health Physician, who will provide written clearance for hazardous waste site work and respirator usage. Protocols for the baseline, periodic, and exit exams must be at least as stringent as those defined in the Amec Foster Wheeler Medical Surveillance Program, Volume II of Amec Foster Wheeler's Corporate Health and Safety Manual.

### 4.2 Personal Protective Equipment and Action Levels

During field activities, controls will be implemented using the OSHA hierarchy of controls (e.g., engineering, administrative, and PPE, as the last resort). When engineering and administrative controls are not feasible or additional controls are needed, the use of PPE is implemented. The use of PPE shall be in compliance with 29 CFR 1910 Subpart I.

Prior to commencement of field activities, site personnel will be trained in the use of PPE. Standard minimum PPE for this project will consist of modified Level D protection, which includes the following:

- Cotton Coveralls
- Hardhat;
- ANSI Z87.1 approved safety glasses;
- Long Pants;
- Nitrile gloves;
- Steel-toed boots (ANSI Z41 approved);
- Hearing protection, as needed; and,
- Class II High Visibility Work Vest.

# NGB/A7OR

Given the low detection limits associated with PFAS analysis and the many potential sources of trace levels of PFAS, field personnel are advised to err on the side of caution by strictly following protocols to help mitigate the potential for false detections of PFAS. The following table lists the acceptable and unacceptable PPE for this project:

**TABLE 4-1  
SUMMARY OF PROHIBITED AND ACCEPTABLE ITEMS FOR SAMPLING OF PFAS**

Prohibited Items	Acceptable Items
Field Clothing and Personal Protective Equipment	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and polyvinyl chloride (PVC)
Tyvek®	Cotton Clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	<b>Sunscreens</b> - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" <b>Insect Repellents</b> - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California Baby Natural Bug Spray, BabyGanics <b>Sunscreen and insect repellent</b> - Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion

## 4.2.1 Work Practices

Good personal hygiene shall be practiced by all site personnel. This includes:

- No eating, drinking, chewing of gum or tobacco, application of cosmetics, or smoking on site.
- Washing hands frequently, prior to eating or drinking, and at the end of each day's activities.

## 4.3 Monitoring Requirements

### 4.3.1 Exposure/Air Monitoring

The SHSO or designee shall test for hazardous atmospheres in the confined space before the entry supervisor will authorize entry into the space. The sequence of testing will be oxygen, flammability, toxicity. Preliminary tests shall be conducted before and after ventilation of the confined space. Testing should be conducted for at least 15 minutes before employees enter the space and continuously while they occupy it. If a permanent monitor is installed in the space, it must operate continuously while the confined space is occupied.

During occupancy, the frequency of testing shall be as stated in the Confined Space Entry Permit, (as previously determined by the Corporate HSE Director or local HSE designee). In cases that require continuous atmospheric testing, the results will be recorded on the Confined Space Entry Permit at an interval no longer than every 30 minutes. Testing shall be conducted throughout the entire space occupied by using direct reading instruments (DRIs) worn by entrants. The required atmospheric test equipment shall be listed on the Confined Space Entry Permit (**Appendix D**). The atmosphere of a confined space shall be considered within acceptable limits whenever the following conditions are maintained:

- Oxygen between 19.5% and 23.5%;
- Flammability less than 10% of the LEL;
- Hydrogen sulfide concentration less than 10 ppm;
- CO concentration less than 25 ppm;
- CO<sub>2</sub> concentration less than 5,000 ppm; and,
- Toxicity concentrations less than one-half the OSHA PEL or ACGIH TLV (whichever is lower).

### 4.3.2 Routine Monitoring for Explosive Environments

Explosive environments are not anticipated for the fieldwork to be conducted during the investigations. In the unlikely event that unexploded ordnance is discovered during site investigation activities, the field team will cease working and contact the project manager and the Amec Foster Wheeler unexploded ordnance (UXO) Program Manager.

## 4.4 Physical Monitoring

During extreme temperatures, heat or cold stress monitoring will be implemented. The state of California Department of Industrial Relations updated their Heat and Illness Prevention Regulation Amendments on May 14, 2015.

# NGB/A7OR

## 4.4.1 Heat Stress Monitoring

Heat stress monitoring will be conducted at times of elevated ambient temperatures, moderate to heavy workloads, and/or when impermeable protective clothing are being used. Heat stress monitoring will be implemented when impermeable protective clothing is in use and ambient temperatures exceed 70 degrees Fahrenheit (°F). The frequency of monitoring will increase as the ambient temperature increases or if slow recovery rates are indicated. When ambient temperatures exceed 80°F, monitoring will be accomplished after each work period.

The heat stress monitoring program will be managed on site by the SHSO. Table 4-2 provides a summary of the types of heat-related illnesses that are possible when working in hot temperature extremes. Monitoring will increase with temperature extremes

**TABLE 4-2  
SUMMARY OF HEAT-RELATED ILLNESSES**

Heat Related Illness	Signs and symptoms	Emergency Care
Heat Rash	Red skin rash and reduced sweating	Keep the skin clean, change all clothing daily, cover affected areas with powder containing corn starch or regular corn starch
Heat Cramps	Severe muscle cramps, exhaustion, sometimes with dizziness or periods of faintness	Move the patient to a nearby cool place; give the patient half-strength electrolyte fluids; if cramps persist, or if more serious signs develop, seek medical attention

Of particular importance is heat stress resulting when protective clothing decreases natural body ventilation. One or more of the following steps will help reduce heat stress:

- Drinking water and/or electrolyte solution will be made available to the workers in such a way that they are stimulated to frequently drink small amounts (i.e., two or more cups at every break period). The fluid will be kept reasonably cool (55 to 60°F) and shall be placed close to the workplace so that the worker can reach it without abandoning the work area
- Lightweight clothing acts as a wick to help absorb moisture and to protect the skin from direct contact with heat-absorbing protective clothing.
- When determined to be necessary/applicable, the installation of mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing.
- In extremely hot weather, conduct non-emergency response operations in the evening.
- In hot weather, rotate shifts for workers wearing impervious clothing.

## 4.4.2 Cold Stress Monitoring

Evaluating a work environment to determine the degree of cold stress involves measuring air temperature, wind speed, and the amount of energy expended by the workers. **Table 4-3** provides a summary of the types of cold-related illnesses that are possible when working in cold temperature extremes. Monitoring will increase with temperature extremes.

Work place monitoring for cold related stress is required as follows:

- Suitable temperature measurements should be conducted at any workplace where the environment temperature is 60.8°F so that overall compliance with the requirements of the TLV can be maintained.
- Whenever the air temperature at a workplace falls below 30.2°F, the dry bulb temperature should be measured and recorded at least every 4 hours.
- The wind speed should also be recorded at least every 4 hours whenever the rate of air movement exceeds 2 meters per second (5 miles per hour). Contact the local meteorological station (e.g., local airport) for wind speed and direction data.
- In outdoor work situations, the wind speed should be measured and recorded together with the air temperature whenever the air temperature is below 30.2°F.

**TABLE 4-3  
SUMMARY OF COLD-RELATED ILLNESSES**

Cold Related Illness	Symptoms	Possible Underlying Causes	Treatment
Hypothermia	<ul style="list-style-type: none"> <li>• Pain in the extremities</li> <li>• Uncomfortable shivering and the</li> <li>• sensation of cold</li> <li>• Reduction of body core temperature</li> <li>• Cool skin</li> <li>• Rigid muscles</li> <li>• Slowing of heart rate</li> <li>• Weakening of pulse</li> <li>• Low blood pressure</li> <li>• Irritability of heart muscle</li> <li>• Sometimes heart beating abnormally in</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to low air temperatures, high wind, inadequate clothing or water immersion</li> <li>• Underlying disease, such as heart or blood vessel disease</li> <li>• Old age</li> <li>• Allergies</li> <li>• Alcoholism</li> <li>• Recent alcohol consumption</li> <li>• Smoking</li> <li>• Medications that affect the temperature-regulation</li> </ul>	<ul style="list-style-type: none"> <li>• Get the victim out of the wind, snow, or rain</li> <li>• Keep use of energy to a minimum</li> <li>• Keep person awake</li> <li>• Victim should be handled on a stretcher if movement is necessary</li> <li>• Strip off all wet clothes</li> <li>• Get person into dry clothes</li> <li>• Wrap blanket around victim</li> <li>• In conscious victims, body should be packed with heat packs or wet towels no warmer than 105°F, behind the neck, groin, and armpits</li> <li>• Do not rewarm extremities and the core at the same time</li> <li>• Provide lifesaving actions as necessary - mouth-to-</li> </ul>

# NGB/A7OR

Cold Related Illness	Symptoms	Possible Underlying Causes	Treatment
	<p>respect to strength and rhythm</p> <ul style="list-style-type: none"> <li>• Slow irregular breathing</li> <li>• Memory lapses</li> <li>• Vague slow slurred speech</li> <li>• Drowsiness</li> <li>• Incoherence</li> <li>• Diminished reaction time</li> <li>• Diminished coordination</li> <li>• Diminished dexterity</li> </ul>	<p>mechanism</p> <ul style="list-style-type: none"> <li>• Exhaustion</li> <li>• Sedative drugs</li> <li>• Dehydration</li> </ul>	<p>mouth resuscitation or cardiopulmonary resuscitation (CPR), if trained</p> <ul style="list-style-type: none"> <li>• If blankets, sleeping bag, newspapers, heat packs, or wet towels are not available, rewarm victim with body heat</li> <li>• Give sweet warm drinks to conscious victims</li> <li>• Do not immerse victim in a warm water bath</li> <li>• Take victim to the hospital by calling an ambulance and telling them that a cold illness emergency exists</li> </ul>
Raynaud's Syndrome	<ul style="list-style-type: none"> <li>• Fingers turn white and stiff</li> <li>• Intermittent blanching and reddening of the fingers and toes</li> <li>• Affected area tingles and becomes very red or reddish purple</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to low air temperature, high winds</li> <li>• Inadequate clothing</li> <li>• Underlying disease such as blood vessel disease</li> </ul>	<ul style="list-style-type: none"> <li>• Remove to warmer area</li> <li>• Consult physician</li> </ul>
Acrocyanosis	<ul style="list-style-type: none"> <li>• Hands and feet are cold, blue, and sweaty</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to cold</li> <li>• Inadequate clothing</li> <li>• Underlying disease such as blood vessel disease</li> </ul>	<ul style="list-style-type: none"> <li>• Remove to warmer area</li> <li>• Loosen tight clothing</li> <li>• Consult physician</li> </ul>
Frostnip	<ul style="list-style-type: none"> <li>• Skin turns white</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to cold</li> </ul>	<ul style="list-style-type: none"> <li>• Remove to warmer area</li> <li>• Refer to treatment for frostbite</li> </ul>
Chilblain	<ul style="list-style-type: none"> <li>• Recurrent localized itching, swelling, and painful inflammation of the fingers,</li> </ul>	<ul style="list-style-type: none"> <li>• Inadequate clothing</li> <li>• Exposure to cold and moisture</li> <li>• Underlying</li> </ul>	<ul style="list-style-type: none"> <li>• Remove to warmer area</li> <li>• Consult physician</li> </ul>

# NGB/A7OR

Cold Related Illness	Symptoms	Possible Underlying Causes	Treatment
	<ul style="list-style-type: none"> <li>• toes, or ears</li> <li>• Severe spasms</li> </ul>	<ul style="list-style-type: none"> <li>• disease such as blood vessel disease</li> </ul>	
Frostbite	<ul style="list-style-type: none"> <li>• Skin changes color to white or grayish yellow, progresses to reddish violet, and ultimately turns black</li> <li>• Burns at first</li> <li>• Blisters</li> <li>• Affected part cold, numb, and tingling</li> </ul>	<ul style="list-style-type: none"> <li>• Exposure to cold</li> <li>• Lack of acclimatization</li> <li>• Age (very young or old)</li> <li>• Physically disabled or mentally impaired</li> <li>• Underlying diseases, such as heart and blood vessel disease</li> </ul>	<ul style="list-style-type: none"> <li>• Cover the frozen part</li> <li>• Provide extra clothing and blankets</li> <li>• Bring victim indoors as soon as possible</li> <li>• Place the frozen part in warm water at a temperature of 102°F to 105°F or re-warm with warm packs</li> <li>• If affected part has been thawed and refrozen, do not use water, re-warm at room temperature</li> <li>• If no water is available, wrap gently in a sheet and blanket</li> <li>• Discontinue warming the victim as soon as the affected part becomes flushed and swelling develops after thawing</li> <li>• Exercise part after re-warming, but do not allow victim to walk after the affected part thaws</li> <li>• Place dry sterile gauze between affected fingers and toes, do not apply other dressings unless victim is to be transported for medical aid</li> <li>• If travel is necessary, warm affected parts with sterile or clean cloths during transportation</li> <li>• Elevate the frostbitten parts and protect them from contact with bedclothes</li> <li>• Give sweet, warm fluid if victim is conscious and not vomiting; no alcoholic or caffeine beverages</li> <li>• In absence of warm water, frostbitten fingers should be placed uncovered</li> </ul>



# NGB/A7OR

Cold Related Illness	Symptoms	Possible Underlying Causes	Treatment
			under the armpits next to skin <ul style="list-style-type: none"><li>• If the toes or heels are affected, footwear should be covered with dry socks</li><li>• If above measures for feet are not possible, place bare frostbitten feet against the belly of a companion or under clothing</li></ul>

## 4.4.3 Illumination Monitoring

In the event that night-time work is required at any installation, temporary lighting will be utilized in, and immediately surrounding the work area. In order to ensure that the work area is adequately lit, a photometer should be utilized. Illumination levels should be monitored at the start of every night shift to ensure compliance with the requirements outlined in section 3.2.11.

## 5.0 SITE CONTROLS, MEASURES, ACCIDENT PREVENTION, AND CONTINGENCY PLAN

### 5.1 Site Control Measures

The SHSO and/or FM will be responsible for establishing the site control zones, as necessary, around areas that present physical and/or chemical hazards. Unauthorized personnel shall be kept out of work zones.

### 5.2 Work Zone

The work area shall be established to provide for protection of personnel during investigation activities. These work areas will be dynamic and will change as the work proceeds from one area of the site to another and will be identified in the installation-specific HASP. The work area is defined as the overall boundary where field activities will be performed. Activities that will occur in the work area include equipment and material staging, drilling, soil, sediment, surface water and groundwater sampling. Site personnel, including visitors such as client or regulatory agency personnel, will be properly briefed on the HASP prior to entering any designated work area. Work areas will be clearly identified using barricade fencing, hazard tape, or adequate signage.

### 5.3 Safe Work Practices

Project personnel must have adequate training and understanding of this HASP and the appropriate installation-specific HASP. The SHSO will review safe work practices during daily tailgate meetings. Examples of safe work practices include, but are not limited to, the following:

- Unauthorized personnel are not allowed in the work area.
- Work groups will always consist of at least two team members.
- A high standard of personal hygiene will be observed. Smoking, eating, drinking, and chewing gum or tobacco will not be permitted within the work area.
- Personnel under the obvious influence of alcohol or controlled substances will not be allowed on-site; those taking medications must notify the SHSO.
- Site personnel will familiarize themselves with these practices and the emergency procedures during daily tailgate and pre-work safety meetings.
- Workers who are drivers or passengers of vehicles will wear their seat belts any time the vehicle is in motion.
- Cell phone use is prohibited while driving at all times.
- Personnel will avoid contact with contamination or potentially contaminated media. If such contact occurs, the affected areas should be washed thoroughly with soap and water.
- Personnel will discard and replace any damaged or heavily soiled protective clothing.

# NGB/A7OR

---

Discarded

- PPE will be containerized or drummed at the end of each day.
- Personnel should notify the SHSO of any defective monitoring, emergency, or other protective/safety equipment.
- For cold weather work, shelter away from rain, snow, or wind will be provided for breaks.
- Employees will be encouraged to increase fluid intake to prevent dehydration, and to drink warm, sweet, caffeine-free, nonalcoholic drinks periodically.
- If working in hot weather conditions, employees should work at a slow even pace, take frequent rest breaks away from direct sunlight, and drink plenty of electrolyte-containing liquids. Use of the buddy system to monitor co-workers and watch for signs of heat stress will be implemented.
- A supply of potable water, electrolyte replacement solutions, shaded break area, and sufficient lighting will be maintained on site; and sanitary facilities will be accessible to personnel.

## 5.4 Health and Safety Equipment Checklist

Prior to beginning work on-site, the SHSO will make sure necessary safety equipment and PPE are accessible and in good condition. Subcontractors will be responsible for checking their equipment, such as drill rigs, prior to the start of field activities.

A key element of the Project Specific Safety and Health Program is the implementation of an accident prevention program. It is essential that the contents of this HASP are communicated to all personnel who work on the site. The following actions will be used to prevent accidents at the Site:

- Educate personnel as to the requirements of the HASP;
- Eliminate unsafe conditions. Efforts must be initiated to identify conditions that can contribute to an accident and to remove exposure to these conditions;
- Reduce unsafe acts. Personnel shall make a conscious effort to work safely; and
- Inspect frequently. Regular safety inspections of the work site, material, equipment, and operations by qualified persons (i.e., SHSO) will help with early detection of unsafe conditions. Safety and health deficiencies shall be corrected as soon as possible, or site activities shall be suspended.

Adherence to Safe Work Practices and procedures outlined in this HASP will assist with accident prevention. JHA forms are included in **Appendix B**.

## 5.5 Accident Prevention

### 5.5.1 Slips, Trips, and Falls

The following preventive measures will reduce the potential for these hazards:

# NGB/A70R

---

- Personnel will keep working areas clean. Tools, equipment, and materials will be used and stored in a fashion to minimize tripping hazards. Small, loose items such as tools, materials, and other small objects and debris will not be left lying around, particularly in areas where personnel walk.
- Walkways will be kept free of obstacles. Openings in walkways will be repaired, if possible. If not immediately repaired, the section must be roped off or closed until repairs can be made.
- Personnel will not walk or climb on piping, valves, fittings, or any other equipment not designed as walking surface. Walking and working surfaces will be properly maintained during inclement weather.
- Electrical extension cords and electrical wiring must be kept clear of walking and working areas and/or covered, buried, or otherwise secured.
- Personnel will maintain a three-point contact when mounting or dismounting heavy equipment or ladders.
- Running is prohibited on job sites unless under emergency conditions.
- Spills will be cleaned up immediately.
- Personnel will take extra precautions, such as establishing firm hand holds, footwear, and walking slowly when walking or working during wet, snowy, or icy weather.

## 5.5.2 Use of Tools and Machinery

Tools and machinery use safety procedures include:

- Tools and machinery will be inspected and properly maintained in accordance with the manufacturer's instructions and recommendations. Hand tools and machinery should be inspected daily or before each use for defects. Tools that are burred, broomed, mushroomed, have split or loose handles, worn or sprung jaws, or are generally unsafe should be turned in to the FM or SHSO and immediately taken out of service.
- Defective or unsafe machinery must be tagged with "Do Not Use" or "Defective Do Not Use" tags until repaired or otherwise made acceptable. Defective or unsafe equipment must be removed to a secure place to prevent inadvertent use until repaired. Repaired items must be re-inspected by the SHSO before being placed back into service.
- Tools and machinery must be used only for the purpose for which it was designed (do not use a wrench for a hammer, screwdriver for a chisel, pliers for a wrench, pipe or stilson wrenches as a substitute for other wrenches, a pipe handle-extension or a "cheater" on a wrench). All modifications, extensions, replacement parts, or repairs of equipment must maintain at least the same factor of safety as the original equipment.
- Machinery containing liquid systems (e.g., fuel, hydraulic, lubrication) will be inspected daily to ensure that liquid-containing systems (e.g., hoses, tubing, hydraulic lines) are

# NGB/A7OR

---

- in good operating condition and that plugs, stoppers, valves, etc., are properly seated.
- Machinery must not be operated without proper training and special permission unless it is a regularly assigned duty.
- Loose or frayed clothing, dangling ties, rings, etc., must not be worn around moving machinery or other mechanical sources of entanglement.
- Air hoses should not be disconnected from compressors until the air within the hoses has been bled off.
- Pressure reducers will be in place for air hoses used to blow off debris or clothing. Gauges will be used to ensure that air used to blow off debris or clothes will be no more than 30 pounds per square inch.
- Personnel shall not use air hoses to blow off potentially contaminated clothing.
- Electrical power tools, lighting equipment, etc. to be used must be properly grounded by using three-wire receptacles and extension cords rated for the amperage required. Ground fault circuit interrupters (GFCIs) should be used with temporary electrical systems or other proper grounding system.
- Portable electric tools must not be lifted or lowered by means of a power cord. Electrical equipment cords should be kept coiled when not in use. When electrical equipment is in use, cords should be protected and positioned to avoid being run over by vehicles or equipment.
- Machinery must not be repaired or adjusted while in operation. Oiling of moving parts must not be attempted except on equipment that is designed or fitted with safeguards to protect the person performing the work.
- Personnel using hand and mechanical tools will position themselves properly and anticipate what could happen if a tool slips or moves suddenly.

## 5.5.3 Noise

Personnel shall use protective devices per the following guidelines:

- The direction of the FM/SHSO; and,
- When working within 25 feet of operating equipment.

A noise reduction rating (NRR) value of 33 decibels on the A-weighted scale (dBA) is the minimal acceptable value for hearing protection. Protective devices will have an NRR appropriate to reduce the sound levels below 85 dBA while not affecting the worker's ability to communicate, hear alarms, or hear nearby moving equipment. Moreover, project staff will be trained on how to properly use hearing protection. Finally, the use of hearing protection devices will be monitored by the FM and SHSO.

## 5.5.4 Severe Weather

Personnel will receive information regarding severe weather during Tailgate Safety Meetings. The following are examples of typical weather alerts:

# NGB/A7OR

---

- Lightning Watch – Lightning is possible within 5 miles of the site (or within approximately 30 minutes). Work may continue but personnel should be prepared to stop work operations.
- Lightning Warning – Lightning is imminent or occurring on within the immediate area.
- Personnel visually see lightning strikes. Operations must cease and personnel must seek cover (e.g., vehicle or field office) and wait 15 minutes after the final lightning strike.
- Tornado Watch – Issued by the National Weather Service (NWS) when conditions are favorable for the development of tornadoes in and close to the Tornado Watch area. Duration for watch is usually 4 to 8 hours.
- Tornado Warning – The NWS reports where the tornado was located and what towns will be in its path. Personnel are to take cover immediately if within or near the path. Seek low-lying areas if out in an open field. Cover head area with hands and arms, and lay still.
- Hurricane Watch (where applicable) – Issued by the NWS whenever a hurricane becomes a threat to coastal areas. Everyone in the area covered by the “watch” should listen for further advisories and be prepared to act promptly if a hurricane warning is issued.
- Hurricane Warning (where applicable) – Issued by the NWS when hurricane winds of 74 miles per hour (mph) or higher, or a combination of dangerously high water and very rough seas, are expected in a specific coastal area within 24 hours. Precautionary actions should begin immediately.

## 5.5.5 Heavy Equipment

The following guidelines will be adhered to while operating heavy construction equipment:

- Hard hats, steel-toed boots, safety glasses or goggles, and high visibility vest shall be worn at all times when personnel are around heavy equipment. The JHA shall specify any additional PPE requirements.
- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
- Getting off or on any equipment while it is in motion is prohibited.
- Operators will maintain a “three-point” contact while mounting or dismounting equipment (i.e. two hands and one foot contact on stable equipment surface).
- Equipment will be operated in accordance with the manufacturer's instructions and recommendations.
- Drill platforms and immediate work areas must be kept clear. Oil, grease, or excessive mud will not be allowed to accumulate in these areas. Open boreholes will be backfilled immediately, or capped and flagged.
- Machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to remain running during repair is exempt from this requirement.

# NGB/A7OR

---

- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on.
- Mechanized equipment will be shut down prior to and during fueling operations.
- Closed systems, with automatic shut off that prevent spillage if connections are broken, may be used to fuel diesel-powered equipment left running.
- Each piece of heavy equipment and other similar equipment shall be equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 10 pounds B:C.
- Spotters for tight areas, overhead and underground utilities, excavation, etc. and sample collectors will be the only personnel allowed near heavy equipment. Spotters and sample collection personnel will stay out of the boom radius. Personnel needing to approach heavy equipment while it is in operation will observe the following protocols:
  - Never walk directly behind or to the side of heavy equipment without the operator's knowledge.
  - Make eye contact with the operator (and spotter).
  - Signal the operator to cease heavy equipment activity.
  - Approach the equipment only after the operator has given a signal to do so.

## 5.6 Utilities

The minimum clearance from overhead power lines, up to 50 kilovolts (kVs), is 10 feet. For voltages over 50 kV, add 4 inches per 10 kV to obtain the minimum clearance distance to obtain safe distance between equipment and power lines (see Table 5-1, Minimum Clearance from Energized Overhead Electrical Lines). If voltage is unknown, remain at least 20 feet from overhead power lines.

If activities occur where equipment needs to be closer to overhead power lines than the minimum distance shown in **Table 5-1**, the power to the overhead lines will need to be shut off and locked out, unless it can be confirmed that the power lines are not operational.

**TABLE 5-1  
MINIMUM CLEARANCE FROM ENERGIZED OVERHEAD ELECTRICAL LINES**

Nominal System Voltage (kV)	Minimum Rated Clearance (ft)
0-50	9.8
51-200	14.7
201-300	19.7
301-500	24.6

# NGB/A7OR

---

501-750	34.4
751-1000	44.3

**Notes:**

kV – kilovolt  
ft – foot or feet

If for any reason there is a need to either shut-off or turn-on a utility (e.g., steam, water, or electrical), the FM will contact proper authorities prior to this action. In addition, only hand digging is permitted within 3 feet of underground high voltage, product or gas lines. Once the line is exposed, heavy equipment can be used but must remain at least 3 feet from the exposed line.

## 5.7 Site Security

Workers and visitors in the work area will be monitored by the FM and SHSO and required to sign the daily tailgate meeting form and HASP acceptance form.

## 5.8 Communication

On-site personnel will be trained on the physical and health hazards associated with hazardous materials planned for use during the project in compliance with OSHA standards 29 CFR 1910.1200 and 29 CFR 1926.59. The HAZCOM Program formulates the basis for chemical safety found in the aforementioned OSHA standards. These standards provide the basis for workers to know the physical and health hazards involved with the chemicals used on site. The implementation of an effective HAZCOM Program reduces the potential for workers to be exposed to hazardous chemicals. This program encompasses chemicals workers use in their daily activities. The elements of a HAZCOM Program include:

- Written workplace program;
- Chemical inventory;
- SDSs (Appendix C);
- Training workers on the physical and health hazards, and methods and observations to detect the release or presence of hazardous chemicals; and,
- Labeling system.

The SHSO will maintain a Chemical Inventory Form (Appendix A) and copies of SDSs (Appendix C) for hazardous chemicals that are to be used on-site during project work. The SHSO will maintain a binder with contents of the OSHA standard (29 CFR 1910.1200 or 29 CFR 1926.59), written program, chemical inventory, and corresponding SDSs in the Amec Foster Wheeler site office. The SHSO will provide copies of applicable SDSs to emergency service personnel as needed or requested.

Subcontractors shall provide a complete chemical inventory of chemicals intended for use



# NGB/A7OR

---

on-site prior to mobilization. The Amec Foster Wheeler Site Chemical Inventory Form (Appendix A) can be used to document chemicals brought on site. In addition, corresponding SDSs for each chemical listed will be provided with the inventory for inclusion into the site HAZCOM binder. The SHSO will in turn inform subcontractors of the location of the project HAZCOM binder. The SHSO will provide copies of applicable SDSs to subcontractor personnel as needed or requested. Site personnel will be informed of the hazardous substances that they will be working with through HAZCOM training at the time of SHSO review and at safety meetings.

Primary containers (i.e., manufacturer's label) will include the product identity, hazard warnings, and manufacturer's name and address. If the label is defaced, an alternate label with the product identity and hazard warnings is required. Secondary containers package hazardous substances transferred from an original container to another container. These containers require labeling at the time that they are filled. The label shall include the identity of the product and any hazard warnings found on the original container (e.g., flammable, corrosive). The precautions described under each JHA in **Appendix B** shall ensure that potential exposure to chemicals brought on-site is minimized.

Subcontractors are responsible for providing HAZCOM training for their personnel. SDSs for the site-related contaminants such as lead, gasoline, diesel fuel are included in this HASP (Appendix C). These SDSs are provided for informational purpose only. They are not part of the HAZCOM program. SDSs provide information such as health effects that can result from exposure, flammability, and reactivity hazards associated with handling these materials. The SHSO will ensure the HAZCOM binder is appropriately supplemented with additional SDSs as required during performance of field activities, that the Chemical Inventory is maintained accurately on-site, that site personnel review appropriate SDSs prior to using or handling these substances, and that SDSs are maintained with this HASP in an area accessible to all site personnel.

Personnel will observe all of the requirements and restrictions specified on the product SDS (e.g., PPE, first aid, disposal, incompatibilities, etc.). The SHSO will determine respiratory protection requirements based on air monitoring results. Persons using a substance and who are unfamiliar with the hazards conveyed by the substance or the necessary control measures must first review the SDS, and have an opportunity to ask the SHSO any questions. The SHSO is responsible for ensuring that persons using or handling the substances have been trained in HAZCOM (e.g., how to read and understand an SDS, chemical labeling, etc.).

## 5.9 Contingency Plan

Project personnel shall be familiar with the various contingency measures should an accident occur. Emergency telephone numbers and other emergency provisions for the Site are listed on the cover page of the installation-specific HASP. A hospital map is provided in the installation-specific HASP.

# NGB/A7OR

---

## 5.9.1 Fire

In case of a fire, personnel shall exit the site by the nearest means of egress, find the nearest telephone and call/dial 911. Once contact is made, witnessing personnel shall stay on the telephone to provide the responding elements with additional data. In no case shall witnessing personnel attempt to fight a major fire.

Once off the site, personnel shall assemble at a location designated by the FM or SHSO and be counted. Any missing personnel shall be brought to the attention of the emergency response personnel.

## 5.9.2 Chemical Exposure

Chemical exposures are not anticipated during installation investigations; however, if a member of the field crew demonstrates symptoms of chemical exposure, the procedures outlined below should be followed:

- Another team member (buddy) will remove the individual from the immediate area of contamination, if safe to do so. The buddy will communicate to the field team of the chemical exposure. The FM will contact the appropriate emergency response agency.
- Precautions will be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individuals clothing, the chemical will be neutralized or removed if it is safe to do so.
- In the case of eye contact, an emergency eye wash will be used. Eyes will be washed for at least 15 minutes.
- Chemical exposure incidents must be reported in writing to the Health, Safety, and Environment Program Manager.

## 5.9.3 Spill or Hazardous Materials Release

In the event of a spill or release, the SHSO or FM should be notified immediately. After taking precautions for personal safety, Amec Foster Wheeler or the subcontractor will contain the spill if possible with on- site equipment, to the extent that the responder's training and capability allows. If necessary, the SHSO will evacuate personnel and visitors to the refuge area. Contained materials must be properly drummed and handled as hazardous waste. The FM will notify the client to contact the United States Environmental Protection Agency (USEPA) within 24 hours after occurrence, provided the spill is greater than the reportable quantity.

## 5.9.4 Confined Space Emergency Response

The authorized attendant shall call the authorized entrants out of the confined space if any of the following occurs:

- An emergency signal or alarm is sounded;

# NGB/A7OR

---

- The attendant cannot effectively or safely perform all the duties required, or has to leave the area without transferring responsibility;
- The attendant detects or suspects the presence of any substance that could endanger the entrants;
- The attendant detects or suspects any atmospheric hazard at or above the prohibited levels;
- Any of the required air monitoring equipment malfunctions;
- There is a breakdown in communication with the entrants;
- The attendant detects the behavioral effects of a hazard exposure in an entrant; or,
- The attendant detects a situation outside the confined space that could endanger the entrants.

When rescue becomes necessary, the authorized attendant shall:

- Notify the entry supervisor of an emergency and, if possible, describe the nature of the emergency, the extent of injuries if any, and the exact location;
- Tell the entry supervisor to contact rescue services and other emergency services;
- Initiate rescue operations from outside the confined space by using the winch(es) and retrieval line(s) attached to the authorized entrant(s);
- Prohibit unauthorized personnel from attempting rescue;

**NOTE:** An injured, ill, or incapacitated person should not be pulled from a confined space by the lifeline without a trained and properly outfitted rescuer inside the confined space guiding them to ensure that there will be no further injury by supports or protruding objects.

- Provide first aid or CPR as necessary; and,
- Give the rescue service a situation report immediately upon their arrival on site.

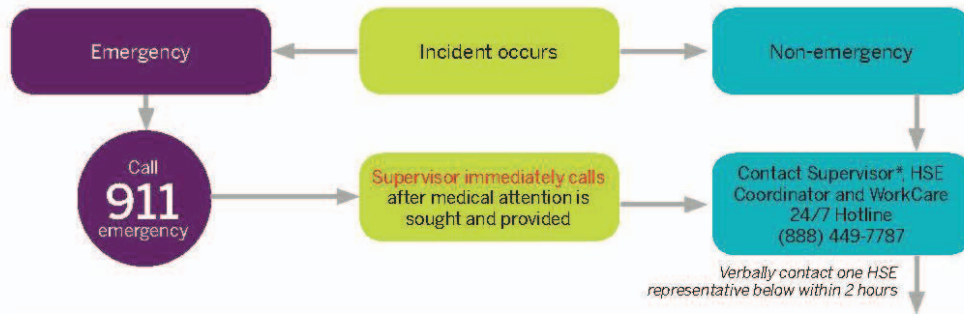
If the entrants are still within the confined space, the rescue service will enter the space wearing the same PPE as the attendant and a self-contained breathing apparatus (SCBA) or airline (if space permits) and fully equipped life-support equipment.

Any injured person will receive emergency treatment at the site and then, if necessary, will be transported to the nearest medical facility, as specified in the Confined Space Entry Permit.

## 5.9.5 Incident Reporting Procedures

### Incident flow chart

Call immediately



E&I Corporate HSE department contact list

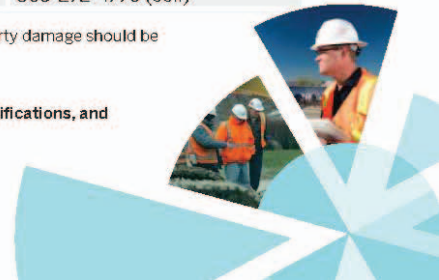
Name/email	Office location	Contact information
Bruce Voss bruce.voss@amecfw.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@amecfw.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@amecfw.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Gabe Sandholm gabe.sandholm@amecfw.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
John Mazur john.mazur@amecfw.com	Wilmington, NC	910.444.2978 (office) 910.431.2330 (cell) 910.681.0538 (home)
Lori Dowling lori.dowling@amecfw.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@amecfw.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@amecfw.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivensky@amecfw.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@amecfw.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)

High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage should be reported within 60 minutes to one of the above HSE Representatives.

**\*Supervisor Responsible For:**

- D&A Testing Coordination as per client and AmecFW requirements, Local/Client Notifications, and Completing Initial IAR within 24 hours and forwarding to Corporate HSE.

Rev. Oct 2015



# NGB/A7OR

---

## 5.9.6 Evacuation Procedures

Site personnel shall be made aware of the provisions of the emergency response plan. This awareness training shall be conducted by the FM or SHSO prior to the commencement of site activities. This will be conducted in conjunction with the mandatory daily job safety briefing.

Prior to the commencement of site activities, the FM or SHSO shall select a location at an appropriate distance from the site where personnel can gather in the event of an emergency requiring evacuation of the site. This location shall be pointed out to site personnel during the mandatory daily job safety briefing. This refuge site may change depending on weather and activity. The SHSO shall ensure that all personnel are made aware of any changes. Workers will pay special note to the wind direction and evacuate the work area upwind during an emergency. During accidents involving a fire or spill of potentially explosive materials, site personnel shall turn off any operating equipment and evacuate the site by the nearest means of egress.

Personnel shall exit the site by the nearest means of egress during accidents requiring site evacuation. Once off the site, personnel shall assemble at a location designated by the FM or SHSO and be counted. If any person is determined to be missing, it shall be brought to the attention of the emergency response personnel.

If an operation shutdown is necessary, the steps below shall be followed:

- Personnel are to leave the work location (upwind) and assemble at a designated assembly point
- (if safe) after detecting the emergency signal for evacuation;
- If an emergency situation is of concern to local site personnel, they will notify the SHSO who will notify the appropriate individuals;
- If appropriate and safe, the SHSO and a “buddy” are to remain at or near the location after it has been evacuated to assist local responders and advise them of the nature and location of the incident; and,
- The FM is to account for field team members at the assembly point.
- 

Evacuation routes and assembly points will be documented by the SHSO or FM during the employee health and safety briefing and daily tailgate meetings. Such locations shall minimize the spread of contamination.

## 5.10 Recordkeeping

The SHSO will establish and maintain documents regarding health and safety records; reports; and information concerning individual training, medical surveillance, etc. Sections in this filing system will include:

## NGB/A7OR

---

- Personnel Records – Certificates for training required under 29 CFR 120, medical examination summary letters or certificates, monitoring results, etc.
- Incident Analysis Reports – Reports on any medical, vehicle, property damage, near miss incidents, first aid, etc.
- Training – Sign-in sheets for on-site training with topics and dates.
- Visitor Logs – Sign-in sheets for site visitors.
- Inspection reports – Reports of daily inspections by the SHSO and others concerning health and safety issues.
- Accident Prevention – Copies of hazard analyses performed on new tasks or activities. Copies of any accident/incident reports and follow-up reports. Other pertinent correspondence.
- PPE – Records of periodic inspection, testing, and maintenance performed on PPE.

# NGB/A7OR

---

## 6.0 REFERENCES

Code of Federal Regulation (CFR); Title 29 – Labor; Subtitle B – Regulations Relating to Labor; Chapter XVII – Occupational Safety and Health Administration, Department of Labor; Part 1910 – Occupational Safety and Health Standards.

CFR, Title 29 – Labor; Subtitle B – Regulations Relating to Labor; Chapter XVII – Occupational Safety and Health Administration, Department of Labor; Part 1926 – Safety and Health Regulations for Construction.

National Institute for Occupational Safety and Health (NIOSH), 2005. *NIOSH Guide to Chemical Hazards*. September.

United States Environmental Protection Agency (USEPA), 1984. *Standard Operating Safety Guides*. November.

# NGB/A7OR

---

## Health and Safety Plan Acceptance

I have had the opportunity to read and ask questions regarding the information presented in this HASP. I understand the procedures, equipment, and restrictions of this plan and agree to abide by them. By signing below, personnel are indicating they have received and are current with their medical surveillance and training certification; in accordance with 29 CFR 1910.120 and Amec Foster Wheeler corporate health and safety policies.

<b>Signature*</b>	<b>Printed Name</b>	<b>Company</b>	<b>Date</b>

\* This acceptance form is required for all routine site staff, subcontracting personnel, visitors, and non-routine subcontractors.



**Appendix A**

**Field Forms**



# Hazard Assessment and PPE Selection



Task: \_\_\_\_\_  
Department: \_\_\_\_\_

## HAZARDS IDENTIFIED: Seriousness of Injury?

Impact (Explain): _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	Falling Objects: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>
Penetration: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	Sharp Objects: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>
Compression: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	Rolling or Pinching Objects: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>
Chemical: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	Electrical Hazards: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>
Heat, Hot Surfaces: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	Ergonomic/Lifting: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>
Harmful Dust: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	Other: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>
Light Radiation: _____ None <input type="checkbox"/> Lo <input type="checkbox"/> Med <input type="checkbox"/> Hi <input type="checkbox"/>	

Can the task be modified to reduce/eliminate the hazard? Yes \_\_\_ No \_\_\_ If yes, how? \_\_\_\_\_

## MSDS PPE RECOMMENDATIONS:

<input type="checkbox"/> Gloves, Type: _____	<input type="checkbox"/> Coveralls, Type: _____
<input type="checkbox"/> Safety-toe Boots	<input type="checkbox"/> Apron
<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Safety Glasses, Goggles, or Faceshield Type: _____
<input type="checkbox"/> Hard Hats	<input type="checkbox"/> Respirator Type: _____
<input type="checkbox"/> Other _____	

## PPE REQUIRED FOR THE TASK:

<input type="checkbox"/> Gloves, Type: _____	<input type="checkbox"/> Coveralls, Type: _____
<input type="checkbox"/> Safety-toe Boots	<input type="checkbox"/> Apron
<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Safety Glasses, Goggles, or Faceshield Type: _____
<input type="checkbox"/> Hard Hats	<input type="checkbox"/> Respirator Type: _____
<input type="checkbox"/> Other _____	

Training Required for Task: \_\_\_\_\_

**POST THIS FORM IN THE WORK AREA WHERE THE TASK IS ROUTINELY PERFORMED.**





# Tailgate Safety Meeting Report

amec  
foster  
wheeler

Check One:

- Initial Kickoff Safety Meeting   
  Regular/Daily Tailgate Safety Meeting   
  Unscheduled Tailgate Safety Meeting

Date: \_\_\_\_\_ Site: \_\_\_\_\_

Field Manager: \_\_\_\_\_ Site Health and Safety Coordinator: \_\_\_\_\_  
*(print)* *(print)*

## Order of Business

Topics Discussed (check all that apply):

- |  |  |
|--|--|
| <input type="checkbox"/> Site History/Site Layout  | <input type="checkbox"/> Engineering Controls  |
| <input type="checkbox"/> Scope of Work   | <input type="checkbox"/> PPE Required/PPE Used   |
| <input type="checkbox"/> Personnel Responsibilities  | <input type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures  |
| <input type="checkbox"/> Medical Surveillance Requirements   | <input type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)  |
| <input type="checkbox"/> Training Requirements   | <input type="checkbox"/> Decontamination Procedures for Personnel and Equipment  |
| <input type="checkbox"/> Safe Work Practices   | <input type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)                 |
| <input type="checkbox"/> Logs, Reports, Recordkeeping  | <input type="checkbox"/> Site/Regional Emergency Procedures (e.g., earthquake response, typhoon response, etc.)                      |
| <input type="checkbox"/> Sanitation and Illumination   | <input type="checkbox"/> Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.) |
| <input type="checkbox"/> Air Surveillance Type and Frequency   | <input type="checkbox"/> Hazardous Materials Spill Procedures  |
| <input type="checkbox"/> Monitoring Instruments and Personal Monitoring  | <input type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)                                    |
| <input type="checkbox"/> Action Levels   | <input type="checkbox"/> Injury/Illness Reporting Procedures   |
| <input type="checkbox"/> Accident Reporting Procedures   | <input type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines  |
| <input type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)   | <input type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)        |
| <input type="checkbox"/> Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences |  |

Safety suggestions by site workers: \_\_\_\_\_

Action taken on previous suggestions: \_\_\_\_\_

Injuries/accidents/personnel changes since previous meeting: \_\_\_\_\_

## Tailgate Safety Meeting Report *(continued)*



amec  
foster  
wheeler

Observations of unsafe work practices/conditions that have developed since previous meeting: \_\_\_\_\_

---

---

Location of (or changes in the locations of) evacuation routes/safe refuge areas: \_\_\_\_\_

---

---

Additional comments: \_\_\_\_\_

---

---

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Name (print)	Company	Signature
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Meeting conducted by: \_\_\_\_\_ *(print)* Title: \_\_\_\_\_

Signature: \_\_\_\_\_ Time: \_\_\_\_\_

**Appendix B**  
**Job Hazard Analysis (JHAS)**



## JOB HAZARD ANALYSIS (JHA) FOR DRILLING/BORING AND ASSOCIATED SOIL SAMPLING

Risk Assessment Code (RAC) Table							
Probability							
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
Negligible	M	L	L	L	L		

PREREQUISITES		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<p>Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, hearing protection, and reflective safety vest.</p> <p>Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves, and cotton coveralls.</p> <p>Eye wash station capable of providing 15 minutes of continuous service.</p>	<p>Inspect PPE equipment prior to donning and doffing equipment.</p> <p>Inspect eye wash station at least weekly.</p> <p>Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.</p>	<p>Only trained and qualified personnel will be allowed to work within exclusion zone.</p> <p>Only trained and qualified personnel will be allowed to operate equipment.</p> <p>All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.</p>

WORK	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
All Drilling/ Boring Activities	Slips, trips, and falls (RAC: M)	<ul style="list-style-type: none"> <li>• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow).</li> <li>• Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces.</li> <li>• Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order.</li> <li>• ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.</li> </ul>





## JOB HAZARD ANALYSIS (JHA) FOR DRILLING/BORING AND ASSOCIATED SOIL SAMPLING

WORK	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
All Drilling/ Boring Activities	Heat/Cold Stress (RAC: M)	<ul style="list-style-type: none"> <li>• Take breaks if feeling faint or overexerted</li> <li>• Consume adequate food/beverages (water, sports drinks)</li> <li>• If possible, adjust work schedule to avoid temperature extremes.</li> <li>• Wear temperature appropriate clothing (including layering for cold weather)</li> </ul>
	Biological Hazards: Insects, Snakes, Wildlife, Vegetation (RAC: L)	<ul style="list-style-type: none"> <li>• Inspect work areas when arrive at site to identify hazard(s)</li> <li>• Open enclosures slowly</li> <li>• Survey site for presence of biological hazards and maintain safe distance</li> <li>• Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions</li> </ul>
	Traffic (including pedestrian) (RAC: M)	<ul style="list-style-type: none"> <li>• Notify attendant or site owner/manager of work activities and location</li> <li>• Use cones, signs, flags or other traffic control devices as necessary to establish work area</li> <li>• Wear appropriate PPE including high visibility clothing such as reflective vest</li> <li>• Inspect area behind vehicle prior to backing and use spotter</li> </ul>
	Fire/ Explosion (RAC: L)	<ul style="list-style-type: none"> <li>• Post No Smoking signs around work area</li> <li>• Establish designated smoking area away from work area</li> <li>• Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period</li> <li>• As site conditions/activities warrant, establish Hot Work Permit</li> <li>• Stop work if hazardous conditions (explosive atmosphere) are identified</li> </ul>
Concrete Coring	Ignition Sources (RAC: L)	<ul style="list-style-type: none"> <li>• Ensure electrical equipment properly grounded</li> <li>• Apply water as necessary to address surface sparking potential</li> </ul>
	High Noise Levels (RAC: M)	<ul style="list-style-type: none"> <li>• Hearing protection required when working around operating equipment if levels are suspected to be &gt;85 dBA (if have to yell to person at a distance of 3 ft to be heard, likely exceeding 85 dBA).</li> </ul>
	Airborne Particulates and Debris (RAC: L)	<ul style="list-style-type: none"> <li>• Use water as necessary to control dust in area</li> <li>• Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves</li> </ul>
	Sharp Rough Materials (RAC: L)	<ul style="list-style-type: none"> <li>• Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots</li> </ul>
	Impact to Subsurface Lines (RAC: L)	<ul style="list-style-type: none"> <li>• Ensure all underground features have been identified in area prior to start of activities</li> </ul>



**JOB HAZARD ANALYSIS (JHA)  
FOR DRILLING/BORING AND ASSOCIATED SOIL SAMPLING**

WORK	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Drill Rig Set-Up	Rig Roll Over (RAC: L)	<ul style="list-style-type: none"> <li>• Do not move rig with mast raised</li> <li>• Cross all hills and obstructions head on</li> <li>• Set riggers prior to raising mast</li> <li>• If soil appears unstable, the soil should be assessed by a qualified professional engineer to ensure safe conditions with implementation of design control measures prior to start of work</li> </ul>
	Contact with Electric Lines and Other Overhead Obstacles (RAC: L)	<ul style="list-style-type: none"> <li>• Position rig to avoid overhead utility lines by distance defined by voltage and local regulations</li> <li>• Use a spotter when raising mast to confirm clearance of overhead lines and other obstructions</li> </ul>
	Rig Movement (RAC: L)	<ul style="list-style-type: none"> <li>• Heavy equipment should be equipped with back-up alarm or use horn when backing - use spotter when available</li> <li>• Stay clear of operating equipment and rig when moving</li> </ul>
	Heavy Equipment Lifting/Carrying (RAC: M)	<ul style="list-style-type: none"> <li>• Use at least 2 people to lift and carry sections, use mechanical lift devices whenever possible, bend and lift with legs and arms, not back</li> </ul>
	Sharp or Elevated Equipment (RAC: L)	<ul style="list-style-type: none"> <li>• Wear appropriate PPE including steel-toed safety boots, leather gloves and hard hat</li> <li>• Establish communication system between workers involved in moving/attaching sections</li> </ul>
Ground Disturbance: Auger/Boring Advancement	Faulty or Inappropriate Equipment (RAC: L)	<ul style="list-style-type: none"> <li>• Qualified driller must inspect drill rig prior to use, if faulty or inappropriate, do not proceed until repaired or replaced</li> <li>• Inspect all hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced</li> </ul>
	Moving Equipment (RAC: M)	<ul style="list-style-type: none"> <li>• Clear area of obstructions and communicate with all workers involved that drilling is beginning</li> <li>• Do not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with hands on the controls for at least the first foot of soil to minimize chance of auger kick-out</li> <li>• Stay clear of rotating auger</li> <li>• Use long-handled shovel to clear away cuttings when auger has stopped</li> <li>• Do not wear loose clothing</li> <li>• Wear appropriate PPE including leather gloves and steel-toed boots</li> </ul>



**JOB HAZARD ANALYSIS (JHA)  
FOR DRILLING/BORING AND ASSOCIATED SOIL SAMPLING**

Suspended Loads (RAC: M)	<ul style="list-style-type: none"> <li>Do not walk under suspended loads</li> <li>When possible, remove overhead hazards promptly</li> <li>Wear appropriate PPE including hard hat and steel-toed boots</li> </ul>
High Noise Levels (RAC: M)	<ul style="list-style-type: none"> <li>Use hearing protection if within 20 feet of active drill rig</li> </ul>

<b>WORK</b>	<b>POTENTIAL HAZARD</b>	<b>REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE</b>
Ground Disturbance: Auger/Boring Advancement (cont.)	Impact to Subsurface Lines/Tanks (RAC: L)	<ul style="list-style-type: none"> <li>Only drill in areas where underground features have been identified and if hole has to be moved, clear new location first</li> <li>Wear appropriate PPE including insulating gloves or stand on an insulating mat when in contact with drill rig</li> <li>Ensure first aid responders are trained to deal with electric shock and flash burns</li> </ul>
Ground Intrusion: Split Spoon	Faulty Equipment (RAC: L)	<ul style="list-style-type: none"> <li>Inspect rope/cable/rod for wear, fraying, oils and moisture prior to use, do not use if faulty until repaired or replaced</li> <li>Inspect cathead for rust and rope grooves prior to use, do not use if faulty until repaired or replaced</li> </ul>
	Moving Equipment (RAC: M)	<ul style="list-style-type: none"> <li>Do not wrap rope around any part of the hand or body</li> <li>Maintain distance of at least 18-inches from in-running points on running/reciprocating equipment</li> <li>Eliminate excess rope</li> <li>Do not wear loose clothing</li> <li>Wear appropriate PPE including leather gloves</li> </ul>
Soil Sampling	Sharp Sampling Tools (RAC: L)	<ul style="list-style-type: none"> <li>Use correct tools for opening sleeves</li> <li>When opening sleeve, cut away from body</li> <li>Place soil core on sturdy surface prior to cutting</li> <li>Wear appropriate PPE including respirator if conditions warrant</li> <li>Double-check sample labels to ensure accuracy and adhesion to containers</li> </ul>
	Heavy Materials and Containers Lifting/ Moving (RAC: M)	<ul style="list-style-type: none"> <li>Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings</li> <li>Do not lift or move heavy containers without assistance</li> <li>Use proper bending/lifting techniques by lifting with arms and legs and not with back</li> <li>Take breaks if feeling faint or overexerted</li> <li>Wear appropriate PPE including leather gloves and steel-toed boots</li> </ul>



**JOB HAZARD ANALYSIS (JHA)  
FOR DRILLING/BORING AND ASSOCIATED SOIL SAMPLING**

General safety during this activity	Severe Weather (RAC: L)	<ul style="list-style-type: none"><li>• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted.</li><li>• Wear appropriate clothing for weather conditions.</li></ul>
	Sunburn (RAC: L)	<ul style="list-style-type: none"><li>• Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense.</li><li>• Wear hats and other protective garments to provide shade.</li></ul>



## JOB HAZARD ANALYSIS (JHA) FOR GROUNDWATER SAMPLING ACTIVITIES

**Risk Assessment Code (RAC) Table**

Probability							
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk Noted in "Potential Hazard" Column
	Critical	E	H	H	M	L	
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

### PREREQUISITES

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<p>Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest.</p> <p>Contact with groundwater: Standard PPE plus nitrile gloves and cotton coveralls.</p> <p>Eye wash station capable of providing 15 minutes of continuous service.</p>	<p>Inspect PPE equipment prior to donning and doffing equipment.</p> <p>Inspect eye wash station at least weekly.</p> <p>Prior to equipment demobilization, equipment used in work areas shall be decontaminated appropriately.</p>	<p>Only trained and qualified personnel will be allowed to work within work area</p> <p>Only trained and qualified personnel will be allowed to operate equipment.</p> <p>All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be SDSs from supplier of items.</p>

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area and groundwater sample collection equipment	Slips, trips, and falls (RAC: M)	<ul style="list-style-type: none"> <li>• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow).</li> <li>• Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces.</li> <li>• Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order.</li> <li>• ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR GROUNDWATER SAMPLING ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area and groundwater sample collection equipment (cont.)	Heavy lifting, muscle strains and sprains involved with handling pumps, polyethylene lining rolls, and generator equipment.(RAC: L)	<ul style="list-style-type: none"> <li>• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit.</li> <li>• Use proper lifting techniques:               <ul style="list-style-type: none"> <li>- Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available.</li> <li>- Minimize the horizontal distance to the center of the lift to your center of gravity.</li> <li>- Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time.</li> <li>- Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive.</li> </ul> </li> <li>• Other considerations defining lifting hazards               <ul style="list-style-type: none"> <li>- Area available to maneuver the lift.</li> <li>- Area of the lift – workplace clutter, slippery surfaces.</li> <li>- Overall physical condition.</li> </ul> </li> </ul>
	Use of sharp edge hand tools to cut tubing (RAC: M)	<ul style="list-style-type: none"> <li>• Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus).</li> <li>• Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade.</li> <li>• All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use.</li> <li>• ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body.</li> <li>• All personnel will maintain a 10-foot perimeter around persons clearing brush.</li> </ul>
	Struck by hazard (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard.</li> <li>• Personnel shall not position themselves between trucks, and equipment or structures.</li> <li>• Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.</li> </ul>
Collecting purge water from wells using submersible pump connected to 110 W generator	Portable energized sources (RAC: M)	<ul style="list-style-type: none"> <li>• Perform all service and maintenance work with the generator engine off and the positive battery cable disconnected. Moving parts can cause severe personal injury or death, and live wires could cause fatal electrocution.</li> <li>• Keep the exhaust and air intake free from obstructions such as clothing, furniture or other material.</li> <li>• Always operate the generator in an area where the wind will carry away the exhaust fumes.</li> <li>• Do not overload the generator.</li> <li>• Use the right power cords with your portable power generators such as heavy duty, outdoor rated cords with a wire gauge adequate for the equipment load. Overloaded cords can cause fires or equipment damage. You must also not use extension cords with exposed wires or worn shielding.</li> <li>• Fuels and other flammable liquids should be stored away from exhaust. In addition, the container of flammable or combustible liquids shall an approved safety can.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR GROUNDWATER SAMPLING ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Noise hazard (RAC: M)	<ul style="list-style-type: none"> <li>• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required.</li> <li>• Personnel within 15 feet of operating generator shall wear hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers.</li> <li>• Position generator at least 20 feet way from sample collection area.</li> </ul>
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Potential inhalation hazard from contaminants of concern in groundwater (RAC: L)  The primary contaminants of concern (COC) include PFCs.	<ul style="list-style-type: none"> <li>• It is not anticipated that potential contaminant concentrations at outdoor sample locations will present an inhalation hazard.</li> <li>• Personnel shall receive training on the elements of each of the identified COCs.</li> </ul>
	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall wear nitrile rubber gloves during contact with groundwater.</li> <li>• Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.</li> </ul>
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Transfer of contamination into clean areas (RAC: M)	<ul style="list-style-type: none"> <li>• Decontaminate all equipment and supplies if they become contaminated, between locations and prior to leaving the site.</li> <li>• Dispose of all supplies in direct contact with groundwater into heavy duty plastic liners with 6 mm thickness. (e.g. tubing, disposable PPE).</li> <li>• Minor decontamination of equipment requires the use of Citranox®, “PFC-free” water, and methanol. These items are placed in secondary container spray bottles (normally 32 fl oz).</li> <li>• Personnel shall ensure spray bottles are properly label in accordance with Hazard Communication requirements.</li> <li>• Ensure all transport containers (e.g. polyethylene tanks) are not filled to the top. Secure transport container lids when in transit.</li> <li>• All transport containers shall be label with “Non Potable Water” stickers or hand written.</li> <li>• Transport containers shall have camlock fittings and ball valve to control flow of water.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR GROUNDWATER SAMPLING ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collecting samples for groundwater analysis (cont.)	Repetitive movements while using bailers to collect samples from wells (RAC: M)	<ul style="list-style-type: none"> <li>• Bailers are used to collect groundwater. Personnel use a 3/8 inch braided nylon rope or nylon masonry string to lower bailers into well screen. The following measures should reduce repetitive trauma to arms and hands:               <ul style="list-style-type: none"> <li>- Wear two layers of nitrile rubber gloves to minimize contact with contaminated material.</li> <li>- Rotate team members between sampling events.</li> <li>- Maintain a good posture position when lifting bailer out of the well casing.</li> </ul> </li> </ul>
Transporting purge water from transport containers into frac tank	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater.</li> <li>• Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.</li> <li>• Due to the greater potential for splash during transfer of purge water into the frac tank, personnel shall don a full face shield.</li> </ul>
	Transfer of contamination into clean areas (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall adequately secure hose to frac tank.</li> <li>• Ensure cam locks are secure.</li> <li>• Frac containers shall be label with “Non Potable Water” stickers or hand written.</li> <li>• Maintain a small spill kit to handle incidental spill of purge water at the storage lay down area.</li> </ul>
	Fall hazard (RAC: M)	<ul style="list-style-type: none"> <li>• Inspect hand railing of frac tank regularly to ensure pins are secured and integrity of railing.</li> <li>• If railing is bent, cracked, or heavily rust, report to SM or SSO.</li> <li>• Always utilize a “three-point” contact when climbing railing. Do not jump off railing at anytime.</li> </ul>
	Noise hazard while using trash pump during transfer from container to frac tank (RAC: M)	<ul style="list-style-type: none"> <li>• Equipment producing sound level measurements in excess of 85 dBA-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required.</li> <li>• Personnel within 15 feet of operating generator shall wear hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers.</li> <li>• Position trash pump at least 20 feet way from railing.</li> </ul>





## JOB HAZARD ANALYSIS (JHA) FOR GROUNDWATER SAMPLING ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity	Severe Weather (RAC: L)	<ul style="list-style-type: none"> <li>• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted.</li> <li>• Wear appropriate clothing for weather conditions.</li> </ul>
	Sunburn (RAC: L)	<ul style="list-style-type: none"> <li>• Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense.</li> <li>• Wear hats and other protective garments to provide shade.</li> </ul>
	Heat/Cold Stress (RAC: L)	<ul style="list-style-type: none"> <li>• Drink plenty of fluids to keep your body hydrated.</li> <li>• Heat stress and cold related injuries will be monitored and controls will be implemented as necessary.</li> <li>• An adequate supply of drinking water shall be provided in all places of employment. Frequent rest breaks shall be taken as needed to insure proper hydration during weather extremes.</li> </ul>
	Struck by hazards (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard.</li> <li>• Personnel shall not position themselves between support materials and equipment or structures.</li> <li>• Personnel shall not stand next to vehicles being loaded or unloaded.</li> <li>• Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.</li> </ul>
	Insects, Spiders, and Ticks (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel will be instructed to be cautious of insects, spiders, and ticks, especially when opening well covers.</li> <li>• Wear clothing that covers potentially affected body parts.</li> <li>• Seal pants legs against contact with plants and to prevent access by organisms (examples – ticks &amp; chiggers).</li> </ul>
	Hypersensitivity or Allergic Reactions (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken.</li> </ul>
	Personnel Injury (RAC: L)	<ul style="list-style-type: none"> <li>• Wear appropriate PPE.</li> <li>• Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts.</li> <li>• Keep non-essential personnel out of the work zone. Barricade as necessary.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES

**Risk Assessment Code (RAC) Table**

Probability							
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk Noted in "Potential Hazard" Column
	Critical	E	H	H	M	L	
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

### PREREQUISITES

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<p>Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest.</p> <p>Eye wash station capable of providing 15 minutes of continuous service when corrosive materials are used on site.</p>	<p>Inspect PPE equipment prior to donning and doffing equipment.</p> <p>Inspect eye wash station at least weekly.</p> <p>Completion of Equipment Inspection Form before subsequent daily use.</p>	<p>Only trained and qualified personnel will be allowed to work within work area.</p> <p>Only trained and qualified personnel will be allowed to operate equipment.</p> <p>All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.</p>

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
<p>Collect and confirm required worker training and medical compliance documentation.</p>	<p>Acceptable worker knowledge and fit-for-duty status (RAC: M)</p>	<ul style="list-style-type: none"> <li>All personnel participating in field activities shall be current on HAZWOPER training requirements listed in 29 CFR 1910.120 (e) as well as medical surveillance requirements in 29 CFR 1910.120 (f).</li> <li>Visitors not meeting the above requirements shall be escorted throughout their visit by an Amec Foster Wheeler representative.</li> </ul>
<p>Perform site survey and initial inspections of intended work areas</p>	<p>Slips, trips, and falls (RAC: M)</p>	<ul style="list-style-type: none"> <li>Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow).</li> <li>Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces.</li> <li>Maintain work area clear and in good order.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Perform site survey and initial inspections of intended work areas (cont.)	Traffic safety (RAC: M)	<ul style="list-style-type: none"> <li>• Stay clear of the designated contractor’s route, use signals, horns, etc. when entering site where workers are present.</li> <li>• Post “Men at Work” signage to notify vehicular traffic of activity being performed adjacent to roadway.</li> <li>• Use traffic cones to demarcate work zone entrance near roadway.</li> <li>• Designated traffic pattern shall be used to ensure safe movement of trucks in and out of loading zone.</li> <li>• Use escort vehicles with flashing lights to warn and control local traffic when moving large equipment to support area.</li> <li>• A spotter shall guide drivers when backing up into congested and narrow path areas.</li> </ul>
	Struck by hazard (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard.</li> <li>• Personnel shall not position themselves between trucks and equipment or structures.</li> <li>• Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.</li> </ul>
Perform inspections of vehicles and equipment arriving/preparing to depart the site	Operating vehicles and heavy equipment unsafely (RAC: M)	<ul style="list-style-type: none"> <li>• Prior to operating a vehicle, the driver shall perform daily inspections using the Safety Inspection Form.</li> <li>• Prior to operating equipment, operator shall perform daily inspection using Safety Inspection Form.</li> <li>• Personnel working near heavy equipment shall wear high visibility vests.</li> <li>• The equipment operators and on-site supervisors are responsible for ensuring that the Safety Inspection Forms have been reviewed and completed, and that all moving parts are guarded if such parts are exposed.</li> <li>• Equipment operators shall operate equipment in a safe manner at all times and wear seatbelts while operating heavy equipment.</li> <li>• Check/test all emergency stop controls. Personnel shall only operate equipment that is in good condition and safe to operate.</li> <li>• Equipment found to be in need of repair, defective, or unsafe in any way, shall be tagged and taken out of service. Equipment shall not be operated with damaged windshield or glass. Equipment shall not be placed back into service until repaired and inspected and authorized to do so by SHSO.</li> <li>• Loads shall be lowered and power shut off when equipment is left unattended. Heavy equipment shall be equipped with backup alarms.</li> <li>• Equipment shall have properly functioning: brake system, brake lights, audible horn, and all other safety systems specified in the operator’s manual.</li> <li>• Fire extinguishers shall be mounted on diesel and propane powered mobile equipment.</li> <li>• Equipment shall be shut-off prior to refueling.</li> <li>• No smoking or spark sources shall be allowed near refueling or battery maintenance areas.</li> </ul>



**JOB HAZARD ANALYSIS (JHA)  
FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Limited Site Clearing including brush removal using heavy equipment, chain saws, and other similar equipment	Rotating/cutting machinery and light equipment operation (RAC: M)	<ul style="list-style-type: none"> <li>• Equipment shall be inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design.</li> <li>• Only manufacturer-approved parts may be used in repair of site equipment.</li> <li>• An equipment inspection checklist will be completed prior to the use of project vehicles, machinery and equipment.</li> <li>• Equipment shall be operated by knowledgeable ground crew.</li> <li>• Establish safe zones and routes of approach to the operation (personnel should remain cognizant that this is a multi-task operation with many activities engaged in simultaneously).</li> <li>• Restrictions at the operation (All personnel not directly supporting this clearance activity will remain at least 50-100 feet from the point of this operation).</li> <li>• Hand signals with the light equipment operator will be established prior to the commencement of activities.</li> <li>• Work areas will be kept clear of clutter.</li> <li>• Secure all loose articles to avoid possible entanglement.</li> <li>• Self-propelled equipment shall be equipped with movement warning systems.</li> <li>• Personnel will be instructed in the location and operations of the emergency shut-off device(s). This device will be tested initially (and then periodically) to insure its operational status.</li> <li>• Damaged or questionable equipment shall not be used and labeled with “Do Not Use”.</li> </ul>
	Noise hazard (RAC: M)	<ul style="list-style-type: none"> <li>• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required.</li> <li>• Due to expected high elevated noise levels from machinery and equipment, excessive noise control will be facilitated through the use of hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Limited Site Clearing including brush removal using heavy equipment, chain saws, and other similar equipment (cont.)	Flying projectiles/falling tree limbs (RAC: M)	<ul style="list-style-type: none"> <li>• Inspect the chainsaw prior to each use. Insure the blade is adjusted and sharp, and all parts are lubricated per the manufacturer’s instruction. Test all safety devices initially and then periodically to insure operational status.</li> <li>• When starting, place the chainsaw on the ground or some other firm surface. Place your foot in the hand guard at the rear of the saw, grip the top handle of the saw with one hand, pull the start cord with the free hand. Never attempt to start the saw free hand or by placing on your knee.</li> <li>• Never cut with tip of the chain saw blade.</li> <li>• Plan the cut. Know where the tree will fall. Have a clear escape plan when dropping trees greater than 2 inches in diameter.</li> <li>• Preview the tree to be dropped. Often, red wasps will nest in hollowed out trunks and in tree tops. Do not stand between falling trees and branches and fixed items or other trees.</li> <li>• Do not cut over your head.</li> <li>• Do not cut materials other than wood with the chain saw.</li> <li>• Wear prescribed safety equipment (hard hat with mesh face shield, chainsaw chaps, etc.).</li> <li>• Monitor, the condition of the saw during use, make adjustments as necessary.</li> <li>• When limbing a tree, to the extent possible cut from the other side of the trunk, which will serve as a shield.</li> <li>• Be attentive as to which way the trunk may move when removing limbs, place yourself out of the anticipated pathway when cutting.</li> <li>• Be attentive to movement of the trunk as an indication of the stability of the tree and brush pile.</li> <li>• Keep the work area free from clutter to avoid potential slip, trip, and fall hazards.</li> </ul>
Set up material and equipment lay-down areas	Injuries from hand and power tools (RAC: L)	<ul style="list-style-type: none"> <li>• All hand and power tools shall be used in accordance with the HASP.</li> <li>• Keep any machine guarding in place.</li> <li>• Avoid any moving parts and secure loose clothing, jewelry or long hair that could become entangled. Inspect tools prior to use. Damaged tools shall be removed immediately. Tools shall be used for its designed purpose.</li> </ul>
	Crushing injuries from unstable loads (RAC: M)	<ul style="list-style-type: none"> <li>• Inspect staging areas prior to placing materials.</li> <li>• Utilize traffic cones to demarcate loading/unloading zone for delivery of support materials</li> <li>• Prior to the initiation of work, personnel will be informed of potential hazards and required precautions. Equipment shall be properly leveled/stabilized and checked to insure that it will not move once in place. All rigging equipment shall be inspected prior to use. Only rigging equipment with the load capacity stamped or labeled on the equipment shall be used.</li> <li>• Rigging equipment rating to load ratio shall be 4 to 1 as a minimum. Ensures stability of load during transport.</li> <li>• No load shall be transported above any individual. Maintain load as close to the ground when transporting from one location to the other.</li> <li>• Personnel shall not stand underneath loads handled by lifting or digging equipment.</li> <li>• Damaged, unrated, or questionable rigging equipment shall not be used and labeled with “Do Not Use”.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES

	Noise hazard (RAC: L)	<ul style="list-style-type: none"> <li>Equipment producing sound level measurements in excess of 85 dBA-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Utilize hearing protection with Noise Reduction Rating of at least 33 dB. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required.</li> </ul>
--	-----------------------	--

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up material and equipment lay-down areas (cont.)	Pinch point hazards (RAC: L)	<ul style="list-style-type: none"> <li>Wear leather work gloves when handling support materials.</li> <li>Never place hands into bind spots of equipment.</li> </ul>
	Heavy Lifting, Strains, Sprains (RAC: L)	<ul style="list-style-type: none"> <li>No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit. Use proper lifting techniques:               <ul style="list-style-type: none"> <li>Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available.</li> <li>Minimize the horizontal distance to the center of the lift to your center of gravity.</li> <li>Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time.</li> <li>Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive.</li> </ul> </li> <li>Other considerations defining lifting hazards               <ul style="list-style-type: none"> <li>Area available to maneuver the lift.</li> <li>Area of the lift – workplace clutter, slippery surfaces.</li> <li>Overall physical condition.</li> </ul> </li> </ul>
	Chemical hazards from chemicals utilized on site (RAC: L)	<ul style="list-style-type: none"> <li>The on-site Hazard Communication Program will be followed. All chemicals brought onto the site by Amec Foster Wheeler and subcontractor personnel will be inventoried and have an SDS on-site, on file. This effort shall include:               <ul style="list-style-type: none"> <li>Maintain an accurate chemical inventory list (entries will match chemicals brought on-site, as the names appear on the MSDS)</li> <li>MSDSs will be maintained in a central location, accessible to all personnel.</li> </ul> </li> <li>All containers will have labels specifying the following information:               <ul style="list-style-type: none"> <li>Chemical Identity (As it appears on the label, SDS, and Chemical Inventory List)</li> <li>Appropriate Warning (i.e., eye and skin irritation, flammable, etc.)</li> <li>Manufacturer's Name, Address, and Phone Number</li> </ul> </li> <li>It will be the SM and/or the SSO's responsibility to insure this is completed.</li> </ul>
Establish excavation locations and arrange for utility clearances prior to intrusive activities. Secure permits from	Potential to strike existing utility lines (RAC: H)	<ul style="list-style-type: none"> <li>Pre-inspect vehicle moving lanes noting overhead utilities.</li> <li>Do not approach within 10' of any overhead electric line of 50 kV or less. Additional clearance distance is required for lines of &gt; 50kV. Reference Section 5.8.2.</li> <li>Pre-survey the height of equipment and height of utility lines to determine which lines must be removed or raised.</li> <li>Pre-plan the move with the local utility companies if utility lines must be moved.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES

appropriate  
authorities

Electrocution or penetration  
of buried utilities from  
equipment coming into  
contact with power, gas,  
water or sewer lines (RAC:  
H)

- Contact appropriate installation to mark locations of utilities prior to intrusive activities.
- All underground and above utilities will be located prior to the initiation of work. Only qualified personnel shall install temporary utilities.
- The locations of all underground utilities will be identified and marked in the field prior to subsurface investigation.



**JOB HAZARD ANALYSIS (JHA)  
FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES**

<b>WORK ACTIVITY</b>	<b>POTENTIAL HAZARD</b>	<b>REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE</b>
General safety during this activity	Severe Weather (RAC: L)	<ul style="list-style-type: none"><li>• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted.</li><li>• Wear appropriate clothing for weather conditions.</li></ul>
	Sunburn (RAC: L)	<ul style="list-style-type: none"><li>• Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense.</li><li>• Wear hats and other protective garments to provide shade.</li></ul>
	Heat/Cold Stress (RAC: L)	<ul style="list-style-type: none"><li>• Drink plenty of fluids to keep your body hydrated.</li><li>• Heat stress and cold related injuries will be monitored and controls will be implemented as necessary.</li><li>• An adequate supply of drinking water shall be provided in all places of employment. Frequent rest break shall be taken as needed to insure proper hydration during weather extremes.</li></ul>





## JOB HAZARD ANALYSIS (JHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES

**Risk Assessment Code (RAC) Table**

Probability							
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

### PREREQUISITES

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<p>Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest.</p> <p>Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves, and cotton coveralls.</p> <p>Eye wash station capable of providing 15 minutes of continuous service.</p>	<p>Inspect PPE equipment prior to donning and doffing equipment.</p> <p>Inspect eye wash station at least weekly.</p>	<p>Only trained and qualified personnel will be allowed to work within work area.</p> <p>Only trained and qualified personnel will be allowed to operate equipment.</p> <p>All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.</p>

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up work area.	Slips, trips, and falls (RAC: M)	<ul style="list-style-type: none"> <li>• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow).</li> <li>• Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces.</li> <li>• Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order.</li> <li>• ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up work area. (cont.)	Heavy lifting, muscle strains and sprains involved with handling drums, polyethylene lining rolls, and generator equipment. (RAC: M)	<ul style="list-style-type: none"> <li>• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit.</li> <li>• Use proper lifting techniques:               <ul style="list-style-type: none"> <li>- Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available.</li> <li>- Minimize the horizontal distance to the center of the lift to your center of gravity.</li> <li>- Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time.</li> <li>- Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive.</li> </ul> </li> <li>• Other considerations defining lifting hazards               <ul style="list-style-type: none"> <li>- Area available to maneuver the lift.</li> <li>- Area of the lift – workplace clutter, slippery surfaces.</li> <li>- Overall physical condition.</li> </ul> </li> </ul>
	Use of sharp edge hand tools to cut material (e.g. heavy duty liner, boxes) (RAC: M)	<ul style="list-style-type: none"> <li>• Wear cut-resistant gloves when handling items with sharp or rough edges.</li> <li>• Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus).</li> <li>• Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade.</li> <li>• All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use.</li> <li>• ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body.</li> <li>• All personnel will maintain a 10-foot perimeter around persons clearing brush.</li> </ul>
	Traffic safety (RAC: M)	<ul style="list-style-type: none"> <li>• Designated traffic pattern shall be used to ensure safe movement of trucks in and out of support zone.</li> <li>• A spotter shall guide drivers when backing up into congested and narrow path areas.</li> <li>• If driver's line of sight is block when moving backwards, the vehicle should have back-up alarm and a spotter assigned to lead the driver.</li> </ul>
	Struck by hazard (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard.</li> <li>• Personnel shall not position themselves between trucks, and equipment or structures.</li> <li>• Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.</li> </ul>
Personal decontamination	Cross contamination while doffing personal protective equipment (PPE) (RAC:L)	<ul style="list-style-type: none"> <li>• Personnel shall be trained on the proper procedures for doffing PPE. The first PPE item removed shall be the cotton coveralls. Then the Nitrile gloves.</li> <li>• Place all disposable PPE items into commercial heavy duty plastic liners.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Decontamination of heavy equipment using pressure washer	Slips, trips, and falls (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces.</li> <li>• Clear debris from work area prior to commencing work in the area. Maintain work area clear and in good order.</li> </ul>
	Injuries from hand and power tools (RAC: L)	<ul style="list-style-type: none"> <li>• All hand and power tools shall be used in accordance with the HASP.</li> <li>• Keep any machine guarding in place.</li> <li>• Avoid any moving parts and secure loose clothing, jewelry or long hair that could become entangled. Damaged tools shall be removed immediately. Tools shall be used for its designed purpose.</li> </ul>
	Injury due to misuse or accidental contact (system is operating at pressures up to 3000 psi) (RAC: M)	<ul style="list-style-type: none"> <li>• <b>Caution!</b> This equipment operates at high pressure. Accidental contact with pressurized water could cause serious injury. The spray nozzle should never be directed towards personnel.</li> <li>• Equipment operating pressure should never exceed that which is necessary to accomplish the job. Inspect hoses, cords and connections for deformities, cuts, leaks and other damage prior to startup.</li> <li>• Hoses and fittings should be supported to prevent excessive sway, vibration or stress on end connections. Hoses should be protected to prevent kinking or excessive wear. Install whip-checks on hose.</li> <li>• Protect hoses and cords from traffic. Do NOT allow machinery or equipment to drive over them.</li> <li>• At a minimum, PPE shall include requirements specified in JHA. In areas where respiratory protection is not necessary, eye and face protection (safety goggles and face-shield) and rubber gloves shall be worn.</li> <li>• When necessary, liquid proof coveralls (rain gear or other similar material) shall be worn. Foot wear shall include steel toe boots w/metatarsal protection; shin guards.</li> <li>• When not in use and when making repairs, the system shall be depressurized (both air and water). Ensure that equipment guards/covers removed for adjustments or repairs are properly installed before restarting.</li> <li>• Never leave the system unattended while pressurized. Only non-sparking tools shall be used in locations where sources of ignition may cause fire or explosion.</li> <li>• Fuel powered tools (generators, tamps, pumps, etc.) shall be turned off during refueling.</li> </ul>
	Electric Shock (RAC: M)	<ul style="list-style-type: none"> <li>• Electric tools with missing ground prongs or cut or frayed cords shall be removed from service and tagged.</li> <li>• Electric tools used in highly conductive locations, such as where the employee may contact water, shall be approved for use in those locations.</li> <li>• Power for portable electric tools shall be supplied from a GFCI receptacle.</li> <li>• Electric tools must be grounded, except tools, which are equipped with double insulation.</li> <li>• Electric tools shall not be used in hazardous locations such as flammable or explosive atmospheres unless they are approved for such locations.</li> </ul>
	Injury to unqualified operators/on-lookers (RAC: M)	<ul style="list-style-type: none"> <li>• Only trained and qualified personnel shall operate this equipment</li> <li>• Non-essential personnel shall remain a safe distance (at least 25 feet) from pressure washing activities. Barricade areas.</li> </ul>



**JOB HAZARD ANALYSIS (JHA)  
FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Decontamination of heavy equipment using pressure washer (cont.)	Portable energized sources (RAC: M)	<ul style="list-style-type: none"> <li>• Perform all service and maintenance work with the generator engine off and the positive battery cable disconnected. Moving parts can cause severe personal injury or death, and live wires could cause fatal electrocution.</li> <li>• Keep the exhaust and air intake free from obstructions such as clothing, furniture or other material.</li> <li>• Always operate the generator in an area where the wind will carry away the exhaust fumes.</li> <li>• Do not overload the generator.</li> <li>• Use the right power cords with your portable power generators such as heavy duty, outdoor rated cords with a wire gauge adequate for the equipment load. Overloaded cords can cause fires or equipment damage. You must also not use extension cords with exposed wires or worn shielding.</li> <li>• Fuels and other flammable liquids should be stored away from exhaust. In addition, the container of flammable or combustible liquids shall an approved safety can.</li> </ul>
	Noise hazard (RAC: M)	<ul style="list-style-type: none"> <li>• Equipment producing sound level measurements in excess of 85 dBA-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required.</li> <li>• Place hazardous noise warning signs at least 25 feet from generators.</li> </ul>
	Struck by hazard (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective head gear (e.g. hard hats) and faceshield to reduce risk of hazard.</li> <li>• Personnel shall not position themselves between trucks, and equipment or structures.</li> <li>• Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.</li> <li>• Personnel shall wear PPE for pressure washing activities.</li> </ul>



## JOB HAZARD ANALYSIS (JHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
	Use of sharp edge hand tools to cut material (e.g. stainless steel augers and ) (RAC: M)	<ul style="list-style-type: none"> <li>• Wear cut-resistant gloves when handling items with sharp or rough edges.</li> <li>• Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus).</li> <li>• Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade.</li> <li>• All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use.</li> <li>• ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. If possible, place liners on a table or elevated platform at waist height. Use a device to secure the liners when performing cutting actions (e.g. clamps).</li> </ul>
	Potential contact and ingestion hazards from COCs in potentially contaminated soils (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater.</li> <li>• Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.</li> </ul>
	Cross-contamination personnel or clean areas (RAC: M)	<ul style="list-style-type: none"> <li>• Decontamination tools using the following procedures:               <ul style="list-style-type: none"> <li>– Wash with Citraonox</li> <li>– Rinse with “PFC-free” water</li> <li>– Rinse with methanol</li> <li>– Final rinse with “PFC-free” water</li> <li>– Air dry</li> </ul> </li> </ul>
General safety during this activity	Severe Weather (RAC: L)	<ul style="list-style-type: none"> <li>• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted.</li> <li>• Wear appropriate clothing for weather conditions.</li> </ul>
	Sunburn (RAC: L)	<ul style="list-style-type: none"> <li>• Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense.</li> <li>• Wear hats and other protective garments to provide shade.</li> </ul>
	Heat/Cold Stress (RAC: L)	<ul style="list-style-type: none"> <li>• Drink plenty of fluids to keep your body hydrated.</li> <li>• Heat stress and cold related injuries will be monitored and controls will be implemented as necessary.</li> <li>• An adequate supply of drinking water shall be provided in all places of employment. Frequent rest breaks shall be taken as needed to insure proper hydration during weather extremes.</li> </ul>
	Struck by hazards (RAC: M)	<ul style="list-style-type: none"> <li>• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard.</li> <li>• Personnel shall not position themselves between support materials and equipment or structures. Personnel shall not stand next to vehicles being loaded or unloaded.</li> <li>• Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.</li> </ul>



**JOB HAZARD ANALYSIS (JHA)  
FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity (cont.)	Insects, Spiders, and Ticks (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel will be instructed to be cautious of insects, spiders, and ticks, especially when opening well covers. Wear clothing that covers potentially affected body parts. Seal pants legs against contact with plants and to prevent access by organisms (examples – ticks &amp; chiggers). Check body thoroughly after work to detect ticks and chiggers. Take hot shower after field work and wash thoroughly.</li> <li>• Avoid nesting areas.</li> <li>• Report any insect bite to the SHSO.</li> </ul>
	Hypersensitivity or Allergic Reactions (RAC: L)	<ul style="list-style-type: none"> <li>• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken.</li> </ul>
	Personnel Injury (RAC: L)	<ul style="list-style-type: none"> <li>• Wear appropriate PPE.</li> <li>• Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts.</li> <li>• Keep non-essential personnel out of the work zone. Barricade as necessary.</li> </ul>

**Appendix C**  
**Safety Data Sheets (SDSs)**



# Safety Data Sheet

**Material Name: Diesel Fuel, All Types**

**SDS No. 9909**  
US GHS

**Synonyms:** Ultra Low Sulfur Diesel; Low Sulfur Diesel; No. 2 Diesel; Motor Vehicle Diesel Fuel; Non-Road Diesel Fuel; Locomotive/Marine Diesel Fuel

## \*\*\* Section 1 - Product and Company Identification \*\*\*

### Manufacturer Information

Hess Corporation  
1 Hess Plaza  
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS  
Emergency # 800-424-9300 CHEMTREC  
[www.hess.com](http://www.hess.com) (Environment, Health, Safety Internet Website)

## \*\*\* Section 2 - Hazards Identification \*\*\*

### GHS Classification:

Flammable Liquids - Category 3  
Skin Corrosion/Irritation – Category 2  
Germ Cell Mutagenicity – Category 2  
Carcinogenicity - Category 2  
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)  
Aspiration Hazard – Category 1  
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

### GHS LABEL ELEMENTS

#### Symbol(s)



#### Signal Word

DANGER

#### Hazard Statements

Flammable liquid and vapor.  
Causes skin irritation.  
Suspected of causing genetic defects.  
Suspected of causing cancer.  
May cause respiratory irritation.  
May cause drowsiness or dizziness.  
May be fatal if swallowed and enters airways.  
Harmful to aquatic life.

#### Precautionary Statements

##### Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking  
Keep container tightly closed.  
Ground/bond container and receiving equipment.



# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Use explosion-proof electrical/ventilating/lighting/equipment.  
Use only non-sparking tools.  
Take precautionary measures against static discharge.  
Wear protective gloves/protective clothing/eye protection/face protection.  
Wash hands and forearms thoroughly after handling.  
Obtain special instructions before use.  
Do not handle until all safety precautions have been read and understood.  
Avoid breathing fume/mist/vapours/spray.

## Response

In case of fire: Use water spray, fog or foam to extinguish.  
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.  
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.  
If swallowed: Immediately call a poison center or doctor. Do NOT induce vomiting.  
IF exposed or concerned: Get medical advice/attention.

## Storage

Store in a well-ventilated place. Keep cool.  
Keep container tightly closed.  
Store locked up.

## Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

## \* \* \* Section 3 - Composition / Information on Ingredients \* \* \*

CAS #	Component	Percent
68476-34-6	Fuels, diesel, no. 2	100
91-20-3	Naphthalene	<0.1

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher.

## \* \* \* Section 4 - First Aid Measures \* \* \*

### First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

### First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

### First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

## First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

## \* \* \* Section 5 - Fire Fighting Measures \* \* \*

### General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

### Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

### Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO<sub>2</sub>, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

### Unsuitable Extinguishing Media

None

### Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

## \* \* \* Section 6 - Accidental Release Measures \* \* \*

### Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

### Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

### Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

## Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

## Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

## Prevention of Secondary Hazards

None

## \* \* \* Section 7 - Handling and Storage \* \* \*

### Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

### Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

### Incompatibilities

Keep away from strong oxidizers.

## \* \* \* Section 8 - Exposure Controls / Personal Protection \* \* \*

### Component Exposure Limits

#### Fuels, diesel, no. 2 (68476-34-6)

ACGIH: 100 mg/m<sup>3</sup> TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel)  
Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

## Naphthalene (91-20-3)

ACGIH: 10 ppm TWA  
15 ppm STEL  
Skin - potential significant contribution to overall exposure by the cutaneous route  
OSHA: 10 ppm TWA; 50 mg/m<sup>3</sup> TWA  
NIOSH: 10 ppm TWA; 50 mg/m<sup>3</sup> TWA  
15 ppm STEL; 75 mg/m<sup>3</sup> STEL

## Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

## Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

## Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

## Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

## Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

## \*\*\* Section 9 - Physical & Chemical Properties \*\*\*

<b>Appearance:</b>	Clear, straw-yellow.	<b>Odor:</b>	Mild, petroleum distillate odor
<b>Physical State:</b>	Liquid	<b>pH:</b>	ND
<b>Vapor Pressure:</b>	0.009 psia @ 70 °F (21 °C)	<b>Vapor Density:</b>	>1.0
<b>Boiling Point:</b>	320 to 690 °F (160 to 366 °C)	<b>Melting Point:</b>	ND
<b>Solubility (H<sub>2</sub>O):</b>	Negligible	<b>Specific Gravity:</b>	0.83-0.876 @ 60°F (16°C)
<b>Evaporation Rate:</b>	Slow; varies with conditions	<b>VOC:</b>	ND
<b>Percent Volatile:</b>	100%	<b>Octanol/H<sub>2</sub>O Coeff.:</b>	ND
<b>Flash Point:</b>	>125 °F (>52 °C) minimum	<b>Flash Point Method:</b>	PMCC
<b>Upper Flammability Limit (UFL):</b>	7.5	<b>Lower Flammability Limit (LFL):</b>	0.6
<b>Burning Rate:</b>	ND	<b>Auto Ignition:</b>	494°F (257°C)

## \*\*\* Section 10 - Chemical Stability & Reactivity Information \*\*\*

### Chemical Stability

This is a stable material.

### Hazardous Reaction Potential

Will not occur.

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

## Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

## Incompatible Products

Keep away from strong oxidizers.

## Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

## \* \* \* Section 11 - Toxicological Information \* \* \*

### Acute Toxicity

#### A: General Product Information

Harmful if swallowed.

#### B: Component Analysis - LD50/LC50

##### Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m<sup>3</sup> 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

### Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

### Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

### Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

### Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

### Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

### Generative Cell Mutagenicity

This material has been positive in a mutagenicity study.

### Carcinogenicity

#### A: General Product Information

Suspected of causing cancer.

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

## B: Component Carcinogenicity

### Fuels, diesel, no. 2 (68476-34-6)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

### Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)

IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

## Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

## Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

## Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

## Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

## \* \* \* Section 12 - Ecological Information \* \* \*

## Ecotoxicity

### A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

### B: Component Analysis - Ecotoxicity - Aquatic Toxicity

#### Fuels, diesel, no. 2 (68476-34-6)

##### Test & Species

Test & Species	Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow-through]

##### Conditions

#### Naphthalene (91-20-3)

##### Test & Species

Test & Species	Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L [static]
96 Hr LC50 Pimephales promelas	1.99 mg/L [static]

##### Conditions

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L
48 Hr LC50 Daphnia magna	2.16 mg/L
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]

## Persistence/Degradability

No information available.

## Bioaccumulation

No information available.

## Mobility in Soil

No information available.

### \*\*\* Section 13 - Disposal Considerations \*\*\*

## Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

## Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

### \*\*\* Section 14 - Transportation Information \*\*\*

## DOT Information

Shipping Name: Diesel Fuel

NA #: 1993 Hazard Class: 3 Packing Group: III

Placard:



### \*\*\* Section 15 - Regulatory Information \*\*\*

## Regulatory Information

### Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

#### Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

#### SARA Section 311/312 – Hazard Classes

<u>Acute Health</u>	<u>Chronic Health</u>	<u>Fire</u>	<u>Sudden Release of Pressure</u>	<u>Reactive</u>
X	X	X	--	--

# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

## SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

## State Regulations

### Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Fuels, diesel, no. 2	68476-34-6	No	No	No	Yes	No	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

### Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

### Additional Regulatory Information

### Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Fuels, diesel, no. 2	68476-34-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

## \*\*\* Section 16 - Other Information \*\*\*

**NFPA® Hazard Rating**

Health	1
Fire	2
Reactivity	0



**HMIS® Hazard Rating**

Health	1*	Slight
Fire	2	Moderate
Physical	0	Minimal

\*Chronic



# Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

## Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

## Literature References

None

## Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet



# Safety Data Sheet

**Material Name: Gasoline All Grades**

**SDS No. 9950**  
US GHS

**Synonyms:** Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

## \*\*\* Section 1 - Product and Company Identification \*\*\*

### Manufacturer Information

Hess Corporation  
1 Hess Plaza  
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS  
Emergency # 800-424-9300 CHEMTREC  
[www.hess.com](http://www.hess.com) (Environment, Health, Safety Internet Website)

## \*\*\* Section 2 - Hazards Identification \*\*\*

### GHS Classification:

Flammable Liquid - Category 2  
Skin Corrosion/Irritation - Category 2  
Germ Cell Mutagenicity - Category 1B  
Carcinogenicity - Category 1B  
Toxic to Reproduction - Category 1A  
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)  
Specific Target Organ Toxicity (Repeat Exposure) - Category 1 (liver, kidneys, bladder, blood, bone marrow, nervous system)  
Aspiration Hazard - Category 1  
Hazardous to the Aquatic Environment – Acute Hazard - Category 3

### GHS LABEL ELEMENTS

#### Symbol(s)



#### Signal Word

DANGER

#### Hazard Statements

Highly flammable liquid and vapour.  
Causes skin irritation.  
May cause genetic defects.  
May cause cancer.  
May damage fertility or the unborn child.  
May cause respiratory irritation.  
May cause drowsiness or dizziness.  
Causes damage to organs (liver, kidneys, bladder, blood, bone marrow, nervous system) through prolonged or repeated exposure.  
May be fatal if swallowed and enters airways.  
Harmful to aquatic life.

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## Precautionary Statements

### Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking  
Keep container tightly closed.  
Ground/bond container and receiving equipment.  
Use explosion-proof electrical/ventilating/lighting/equipment.  
Use only non-sparking tools.  
Take precautionary measures against static discharge.  
Wear protective gloves/protective clothing/eye protection/face protection.  
Wash hands and forearms thoroughly after handling.  
Obtain special instructions before use.  
Do not handle until all safety precautions have been read and understood.  
Do not breathe mist/vapours/spray.  
Use only outdoors or in well-ventilated area.  
Do not eat, drink or smoke when using this product.  
Avoid release to the environment.

### Response

In case of fire: Use water spray, fog, dry chemical fire extinguishers or hand held fire extinguisher.  
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash before reuse. If skin irritation occurs, get medical advice/attention.  
IF exposed or concerned: Get medical advice/attention.  
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center or doctor/physician if you feel unwell.  
Get medical advice/attention if you feel unwell.  
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do not induce vomiting.

### Storage

Store in a well-ventilated place.  
Keep cool. Keep container tightly closed.  
Store locked up.

### Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

## \* \* \* Section 3 - Composition / Information on Ingredients \* \* \*

CAS #	Component	Percent
86290-81-5	Gasoline, motor fuel	100
108-88-3	Toluene	1-25
106-97-8	Butane	<10
1330-20-7	Xylenes (o-, m-, p- isomers)	1-15
95-63-6	Benzene, 1,2,4-trimethyl-	<6
64-17-5	Ethyl alcohol	0-10
100-41-4	Ethylbenzene	<3
71-43-2	Benzene	0.1-4.9

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

110-54-3	Hexane	0.5-4
----------	--------	-------

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

## \* \* \* Section 4 - First Aid Measures \* \* \*

### First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

### First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops.

### First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

### First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

## \* \* \* Section 5 - Fire Fighting Measures \* \* \*

### General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

### Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitroresols that can decompose violently.

### Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO<sub>2</sub>, water spray, fire fighting foam, or gaseous extinguishing agent.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration.

### Unsuitable Extinguishing Media

None

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

## \* \* \* Section 6 - Accidental Release Measures \* \* \*

### Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

### Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

### Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

### Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

### Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

### Prevention of Secondary Hazards

None

## \* \* \* Section 7 - Handling and Storage \* \* \*

### Handling Procedures

USE ONLY AS A MOTOR FUEL.  
DO NOT SIPHON BY MOUTH

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

## Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

## Incompatibilities

Keep away from strong oxidizers.

## \* \* \* Section 8 - Exposure Controls / Personal Protection \* \* \*

### Component Exposure Limits

#### Gasoline, motor fuel (86290-81-5)

ACGIH: 300 ppm TWA  
500 ppm STEL

#### Toluene (108-88-3)

ACGIH: 20 ppm TWA  
OSHA: 200 ppm TWA; 375 mg/m<sup>3</sup> TWA  
150 ppm STEL; 560 mg/m<sup>3</sup> STEL  
NIOSH: 100 ppm TWA; 375 mg/m<sup>3</sup> TWA  
150 ppm STEL; 560 mg/m<sup>3</sup> STEL

#### Butane (106-97-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases: Alkane C1-4)  
OSHA: 800 ppm TWA; 1900 mg/m<sup>3</sup> TWA  
NIOSH: 800 ppm TWA; 1900 mg/m<sup>3</sup> TWA

#### Xylenes (o-, m-, p- isomers) (1330-20-7)

ACGIH: 100 ppm TWA  
150 ppm STEL  
OSHA: 100 ppm TWA; 435 mg/m<sup>3</sup> TWA  
150 ppm STEL; 655 mg/m<sup>3</sup> STEL

#### Benzene, 1,2,4-trimethyl- (95-63-6)

NIOSH: 25 ppm TWA; 125 mg/m<sup>3</sup> TWA

#### Ethyl alcohol (64-17-5)

ACGIH: 1000 ppm STEL  
OSHA: 1000 ppm TWA; 1900 mg/m<sup>3</sup> TWA  
NIOSH: 1000 ppm TWA; 1900 mg/m<sup>3</sup> TWA

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## Ethylbenzene (100-41-4)

ACGIH: 20 ppm TWA  
OSHA: 100 ppm TWA; 435 mg/m<sup>3</sup> TWA  
125 ppm STEL; 545 mg/m<sup>3</sup> STEL  
NIOSH: 100 ppm TWA; 435 mg/m<sup>3</sup> TWA  
125 ppm STEL; 545 mg/m<sup>3</sup> STEL

## Benzene (71-43-2)

ACGIH: 0.5 ppm TWA  
2.5 ppm STEL  
Skin - potential significant contribution to overall exposure by the cutaneous route  
OSHA: 5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA  
NIOSH: 0.1 ppm TWA  
1 ppm STEL

## Hexane (110-54-3)

ACGIH: 50 ppm TWA  
Skin - potential significant contribution to overall exposure by the cutaneous route  
OSHA: 500 ppm TWA; 1800 mg/m<sup>3</sup> TWA  
NIOSH: 50 ppm TWA; 180 mg/m<sup>3</sup> TWA

## Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

## Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

## Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

## PERSONAL PROTECTIVE EQUIPMENT

### Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

### Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## \*\*\* Section 9 - Physical & Chemical Properties \*\*\*

<b>Appearance:</b>	Translucent, straw-colored or light yellow	<b>Odor:</b>	Strong, characteristic aromatic hydrocarbon odor. Sweet-ether like
<b>Physical State:</b>	Liquid	<b>pH:</b>	ND
<b>Vapor Pressure:</b>	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C))	<b>Vapor Density:</b>	AP 3-4
<b>Boiling Point:</b>	85-437 °F (39-200 °C)	<b>Melting Point:</b>	ND
<b>Solubility (H2O):</b>	Negligible to Slight	<b>Specific Gravity:</b>	0.70-0.78
<b>Evaporation Rate:</b>	10-11	<b>VOC:</b>	ND
<b>Percent Volatile:</b>	100%	<b>Octanol/H2O Coeff.:</b>	ND
<b>Flash Point:</b>	-45 °F (-43 °C)	<b>Flash Point Method:</b>	PMCC
<b>Upper Flammability Limit (UFL):</b>	7.6%	<b>Lower Flammability Limit (LFL):</b>	1.4%
<b>Burning Rate:</b>	ND	<b>Auto Ignition:</b>	>530°F (>280°C)

## \*\*\* Section 10 - Chemical Stability & Reactivity Information \*\*\*

### Chemical Stability

This is a stable material.

### Hazardous Reaction Potential

Will not occur.

### Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

### Incompatible Products

Keep away from strong oxidizers.

### Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

## \*\*\* Section 11 - Toxicological Information \*\*\*

### Acute Toxicity

#### A: General Product Information

Harmful if swallowed.

#### B: Component Analysis - LD50/LC50

##### Gasoline, motor fuel (86290-81-5)

Inhalation LC50 Rat >5.2 mg/L 4 h; Oral LD50 Rat 14000 mg/kg; Dermal LD50 Rabbit >2000 mg/kg

##### Toluene (108-88-3)

Inhalation LC50 Rat 12.5 mg/L 4 h; Inhalation LC50 Rat >26700 ppm 1 h; Oral LD50 Rat 636 mg/kg; Dermal LD50 Rabbit 8390 mg/kg; Dermal LD50 Rat 12124 mg/kg

##### Butane (106-97-8)

Inhalation LC50 Rat 658 mg/L 4 h



# Safety Data Sheet

**Material Name: Gasoline All Grades**

**SDS No. 9950**

**Xylenes (o-, m-, p- isomers) (1330-20-7)**

Inhalation LC50 Rat 5000 ppm 4 h; Inhalation LC50 Rat 47635 mg/L 4 h; Oral LD50 Rat 4300 mg/kg; Dermal LD50 Rabbit >1700 mg/kg

**Benzene, 1,2,4-trimethyl- (95-63-6)**

Inhalation LC50 Rat 18 g/m<sup>3</sup> 4 h; Oral LD50 Rat 3400 mg/kg; Dermal LD50 Rabbit >3160 mg/kg

**Ethyl alcohol (64-17-5)**

Oral LD50 Rat 7060 mg/kg; Inhalation LC50 Rat 124.7 mg/L 4 h

**Ethylbenzene (100-41-4)**

Inhalation LC50 Rat 17.2 mg/L 4 h; Oral LD50 Rat 3500 mg/kg; Dermal LD50 Rabbit 15354 mg/kg

**Benzene (71-43-2)**

Inhalation LC50 Rat 13050-14380 ppm 4 h; Oral LD50 Rat 1800 mg/kg

**Hexane (110-54-3)**

Inhalation LC50 Rat 48000 ppm 4 h; Oral LD50 Rat 25 g/kg; Dermal LD50 Rabbit 3000 mg/kg

## Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

## Potential Health Effects: Eye Critical Damage/ Stimulativeness

Moderate irritant. Contact with liquid or vapor may cause irritation.

## Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

## Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

## Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

## Generative Cell Mutagenicity

This product may cause genetic defects.

## Carcinogenicity

### A: General Product Information

May cause cancer.

# Safety Data Sheet

**Material Name: Gasoline All Grades**

**SDS No. 9950**

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

## **B: Component Carcinogenicity**

### **Gasoline, motor fuel (86290-81-5)**

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

### **Toluene (108-88-3)**

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71 [1999]; Monograph 47 [1989] (Group 3 (not classifiable))

### **Xylenes (o-, m-, p- isomers) (1330-20-7)**

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71 [1999]; Monograph 47 [1989] (Group 3 (not classifiable))

### **Ethyl alcohol (64-17-5)**

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

IARC: Monograph 100E [in preparation] (in alcoholic beverages); Monograph 96 [2010] (in alcoholic beverages) (Group 1 (carcinogenic to humans))

### **Ethylbenzene (100-41-4)**

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

IARC: Monograph 77 [2000] (Group 2B (possibly carcinogenic to humans))

### **Benzene (71-43-2)**

ACGIH: A1 - Confirmed Human Carcinogen

OSHA: 5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA

NIOSH: potential occupational carcinogen

NTP: Known Human Carcinogen (Select Carcinogen)

IARC: Monograph 100F [in preparation]; Supplement 7 [1987]; Monograph 29 [1982] (Group 1 (carcinogenic to humans))

## **Reproductive Toxicity**

This product is suspected of damaging fertility or the unborn child.

## **Specified Target Organ General Toxicity: Single Exposure**

This product may cause drowsiness or dizziness.

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## Specified Target Organ General Toxicity: Repeated Exposure

This product causes damage to organs through prolonged or repeated exposure.

## Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

## \* \* \* Section 12 - Ecological Information \* \* \*

### Ecotoxicity

#### A: General Product Information

Very toxic to aquatic life with long lasting effects. Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

#### B: Component Analysis - Ecotoxicity - Aquatic Toxicity

##### Gasoline, motor fuel (86290-81-5)

Test & Species	Conditions
96 Hr LC50 <i>Alburnus alburnus</i>	119 mg/L [static]
96 Hr LC50 <i>Cyprinodon variegatus</i>	82 mg/L [static]
72 Hr EC50 <i>Pseudokirchneriella subcapitata</i>	56 mg/L
24 Hr EC50 <i>Daphnia magna</i>	170 mg/L

##### Toluene (108-88-3)

Test & Species	Conditions	
96 Hr LC50 <i>Pimephales promelas</i>	15.22-19.05 mg/L [flow-through]	1 day old
96 Hr LC50 <i>Pimephales promelas</i>	12.6 mg/L [static]	
96 Hr LC50 <i>Oncorhynchus mykiss</i>	5.89-7.81 mg/L [flow-through]	
96 Hr LC50 <i>Oncorhynchus mykiss</i>	14.1-17.16 mg/L [static]	
96 Hr LC50 <i>Oncorhynchus mykiss</i>	5.8 mg/L [semi-static]	
96 Hr LC50 <i>Lepomis macrochirus</i>	11.0-15.0 mg/L [static]	
96 Hr LC50 <i>Oryzias latipes</i>	54 mg/L [static]	
96 Hr LC50 <i>Poecilia reticulata</i>	28.2 mg/L [semi-static]	
96 Hr LC50 <i>Poecilia reticulata</i>	50.87-70.34 mg/L [static]	
96 Hr EC50 <i>Pseudokirchneriella subcapitata</i>	>433 mg/L	
72 Hr EC50 <i>Pseudokirchneriella subcapitata</i>	12.5 mg/L [static]	
48 Hr EC50 <i>Daphnia magna</i>	5.46 - 9.83 mg/L [Static]	
48 Hr EC50 <i>Daphnia magna</i>	11.5 mg/L	

##### Xylenes (o-, m-, p- isomers) (1330-20-7)

Test & Species	Conditions
96 Hr LC50 <i>Pimephales promelas</i>	13.4 mg/L [flow-through]

# Safety Data Sheet

**Material Name: Gasoline All Grades**

**SDS No. 9950**

96 Hr LC50 Oncorhynchus mykiss	2.661-4.093 mg/L [static]
96 Hr LC50 Oncorhynchus mykiss	13.5-17.3 mg/L
96 Hr LC50 Lepomis macrochirus	13.1-16.5 mg/L [flow-through]
96 Hr LC50 Lepomis macrochirus	19 mg/L
96 Hr LC50 Lepomis macrochirus	7.711-9.591 mg/L [static]
96 Hr LC50 Pimephales promelas	23.53-29.97 mg/L [static]
96 Hr LC50 Cyprinus carpio	780 mg/L [semi- static]
96 Hr LC50 Cyprinus carpio	>780 mg/L
96 Hr LC50 Poecilia reticulata	30.26-40.75 mg/L [static]
48 Hr EC50 water flea	3.82 mg/L
48 Hr LC50 Gammarus lacustris	0.6 mg/L

## **Benzene, 1,2,4-trimethyl- (95-63-6)**

### **Test & Species**

### **Conditions**

96 Hr LC50 Pimephales promelas	7.19-8.28 mg/L [flow-through]
48 Hr EC50 Daphnia magna	6.14 mg/L

## **Ethyl alcohol (64-17-5)**

### **Test & Species**

### **Conditions**

96 Hr LC50 Oncorhynchus mykiss	12.0 - 16.0 mL/L [static]
96 Hr LC50 Pimephales promelas	>100 mg/L [static]
96 Hr LC50 Pimephales promelas	13400 - 15100 mg/L [flow-through]
48 Hr LC50 Daphnia magna	9268 - 14221 mg/L
24 Hr EC50 Daphnia magna	10800 mg/L
48 Hr EC50 Daphnia magna	2 mg/L [Static]

## **Ethylbenzene (100-41-4)**

### **Test & Species**

### **Conditions**

96 Hr LC50 Oncorhynchus mykiss	11.0-18.0 mg/L [static]
96 Hr LC50 Oncorhynchus mykiss	4.2 mg/L [semi- static]
96 Hr LC50 Pimephales promelas	7.55-11 mg/L [flow- through]
96 Hr LC50 Lepomis macrochirus	32 mg/L [static]
96 Hr LC50 Pimephales promelas	9.1-15.6 mg/L [static]
96 Hr LC50 Poecilia reticulata	9.6 mg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	4.6 mg/L
96 Hr EC50 Pseudokirchneriella subcapitata	>438 mg/L
72 Hr EC50 Pseudokirchneriella subcapitata	2.6 - 11.3 mg/L [static]

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

96 Hr EC50 Pseudokirchneriella subcapitata	1.7 - 7.6 mg/L [static]
48 Hr EC50 Daphnia magna	1.8 - 2.4 mg/L

## Benzene (71-43-2)

### Test & Species

### Conditions

96 Hr LC50 Pimephales promelas	10.7-14.7 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	5.3 mg/L [flow-through]
96 Hr LC50 Lepomis macrochirus	22.49 mg/L [static]
96 Hr LC50 Poecilia reticulata	28.6 mg/L [static]
96 Hr LC50 Pimephales promelas	22330-41160 µg/L [static]
96 Hr LC50 Lepomis macrochirus	70000-142000 µg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	29 mg/L
48 Hr EC50 Daphnia magna	8.76 - 15.6 mg/L [Static]
48 Hr EC50 Daphnia magna	10 mg/L

## Hexane (110-54-3)

### Test & Species

### Conditions

96 Hr LC50 Pimephales promelas	2.1-2.98 mg/L [flow-through]
24 Hr EC50 Daphnia magna	>1000 mg/L

## Persistence/Degradability

No information available.

## Bioaccumulation

No information available.

## Mobility in Soil

No information available.

## \* \* \* Section 13 - Disposal Considerations \* \* \*

## Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

## Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## \*\*\* Section 14 - Transportation Information \*\*\*

### Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Gasoline, motor fuel	86290-81-5	DOT regulated marine pollutant

### DOT Information

Shipping Name: Gasoline

UN #: 1203 Hazard Class: 3 Packing Group: II

Placard:



## \*\*\* Section 15 - Regulatory Information \*\*\*

### Regulatory Information

#### A: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

##### **Toluene (108-88-3)**

SARA 313: 1.0 % de minimis concentration  
CERCLA: 1000 lb final RQ; 454 kg final RQ

##### **Xylenes (o-, m-, p- isomers) (1330-20-7)**

SARA 313: 1.0 % de minimis concentration  
CERCLA: 100 lb final RQ; 45.4 kg final RQ

##### **Benzene, 1,2,4-trimethyl- (95-63-6)**

SARA 313: 1.0 % de minimis concentration

##### **Ethylbenzene (100-41-4)**

SARA 313: 0.1 % de minimis concentration  
CERCLA: 1000 lb final RQ; 454 kg final RQ

##### **Benzene (71-43-2)**

SARA 313: 0.1 % de minimis concentration  
CERCLA: 10 lb final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule); 4.54 kg final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule)

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## Hexane (110-54-3)

SARA 313: 1.0 % de minimis concentration

CERCLA: 5000 lb final RQ; 2270 kg final RQ

## SARA Section 311/312 – Hazard Classes

Acute Health

X

Chronic Health

X

Fire

X

Sudden Release of Pressure

--

Reactive

--

## Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Gasoline, motor fuel	86290-81-5	DOT regulated marine pollutant

## State Regulations

### Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Gasoline, motor fuel	86290-81-5	No	No	No	No	Yes	No
Toluene	108-88-3	Yes	Yes	Yes	Yes	Yes	No
Butane	106-97-8	Yes	Yes	Yes	Yes	Yes	No
Xylenes (o-, m-, p- isomers)	1330-20-7	Yes	Yes	Yes	Yes	Yes	No
Benzene, 1,2,4-trimethyl-	95-63-6	No	Yes	Yes	Yes	Yes	No
Ethyl alcohol	64-17-5	Yes	Yes	Yes	Yes	Yes	No
Ethylbenzene	100-41-4	Yes	Yes	Yes	Yes	Yes	No
Benzene	71-43-2	Yes	Yes	Yes	Yes	Yes	No
Hexane	110-54-3	No	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

# Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

## Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Toluene	108-88-3	1 %
Butane	106-97-8	1 %
Benzene, 1,2,4-trimethyl-	95-63-6	0.1 %
Ethyl alcohol	64-17-5	0.1 %
Ethylbenzene	100-41-4	0.1 %
Benzene	71-43-2	0.1 %
Hexane	110-54-3	1 %

## Additional Regulatory Information

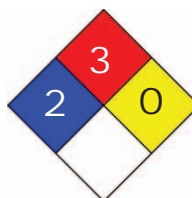
## Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Gasoline, motor fuel	86290-81-5	No	DSL	EINECS
Toluene	108-88-3	Yes	DSL	EINECS
Butane	106-97-8	Yes	DSL	EINECS
Xylenes (o-, m-, p- isomers)	1330-20-7	Yes	DSL	EINECS
Benzene, 1,2,4-trimethyl-	95-63-6	Yes	DSL	EINECS
Ethyl alcohol	64-17-5	Yes	DSL	EINECS
Ethylbenzene	100-41-4	Yes	DSL	EINECS
Benzene	71-43-2	Yes	DSL	EINECS
Hexane	110-54-3	Yes	DSL	EINECS

## \*\*\* Section 16 - Other Information \*\*\*

**NFPA® Hazard Rating**

Health	2
Fire	3
Reactivity	0



**HMIS® Hazard Rating**

Health	2	Moderate
Fire	3	Serious
Physical	0	Minimal

\*Chronic

## Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration., NJTSR = New Jersey Trade Secret Registry.

## Literature References

None



# Safety Data Sheet

**Material Name: Gasoline All Grades**

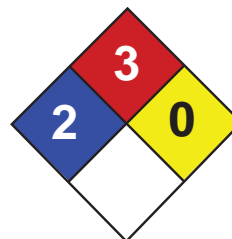
**SDS No. 9950**

## Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet



Health	2
Fire	3
Reactivity	0
Personal Protection	H

## Material Safety Data Sheet Benzene MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Benzene

**Catalog Codes:** SLB1564, SLB3055, SLB2881

**CAS#:** 71-43-2

**RTECS:** CY1400000

**TSCA:** TSCA 8(b) inventory: Benzene

**CI#:** Not available.

**Synonym:** Benzol; Benzine

**Chemical Name:** Benzene

**Chemical Formula:** C6-H6

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

**For non-emergency assistance, call:** 1-281-441-4400

### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Benzene	71-43-2	100

**Toxicological Data on Ingredients:** Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

### Section 3: Hazards Identification

**Potential Acute Health Effects:**

Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

**Potential Chronic Health Effects:**

**CARCINOGENIC EFFECTS:** Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. **MUTAGENIC EFFECTS:** Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. Repeated or prolonged exposure to the substance can produce target organs damage.

### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

**Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

**Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

**Ingestion:**

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 497.78°C (928°F)

**Flash Points:** CLOSED CUP: -11.1°C (12°F). (Setaflash)

**Flammable Limits:** LOWER: 1.2% UPPER: 7.8%

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

**Fire Hazards in Presence of Various Substances:**

Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

**Fire Fighting Media and Instructions:**

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

**Special Remarks on Fire Hazards:**

Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powerful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Vigorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

**Special Remarks on Explosion Hazards:**

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction

of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid ( or its explosive anhydride, dimanganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

## Section 6: Accidental Release Measures

**Small Spill:** Absorb with an inert material and put the spilled material in an appropriate waste disposal.

**Large Spill:**

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

**Storage:**

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection:**

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m<sup>3</sup>) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m<sup>3</sup>) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m<sup>3</sup>) [Canada] TWA: 0.5 (ppm) [Canada] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:**

Aromatic. Gasoline-like, rather pleasant. (Strong.)

**Taste:** Not available.

**Molecular Weight:** 78.11 g/mole

**Color:** Clear Colorless. Colorless to light yellow.

**pH (1% soln/water):** Not available.

**Boiling Point:** 80.1 (176.2°F)

**Melting Point:** 5.5°C (41.9°F)

**Critical Temperature:** 288.9°C (552°F)

**Specific Gravity:** 0.8787 @ 15 C (Water = 1)

**Vapor Pressure:** 10 kPa (@ 20°C)

**Vapor Density:** 2.8 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 4.68 ppm

**Water/Oil Dist. Coeff.:** The product is more soluble in oil; log(oil/water) = 2.1

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, diethyl ether, acetone.

**Solubility:**

Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Heat, ignition sources, incompatibles.

**Incompatibility with various substances:** Highly reactive with oxidizing agents, acids.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid ( or its explosive anhydride, dimanganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation.

**Toxicity to Animals:**

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

**Chronic Effects on Humans:**

**CARCINOGENIC EFFECTS:** Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. **MUTAGENIC EFFECTS:** Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. **DEVELOPMENTAL TOXICITY:** Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

**Other Toxic Effects on Humans:**

Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**

May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia)) Human: passes the placental barrier, detected in maternal milk.

**Special Remarks on other Toxic Effects on Humans:**

**Acute Potential Health Effects:** Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism, and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

## Section 14: Transport Information

**DOT Classification:** CLASS 3: Flammable liquid.

**Identification:** : Benzene UNNA: 1114 PG: II

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients

for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

**Other Regulations:**

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:**

**WHMIS (Canada):**

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

**DSCL (EEC):**

R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 3

**Reactivity:** 0

**Personal Protection:** h

**National Fire Protection Association (U.S.A.):**

**Health:** 2

**Flammability:** 3

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

**Section 16: Other Information**

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:35 PM

**Last Updated:** 05/21/2013 12:00 PM

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.*

MATERIAL SAFETY 3M  
 DATA SHEET 3M Center  
 St. Paul, Minnesota  
 55144-1000  
 1-800-364-3577 or (651) 737-6501 (24 hours)

Copyright, 2000, Minnesota Mining and Manufacturing Company.  
 All rights reserved. Copying and/or downloading of this  
 information for the purpose of properly utilizing 3M products  
 is allowed provided that:  
 1) the information is copied in full with no changes unless  
 prior agreement is obtained from 3M, and  
 2) neither the copy nor the original is resold or otherwise  
 distributed with the intention of earning a profit thereon.

DIVISION: 3M SPECIALTY MATERIALS  
 TRADE NAME:  
 FC-201F LIGHT WATER(TM) AFFF 1%  
 ID NUMBER/U.P.C. :  
 98-0211-6542-2 00-51135-10364-7 98-0211-6543-0 00-51135-10365-4  
 ZF-0002-0838-7 - - - ZF-0002-0839-5 - - -  
 ZF-0002-0840-3 - - -  
 ISSUED: September 29, 2000  
 SUPERSEDES: September 29, 1998  
 DOCUMENT: 05-4931-1

1. INGREDIENT	C.A.S. NO.	PERCENT
WATER.....	7732-18-5	35 - 38
DIETHYLENE GLYCOL BUTYL ETHER.....	112-34-5	36
Amphoteric Fluoroalkylamide Derivative +(5887P).....	TradeSecret	6 - 10
Alkyl Sulfate Salts(2) +(5884P, 5886P)..	TradeSecret	11 - 15
TRIETHANOLAMINE.....	102-71-6	1 - 5
Perfluoroalkyl Sulfonate Salts(5) +(5885P).....	2795-39-3	1 - 5
TOLYL TRIAZOLE.....	29385-43-1	0.15

The components of this product are in compliance with the chemical notification requirements of TSCA. All applicable chemical ingredients in this material are listed on the European Inventory of Existing Chemical Substances (EINECS), or are exempt polymers whose monomers are listed on EINECS.

New Jersey Trade Secret Registry (EIN) 04499600-+

This product contains the following toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Emergency Planning and Community Right-To-Know Act of 1986 and 40 CFR Part 372:  
 DIETHYLENE GLYCOL BUTYL ETHER

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately



-----  
2. PHYSICAL DATA  
-----

BOILING POINT:..... ca. 100 C  
VAPOR PRESSURE:..... ca. 16.2 mmHg  
                                Calc. @ 20 C  
VAPOR DENSITY:..... ca. 1.11 Air=1  
                                Calc. @ 20 C  
EVAPORATION RATE:..... < 1.0 BuOAc=1  
SOLUBILITY IN WATER:..... Miscible  
SPECIFIC GRAVITY:..... ca. 1.1 Water=1  
PERCENT VOLATILE:..... 72 %  
pH:..... 7.5 - 8.5  
VISCOSITY:..... N/D  
MELTING POINT:..... N/A

APPEARANCE AND ODOR:  
Clear, amber colored liquid.

-----  
3. FIRE AND EXPLOSION HAZARD DATA  
-----

FLASH POINT:..... Non-flammable  
FLAMMABLE LIMITS - LEL:..... N/A  
FLAMMABLE LIMITS - UEL:..... N/A  
AUTOIGNITION TEMPERATURE:..... N/A

EXTINGUISHING MEDIA:  
Product is a fire-extinguishing agent.

SPECIAL FIRE FIGHTING PROCEDURES:  
Not applicable

UNUSUAL FIRE AND EXPLOSION HAZARDS:  
See Hazardous Decomposition section for products of combustion.

-----  
4. REACTIVITY DATA  
-----

STABILITY: Stable

INCOMPATIBILITY - MATERIALS/CONDITIONS TO AVOID:  
Not applicable.

HAZARDOUS POLYMERIZATION: Hazardous polymerization will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS:  
Carbon Monoxide and Carbon Dioxide, Oxides of Nitrogen, Oxides of  
Sulfur, Hydrogen Fluoride

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
4. REACTIVITY DATA (continued)  
-----

Thermal decomposition of usage concentrations does not present a hazard.

-----  
5. ENVIRONMENTAL INFORMATION  
-----

SPILL RESPONSE:

Observe precautions from other sections. Ventilate area. Contain spill. Cover with absorbent material. Collect spilled material. Clean up residue with water. Place in a closed container.

RECOMMENDED DISPOSAL:

Discharge spent solutions and small quantities (less than 5 gal.(19 L)) to a wastewater treatment system. Reduce discharge rate if foaming occurs. Large quantities may adversely affect biological wastewater treatment systems. Incinerate large quantities in an industrial or commercial incinerator. Combustion products will include HF.

ENVIRONMENTAL DATA:

BIODEGRADATION:

Chemical Oxygen Demand (COD): 11,000 mgO<sub>2</sub>/l  
5-Day Biochemical Oxygen Demand (BOD<sub>5</sub>): 6250 mgO<sub>2</sub>/l  
%BOD<sub>5</sub>/COD = 56.8

AQUATIC TOXICITY:

Fathead minnow (*Pimephales promelas*) 96-hr LC<sub>50</sub>: > 1000 mg/L  
Water flea (*Daphnia magna*) 48-hr EC<sub>50</sub>: 308 mg/L

REGULATORY INFORMATION:

Volatile Organic Compounds: 396 gms/liter South Coast Air Quality Mgmt Dist Method.  
VOC Less H<sub>2</sub>O & Exempt Solvents: N/A gms/liter.

Since regulations vary, consult applicable regulations or authorities before disposal. In the event of an uncontrolled release of this material, the user should determine if the release qualifies as a reportable quantity. U.S. EPA Hazardous Waste Number = None (Not U.S. EPA Hazardous).

The components of this product are in compliance with the chemical registration requirements of: TSCA, EINECS, CDSL, AICS, MITI.

OTHER ENVIRONMENTAL INFORMATION:

Handling this product according to recommendations is important because its properties present a moderate environmental hazard.

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
5. ENVIRONMENTAL INFORMATION (continued)  
-----

There is insufficient component information to calculate the wastewater treatment system effects of this product.

The components labeled "readily biodegradable" are expected to fully degrade in wastewater treatment and in most aerobic water or soil environments.

The components labeled "partially biodegradable" are not readily biodegradable but are partially degraded in ready biodegradation tests.

The components labeled "insignificant biodegradation" did not degrade significantly in ready biodegradation tests.

The components labeled "resistant moieties" have chemical moieties that are resistant to biodegradation. They are likely to only undergo partial biodegradation in the environment.

The components labeled "perfluorinated" are completely fluorinated. Perfluoroalkyl compounds resist degradation in most natural environments.

Testing indicates this product has minimal toxicity to aquatic organisms (100 mg/L < Lowest LC50, EC50, or IC50 < or = 1000 mg/L).

Bioassays on the product have been run on organisms from less than three phyla. Organisms from taxa that were not tested may show greater sensitivity.

Some toxicity may persist after wastewater treatment or for days or longer in aquatic systems because components responsible for >10% to 50% of the toxicity are not readily biodegradable.

The toxicity of this product after the readily biodegradable components are removed is calculated to be >10 - 100.

The components labeled "Log Kow <3" have measured or calculated log Kow values <3 indicating they are unlikely to bioconcentrate to high concentrations in aquatic organisms by partitioning into lipid tissues

This product contains one or more organic fluorochemicals that have the potential to resist degradation and persist in the environment.

Readily Biodegradable: Diethylene Glycol Butyl Ether, Sodium Octyl Sulfate.

Partially Biodegradable: Alkyl Sulfate Salts(2) +(5884P, 5886P)

Insignificantly Biodegradable: Triethanolamine, Tolyl Triazole

Resistant Moieties: Amphoteric Fluoroalkylamide Derivative+(5887P)

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
5. ENVIRONMENTAL INFORMATION (continued)  
-----

Perfluorinated: Perfluoroalkyl Sulfonate Salts(5)+(5885P)

Log Kow <3: Diethylene Glycol Butyl Ether, Triethanolamine, Toly  
Triazole

EPCRA HAZARD CLASS:

FIRE HAZARD: No PRESSURE: No REACTIVITY: No ACUTE: Yes CHRONIC: No

-----  
6. SUGGESTED FIRST AID  
-----

EYE CONTACT:

Immediately flush eyes with large amounts of water. Get immediate  
medical attention.

SKIN CONTACT:

Immediately wash skin with soap and large amounts of water. Remove  
contaminated clothing. If signs/symptoms occur, call a physician.  
Wash contaminated clothing before reuse and dispose of contaminated  
shoes.

INHALATION:

If signs/symptoms occur, remove person to fresh air. If  
signs/symptoms continue, call a physician.

IF SWALLOWED:

If swallowed, call a physician immediately. Only induce vomiting at  
the instruction of a physician. Never give anything by mouth to an  
unconscious person.

-----  
7. PRECAUTIONARY INFORMATION  
-----

EYE PROTECTION:

Avoid eye contact with vapor, spray, or mist. Wear vented goggles.

SKIN PROTECTION:

Avoid skin contact. Wear appropriate gloves when handling this  
material. A pair of gloves made from the following material(s) are  
recommended: butyl rubber.

RECOMMENDED VENTILATION:

Use with adequate dilution ventilation. If exhaust ventilation is  
not adequate, use appropriate respiratory protection. Provide  
ventilation adequate to control vapor concentrations below  
recommended exposure limits and/or control spray or mist.

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
7. PRECAUTIONARY INFORMATION (continued)  
-----

RESPIRATORY PROTECTION:

Avoid breathing of airborne material. Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: Half-mask organic vapor respirator with dust/mist prefilter.

PREVENTION OF ACCIDENTAL INGESTION:

Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Wash hands after handling and before eating.

RECOMMENDED STORAGE:

Store away from areas where product may come into contact with food or pharmaceuticals. Store at temperatures below 120 degrees F (49 degrees C). Store at temperatures above 32 degrees F (0 degrees C). Keep container closed when not in use. Keep container in well-ventilated area.

FIRE AND EXPLOSION AVOIDANCE:

Keep container tightly closed. Nonflammable.

OTHER PRECAUTIONARY INFORMATION:

No smoking: Smoking while using this product can result in contamination of the tobacco and/or smoke and lead to the formation of the hazardous decomposition products mentioned in the Reactivity Data section of this MSDS.

HMIS HAZARD RATINGS: HEALTH: 2 FLAMMABILITY: 0 REACTIVITY: 0  
PERSONAL PROTECTION: X (See precautions, section 7.)

EXPOSURE LIMITS

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
WATER.....	NONE	NONE	NONE	NONE	
DIETHYLENE GLYCOL BUTYL ETHER.....	35	PPM	TWA	CMRG	
Amphoteric Fluoroalkylamide Derivative +(5887P).....	NONE	NONE	NONE	NONE	
Alkyl Sulfate Salts(2) +(5884P, 5886P).....	NONE	NONE	NONE	NONE	
TRIETHANOLAMINE.....	5	MG/M3	TWA	ACGIH	
Perfluoroalkyl Sulfonate Salts(5) +(5885P).....	0.1	MG/M3	TWA	3M	Y
TOLYL TRIAZOLE.....	NONE	NONE	NONE	NONE	

\* SKIN NOTATION: Listed substances indicated with 'Y' under SKIN refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

EXPOSURE LIMITS (continued)

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
------------	-------	------	------	------	-------

SOURCE OF EXPOSURE LIMIT DATA:

- 3M: 3M Recommended Exposure Guidelines
- ACGIH: American Conference of Governmental Industrial Hygienists
- CMRG: Chemical Manufacturer Recommended Exposure Guidelines
  
- NONE: None Established

8. HEALTH HAZARD DATA

EYE CONTACT:

Moderate Eye Irritation: signs/symptoms can include redness, swelling, pain, tearing, and hazy vision.

SKIN CONTACT:

Moderate Skin Irritation: signs/symptoms can include redness, swelling, itching, and dryness.

Prolonged or repeated exposure may cause:

Allergic Skin Reaction: signs/symptoms can include redness, swelling, blistering, and itching.

INHALATION:

Single overexposure, above recommended guidelines, may cause:

Central Nervous System Depression: signs/symptoms can include headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.

Irritation (upper respiratory): signs/symptoms can include soreness of the nose and throat, coughing and sneezing.

IF SWALLOWED:

Animal studies conducted on organic fluorochemicals which are present in this product indicate effects including liver disturbances, weight loss, loss of appetite, lethargy, and neurological, pancreatic, adrenal and hematologic effects. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

Ingestion may cause:

Aspiration Pneumonitis: signs/symptoms can include coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal.

WHILE THE FOLLOWING EFFECTS ARE ASSOCIATED WITH ONE OR MORE OF THE INDIVIDUAL INGREDIENTS IN THIS PRODUCT AND ARE REQUIRED TO BE

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
8. HEALTH HAZARD DATA (continued)  
-----

INCLUDED ON THE MSDS BY THE U.S. OSHA HAZARD COMMUNICATION STANDARD,  
THEY ARE NOT EXPECTED EFFECTS DURING FORESEEABLE USE OF THIS PRODUCT.

Ingestion may cause:

Irritation of Gastrointestinal Tissues: signs/symptoms can include pain, vomiting, abdominal tenderness, nausea, blood in vomitus, and blood in feces.

Central Nervous System Depression: signs/symptoms can include headache, dizziness, drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue, blurred vision, slurred speech, giddiness, tremors and convulsions.

OTHER HEALTH HAZARD INFORMATION:

A Product Toxicity Summary Sheet is available.

This product contains one or more organic fluorochemicals that have the potential to be absorbed and remain in the body for long periods of time, either as the parent molecule or as metabolites, and may accumulate with repeated exposures. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

The presence of organic fluorochemicals in the blood of the general population and subpopulations, such as workers, has been published dating back to the 1970's. 3M's epidemiological study of its own workers indicates no adverse effects.

-----  
SECTION CHANGE DATES  
-----

INGREDIENTS SECTION CHANGED SINCE September 29, 1998 ISSUE  
PRECAUTIONARY INFO. SECTION CHANGED SINCE September 29, 1998 ISSUE

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately  
-----

-----  
The information in this Material Safety Data Sheet (MSDS) is believed to be correct as of the date issued. 3M MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

3M provides information in electronic form as a service to its customers. Due to the remote possibility that electronic transfer may have resulted in errors, omissions or alterations in this information, 3M makes no representations as to its completeness or accuracy. In addition, information obtained from a database may not be as current as the information in the MSDS available directly from 3M.



MATERIAL SAFETY 3M  
 DATA SHEET 3M Center  
 St. Paul, Minnesota  
 55144-1000  
 1-800-364-3577 or (651) 737-6501 (24 hours)

Copyright, 1999, Minnesota Mining and Manufacturing Company.  
 All rights reserved. Copying and/or downloading of this  
 information for the purpose of properly utilizing 3M products  
 is allowed provided that:  
 1) the information is copied in full with no changes unless  
 prior agreement is obtained from 3M, and  
 2) neither the copy nor the original is resold or otherwise  
 distributed with the intention of earning a profit thereon.

DIVISION: 3M SPECIALTY MATERIALS  
 TRADE NAME:  
 FX-8B 3M Fire Fighting Foam Intermediate  
 ID NUMBER/U.P.C.:  
 ZF-0002-0683-7 - - - ZF-0002-1168-8 - - -  
 ISSUED: December 23, 1999  
 SUPERSEDES: December 09, 1999  
 DOCUMENT: 06-7386-3

1. INGREDIENT	C.A.S. NO.	PERCENT
PERFLUOROOCTANESULFONYL FLUORIDE.....	307-35-7	> 95.5
PERFLUOROHEPTANESULFONYL FLUORIDE.....	335-71-7	< 4.5

The components of this product are in compliance with the chemical  
 notification requirements of TSCA. All applicable chemical  
 ingredients in this material are listed on the European Inventory of  
 Existing Chemical Substances (EINECS), or are exempt polymers whose  
 monomers are listed on EINECS.

2. PHYSICAL DATA

BOILING POINT:..... 154 C  
 VAPOR PRESSURE:..... < 10 mmHg  
                                     Calc. @ 20 C  
 VAPOR DENSITY:..... > 1.0 Air=1  
                                     Calc. @ 20 C  
 EVAPORATION RATE:..... < 1.0 BuOAc=1  
 SOLUBILITY IN WATER:..... neglig.  
 SPECIFIC GRAVITY:..... ca. 1.8 Water=1  
 PERCENT VOLATILE:..... nil  
 pH:..... N/A  
 VISCOSITY:..... N/D  
 MELTING POINT:..... N/A

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
2. PHYSICAL DATA (continued)  
-----

APPEARANCE AND ODOR:  
Clear liquid.

-----  
3. FIRE AND EXPLOSION HAZARD DATA  
-----

FLASH POINT:..... > 100 C Setaflash  
FLAMMABLE LIMITS - LEL:..... N/A  
FLAMMABLE LIMITS - UEL:..... N/A  
AUTOIGNITION TEMPERATURE:..... N/A

EXTINGUISHING MEDIA:  
Water, Carbon dioxide, Dry chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES:  
Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

UNUSUAL FIRE AND EXPLOSION HAZARDS:  
See Hazardous Decomposition section for products of combustion.

-----  
4. REACTIVITY DATA  
-----

STABILITY: Stable

INCOMPATIBILITY - MATERIALS/CONDITIONS TO AVOID:  
Strong Bases, Amines.

HAZARDOUS POLYMERIZATION: Hazardous polymerization will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS:  
Carbon Monoxide and Carbon Dioxide, Oxides of Sulfur, Hydrogen Fluoride, Toxic Vapors, Gases or Particulates.

-----  
5. ENVIRONMENTAL INFORMATION  
-----

SPILL RESPONSE:  
Observe precautions from other sections. Ventilate area. Contain spill. Cover with inorganic absorbent material. Collect spilled material. Clean up residue with an appropriate organic solvent. Read and follow safety precautions on the solvent label and MSDS. Place in a closed container.

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
5. ENVIRONMENTAL INFORMATION (continued)  
-----

RECOMMENDED DISPOSAL:

Incinerate in an industrial or commercial facility in the presence of a combustible material. Combustion products will include HF.

Disposal alternative: Dispose of completely absorbed waste product in a facility permitted to accept chemical wastes.

ENVIRONMENTAL DATA:

3M COMPOSED HAZARD ASSESSMENT

ENVIRONMENTAL FATE AND EFFECTS:

This substance did not degrade significantly in a ready biodegradation test. This compound is completely fluorinated (perfluorinated), or it contains perfluorinated portions. Perfluoroalkyl groups resist degradation in most natural environments.

This low-solubility substance has minimal toxicity to aquatic organisms (Lowest LL50 or EL50 > 1000 mg/L). LL50 (Lethal Level) and EL50 (Effective Level) are similar to LC50 and EC50, but tests the water phase from incompletely-miscible mixtures. Bioassays have been run on organisms from less than three phyla. Organisms from taxa that were not tested may show greater sensitivity.

SUPPORTING DATA

Biodegradation:

Chemical Oxygen Demand (COD): 500 - 720 mg/kg  
20-Day Biochemical Oxygen Demand (BOD20): Nil

Aquatic toxicity:

96-HR LL50 Fathead minnow (*Pimephales promelas*) - >1000 mg/L.  
No acute inhibition of microbial oxygen uptake at 1000 mg/L.

REGULATORY INFORMATION:

Volatile Organic Compounds: N/A.  
VOC Less H2O & Exempt Solvents: N/A.

Since regulations vary, consult applicable regulations or authorities before disposal. U.S. EPA Hazardous Waste Number = None (Not U.S. EPA Hazardous).

OTHER ENVIRONMENTAL INFORMATION:

This product contains one or more organic fluorochemicals that have the potential to resist degradation and persist in the environment.

EPCRA HAZARD CLASS:

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
5. ENVIRONMENTAL INFORMATION (continued)  
-----

FIRE HAZARD: No PRESSURE: No REACTIVITY: No ACUTE: No CHRONIC: No

-----  
6. SUGGESTED FIRST AID  
-----

EYE CONTACT:

Immediately flush eyes with large amounts of water. Get immediate medical attention.

SKIN CONTACT:

Flush skin with large amounts of water. If irritation persists, get medical attention.

INHALATION:

If signs/symptoms occur, remove person to fresh air. If signs/symptoms continue, call a physician.

IF SWALLOWED:

Drink two glasses of water. Call a physician.

-----  
7. PRECAUTIONARY INFORMATION  
-----

EYE PROTECTION:

Avoid eye contact with vapor, spray, or mist. Wear vented goggles.

SKIN PROTECTION:

Avoid skin contact. Wear appropriate gloves when handling this material. A pair of gloves made from the following material(s) are recommended: butyl rubber. Use one or more of the following personal protection items as necessary to prevent skin contact: coveralls.

RECOMMENDED VENTILATION:

If exhaust ventilation is not adequate, use appropriate respiratory protection. Provide ventilation adequate to control vapor concentrations below recommended exposure limits and/or control spray or mist.

RESPIRATORY PROTECTION:

Avoid breathing of airborne material. Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: Half-mask organic vapor respirator with dust/mist prefilter.

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
7. PRECAUTIONARY INFORMATION (continued)  
-----

PREVENTION OF ACCIDENTAL INGESTION:

Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Wash hands after handling and before eating.

RECOMMENDED STORAGE:

Store away from areas where product may come into contact with food or pharmaceuticals. Do not store containers on their sides. Store away from heat. Allow material to return to room temperature before use. Keep container closed when not in use. Keep container in well-ventilated area.

FIRE AND EXPLOSION AVOIDANCE:

Nonflammable.

OTHER PRECAUTIONARY INFORMATION:

No smoking: Smoking while using this product can result in contamination of the tobacco and/or smoke and lead to the formation of the hazardous decomposition products mentioned in the Reactivity Data section of this MSDS.

HMIS HAZARD RATINGS: HEALTH: 1 FLAMMABILITY: 1 REACTIVITY: 0  
PERSONAL PROTECTION: X (See precautions, section 7.)

EXPOSURE LIMITS

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
PERFLUOROOCETANESULFONYL FLUORIDE.....	0.1	MG/M3	TWA	3M	Y
PERFLUOROHEPTANESULFONYL FLUORIDE....	0.1	MG/M3	TWA	3M	Y

\* SKIN NOTATION: Listed substances indicated with 'Y' under SKIN refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

SOURCE OF EXPOSURE LIMIT DATA:

- 3M: 3M Recommended Exposure Guidelines

-----  
8. HEALTH HAZARD DATA  
-----

EYE CONTACT:

Mild Eye Irritation: signs/symptoms can include redness, swelling, pain, and tearing.

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

-----  
8. HEALTH HAZARD DATA (continued)  
-----

SKIN CONTACT:

Product is not expected to be irritating to the skin.

May be absorbed through the skin and produce effects similar to those caused by inhalation and/or ingestion.

INHALATION:

Single overexposure, above recommended guidelines, may cause:

Irritation (upper respiratory): signs/symptoms can include soreness of the nose and throat, coughing and sneezing.

IF SWALLOWED:

Animal studies conducted on organic fluorochemicals which are present in this product indicate effects including liver disturbances, weight loss, loss of appetite, lethargy, and neurological, pancreatic, adrenal and hematologic effects. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

OTHER HEALTH HAZARD INFORMATION:

This product contains one or more organic fluorochemicals that have the potential to be absorbed and remain in the body for long periods of time, either as the parent molecule or as metabolites, and may accumulate with repeated exposures. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

The presence of organic fluorochemicals in the blood of the general population and subpopulations, such as workers, has been published dating back to the 1970's. 3M's epidemiological study of its own workers indicates no adverse effects.

-----  
SECTION CHANGE DATES  
-----

HEADING	SECTION CHANGED SINCE	December 09, 1999	ISSUE
INGREDIENTS	SECTION CHANGED SINCE	December 09, 1999	ISSUE
ENVIRONMENTAL INFO.	SECTION CHANGED SINCE	December 09, 1999	ISSUE

-----  
Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately  
-----

-----  
The information in this Material Safety Data Sheet (MSDS) is believed to be correct as of the date issued. 3M MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

3M provides information in electronic form as a service to its customers. Due to the remote possibility that electronic transfer may have resulted in errors, omissions or alterations in this information, 3M makes no representations as to its completeness or accuracy. In addition, information obtained from a database may not be as current as the information in the MSDS available directly from 3M.

## LIQUINOX MSDS

### Section 1 : MANUFACTURER INFORMATION

**Supplier:** Same as manufacturer.

**Manufacturer:** Alconox, Inc.  
30 Glenn St.  
Suite 309  
White Plains, NY 10603.

**Manufacturer emergency phone number:** 800-255-3924.  
813-248-0585 (outside of the United States).

**Manufacturer:** Alconox, Inc.  
30 Glenn St.  
Suite 309  
White Plains, NY 10603.

**Supplier MSDS date:** 2005/02/24

**D.O.T. Classification:** Not regulated.

### Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL  1330 MG/KG MOUSE ORAL	NOT AVAILABLE

### Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

**Physical state:** Liquid.

**Appearance & odor:** Odourless.  
Pale yellow.

**Odor threshold (ppm):** Not available.

**Vapour pressure @ 20°C (68°F):**  
**(mmHg):** 17

**Vapour density (air=1):** >1

**Volatiles (%)**

**By volume:** Not available.

**Evaporation rate (butyl acetate = 1):** < 1.



**Boiling point (°C):** 100 (212F)  
**Freezing point (°C):** Not available.  
**pH:** 8.5  
**Specific gravity @ 20 °C:** (water = 1).  
1.083  
**Solubility in water (%):** Complete.  
**Coefficient of water\oil dist.:** Not available.  
**VOC:** None

**Section 4 : FIRE AND EXPLOSION HAZARD DATA**

**Flammability:** Not flammable.  
**Conditions of flammability:** Surrounding fire.  
**Extinguishing media:** Carbon dioxide, dry chemical, foam.  
Water  
Water fog.  
**Special procedures:** Self-contained breathing apparatus required.  
Firefighters should wear the usual protective gear.  
Use water spray to cool fire exposed containers.  
**Auto-ignition temperature:** Not available.  
**Flash point (°C), method:** None  
**Lower flammability limit (% vol):** Not applicable.  
**Upper flammability limit (% vol):** Not applicable.  
Not available.  
**Sensitivity to mechanical impact:** Not available.  
**Hazardous combustion products:** Oxides of carbon (COx).  
Hydrocarbons.  
**Rate of burning:** Not available.  
**Explosive power:** Containers may rupture if exposed to heat or fire.

**Section 5 : REACTIVITY DATA**

**Chemical stability:** Product is stable under normal handling and storage conditions.  
**Conditions of instability:** Extreme temperatures.  
**Hazardous polymerization:** Will not occur.  
**Incompatible substances:** Strong acids.  
Strong oxidizing agents.  
**Hazardous decomposition products:** See hazardous combustion products.

**Section 6 : HEALTH HAZARD DATA**

**Route of entry:** Skin contact, eye contact, inhalation and ingestion.

**Effects of Acute Exposure**

**Eye contact:** May cause irritation.

**Skin contact:** Prolonged and repeated contact may cause irritation.

**Inhalation:** May cause headache and nausea.

**Ingestion:** May cause vomiting and diarrhea.  
May cause gastric distress.

**Effects of chronic exposure:** See effects of acute exposure.

**LD50 of product, species & route:** > 5000 mg/kg rat oral.

**LC50 of product, species & route:** Not available.

**Exposure limit of material:** Not available.

**Sensitization to product:** Not available.

**Carcinogenic effects:** Not listed as a carcinogen.

**Reproductive effects:** Not available.

**Teratogenicity:** Not available.

**Mutagenicity:** Not available.

**Synergistic materials:** Not available.

**Medical conditions aggravated by exposure:** Not available.

**First Aid**

**Skin contact:** Remove contaminated clothing.  
Wash thoroughly with soap and water.  
Seek medical attention if irritation persists.

**Eye contact:** Check for and remove contact lenses.  
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

**Inhalation:** Remove victim to fresh air.  
If irritation persists, seek medical attention.

**Ingestion:** Do not induce vomiting, seek medical attention.  
Dilute with two glasses of water.  
Never give anything by mouth to an unconscious person.

**Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE**

**Leak/Spill:** Contain the spill.  
Prevent entry into drains, sewers, and other waterways.  
Wear appropriate protective equipment.  
Small amounts may be flushed to sewer with water.  
Soak up with an absorbent material.  
Place in appropriate container for disposal.  
Notify the appropriate authorities as required.

**Waste disposal:** In accordance with local and federal regulations.

**Handling procedures and equipment:** Protect against physical damage.  
Avoid breathing vapors/mists.  
Wear personal protective equipment appropriate to task.

Wash thoroughly after handling.  
Keep out of reach of children.  
Avoid contact with skin, eyes and clothing.  
Avoid extreme temperatures.  
Launder contaminated clothing prior to reuse.

**Storage requirements:** Store away from incompatible materials.  
Keep containers closed when not in use.

<b>Section 8 : CONTROL MEASURES</b>
-------------------------------------

**Precautionary Measures**

**Gloves/Type:**



Wear appropriate gloves.

**Respiratory/Type:** None required under normal use.

**Eye/Type:**



Safety glasses recommended.

**Footwear/Type:** Safety shoes per local regulations.

**Clothing/Type:** As required to prevent skin contact.

**Other/Type:** Eye wash facility should be in close proximity.  
Emergency shower should be in close proximity.

**Ventilation requirements:** Local exhaust at points of emission.

**Appendix D**  
**Confined Space Entry Permit**



## CONFINED SPACE ENTRY PERMIT

**This permit (or a copy) shall be posted, when completed, at the entrance to the confined space before authorized entrants are allowed to enter. This permit is revoked if conditions in the confined space change and are no longer acceptable under the guidelines of this permit.**

Date of issue: \_\_\_\_\_ Expiration Date: \_\_\_\_\_

Entry time: \_\_\_\_\_ Expiration Time: \_\_\_\_\_

Location of Space: \_\_\_\_\_

Description of Space: \_\_\_\_\_

Purpose of Entry: \_\_\_\_\_

Attendant(s): \_\_\_\_\_

Authorized Entrant(s): \_\_\_\_\_

HAZARD ASSESSMENT	YES	NO	HAZARD ASSESSMENT	YES	NO
Oxygen deficiency (<19.5%)			Materials harmful to the skin		
Combustible gases (>10% of LEL)			Noise		
H <sub>2</sub> S (>10 ppm)			Asbestos		
CO (>25 ppm)			Electrical shock		
Other chemicals - List:			Heat stress		
List:			Darkness		

SAFETY EQUIPMENT	YES	NO	PERSONAL PROTECTIVE EQUIP.	YES	NO
Lockout/tagout			Self-contained Breathing Apparatus		
Pipe lines capped/blanked/purged, flushed			Airline Supplied Respirator w/escape		
Mechanical ventilation			Air Purifying Respirator - Type:		
Area secure and signs posted			Five-minute escape air bottles		
Retrieval system/tripod			Safety glasses and goggles		
Communication equipment			Hard Hat		
Monitoring instr. - Type:			Chemical resistant clothing - Type:		
Fire extinguisher - Type:			Protective boots and/or gloves		
Ground fault circuit interrupter			Hearing protection - Type:		
Lighting			Tripod, winch, body harness, and life line		
Other permits - Type:			Other:		

Tests to be performed:

	TIME: _____	TIME: _____	TIME: _____	TIME: _____	TIME: _____	TIME: _____
OXYGEN						
FLAMMABILITY						
H <sub>2</sub> S						
CO						
OTHER						

Sampling Equipment:

Type	Model	Serial	Calibration (Yes/No)

Signature of person who conducted testing: \_\_\_\_\_

Entry Supervisor (Print Name)	Signature	Date	Time
-------------------------------	-----------	------	------

Rescue and Emergency Services Phone Number: \_\_\_\_\_

## INSTRUCTIONS FOR USE OF THIS PERMIT

This permit is used to control entry and work in a permit-required confined space. This permit is initiated by the entry supervisor and all information must be completed and all requirements must be checked off as a “yes” on the permit, or if “no” is checked it must have an explanation or an “N/A” placed in the box.

A copy of this completed permit must be posted at the confined space before any person is allowed entry.

This permit is good only for the following:

- confined space identified
- period given
- operation(s) (purpose of entry) listed

If any of the operations within the confined space will generate flames, sparks, or heat, a Hot Work Permit must be completed and posted at the confined space along with this permit.

A copy of this completed permit must be returned to the office SHE Coordinator by the entry supervisor. A copy of this permit will be filed for a period of at least 1 year.

If the entry supervisor terminates the entry for any reason, this permit will be removed from the posted area.

The FM must ensure that all persons involved with the entry have received the prerequisite training before entry into the confined space is allowed.

The entry supervisor or the SHSC shall ensure that all required testing instruments are calibrated and working, that all communication devices are working, and all emergency equipment is available and in good condition.

**NOTE: An entry is defined as any time a person’s face or other body part breaks the plane of the entrance to the confined space.**

At the end of the entry, a copy of the permit shall be submitted to the regional SHE Manager to assist in program review.

**APPENDIX B**  
**SITE HEALTH AND SAFETY PLAN**

# Amec Foster Wheeler Environment & Infrastructure Truax Field Air National Guard Base Short Form HASP



Site: Truax Field Air National Guard Base Job #/Task # \_\_\_\_\_

Street Address: 2400 Wright St, Madison, WI 53704 (approximate location of site)

Proposed Date(s) of Investigation: July 2017

Prepared by: Reid Crawford Date: 04/25/17

\*Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

Site Description: **(attach map)** Airport - Building, Hangars, Aircraft Apron

Comments: Ensure all vehicles have overhead yellow flashing light

\*Approval also serves as certification of a Hazard Assessment as required by 29 CFR 1910.132

## Tasks:

AMEC	Other contractor	Task Description
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Drilling
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Temporary Monitoring Well Installation
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Soil Sampling
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Groundwater Sampling

## Dates of Required Training and Medical Surveillance (add additional training topics, as required):

Name					
<b>Job duties:</b>	<b>Field Manager, HSE</b>	<b>Field</b>	<b>Field</b>	<b>Field</b>	
<b>Names:</b>	<b>Lauren Bugdalski</b>	<b>Jeremiah Morse</b>	<b>Reid Crawford</b>	<b>Kurt Cunningham</b>	
	<b>Dates</b>	<b>Dates</b>	<b>Dates</b>	<b>Dates</b>	<b>Dates</b>
<b>Medical Surveillance</b>	6/28/16				
<b>-Exam Type (A<sup>4</sup>, B, C)</b>	B	B	B	C	
<b>40-Hour Initial</b>	7/11/13	7/22/09	7/10/15	5/24/91	
<b>8-Hour Supervisor <sup>3</sup></b>	2/7/14	8/19/88		5/25/91	
<b>8-Hour Refresher</b>	2/27/17	8/17/16	2/27/17		
<b>First Aid</b>	11/2/15	1/21/16	3/22/17	3/23/16	
<b>CPR</b>	11/2/15	1/21/16	3/22/17	3/23/16	
<b>Hazard Communication</b>	11/22/15	9/30/15	9/27/16		

<sup>2</sup> At least one worker must be trained in First Aid/CPR

<sup>3</sup> Required for Site Manager and Site Health and Safety Officer

<sup>4</sup> **Medical Surveillance Exam A has no respiratory clearance so can only be used for Level D PPE.** Exam A (basic HAZWOPER), Exam B (respirator & HAZWOPER under 40 years old), Exam C (respirator & HAZWOPER over 40 years old), Exam E (DOT), Exam F (asbestos monitoring), Exam G (lead monitoring) etc. **Contact HSE Coordinator or Cindy Sundquist to determine type of exam employee received.**

## Known or Suspected Contaminants (include PELs/TLVs):

Contaminants of Concern (COC) (Attach Fact Sheets*)	Maximum Concentrations		PEL/TLV
	Soil (mg/kg)	Water/Groundwater (µg/l)	
Perfluorinated Compounds	Unknown	Unknown	Unknown

\*Workers must be made aware of the signs, symptoms, and first aid for each COC. Information is located on the COC fact sheets.

## Air Monitoring Action Levels:



**Amec Foster Wheeler Environment & Infrastructure  
Truax Field Air National Guard Base Short Form HASP**



PID/FID Reading <sup>1</sup>	Detector Tube <sup>1</sup>	Dust Meter <sup>1</sup>	LEL <sup>2</sup> /O <sub>2</sub> <sup>1</sup>	Action
NONE				
			>10% LEL	Stop work. Evacuate area. Consider return with ventilation system and spark proof/intrinsically safe equipment.
			<19.5% O <sub>2</sub>	Stop work and evacuate area.

<sup>1</sup> Sustained readings measured in the breathing zone

<sup>2</sup> Readings at measured at the source (borehole, well, etc.)

**AHAs: Check and attach all that apply (add applicable AHAs not already listed):**

**Activity Specific AHAs:**

<input checked="" type="checkbox"/>	Mobilization/Demobilization and Site Preparation
<input checked="" type="checkbox"/>	Field Work - General
<input checked="" type="checkbox"/>	Field Work - Oversight
<input checked="" type="checkbox"/>	Decontamination
<input checked="" type="checkbox"/>	Utility Clearance Activities
<input checked="" type="checkbox"/>	Groundwater Sampling
<input checked="" type="checkbox"/>	Soil Sampling
<input type="checkbox"/>	Drilling Operation (Amec Foster Wheeler Driller)
<input type="checkbox"/>	Geoprobe (Amec Foster Wheeler Geoprobe Operator)
<input type="checkbox"/>	Excavations and Backfilling
<input type="checkbox"/>	Stream/Wetlands Work

**Hazard Specific AHAs:**

<input checked="" type="checkbox"/>	Insect Stings and Bites
<input type="checkbox"/>	Gasoline
<input type="checkbox"/>	Working with Preservatives (Acids)
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	

AHA's located in Attachment G of FY16 Phase I Regional Site Inspections for Perfluorinated Compounds QAPP

**HAZARD IDENTIFICATION SUMMARY**

Complete the checklist for summarizing the hazards identified in the JHAs

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input checked="" type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/aerosols/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> O <sub>2</sub> deficient	<input type="checkbox"/> Metals	<input type="checkbox"/> Asbestos
Chemical Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles/Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Cold Stress	<input checked="" type="checkbox"/> Heat Stress	<input checked="" type="checkbox"/> Wet location	<input checked="" type="checkbox"/> Bio hazards (snakes, insects, spiders, poisonous plants, etc.)		
<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	<input checked="" type="checkbox"/> Working near water			

**Amec Foster Wheeler Environment & Infrastructure  
Truax Field Air National Guard Base Short Form HASP**



Electrical Hazards				
<input type="checkbox"/> None	<input type="checkbox"/> Energized equipment or circuits	<input checked="" type="checkbox"/> Overhead utilities	<input checked="" type="checkbox"/> Underground utilities	<input type="checkbox"/> Wet location
Fire Hazards				
<input type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location	
Ergonomic Hazards				
<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion
Computer Use in the:		<input checked="" type="checkbox"/> Office	<input checked="" type="checkbox"/> Field	<input type="checkbox"/> _____
Radiological Hazards				
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron
		<input type="checkbox"/> Radon	<input type="checkbox"/> Non-Ionizing	
Other Hazards				
<input checked="" type="checkbox"/> Working in Airport property and DoD property – Ensure to comply with site restrictions				

**PPE and Monitoring Instruments**

Initial Level of PPE *			
<input checked="" type="checkbox"/> Level D	<input type="checkbox"/> Modified Level D	<input type="checkbox"/> Level C	* Cannot use Short Form HASP for Level B or A or Confined Space Entry work
Standard PPE			
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety boots	<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Chem. Resistant Boots
		<input checked="" type="checkbox"/> High visibility vest	<input type="checkbox"/> Other: _____
Eye and Face Protection			
<input type="checkbox"/> Face shield	<input type="checkbox"/> Vented goggles	<input type="checkbox"/> Unvented goggles	<input type="checkbox"/> Indirect vented goggles
Hearing Protection			
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____
Respiratory Protection			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust mask	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR
		Cartridge Type: _____	Change Cartridges: _____
Protective Clothing			
<input type="checkbox"/> Work uniform	<input type="checkbox"/> White uncoated Tyvek®	<input type="checkbox"/> Poly-coated Tyvek®	<input type="checkbox"/> Saranex®
<input type="checkbox"/> Boot covers	<input checked="" type="checkbox"/> Reflective vest	<input type="checkbox"/> Chaps or Snake Legs	<input checked="" type="checkbox"/> Other NO GORE-TEX____
Hand Protection			
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Glove liners
		<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Outer Gloves: List Type _____ Nitrile _____		<input type="checkbox"/> Inner Gloves: List Type _____	

# Amec Foster Wheeler Environment & Infrastructure Truax Field Air National Guard Base Short Form HASP



<b>Monitoring Instruments Required*</b>			
Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows: <ul style="list-style-type: none"> <li>▪ When work begins on a different portion of the site.</li> <li>▪ When contaminants other than those previously identified are being handled.</li> <li>▪ When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.)</li> <li>▪ When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon.)</li> </ul>			
<input type="checkbox"/> LEL/O2 Meter	<input checked="" type="checkbox"/> PID: <input checked="" type="checkbox"/> 10.0-10.6 eV Lamp <input type="checkbox"/> 11.7 eV Lamp	<input type="checkbox"/> FID	<input type="checkbox"/> Hydrogen Sulfide/Carbon Monoxide
<input type="checkbox"/> Dräger Pump (or equivalent) List Tubes _____	<input type="checkbox"/> Dust Meter: <input type="checkbox"/> Respirable dust <input type="checkbox"/> Total dust	<input type="checkbox"/> Other _____	

\*Monitoring instruments will be calibrated daily in accordance with manufacturer's instructions. Results will be recorded in the field logbook.

### Chemicals Brought to the Site:

List all chemicals brought to the site (e.g., preservatives, decon solutions, calibration gases, gasoline, etc.).

Chemicals (Note: Name listed must match name on label and MSDS)	MSDS Attached?
NONE	<input type="checkbox"/>
	<input type="checkbox"/>
	<input type="checkbox"/>
	<input type="checkbox"/>
	<input type="checkbox"/>

Chemicals will be kept in their original containers. If transferred to another container, aside from days use by one individual, the new container will be clearly labeled with the name of the chemical (product identifier), signal word, hazard statement, pictogram(s), precautionary statement, and name, address and telephone number of the chemical manufacturer, importer or other responsible party.

### Work Zones:

The work zones will be defined relative to the location of the work activity. The Exclusion Zone is considered the area within a 10-foot diameter of the sampling location. The Contamination Reduction Zone is considered to be the area within a 20-foot diameter of the sampling location. The Decontamination Zone is to be located upwind of the work area. Work zones will be maintained through the use of:

- Warning Tape
- Cones and Barriers
- Visual Observations

### Decontamination Procedures and Equipment:

Note: See Decontamination JHA for further information

#### Level D Decontamination Procedures

Decontamination Solution:	Detergent and Water
Station 1: Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2: Outer Boots, and Gloves Wash and Rinse (if worn)	Scrub outer boots, and outer gloves decon solution or detergent water. Rinse off using copious amounts of water.

# Amec Foster Wheeler Environment & Infrastructure Truax Field Air National Guard Base Short Form HASP



- Station 3: Outer Boot and Glove Removal (if worn)      Remove outer boots and gloves. Deposit in plastic bag.
- Station 4: Inner glove removal      Remove inner gloves and place in plastic bag.
- Station 5: Field Wash      Hands and face are thoroughly washed. Shower as soon as possible.

### Modified Level D and Level C PPE Decontamination Procedures

- Decontamination Solution:      Detergent and Water
- Station 1: Equipment Drop      Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
- Station 2: Outer Garment, Boots, and Gloves Wash and Rinse      Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
- Station 3: Outer Boot and Glove Removal      Remove outer boots and gloves. Deposit in container with plastic liner.
- Station 4: Canister or Mask (Level C only) Change      If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers are donned, joints are taped, and worker returns to duty.
- Station 5: Boot, Gloves and Outer Garment Removal      Boots, chemical resistant splash suit, and inner gloves are removed and deposited in separate containers lined with plastic.
- Station 6: Face Piece Removal (Level C only)      Facepiece is removed. Avoid touching face with fingers. Facepiece is deposited on plastic sheet.
- Station 7: Field Wash      Hands and face are thoroughly washed. Shower as soon as possible.

### Site Communication:

- Verbal
- Two-way radio
- Cellular telephone
- Hand signals
  - Hand gripping throat \_\_\_\_\_ Out of air, can't breathe
  - Grip partner's wrist or both hands around waist \_\_\_\_\_ Leave area immediately
  - Hands on top of head \_\_\_\_\_ Need assistance
  - Thumbs up \_\_\_\_\_ OK, I am all right, I understand
  - Thumbs down \_\_\_\_\_ No, negative
- Horn
- Siren
- Other:



**EMERGENCY CONTACTS**

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
	Office	Cell	
Fire Department:	911		
Hospital: UW Health Rehabilitation Hospital 5115 N Biltmore Ln, Madison, WI 53718	(608) 592-8100		
WorkCare (Early case management)	1-888-449-7787		
Police Department:	911		
	Office	Cell	
Site Health And Safety Officer: Rich Pletz	309-692-4422	309-253-4578	
Client Contact:			
Regional Lead: Tom Kaugher	248-313-3694	248-996-2447	
Base Lead Chris Kapanowski	248-313-3697	734-341-7318	
*Eastern Group HSE Manager: Cindy Sundquist	207-828-3309	207-650-7593 (Cell) 207-892-4402 (Home)	
Corporate VP of HSE – Vlad Ivensky	610-877-6144	484-919-5175 (Cell) 215-947-0393 (Home)	
EPA/DEP (if applicable):			
OTHER: Ambulance	911		

\*See Incident Flow Chart for additional Group HSE Manager's Contact Information

**Emergency Equipment:**

The following emergency response equipment is required for this project and shall be readily available:

- Field First Aid Kit (including bloodborne pathogen kit/supplies)
- Fire Extinguisher (ABC type)
- Eyewash (Note: 15 minutes of free-flowing fresh water)
- Other: \_\_\_\_\_

**EMERGENCY PROCEDURES**

- The SHSO (or alternate) should be immediately notified via the on-site communication system. The HSO assumes control of the emergency response.



- The SHSO notifies the Project Manager and client contact of the emergency.
- If the emergency involves an injury to an AMEC employee, the HSE Coordinator or Site Manager are to implement the AMEC Early Injury Case Management program. See procedures and Flow Diagram below:
- If applicable, the SHSO shall notify off-site emergency responders (e.g. fire department, hospital, police department, etc.) and shall inform the response team as to the nature and location of the emergency on-site.
- If applicable, the SHSO evacuates the site. Site workers should move to the predetermined evacuation point (See Site Map).
- For small fires, flames should be extinguished using the fire extinguisher. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE, including SCBAs (if available), should be donned. If appropriate PPE is unavailable, site workers should evacuate and call in emergency personnel.
- For chemical spills, follow the job specific JHA for spill containment
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash and wash affected area. Site worker should shower as soon as possible after incident.
- If the emergency involves toxic gases, workers will back off and reassess. Prior to re-entering the work zone, the area must be determined to be safe. Entry will be using Level B PPE and utilize appropriate monitoring equipment to verify that the site is safe.
- An injured worker shall be decontaminated appropriately.
- Within 24 hours after any emergency response, the Incident Analysis Report (and Vehicle Incident Report if vehicle incident) shall be completed and returned to the Group HSE Manager. Injuries requiring medical treatment beyond first aid (as well as work-related vehicle incidents) will require the employee to submit a post incident drug test.

**AMEC Early Injury Case Management Program**

<b>NON-EMERGENCY INCIDENT</b>	<b>EMERGENCY INCIDENT</b>
<p>Steps 1 &amp; 2 must be completed before seeking medical attention other than local first aid.</p> <ol style="list-style-type: none"> <li>1. Provide first-aid as necessary. Report the situation to your immediate supervisor AND HSE coordinator (all incidents with the apparent starting event should be reported within 1 hour of occurrence).</li> <li>2. Injured employee:</li> </ol>	<ol style="list-style-type: none"> <li>1. Provide emergency first aid. Supervisor on duty must immediately call 911 or local emergency number; no employee may respond to outside queries without prior authorization. Any outside media calls concerning this incident must be referred immediately to Lauren Gallagher at 602-757-3211.</li> <li>2. Once medical attention is sought and provided, the supervisor must:</li> </ol>
<p><b>Call WorkCare 24/7 Hotline*</b>  <b>(888) 11-XPRTS or (888) 449-7787</b></p>	
<p>WorkCare will assess the situation and determine whether the incident requires further medical attention. During this process, WorkCare will perform the following:</p> <ul style="list-style-type: none"> <li>• Explain the process to the caller.</li> <li>• Determine the nature of the concern.</li> </ul>	<p>WorkCare will be responsible for performing the following:</p> <ul style="list-style-type: none"> <li>• Contact the treating physician.</li> </ul>

**Amec Foster Wheeler Environment & Infrastructure  
Truax Field Air National Guard Base Short Form HASP**



<ul style="list-style-type: none"> <li>• Provide appropriate medical advice to the caller.</li> <li>• Determine appropriate path forward with the caller.</li> <li>• Maintain appropriate medical confidentiality.</li> <li>• Help caller to execute path forward, including referral to the appropriate local medical facility.</li> <li>• Send an email notification to the Corporate HSE Department.</li> </ul>	<ul style="list-style-type: none"> <li>• Request copies of all medical records from clinic.</li> <li>• Send an email update to the Corporate HSE Department.</li> </ul>
<ol style="list-style-type: none"> <li>3. IMMEDIATELY after contacting WorkCare send a brief email notification AND inform verbally (direct contact is required) ONE of HSE corporate representatives See Figure 11.3.</li> <li>4. Make all other local notifications and client notifications.</li> <li>5. Local Supervisor, HSE Coordinator, SSHO and any applicable safety committees to complete preliminary investigation, along with the initial Incident Report within 24 hours.</li> <li>6. Corporate Loss Prevention Manager to complete Worker's Compensation Insurance notifications as needed.</li> <li>7. Corporate HSE to conduct further incident notifications, investigation, include in statistics, classify, and develop lessons learned materials.</li> </ol> <p><b>* - NOTE: Step 2 is only applicable to the North-American operations and to incidents involving AMEC personnel. High potential near misses, subcontractors' incidents, regulatory inspections, spills and property damages above \$1,000 should be reported immediately, following directions from Step 3.</b></p>	

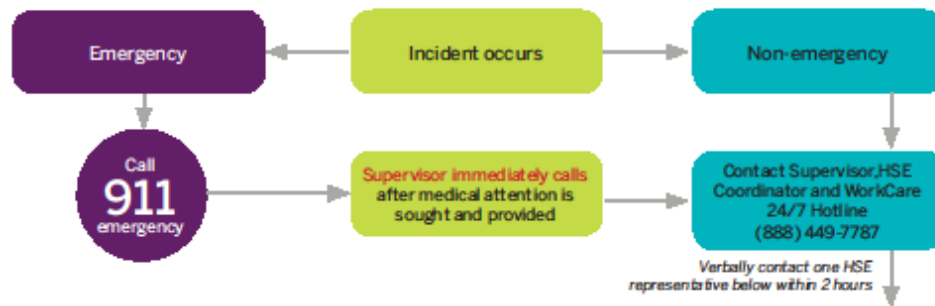
**Site Specific Procedures are as follows:**

NONE

INCIDENT FLOW CHART

# Incident flow chart

Call immediately



E&I Corporate HSE department contact list

Name/email	Office location	Contact information
Bruce Voss bruce.voss@amecfw.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@amecfw.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@amecfw.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Gabe Sandholm gabe.sandholm@amec.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
John Mazur john.mazur@amec.com	Wilmington, NC	910.444.2978 (office) 910.431.2330 (cell) 910.681.0538 (home)
Lori Dowling lori.dowling@amec.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@amec.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@amec.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivenky@amec.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@amec.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)

\*High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage should be reported within 60 minutes to one of the above HSE Representatives.  
 WITHIN 24 HOURS - Local Supervisor, HSE Coordinator, Project HSE Officer, and any applicable safety committees must complete preliminary investigation, along with the initial Incident Analysis Report Form and forward it to the Corporate HSE Department





**Amec Foster Wheeler Environment & Infrastructure  
Truax Field Air National Guard Base Short Form HASP**



**FIELD TEAM REVIEW:** I acknowledge that I understand the requirements of this HASP, and agree to abide by the procedures and limitations specified herein. I also acknowledge that I have been given an opportunity to have my questions regarding the HASP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my field activities at this site are current and will not expire during on-site activities.

Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____
Name: _____	Date: _____

# Amec Foster Wheeler Environment & Infrastructure Truax Field Air National Guard Base Short Form HASP



## Routes to Emergency Medical Facilities

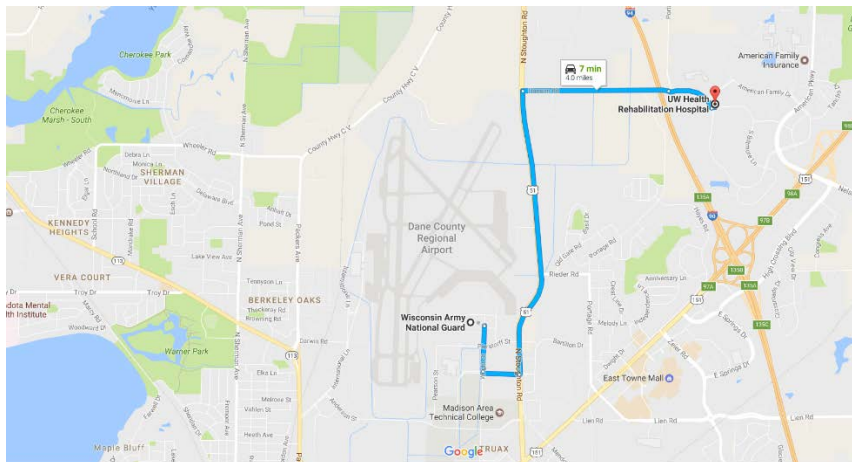
### HOSPITAL(for immediate emergency treatment):

Facility Name: UW Health Rehabilitation Hospital 5115 N Biltmore Ln, Madison, WI 53718

Address: 5115 N Biltmore Ln, Madison, WI 53718

Telephone Number: (608) 592-8100

### DIRECTIONS TO PRIMARY HOSPITAL (attach map):



#### Wisconsin Army National Guard

Dane County Regional Airport, 2400 Wright St, Madison, WI 53704

- ↑ 1. Head south on Wright St toward Mitchell St
- ↶ 2. Turn left onto Kinsman Blvd
- ↶ 3. Turn left onto US-51 N/N Stoughton Rd
- ↷ 4. Turn right onto Hanson Rd
- ⦿ 5. At the traffic circle, take the 1st exit onto Eastpark Blvd
- ↶ 6. Turn left onto N Biltmore Ln  
📍 Destination will be on the left

#### UW Health Rehabilitation Hospital

5115 N Biltmore Ln, Madison, WI 53718

### CLINIC (for non-emergency medical treatment)

Facility Name: Same as Hospital

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

# Tailgate Safety Meeting Report



Check One:

- Initial Kickoff Safety Meeting    Regular/Daily Tailgate Safety Meeting    Unscheduled Tailgate Safety Meeting

Date: \_\_\_\_\_ Site: \_\_\_\_\_

Site Manager: \_\_\_\_\_ Site Health and Safety Officer: \_\_\_\_\_  
*Print* *Print*

**Planned Activities:** \_\_\_\_\_

## Order of Business

*Topics Discussed (Check all that apply)*

- |  |   |
|--|---|
| <input type="checkbox"/> Scope of Work   | <input type="checkbox"/> Decontamination Procedures for Personnel and Equipment   |
| <input type="checkbox"/> Site History/Site Layout  | <input type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)   |
| <input type="checkbox"/> Personnel Responsibilities  | <input type="checkbox"/> Anticipated Weather (snow, high winds, rain)   |
| <input type="checkbox"/> Training Requirements   | <input type="checkbox"/> Temperature Extremes (heat or cold stress symptoms and controls)   |
| <input type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazard effects) | <input type="checkbox"/> Biological Hazards and Controls (e.g., poison ivy, spiders)  |
| <input type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)                        | <input type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)                                  |
| <input type="checkbox"/> Safe Work Practices   | <input type="checkbox"/> Sanitation and Illumination  |
| <input type="checkbox"/> Engineering Controls  | <input type="checkbox"/> Logs, Reports, Recordkeeping   |
| <input type="checkbox"/> Chemical Hazards and Controls   | <input type="checkbox"/> Incident Reporting Procedures  |
| <input type="checkbox"/> Signs and symptoms of over exposure to site chemicals   | <input type="checkbox"/> Near Misses/Hazard ID including worker suggestions to correct and work practices to avoid similar occurrences      |
| <input type="checkbox"/> Medical Surveillance Requirements   | <input type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)                        |
| <input type="checkbox"/> Action Levels   | <input type="checkbox"/> General Emergency Response Procedures (e.g., earthquake response, typhoon response, etc.)                          |
| <input type="checkbox"/> Monitoring Instruments and Personal Monitoring  | <input type="checkbox"/> Medical Emergency Procedures (e.g., exposure control precautions, location of first aid kits, etc.)                |
| <input type="checkbox"/> Perimeter Monitoring, Type and Frequency  | <input type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines   |
| <input type="checkbox"/> PPE Required/PPE Used   | <input type="checkbox"/> Site/Regional Emergency Response Procedures (e.g., exposure control precautions, location of first aid kits, etc.) |
| <input type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures  | <input type="checkbox"/> Hazardous Materials Spill Procedures   |

PPE required for the tasks to be conducted: \_\_\_\_\_

Required Permits: \_\_\_\_\_

Site Access or other issues: \_\_\_\_\_



## PPE Selection Guidelines

### When selecting the appropriate PPE for the job, consider the following:

- **Safety glasses** – general eye protection – source of hazard, typically coming from straight on, required at most sites
- **Tinted Safety Glasses** – same as above, but when working in direct sunlight. May need two both tinted and untinted if working in both sunlight and shade/overcast skies.
- **Safety goggles** – needed for splash hazard, more severe eye exposures coming from all directions. Non-vented or indirect venting for chemical splash, non-vented for hazardous gases or very fine dust, vented for larger particulates coming from all directions.
- **Face shield** – needed to protect face from cuts, burns, chemicals (corrosives or chemicals with skin notation), etc.
- **Safety boots** – needed if danger of items being dropped on foot that could injure foot
- **Hard hat** – danger from items falling on head or bumping head against objects – any overhead work, tools, equipment, etc. that is above the head and could fall on head of item fails, or falls off work platform. Any work around low hanging equipment or structures. Typically required at most sites as a general PPE
- **Thin, chemical protective inner gloves** (e.g., thin Nitrile, PVC – do not use latex – many people are allergic to latex) – needed to protect hands from incidental contact with low risk contamination at very low concentrations (ppb or low ppm concentrations in groundwater or soil) or used in combination with outer gloves as a last defense against contamination. Need to specify type
- **Outer gloves** – thicker gloves (e.g., Nitrile, Butyl, Viton, etc.) – used when potential for high concentrations of contaminants (e.g., floating product, percent ranges of contaminant, opening drums, handling pure undiluted chemicals, etc.). Need to specify type.
- **Leather gloves, leather palm, cotton** – good in protecting hands against cuts – no protection from chemicals. May be used in combination with chemical protective gloves.
- **Boot Covers** – when there is contamination in surface soils or working surface in general. When safety boots need protection from contact with contaminants.
- **White (uncoated) Tyveks** – protect clothing from getting dirty, good for protection against solid, non-volatile chemicals (e.g., asbestos, metals) – no chemical protection.
- **Polycoated Tyveks** – least protective of chemical protective clothing. Used when some risk of contamination getting on skin or clothing. Usually, lower ppm ranges of contaminants.
- **Saranex** – Greater protection against contamination than Polycoated Tyveks. Used to protect against PCBs or higher concentrations of contaminants in the soil or groundwater.
- **Other Chemical protective clothing** – if significant risk of dermal exposure, contact H&S to determine best kind.
- **Long sleeved shirts, long pants** – if working in areas with poison ivy/oak/sumac, poisonous insects, etc. and no chemicals exposure. May want to use uncoated Tyveks for work in areas where poisonous plants are known to be to protect clothing.
- **Cartridge Respirator (Level C PPE)** – Need to calculate change schedule (contact Division EH&S Manager for this) to determine length of use. To be able to use cartridge respirators, need to know contaminants, estimate levels to be encountered in the breathing zone, need to ensure that cartridge will be effective against COCs, and need to be able to monitor for COCs using PID, FID, Dräger tubes, etc. If can't do any of these, then Level B PPE is probably going to be needed.
- **High Visibility Vest** – needed for any road work (within 15 feet of a road) or when working on a site with vehicular traffic or working around heavy equipment. Needed if work tasks would take employee concentration away from movement of vehicles and workers would have to rely on the other driver's ability to see the employee in order not to hit them. This includes heavy equipment as well as cars and trucks, on public roads or the jobsite. Not needed if wearing Polycoated Tyveks – as they are already high visibility.
- **Reflective Vest** – see above, but for use at night.
- **Hearing Protection** – needed if working at noise levels above 85 dBA on a time weighted average. If noise measurements are not available, use around noisy equipment, or in general, if you have to raise your voice to be heard when talking to someone standing two feet away.
- **Protective Chaps** – required when using a machete or chain saw or any other cut hazard to legs.

## **Incident Report Forms**



**Check one**

Initial Report:   
Update:   
Final Report:  \_\_\_\_

# INCIDENT ANALYSIS REPORT (IAR)

Amec Foster Wheeler E&I  
Confidential - Privileged

**Incident Potential Severity**

Letter: Select One  
Number: Select One  
Investigation Level: Select One  
[Severity Matrix \(LINK\)](#)

Group: Select One Group HSE Manager: \_\_\_\_ Incident Review Panel Team (if applicable): \_\_\_\_

Incident Date: \_\_\_\_ Report Date: \_\_\_\_

## Section 1 – General Information

Employee Name: \_\_\_\_ Sex:  M  F Date of Birth: \_\_\_\_ Age Range: Select One

Job Position: Select One Hire Date: \_\_\_\_ Time employee began work: \_\_\_\_ Time of incident: \_\_\_\_  am |  pm

Business Line: Select One Department Number: \_\_\_\_ Project Manager: \_\_\_\_

Project Name: \_\_\_\_ Project Number: \_\_\_\_ Client: \_\_\_\_

Office where employee works from: \_\_\_\_ Immediate Supervisor: \_\_\_\_ Hours employee worked during last 7 days: \_\_\_\_ hrs

Location: Select One Is this a Company controlled work site:  Yes  No Incident Assigned to: Select One

Location description: \_\_\_\_

## Section 2 – Incident Type - Process (mark at least ONE BOLD TYPE and all that apply)

- Fatality**       **Environmental**       **Injury/Illness Incident**      If Injury/illness: Select One
- Security**       **Near Miss/Hazard ID(HiPo)**  **Property Damage**      If Damage: Select One       3<sup>rd</sup> Party?
- Hospitalization       **Regulatory Inspection**       **Notice of Violation or Citation**       Agency Reportable
- Motor Vehicle Incident Involving Injury       Other (describe): \_\_\_\_

Outcome/Result: Select One If “other”, specify: \_\_\_\_ Source of Hazard: Select One If “other”, specify: \_\_\_\_

Immediate Cause: Select One

A. If **injury/illness**: Indicate the part of the body: Select One If “other”, specify: \_\_\_\_

Indicate body part location: Select One If “other”, specify: \_\_\_\_

Injury Type: Select One If “other” specify: \_\_\_\_ Illness Type: Select One If “other”, specify: \_\_\_\_

Bleeding? Select One If yes, “First Aider” name: \_\_\_\_  Contact with blood/infectious material? Select One

Exposure Control Precautions taken by First Aider (check all that apply):

- None (If none, contact WorkCare)       Gloves       Previous HBV Immunization
- Immediate Personal Hygiene       One-way CPR valve       Recommended for HBV Immunization
- Eye protection       Face mask       Other (describe): \_\_\_\_

Blood contaminated work area / surface? If contaminated, describe cleanup/disposal: \_\_\_\_

Medical treatment provided (i.e. prescriptions, referrals, etc.). If medical treatment, describe: \_\_\_\_

Physical limitations received from physician? If limitations, describe: \_\_\_\_  Modified Work Offer provided.

Second medical opinion? If second opinion, describe: \_\_\_\_

Workers Compensation claim filed? If filed, claim number: \_\_\_\_

B. If **property damage**: describe what happened and estimate (\$) of damage to all objects involved? \_\_\_\_

C. If **environmental**: Type of Environmental incident?: Select One Name, CAS#, physical state and quantity? \_\_\_\_

Receiving Environment?: Select One Mechanism of Incident?: Select One If “other”, specify: \_\_\_\_

Nature of Breach?: Select One Duration of Breach?: Select One

D. If **security**: Security Incident Type: Select One If Physical: Select One If Criminal: Select One If Intellectual: Select One

E. If an **inspection by a regulatory agency**, what agency, who were the inspectors, inspector contact information? \_\_\_\_

### Section 3 – Incident Description

**Attach and number additional pages, as needed, to ensure all details related to the incident are captured.**

- A. List the names of all persons involved in the incident, and employer information: \_\_\_\_
- B. List the names of any witnesses, their employer, and a local/company telephone number or address: \_\_\_\_
- C. Name of Employee's supervisor: \_\_\_\_ Contact phone number for supervisor: \_\_\_\_
- D. What specific job/task or action was the employee(s) doing just prior to the incident: \_\_\_\_
- E. Was a tool or equipment involved?  Yes  No What was it: \_\_\_\_ Last Inspection Date: \_\_\_\_ Defects: \_\_\_\_
- F. Explain in **detail** what happened: \_\_\_\_
- G. Explain in **detail** what object or substance directly harmed the employee: \_\_\_\_
- H. What were the weather conditions at time of incident?: \_\_\_\_
- I. What was the lighting like at time of incident? Bright  Shadows  Dark  Other: \_\_\_\_
- J. List any damaged equipment or property (other than motor vehicles). Provide model and serial number **and** estimated costs to repair/replace damaged equipment or property, if applicable: \_\_\_\_

### Section 4 - Incident Analysis

- A. Was a Health and Safety Plan (HASP) or Activity Hazard Analysis (AHA) completed for the work being performed?  Yes  No  
If "yes", Who prepared the document?: \_\_\_\_
- B. Who and when was the last manager (Project, Unit, etc.) at the site of the incident?: \_\_\_\_
- C. When and what safety training **directly related** to the incident has the person(s) involved had?: \_\_\_\_
- D. List attached documentation (HASP acknowledgement forms, kickoff/daily/weekly meetings, inspections, photographs): \_\_\_\_

### Section 5 - Incident Investigation Results and Corrective Actions

This section to be completed by the Group HSE Manager/IRP with support from location where incident occurred, in accordance with [A-Z List of Accident Causes](#) and [Glossary of A-Z Causes](#) (click links).

<b>Causal Factors (Acts or Omissions / Conditions)</b>			
(Attach and number any additional pages as needed to completely address this section)			
	<u>IMMEDIATE CAUSE</u>	<u>IMMEDIATE CAUSE SUB-TYPE</u>	<u>DESCRIPTION</u>
1	Select One	_____	_____
2	Select One	_____	_____
3	Select One	_____	_____
4	Select One	_____	_____
<b>Root Cause(s) Analysis</b> - The below items represents major root cause categories which have been determined to be Less Than Adequate (LTA). A more detailed determination of the root cause will be facilitated, if needed, by the applicable Group HSE Manager / IRP.			
	<u>ROOT CAUSE TYPE</u>	<u>ROOT CAUSE SUB-TYPE</u>	<u>DESCRIPTION</u>



1	Select One	_____	_____
2	Select One	_____	_____
3	Select One	_____	_____
4	Select One	_____	_____

**Amec Foster Wheeler Safety Rules and Safety Essentials**

<b>Safety Rules</b> Select all applicable breaches of rules or <input type="checkbox"/> None		<b>Safety Essentials</b> Select all applicable breaches of behavioral expectations or <input type="checkbox"/> None	
<input type="checkbox"/> Permit to Work <input type="checkbox"/> Ground Disturbance <input type="checkbox"/> Driving <input type="checkbox"/> Confined Spaces <input type="checkbox"/> Working At Height	<input type="checkbox"/> Lifting Operations <input type="checkbox"/> Energy Isolations <input type="checkbox"/> Pressure Testing <input type="checkbox"/> Plant and Equipment <input type="checkbox"/> Housekeeping	<input type="checkbox"/> Always Take Care <input type="checkbox"/> Follow the Rules <input type="checkbox"/> Do a Risk Assessment	<input type="checkbox"/> You Must Intervene <input type="checkbox"/> Manage Any Change <input type="checkbox"/> Wear the Correct PPE

**Corrective Actions**

Root Cause #	Corrective Actions Taken (Attach additional pages as needed to completely address this section)	Responsible Person	Proposed Completion Date	Closed on Date	Verified by and Date Verified
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

---



---

**Section 6 - Notifications, Certification & Approvals**

Check the appropriate boxes indicating the applicable reports have been made to the following applicable organizations:

- Auto Insurance Carrier was called       Group HSE Manager Notified   
 WorkCare was called       Post-incident Drug/Alcohol Testing Performed

Incident Report prepared by: \_\_\_\_\_

Employee (s):

\_\_\_\_\_

Date:

\_\_\_\_\_

Employee's Supervisor:

\_\_\_\_\_

Date:

\_\_\_\_\_

HSE Coordinator/Project/Unit Manager:

\_\_\_\_\_

Date:

\_\_\_\_\_

Group HSE Manager:

\_\_\_\_\_

Date:

\_\_\_\_\_



**VEHICLE INCIDENT REPORT (VIR)**  
**Amec Foster Wheeler E&I**  
**Confidential - Privileged**

**Section 1 - General Information**

Date of Incident: \_\_\_\_\_

Time incident occurred: \_\_\_\_\_  am |  pm | Illumination:  Dark  Dusk  Light | Road Condition:  Dry  Wet  Icy/snow

Were police summoned to scene?  Yes  No Police Department and Location: \_\_\_\_\_

Report #: \_\_\_\_\_ Officer's Name: \_\_\_\_\_ Officer's Badge Number: \_\_\_\_\_

**Section 2 - Company Driver and Vehicle**

Driver's name: \_\_\_\_\_ D/L #: \_\_\_\_\_ State: \_\_\_\_\_

Driver's home office address: \_\_\_\_\_ Driver's Phone #: \_\_\_\_\_

Company Vehicle #: \_\_\_\_\_ Year: \_\_\_\_\_ Model: \_\_\_\_\_ License #: \_\_\_\_\_ State: \_\_\_\_\_

Company car?:  Yes  No Personal Vehicle?:  Yes  No Rental Vehicle?:  Yes  No

If rental, rented from: \_\_\_\_\_

Passenger/Witness Name(s): \_\_\_\_\_ Address: \_\_\_\_\_ Telephone: \_\_\_\_\_

Passenger/Witness Name(s): \_\_\_\_\_ Address: \_\_\_\_\_ Telephone: \_\_\_\_\_

Damage to vehicle: \_\_\_\_\_

Was an employee injured?:  Yes  No If yes, please describe: \_\_\_\_\_

Injuries to others?:  Yes  No If yes, please describe: \_\_\_\_\_

Vehicle was being used for: Company business  Yes  No Personal business  Yes  No

Towed?:  Yes  No If yes, by whom?: \_\_\_\_\_ To Where?: \_\_\_\_\_

**Section 3 - Other Driver and Vehicle Information**

Driver's Name: \_\_\_\_\_ D/L #: \_\_\_\_\_ State: \_\_\_\_\_

Current address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_

Telephone: \_\_\_\_\_ Work: \_\_\_\_\_ Cell: \_\_\_\_\_

Registered Owner's Name: \_\_\_\_\_ Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_

*(verify registration document)*

The Other Vehicle: Make: \_\_\_\_\_ Model: \_\_\_\_\_ Year: \_\_\_\_\_ License #: \_\_\_\_\_ State: \_\_\_\_\_

Insurance company name: \_\_\_\_\_ Address: \_\_\_\_\_ Phone #: \_\_\_\_\_

Policy No.: \_\_\_\_\_ Contact Person: \_\_\_\_\_ Phone #: \_\_\_\_\_

Passenger/Witness Name(s): \_\_\_\_\_ Address: \_\_\_\_\_ Telephone: \_\_\_\_\_

Passenger/Witness Name(s): \_\_\_\_\_ Address: \_\_\_\_\_ Telephone: \_\_\_\_\_

Damage: *(Make note of pre-existing damage and take pictures if possible – you may attach additional pages if necessary):* \_\_\_\_\_

Injuries to other driver/passengers: \_\_\_\_\_

**Section 4 - Approvals (signatures required)**

Form completed by (please print): \_\_\_\_\_ Date: \_\_\_\_\_

Office/Project Manager (please print): \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_

Signature: \_\_\_\_\_

## Things to Do First In The Event Of a Motor Vehicle Incident

### **GENERAL INFORMATION**

1. Do not decide on your own whether a particular incident is “covered” by insurance. Should there be any doubt, it is always preferable to report an occurrence, as this allows underwriters, the Risk Management Department and insurance adjusters to determine if a covered loss has taken place.
2. Policy Conditions do require that all losses and occurrences, which may result in a claim be promptly reported.
3. Do not admit liability or offer your opinion of liability to anyone.
4. Complete this IAR/VIR form promptly and forward with all applicable supporting documentation. It is essential both division and location information be provided.
5. For automobile collisions within the **United States**, please indicate on the IAR form that you have contacted Zurich at:
 

**Zurich Insurance Company**  
**1-800-987-3373 or**  
**1-877-928-4531**  
**24 hours a day, 7 days a week**
6. For automobile collisions within **Canada**, please indicate on the IAR form that you have contacted Zurich at:
 

**Crawford Adjusters Canada**  
**Claims Alert**  
**1-888-218-2346**  
**24 hours a day, 7 days a week**

The more details you have the better but, don't delay reporting if you don't have all of the information - that may be obtained later. A Zurich trained operator will answer your call and ask for all relevant information regarding the incident. The initial information required includes:

- Your division,
- Office location and division contact name – advise that you are an AMEC Company
- Name, drivers license and phone number of the driver involved in the loss
- Description of the vehicle which he/she was driving (i.e., year, make, model, license plate number, serial number)
- Date, time and location of incident
- Passenger information (if applicable)
- Third party information (i.e., name, phone number, address, vehicle information, insurance information)
- If any injuries occurred (if applicable)
- Police information
- Witness information (if applicable)

### **Call 911 if there are serious injuries!**

**If you are injured or think you were injured, contact your supervisor and call WorkCare at 888-449-7787.** Your supervisor will notify your HSE Coordinator and your Group HSE Manager. For additional instructions on what to do, go to AMEC's HSE website at:






[http://ee.amecnet.com/she/sheweb/incident\\_reporting.htm](http://ee.amecnet.com/she/sheweb/incident_reporting.htm)

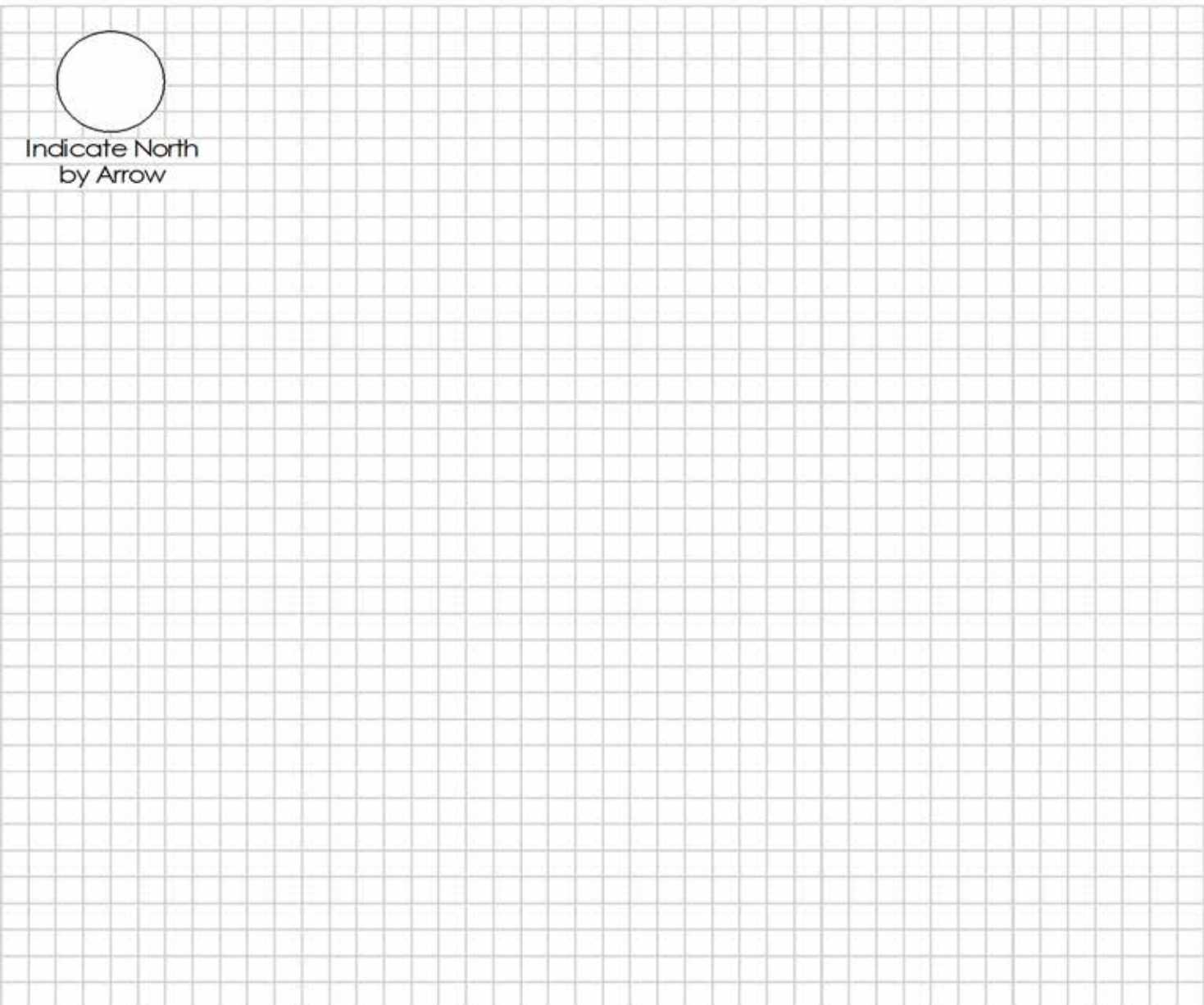
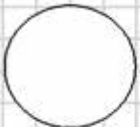
1. **Call for an officer if the incident occurred on public property** (streets, highways or roads). Disputes often arise between the parties involved as to who was at fault; therefore, a police report is important. If an officer is unable to attend the scene of the collision, a counter police report may be filed at most stations. Insurance companies rely on police reports to determine liability.
2. **Complete the Incident Investigation Report and the Vehicle Incident Report forms.** It is important that both these forms are completed in detail. Include a diagram of the incident on the provided sheet. Incomplete information may lead to delays in processing associated claims and in helping to prevent this type of incident from occurring again.
3. **Give only information that is required by the authorities or as directed by AMEC** contractual requirements.
4. **Sign only those statements required by the authorities or as directed by AMEC** contractual requirements. Do not sign away your or the company's rights.

# Vehicle Incident Diagram

This or a similar diagram must be completed with all VIRs

## Instructions:

1. Number each vehicle and show directions 
2. Use a solid line to show path before incident and use a dotted line to show path after incident 
3. Show pedestrian/non-motorist by: 
4. Show railroad by: 
5. Indicate north by arrow as: 
6. Show street or highway names or numbers
7. Show signs, signals, warning and traffic controls.

Indicate North  
by Arrow





# GROUND DISTURBANCE INCIDENT REPORT (GDR)

Amec Foster Wheeler E&I

## Section 1 - General Information

Employee Name: \_\_\_\_\_ Time of incident: \_\_\_\_\_  am |  pm Time Reported: \_\_\_\_\_  am |  pm Report Date: \_\_\_\_\_  
 Project Name: \_\_\_\_\_ Project Number: \_\_\_\_\_ Client: \_\_\_\_\_

### List of All Parties Present

Name	Company	Telephone No.	Role
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Describe the chronological description of the incident and response: \_\_\_\_\_

## Section 2 - Date and Location of Event

A. **\*Date of Event:** \_\_\_\_\_ (MM/DD/YYYY)

B. **\*Country** \_\_\_\_\_ **\*State** \_\_\_\_\_ **\*County** \_\_\_\_\_ **City** \_\_\_\_\_

C. **Street address** \_\_\_\_\_ **Nearest Intersection** \_\_\_\_\_

D. **\*Right of Way where event occurred**

E. **Public:**  City Street  State Highway  County Road  Interstate Highway  Public-Other

F. **Private:**  Private Business  Private Land Owner  Private Easement

G.  Pipeline  Power /Transmission Line  Dedicated Public Utility Easement  
 Federal Land  Railroad  Data not collected  Unknown/Other

List attached documentation (Public Utility Locates, Private Utility Locates, Copy of notifications submitted to Owner or other utility Owners, photographs): \_\_\_\_\_

## Section 3 - Affected Facility Information

**\*What type of facility operation was affected?**

Cable Television  Electric  Natural Gas  Liquid Pipeline  Sewer (Sanitary Sewer)  
 Steam  Telecommunications  Water  Unknown/Other

**\*What type of facility was affected?**

Distribution  Gathering  Service/Drop  Transmission  Unknown/Other

**Was the facility part of a joint trench?**

Unknown  Yes  No

**Was the facility owner a member of One-Call Center?**

Unknown  Yes  No

## Section 4 - Excavation Information

<b>*Type of Excavator</b>				
<input type="checkbox"/> Contractor	<input type="checkbox"/> County	<input type="checkbox"/> Developer	<input type="checkbox"/> Farmer	<input type="checkbox"/> Municipality
<input type="checkbox"/> Railroad	<input type="checkbox"/> State	<input type="checkbox"/> Utility	<input type="checkbox"/> Data not collected	<input type="checkbox"/> Unknown/Other
<b>*Type of Excavation Equipment</b>				
<input type="checkbox"/> Auger	<input type="checkbox"/> Backhoe/Trackhoe	<input type="checkbox"/> Boring	<input type="checkbox"/> Drilling	<input type="checkbox"/> Directional Drilling
<input type="checkbox"/> Explosives	<input type="checkbox"/> Farm Equipment	<input type="checkbox"/> Grader/Scraper	<input type="checkbox"/> Hand Tools	<input type="checkbox"/> Milling Equipment
<input type="checkbox"/> Probing Device	<input type="checkbox"/> Trencher	<input type="checkbox"/> Vacuum Equipment	<input type="checkbox"/> Data Not Collected	<input type="checkbox"/> Unknown/Other
<b>*Type of Work Performed</b>				
<input type="checkbox"/> Agriculture	<input type="checkbox"/> Cable Television	<input type="checkbox"/> Curb/Sidewalk	<input type="checkbox"/> Bldg. Construction	<input type="checkbox"/> Bldg. Demolition
<input type="checkbox"/> Drainage	<input type="checkbox"/> Driveway	<input type="checkbox"/> Electric	<input type="checkbox"/> Engineering/Survey	<input type="checkbox"/> Fencing
<input type="checkbox"/> Grading	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Landscaping	<input type="checkbox"/> Liquid Pipeline	<input type="checkbox"/> Milling
<input type="checkbox"/> Natural Gas	<input type="checkbox"/> Pole	<input type="checkbox"/> Public Transit Auth.	<input type="checkbox"/> Railroad Maint.	<input type="checkbox"/> Road Work
<input type="checkbox"/> Sewer (San/Storm)	<input type="checkbox"/> Site Development	<input type="checkbox"/> Steam	<input type="checkbox"/> Storm Drain/Culvert	<input type="checkbox"/> Street Light
<input type="checkbox"/> Telecommunication	<input type="checkbox"/> Traffic Signal	<input type="checkbox"/> Traffic Sign	<input type="checkbox"/> Water	<input type="checkbox"/> Waterway Improvement
<input type="checkbox"/> Data Not Collected	<input type="checkbox"/> Unknown/Other			

## Section 5 - Pre-Excavation Notification

<b>*Was the One-Call Center notified?</b>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	If Yes, which One-Call Center?
<b>Was Private Contract Locator used?</b>		Ticket number:
<input type="checkbox"/> Yes	<input type="checkbox"/> No	

## Section 6 - Locating and Marking

<b>*Type of Locator</b>			
<input type="checkbox"/> Utility Owner	<input type="checkbox"/> Contract Locator	<input type="checkbox"/> Data Not Collected	
<b>*Were facility marks visible in the area of excavation?</b>			
<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Data Not Collected	
<b>*Were facilities marked correctly?</b>			
<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Data Not Collected	
<b>What technology was used to locate utilities?</b>			
<input type="checkbox"/> Maps	<input type="checkbox"/> Active(transmitter+receiver)	<input type="checkbox"/> Passive (receiver only)	<input type="checkbox"/> GPR
<input type="checkbox"/> Acoustic	<input type="checkbox"/> Magnetic	<input type="checkbox"/> Infrared	<input type="checkbox"/> Unknown/Other
<b>What Factors affected the ability to locate services?</b>			
<input type="checkbox"/> Soil Type: _____	<input type="checkbox"/> Non-Grounded	<input type="checkbox"/> Common Bonded	<input type="checkbox"/> Depth
<input type="checkbox"/> Electromagnetic interference	<input type="checkbox"/> Parallel facilities	<input type="checkbox"/> Congested facilities	<input type="checkbox"/> Unknown/Other

## Section 7 - Excavator Downtime

<b>Did Excavator incur down time?</b>	
<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>If yes, how much time?</b>	
<input type="checkbox"/> Unknown	<input type="checkbox"/> Less than 1 hour
<input type="checkbox"/> 1 hour	<input type="checkbox"/> 2 hours
<input type="checkbox"/> 3 or more hours	Exact Value _____ If
<b>Estimated cost of down time?</b>	
<input type="checkbox"/> Unknown	<input type="checkbox"/> \$0
<input type="checkbox"/> \$1 to 500	<input type="checkbox"/> \$501 to 1,000
<input type="checkbox"/> \$5,001 to 25,000	<input type="checkbox"/> \$1,001 to 2,500
<input type="checkbox"/> \$25,001 to 50,000	<input type="checkbox"/> \$2,501 to 5,000
<input type="checkbox"/> \$50,001 and over	Exact Value _____



---



---

## Section 8 – Description of Damage

<b>*Was there damage to a facility?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No (i.e. near miss)	
<b>*Did the damage cause an interruption in service?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Data Not Collected <input type="checkbox"/> Unknown/Other	
<b>If yes, duration of interruption</b> <input type="checkbox"/> Unknown <input type="checkbox"/> Less than 1 hour <input type="checkbox"/> 1 to 2 hrs <input type="checkbox"/> 2 to 4 hrs <input type="checkbox"/> 4 to 8 hrs <input type="checkbox"/> 8 to 12 hrs <input type="checkbox"/> 12 to 24 hrs <input type="checkbox"/> 1 to 2 days <input type="checkbox"/> 2 to 3 days <input type="checkbox"/> 3 or more days <input type="checkbox"/> Data Not Collected    Exact Value _____	
<b>Approximately how many customers were affected?</b> <input type="checkbox"/> Unknown <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 to 10 <input type="checkbox"/> 11 to 50 <input type="checkbox"/> 51 or more    Exact Value _____	
<b>Estimated cost of damage / repair/restoration</b> <input type="checkbox"/> Unknown <input type="checkbox"/> \$0 <input type="checkbox"/> \$1 to 500 <input type="checkbox"/> \$501 to 1,000 <input type="checkbox"/> \$1,001 to 2,500 <input type="checkbox"/> \$2,501 to 5,000 <input type="checkbox"/> \$5,001 to 25,000 <input type="checkbox"/> \$25,001 to 50,000 <input type="checkbox"/> \$50,001 and over    Exact Value _____	
<b>Number of people injured</b> <input type="checkbox"/> Unknown <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 to 9 <input type="checkbox"/> 10 to 19 <input type="checkbox"/> 20 to 49 <input type="checkbox"/> 50 to 99 <input type="checkbox"/> 100 or more                      Exact Value _____	
<b>Number of fatalities</b> <input type="checkbox"/> Unknown <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 to 9 <input type="checkbox"/> 10 to 19 <input type="checkbox"/> 20 to 49 <input type="checkbox"/> 50 to 99 <input type="checkbox"/> 100 or more                      Exact Value _____	
<b>Was there a Product Release?</b> Product Release: <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> N/A                      Type: _____ <b>If Yes, Incident Type is Environmental Report.</b> Volume: _____                      Spill Controls: _____ Repair Process: _____	

---



---

## Section 9 – Description of the Root Cause [Link to GDR Root Cause Tip Card](#)

<b>Please choose one</b>	
<b>One-Call Notification Practices Not Sufficient</b> <input type="checkbox"/> No notification made to the One-Call Center <input type="checkbox"/> Notification to one-call center made, but not sufficient <input type="checkbox"/> Wrong information provided to One Call Center _____	<b>Locating Practices Not Sufficient</b> <input type="checkbox"/> Facility could not be found or located <input type="checkbox"/> Facility marking or location not sufficient <input type="checkbox"/> Facility was not located or marked <input type="checkbox"/> Incorrect facility records/maps _____
<b>Excavation Practices Not Sufficient</b> <input type="checkbox"/> Failure to maintain marks <input type="checkbox"/> Failure to support exposed facilities <input type="checkbox"/> Failure to use hand tools where required <input type="checkbox"/> Failure to test-hole (pot-hole) <input type="checkbox"/> Improper backfilling practices <input type="checkbox"/> Failure to maintain clearance <input type="checkbox"/> Other insufficient excavation practices	<b>Miscellaneous Root Causes</b> <input type="checkbox"/> One-Call Center error <input type="checkbox"/> Abandoned facility <input type="checkbox"/> Deteriorated facility <input type="checkbox"/> Previous damage <input type="checkbox"/> Data Not Collected <input type="checkbox"/> Other

**Provide explanation of selected root cause/s:** \_\_\_\_\_



## Section 10 - Notifications, Certification & Approvals

Check the appropriate boxes indicating the applicable reports have been made to the following applicable organizations:

**One Call was called**     **Spills Reporting Agency Notified**

**Emergency Responders (Fire) was called**     **Post-incident Drug/Alcohol Testing Performed**

### List of All Agencies Contacted

Name/Agency	Phone #	Date	Time

Incident Report prepared by: \_\_\_\_\_

Employee (s): \_\_\_\_\_

Date: \_\_\_\_\_

Employee's Supervisor: \_\_\_\_\_

Date: \_\_\_\_\_

HSE Coordinator/Project/Unit Manager: \_\_\_\_\_

Date: \_\_\_\_\_

Group HSE Manager: \_\_\_\_\_

Date: \_\_\_\_\_



- Unsafe Act
- Unsafe Condition
- Safe Behaviour Observation

- Amec Foster Wheeler
- Sub-contractor
- Client
- Third Party

Observer name		Observer email	
Observation date		Observation time	
Business Unit		Operating Unit	
Project/Office		Site/Office name	
Exact location of observation			
If Safe Behaviour Observation state name of individual or team			

**Global Safety Rules** *(select one)*

- Confined space
- Excavation
- Overhead lines
- Working at height
- Driving
- Isolations
- Permit to work
- Other (please state)
- Dropped objects
- Lifting activities
- Personal security

**Safety Essential category** *(select one)*

- Always take care
- Follow the rules
- Wear the correct PPE
- Do a risk assessment
- Manage any change
- You must intervene

**Details of safety observation**

**Immediate action taken/recommended**

- Do you require feedback?

**HEART conversation 5 step process**

- ▶ Prepare
- ▶ Observe
- ▶ Initiate
  - ▶ Introduce yourself
  - ▶ Praise good behaviour
  - ▶ Listen
  - ▶ Ask open questions
- ▶ Agree and commit
- ▶ Record and close out

**Typical questions**

- ▶ How can you and your workmates get hurt?
- ▶ What type of accident may happen?
- ▶ How can you and others avoid getting hurt?
- ▶ What if something unexpected happens?
- ▶ What have you done to prevent you and your colleagues getting hurt?
- ▶ How and when was the pre-job safety discussion (toolbox talk) conducted?
- ▶ What are the job specifics/team composition changes that occurred since you started?
- ▶ How has the work environment changed since you started?
- ▶ How can this job be done more safely?

**APPENDIX C**  
**PROJECT SCHEDULE**

**Appendix C**  
**Project Schedule and Deliverables Summary**  
**Truax Field Wisconsin Air National Guard Base**  
**Madison, Wisconsin**

Notice to Proceed (NTP)																		
Project Kickoff Meeting																		
QCP																		
Project HASP																		
Base Kickoff Meeting																		
Base SI Work Plan																		
SI Field Work																		
Reports																		
Meetings/Community Outreach																		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	2016			2017												2018		

**APPENDIX D**  
**FIELD SAMPLING PLAN**

**FINAL  
FIELD SAMPLING PLAN**



**FY16 PHASE 1 REGIONAL SITE INSPECTIONS  
FOR PERFLUORINATED COMPOUNDS**

**TRUAX FIELD  
WISCONSIN AIR NATIONAL GUARD  
MADISON, WISCONSIN**

Contract #: W9133L-14-D-0002

Delivery Order 0006

Amec Foster Wheeler Project #: 2-9133-0006

August 31, 2017

**THIS PAGE INTENTIONALLY LEFT BLANK**



## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1-1
1.1	Project Purpose and Scope .....	1-1
1.2	Document Organization .....	1-3
1.3	Project Setting .....	1-4
2.0	SAMPLING AND ANALYSIS PLAN .....	2-1
2.1	Soil Sampling.....	2-1
2.1.1	Field Screening .....	2-1
2.2	Groundwater Sampling .....	2-2
2.3	Waste Characterization Sampling .....	2-3
2.4	Laboratory Analyses .....	2-4
2.5	Field Procedures and Considerations .....	2-4
2.5.1	Field Equipment & Supplies .....	2-4
2.5.2	Personal Protective Equipment (PPE).....	2-5
2.5.3	Sample Containers.....	2-6
2.5.4	Wet Weather .....	2-6
2.5.5	Decontamination Procedures .....	2-7
2.5.6	Personal Hygiene.....	2-7
2.5.7	Food Considerations .....	2-7
2.5.8	Visitors .....	2-7
2.6	Laboratory Analytical Program.....	2-8
2.7	Quality Assurance/Quality Control .....	2-8
2.7.1	Soil QA/QC Samples.....	2-9
2.7.2	Groundwater QA/QC Samples .....	2-9
2.8	Sample Packing and Shipping .....	2-10
2.9	Field Equipment Calibration .....	2-10
2.9.1	Water Quality Meter Calibration.....	2-10
2.9.2	Photo-Ionization Detector.....	2-11
2.10	Documentation.....	2-11
2.10.1	Daily QC Reports .....	2-11
2.10.2	Field Logbooks.....	2-11
2.10.3	Sample Identification.....	2-12
2.10.4	Chain of Custody.....	2-13
2.10.5	Photo Log.....	2-14
2.10.6	Project File .....	2-14
3.0	REFERENCES .....	3-1

# NGB/A4OR

---

## TABLES

Table 1	Site Inspection Summary
Table 2	Sample Summary

## ATTACHMENTS

Attachment A Field Forms

## ACRONYMS

A4OR	Environmental Restoration Branch
Amec Foster Wheeler	Amec Foster Wheeler, Environment & Infrastructure, Inc.
AFFF	Aqueous Film Forming Foam
ANG	Air National Guard
bgs	Below Ground Surface
Bldg.	Building
°C	Degrees Celsius
COC	Chain of Custody
DO	Dissolved Oxygen or Delivery Order
DPT	Direct-Push Technology
ERPIMS	Environmental Resources Program Info Management System
FM	Field Manager
FSP	Field Sampling Plan
ft.	Feet/Foot
HASP	Health and Safety Plan
HDPE	High-Density Polyethylene
IDW	Investigation-Derived Waste
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NFA	No Further Action
NGB	National Guard Bureau
ORP	Oxidation-Reduction Potential
PA	Preliminary Assessment
PFAS	Perfluoroalkyl Substances
PFBS	Perfluorobutanesulfonic Acid
PFC	Perfluorinated Compounds
PFHpA	Perfluoroheptanoic Acid
PFHxS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFOA	Perfluorooctanoic Acid
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
AOC	Potential Release Location
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SI	Site Inspection
SOP	Standard Operating Procedure
UCMR	Unregulated Contaminant Monitoring Rule
USCS	Unified Soil Classification System
USEPA	U. S. Environmental Protection Agency
WIANG	Wisconsin Air National Guard

**THIS PAGE INTENTIONALLY LEFT BLANK.**

## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) has been contracted by the National Guard Bureau (NGB) under Contract # W9133L-14-D-0002, Delivery Order (DO) 0006, to conduct Phase 1 Regional Site Inspections (SIs) for Perfluorinated Compounds (PFCs) at multiple Air National Guard (ANG) Installations. This Field Sampling Plan (FSP) has been prepared to describe the procedures and activities to be conducted during performance of SI field sampling activities at Truax Field Air National Guard (WIANG) located in Madison, Wisconsin [see Figure 1 of the SI Work Plan(WP), (Amec Foster Wheeler, 2017)].

### 1.1 Project Purpose and Scope

The purpose of the SI is to determine whether per- and polyfluoroalkyl substances (PFAS), specifically perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutane sulfonate (PFBS), are present in soil, groundwater, surface water, and sediment from potential historic releases of Aqueous Film Forming Foam (AFFF) at Truax Field WIANG. Based on locations where AFFF was potentially used or stored, 9 Areas of Concern (PRLs) were identified at the Base in the Preliminary Assessment (PA) Site Visit Report (BB&E, 2015). The nine PRLs included in this SI are illustrated on **Figure 3** of the SI WP, and the SI summary is presented as **Table 1** of this FSP.

The objective of this FSP is to describe the procedures for the collection of field samples and measurements which are appropriate to inspect soil and groundwater for the presence or absence of the six per- and polyfluoroalkyl acids (PFAAs) included on the U.S. Environmental Protection Agency (USEPA) Third Unregulated Contaminant Monitoring Rule (UCMR 3) list (USEPA, 2012). Included are perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), perfluoroheptanoic acid (PFHpA), and perfluorobutanesulfonic acid (PFBS).

This FSP is intended to be used in conjunction with the SI WP (Amec Foster Wheeler, 2017) and the Quality Assurance Project Plan (QAPP) (Amec Foster Wheeler, 2017), prepared concurrently with this FSP. The potential AFFF PRLs and sampling locations are shown on **Figures 3A** through **3E** in the SI Work Plan. The specific objectives at each of the nine PRLs included in the SI are described in the ensuing text:

# NGB/A4OR

---

## PRL1, Bldg. 430 (Current Fire Station)

- Advance three soil borings (01SB01, 01SB02, 01SB03), using direct-push technology (DPT), for collection of one surface sample (0-2 foot [ft.] below ground surface [BGS]) and one deep (15ft. bgs or directly above water table) soil sample per boring (six soil samples total).
- Install one temporary monitoring well ([TW] 01) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW01.

## PRL2, Bldg. 430 Nozzle Testing Area 1

- Advance three soil borings (02SB01, 02SB02, 02SB03), using DPT, for collection of one surface and one deep soil sample per boring (six soil samples total).
- Install one temporary monitoring well (TW02) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW02.

## PRL3, Bldg. 430 Nozzle Testing Area 2

- Advance three soil borings (03SB01, 03SB02, 03SB03), using DPT, for collection of one surface and one deep soil sample per boring (six soil samples total).
- Install one temporary monitoring well (TW03) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW03.

## PRL4, Bldg. 403

- Advance three soil borings (04SB01, 04SB02, 04SB03), using DPT, for collection of one surface and one deep soil sample per boring (six soil samples total).
- Install one temporary monitoring well (TW04) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW04.

## PRL5, Hanger 400

- Advance three soil borings (05SB01, 05SB02, 05SB03), using DPT, for collection of one surface and one deep soil sample per boring (six soil samples total).
- Install one temporary monitoring well (TW05) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW05.

## PRL6, Hanger 406

- Advance three soil borings (06SB01, 06SB02, 06SB03), using DPT, for collection of one

# **NGB/A4OR**

---

surface and one deep soil sample per boring (six soil samples total).

- Install one temporary monitoring well (TW06) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW06.

## PRL7, Hanger 414

- Advance three soil borings (07SB01, 07SB02, 07SB03), using DPT, for collection of one surface and one deep soil sample per boring (six soil samples total).
- Install one temporary monitoring well (TW07) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW07.

## PRL8, Fuel Spill Ditch

- Advance three soil borings (08SB01, 08SB02, 08SB03), using DPT, for collection of one surface and one deep soil sample per boring (6 samples total).
- Install one temporary monitoring well (TW08) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW08.

## PRL9, Bldg. 503 Parking Lot

- Advance three soil borings (09SB01, 09SB02, 09SB03), using DPT, for collection of one surface and one deep soil sample per boring (6 samples total).
- Install one temporary monitoring well (TW09) in one of the downgradient soil borings.
- Collect one shallow groundwater sample from TW09.

## Base Boundary Wells

- Advance three downgradient soil borings, using DPT, and install three temporary monitoring wells (TWBB01, TWBB02, TWBB03) at the base boundary.
- Collect one shallow groundwater sample from each well TWBB01, TWBB02, TWBB03.

## **1.2 Document Organization**

This FSP presents the sampling objectives and outlines for the following SI components:

- Soil sample collection and field screening;
- Groundwater sample collection and field screening;
- Waste characterization sampling;
- Laboratory analyses;
- PFC-specific field procedures and considerations;

- Laboratory analytical program;
- Quality Assurance/Quality Control (QA/QC);
- Sample packaging and shipping;
- Field equipment calibration; and
- Documentation.

Field work will be conducted in accordance with the Site Health and Safety Plan (HASP), provided in Appendix B of the SI Work Plan (Amec Foster Wheeler, 2017)], and with the Standard Operating Procedures (SOP) for PFCs provided in Attachment E of the QAPP (Amec Foster Wheeler, 2017), which is provided in Appendix C of the SI Work Plan.

Blank field reporting forms, such as soil boring logs and monitoring well construction diagrams, are provided in **Attachment A** of this FSP.

### 1.3 Project Setting

A detailed description of the site location and project setting for the PRLs located at Truax Field WIANG, in Madison, Wisconsin is described in Sections 1 and 4 of the SI Work Plan and depicted on **Figures 1** through **3F** of the SI Work Plan (Amec Foster Wheeler, 2017).



## 2.0 SAMPLING AND ANALYSIS PLAN

### 2.1 Soil Sampling

Soil samples will be collected in accordance with Amec Foster Wheeler's SOP AFW-02 developed specifically for collecting soil samples for analysis of PFCs, and included in Attachment E of the QAPP (Amec Foster Wheeler, 2017). Non-disposable equipment will be decontaminated prior to and between sample locations as described in **Section 2.7.5**.

Soil cores will be collected directly in single-use, acetate liners. After retrieval from the core barrel, soil cores will be inspected and screened as described below in **Section 2.1.1**.

Shallow soil samples will be collected from the upper two feet (ft.) of soil, directly beneath asphalt or pavement, if present. Deep soil samples will be collected from the interval above the water table. If refusal occurs prior to encountering groundwater, the deep sample will be collected from the bottom two ft. of the soil boring. If groundwater is not encountered in the upper 15 ft. of the boring, the deep sample will be collected from the bottom of the soil boring.

Soil samples will be homogenized using clean stainless steel bowls and trowels, before being placed in laboratory-supplied containers. Samples will be immediately cooled with ice to less than 4 degrees Celsius (°C). New, disposable nitrile gloves will be donned prior to sample collection at each location and will be worn throughout the sample collection process.

#### 2.1.1 Field Screening

The sample sleeve will be opened lengthwise and the soil will be inspected for evidence of organic contamination (e.g., odor, staining, sheen, and free product). Soil characteristics will be logged in accordance with the Unified Soil Classification System (USCS). A blank soil boring log is presented in **Attachment A**. The boring logs will be prepared for each soil boring and will contain the following information:

- Project name and number
- Date
- Boring number
- Driller
- Sampler's name and title

- Sample number
- Sample depth interval (from, to ft. bgs)
- Sample description (USCS description [color, soil grain size, sorting, plasticity, strength, compaction, moisture], evidence of contamination, and general remarks)
- Depth to water ft. bgs

## 2.2 Groundwater Sampling

Groundwater samples will be collected from temporary groundwater monitoring wells in accordance with Amec Foster Wheeler's Groundwater Sampling SOP (AFW-03), developed specifically for collecting groundwater samples for analysis of PFCs, and is included as Attachment E of the QAPP (Amec Foster Wheeler, 2017). Non-disposable equipment will be decontaminated prior to and between sample locations as described in **Section 2.7.5**. Groundwater samples will be collected once groundwater parameters have achieved stabilization as described below in **Section 2.2.1**.

Groundwater samples will be collected using either a peristaltic pump or submersible pump and tubing. Water levels will be measured prior to placing the pump/tubing into the well, and measured again after placing the pump/tubing in the well. New or dedicated tubing will be used at each location. The pump/tubing will be lowered into the well to the depth of at least 1 ft. above the bottom of the well to prevent disturbance and re-suspension of sediment present in the bottom of the well. The well will be purged prior to sampling at a pump rate of 100 to 500 milliliters per minute with a steady flow rate maintained, such that drawdown of the water level within the well does not exceed a maximum allowable drawdown of 0.3 ft. Laboratory-supplied sample containers will be filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container. Samples will be immediately cooled with ice to less than 4°C. New, disposable nitrile gloves will be donned prior to sample collection at each location and will be worn throughout the sample collection process.

After sample collection is completed, the depth to water will be measured and recorded and the temporary well casing will be removed and the well boring properly abandoned.

Field screening parameters (temperature, pH, dissolved oxygen [DO], specific conductance, oxidation-reduction potential [ORP], and turbidity) will be monitored and recorded approximately every three to five minutes during purging. The well is considered stabilized and ready for sample

# NGB/A4OR

---

collection when the indicator parameters have stabilized for three consecutive readings as follows:

- +/-0.1 for pH
- +/-3% for specific conductance (conductivity)
- +/-10 mv for ORP
- +/-10% for DO and turbidity, and <50 Nephelometric Turbidity Units

If these parameters do not stabilize the sample will be collected after five well volumes have been purged. If the well goes dry, the well will be considered stabilized and ready for sample collection when groundwater has recovered and there is enough water volume to collect the samples. A groundwater sampling log will be prepared for each well sampled and contain the following information:

- Project name and number
- Date
- Well number
- Type of well (temporary or permanent)
- Sampler's name and title
- Depth to water (ft. below top of casing [TOC])
- Purge volumes (containerized for disposal)
- Field screening measurements
- Sample number
- Sample depth interval (ft. below TOC from, to)
- General remarks

## 2.3 Waste Characterization Sampling

After completion of sampling activities, waste characterization samples will be collected from 55-gallon drums containing Investigative-Derived Waste (IDW). Representative composite samples will be collected for both solid and liquid IDW. Samples will be placed in laboratory-supplied containers and immediately cooled with ice to less than 4°C. New, disposable nitrile gloves will be donned prior to sample collection and will be worn throughout the sample collection process.

# NGB/A4OR

---

## 2.4 Laboratory Analyses

Soil and groundwater will be analyzed for PFAS compounds on the UCMR 3 list by Modified USEPA Method 537.1, as described in **Table 1**.

Waste characterization samples will be analyzed for Toxicity Characteristic Leaching Procedure Resource Conservation and Recovery Act metals, volatile organic compounds, semi-volatile organic compounds, and total polychlorinated biphenyls, or as required by the disposal facility. Waste characterization samples will be collected in accordance with the methods outlined in the QAPP (Amec Foster Wheeler, 2017).

Containers will be labeled and the labels will provide the following information, if applicable:

- Site name
- Sample identification
- Date and time of sample collection
- Name of sampler
- Sample preservation
- Type of analysis

## 2.5 Field Procedures and Considerations

The following are procedures and considerations to be made during field activities when assessing potential PFAS releases. A summary of the prohibited and acceptable items for PFC investigation areas is included in Amec Foster Wheeler's PFC-Specific SOP Procedures (AFW-01) included in Attachment E of the QAPP (Amec Foster Wheeler, 2017). The Field Manager (FM) shall review this table with field team members and subcontractors daily, prior to the commencement of field work to ensure compliance, and complete the Daily PFC Protocol Checklist included in the AFW-01 SOP.

### 2.5.1 Field Equipment & Supplies

The following list contains commonly used field items which are **prohibited** from within work zones.

- Teflon®-containing materials (e.g. Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials).
- Waterproof field books other than Rite in the Rain® brand.

# NGB/A4OR

---

- Plastic clipboards, binders, or spiral hard cover notebooks.
- Post-It® notes.
- Markers other than Sharpie® brand.
- Chemical (blue) ice packs. This includes use for the storage of food and/or samples.
- Water resistant, waterproof, or stain resistant clothing. Field clothing made of synthetic and natural (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener. Do not wear new clothing until it has been washed at least 6 times prior to use.
- Gore-Tex™ materials, including in clothing and boots.
- Laboratory-provided sample containers containing Teflon® materials.

The following list contains commonly used field items which are **permitted** for field sampling activities.

- High-density polyethylene (HDPE), low-density polyethylene, and silicon materials, provided they are not stored in containers with PFC-containing materials.
- Acetate or PVC sample liners for direct-push technology or during conventional drilling.
- Peristaltic pumps are preferred for groundwater sample collection at depths shallower than 25 ft.
- Rite in the Rain® products are the only waterproof field books that may be used. To avoid plastic coatings or glue materials, do not use other brands of waterproof field books. If Rite in the Rain® products are not available, field reports will be documented on loose paper secured on Masonite or aluminum clipboards.
- Pens, pencils, and sharpies. Pens are preferred and will be used when documenting field activities in the field log and on field forms as well as sample containers and chain of custody.
- Safety footwear will consist of steel-toe boots made with polyurethane and PVC, untreated leather boots, or well-worn leather boots. Newer leather boots may be worn in they are covered with polypropylene, polyethane, or PVC boot covers.
- Disposable nitrile gloves, which must be worn during sampling and handling of related equipment (e.g., equipment transportation, decontamination, operation).

## 2.5.2 Personal Protective Equipment (PPE)

PPE, including safety-toe boots, reflective vest, safety glasses, hard hat, hearing protection, and

disposable nitrile gloves must be worn as specified in the HASP, included as Appendix B of the SI Work Plan. Safety-toe boots must meet the requirements specified in **Section 2.7.1**. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:

- Decontamination of re-usable sampling equipment;
- Prior to contact with sample bottles or water containers;
- Insertion of anything into the well;
- Insertion of silicon tubing into the peristaltic pump;
- Completion of monitoring well purging, prior to sample collection;
- Handling of any quality assurance/quality control samples including field blanks and equipment blanks.

### **2.5.3 Sample Containers**

Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). All PFAS samples should be collected in polypropylene or HDPE bottles. The screw cap will be made of polypropylene or HDPE and may be lined or unlined. However, if lined, the liner may not be made of Teflon® or contain PFCs. Glass containers are not to be used when collecting PFAS samples due to potential loss of analyte through adsorption. Glass containers may be used for waster characterization samples as appropriate. Container labels will be completed using pens after the caps have been placed back on each bottle.

### **2.5.4 Wet Weather**

Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing the appropriate clothing that will not pose a risk of cross-contamination. Teams will avoid synthetic gear that has been treated with water repellent finishes containing PFCs. Use rain gear made from polyurethane, vinyl, and wax or rubber-coated materials. Teams should consider the use of a gazebo tent, which can be erected overtop of the sample location and provide shelter from inclement weather. It should be noted that the canopy material is likely a treated surface and should be handled as such; therefore, gloves should be worn when setting up and moving the tent, changed immediately afterwards and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on the next sample location. Further, care should be taken when transferring samples from outside the tent to inside to prevent cross contamination, which would require passing beneath the drip edge.

## 2.5.5 Decontamination Procedures

Field sampling equipment (e.g. water level indicators, pumps, bowls, trowels, dip samplers, hand augers, and other downhole equipment) will require cleaning prior to initial use, and between samples. Alconox® and Liquinox® soap is acceptable for use since their safety data sheets do not list fluoro-surfactants as an ingredient. However, Decon 90 will not be used during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified PFC-free water. For larger equipment (e.g. drill rig and downhole drilling and sampling equipment), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water.

## 2.5.6 Personal Hygiene

Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, unless the products are applied to a part of the body that will be covered by clothing. These products may contain surfactants and represent a potential source of PFCs.

Many manufactured sunblock and insect repellants contain PFCs and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural ingredients, unless previously vetted by the project chemist.

For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towels for drying is to be avoided if possible.

## 2.5.7 Food Considerations

No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (e.g. Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

## 2.5.8 Visitors

Visitors to the investigation are asked to remain outside of the exclusion zone during sampling activities.

# NGB/A4OR

---

## 2.6 Laboratory Analytical Program

The analytical program will consist of off-site laboratory analysis and QC samples to evaluate data quality.

Level II validation will be performed on 90% of the analytical results, and Level IV validation performed on 10% of the results. Contents of the Level IV data package will include:

- Analytical results;
- Surrogate recoveries;
- Chain-of-custody;
- Method blanks;
- LCS summaries;
- Matrix Spike (MS) Matrix Spike Duplicate (MSD) summaries;
- Duplicate information;
- Gas Chromatography/Mass Spectrometry tune information;
- Initial calibrations; and
- Continuing Calibration Verification (CCV) summaries.

The laboratory will also provide an ERPIMS compliant electronic data deliverable. Laboratory analysis will be conducted by a Department of Defense Environmental Laboratory Accreditation Program-certified laboratory on soil and groundwater for the six PFAS congeners included in the UCMR 3 list, including PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFBS. The data generated from this analytical program will be validated using USEPA approved protocols for data validation. The analytical program is described in greater detail in the QAPP presented in Appendix A of the SI WP (Amec Foster Wheeler, 2017).

## 2.7 Quality Assurance/Quality Control

Sampling activities will follow the investigation procedures and QA/QC protocols stated in the QAPP presented in Appendix A of the SI WP. Investigation activities including documentation, sampling, decontamination, field screening, and analysis will be in accordance with this SI WP and ANG protocols.

Field Blank: For each sampling event one field blank per lot of laboratory-provided “PFC-free”



# NGB/A4OR

---

deionized water will be collected and analyzed for PFAS. The field blank will consist of the distilled or deionized water used for decontamination. The purpose of the field blank is to demonstrate that the water used for decontaminating the sample tools and equipment does not contain potential contaminants, which may affect the analytical values of the samples.

Additional media specific QA/QC measures to be accomplished are discussed below.

## 2.7.1 Soil QA/QC Samples

The following QA/QC samples will be collected as part of the soil investigation and sampling procedures for the PRLs.

MS/MSD: One MS sample and one MSD sample will be collected for every 20 investigative soil samples collected or one per sample event if less than 20 samples are collected. MS/MSD analysis is conducted to understand the influence the matrix has on analyte recovery during analysis.

Equipment Blank: One equipment blank will be prepared for each soil sampling setup (e.g. bowl and spoon) that is re-used for approximately every 20 samples (or one per event if less than 20 samples are collected). The equipment blank will be prepared from the final rinse of the decontamination rinse for the sampling equipment.

Field Duplicate Sample: One field duplicate sample will be collected for every 10 investigative soil samples during the soil sampling (or one per event if less than 10 samples are collected). The field duplicates will be prepared by thoroughly mixing the soil from a sample location and then splitting the soil into two samples for individual laboratory analysis.

## 2.7.2 Groundwater QA/QC Samples

The following QA/QC samples will be collected as part of the groundwater investigation and sampling procedures at the PRL areas, and the base boundary wells.

MS/MSD: One MS sample and one MSD sample will be collected for every 20 investigative groundwater samples collected or one per sample event if less than 20 samples are collected. MS/MSD analysis is conducted to understand the influence the matrix has on analyte recovery during analysis.

Equipment Blank: One equipment blank will be prepared for each groundwater sampling setup (e.g. submersible pump and tubing) that is re-used for approximately every 10 samples (or one

# NGB/A4OR

---

per event if less than 10 samples are collected). The equipment blank will be prepared from the final decontamination rinse for the sampling equipment.

Field Duplicate Sample: One field duplicate sample will be collected for every 10 investigative groundwater samples during the sampling event (or one per event if less than 10 samples are collected). The field duplicates will be taken directly after the primary sample container has been filled before the pump has been removed from the well.

## **2.8 Sample Packing and Shipping**

Immediately following sample collection, sample containers shall be placed in an insulated cooler. Plastic bags containing ice will be placed in coolers so that samples will be maintained at or below 4°C. Samples will be shipped as soon as possible to allow the laboratory to meet holding times for analyses. Prior to shipment, ice will be replaced to keep samples at or near 4°C during transport.

Glass containers will be wrapped with bubble wrap or other appropriate padding to prevent breakage during transport. The chain-of-custody (COC) will be placed in a sealable plastic bag and taped to the inside cover of the cooler. The cooler drain plug will be taped over to prevent opening, if applicable. Signed and dated custody seals will be placed in two locations such that they will be broken if the cooler is opened. Packing tape will be used to encircle the sample cooler in two locations.

## **2.9 Field Equipment Calibration**

Calibration of field instruments will be performed at the intervals specified by the manufacturer, or more frequently as conditions require. A water quality meter will be used for the collection of groundwater and surface water samples and will include a pH/ORP meter, thermometer, specific conductivity meter, turbidity meter, and dissolved oxygen meter. Calibration procedures and frequency will be recorded in a field logbook.

### **2.9.1 Water Quality Meter Calibration**

The pH/ORP meter will be calibrated with standard buffer solutions prior to initiation of field activities. In the field, the meter will be calibrated daily with standard buffers before use. Thereafter, the meter will be checked against two buffers as deemed necessary by the FM. Calibration procedures and frequency will be recorded in a field logbook.

# NGB/A4OR

---

The thermometer will be calibrated by the manufacturer. No field calibration procedure is necessary.

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards prior to field activities. In the field, the instrument will be checked daily with calibration standards.

The turbidity meter will be calibrated daily (and at the beginning of each sampling event) using one or two standards provided by the manufacturer.

The DO meter will be calibrated daily and at the beginning of each sampling event.

## **2.9.2 Photo-Ionization Detector**

If used, the photo-ionization detector will be calibrated daily per the manufacturer's specifications prior to initiation of field activities. In the field, the meter will be calibrated daily before use. Calibration procedures and frequency will be recorded in a field logbook.

## **2.10 Documentation**

To produce reliable field and laboratory data, certain measures will be taken regarding documentation, field and laboratory checks, and sample handling procedures to show that data has been collected, documented, and managed in a consistent manner.

### **2.10.1 Daily QC Reports**

Fieldwork and daily on-site inspections of field equipment will be recorded on the Daily QC Report maintained by the FM. Daily inspections of on-site field equipment will include drill rigs, monitoring equipment, and sampling devices. Field work descriptions will include the number and names of personnel working on-site, weather conditions, work activities, field measurements, and changes to scope. Daily QC Reports will also include equipment calibration logs as well as health and safety monitoring information.

### **2.10.2 Field Logbooks**

Dedicated field logbooks will be maintained by the FM throughout the duration of the SI. Pertinent information regarding on-site activities will be recorded in the field logbooks. Pertinent information includes, at a minimum, dates, names and details of on-site personnel, detailed descriptions of field activities, sampling activities, field measurements, sample locations, equipment calibrations, and problems encountered. Information recorded in the field logbooks will be entered with an

# NGB/A4OR

---

indelible black or blue ink pen. Logbooks shall be permanently bound with sequentially-numbered pages. Each page will be signed and dated by the personnel documenting the on-site activities. Corrections shall be made by crossing out the error with a single line, and initialing and dating the correction.

## 2.10.3 Sample Identification

Amec Foster Wheeler personnel will perform sample labeling and identification in a consistent manner so that field samples are properly labeled and traceable. A unique alpha-numeric sample identification system will be used for sample collected using the following procedure for each matrix.

### Soil

The following nomenclature shall be used for soil samples (collected from soil borings) and sediment samples (collected from drainage structures, retention basins, surface water bodies, etc.). Soil Sample Example: TRUAX-01-SB01-010717-10-11-FD. Sediment Sample Example: TRUAX-01-SD01-010717-0-1-FD.

- **TRUAX**-01-SB01-010717-10-11-FD: 5 digit ERPIMS installation code;
- TRUAX-**01**-SB01-010717-10-11-FD: 2 digit PRL location;
- TRUAX -01-**SB01**-010717-10-11-FD: Sample type and location within PRL(SB = Soil sample and SD = Sediment sample);
- TRUAX-01-SB01-**010717**-10-11-FD: Date in MMDDYY format;
- TRUAX-01-SB01-010717-**10**-11-FD: Top of sample interval measured from the land surface or top of sediment;
- TRUAX-01-SB01-010717-10-**11**-FD: Bottom of sample interval measured from the land surface or top of sediment;
- TRUAX-01-SB01-010717-10-11-**FD**: Field duplicate. Leave blank for primary samples and MS/MSD samples.

### Groundwater Samples

The following nomenclature shall be used for groundwater samples collected from temporary monitoring wells. Example: TRUAX-GW-TW01-010717-FD.

- **TRUAX**-GW-TW01-010717-FD: 5 digit ERPIMS installation code;
- TRUAX-**GW**-TW01-010717-FD: Groundwater sample. PR location not used for

# NGB/A4OR

---

groundwater samples because some locations are linked to multiple PRLs, and others are base-boundary wells;

- TRUAX-GW-**TW01**-010717-FD: Sample type and location (TW = Temporary monitoring well);
- TRUAX-GW-TW01-**010717**-FD: Date in YYYYMMDD format;
- TRUAX-GW-TW01-010717-**FD**: Field duplicate. Leave blank for primary samples and MS/MSD samples.

## Field QC Samples

The following nomenclature shall be used for field QC samples, including field blanks and equipment blanks. Example: TRUAX-FB-TWD-010717.

- **TRUAX**-FB-TWD-010717: 5 digit ERPIMS installation code;
- TRUAX-**FB**-TWD-010717: Sample type (FB = Field Blank. EB = Equipment blank);
- TRUAX-FB-**TWD**-010717: Sampler initials;
- TRUAX-FB-TWD-**010717**: Date in MMDDYY format.

## Waste Characterization Samples

The following nomenclature shall be used for waste characterization samples, including solid and liquid IDW. Example: TRUAX-IDW-AQ-010717.

- **TRUAX**-IDW-AQ-010717: 5 digit ERPIMS installation code;
- TRUAX-**IDW**-AQ-010717: IDW Sample;
- TRUAX-IDW-**AQ**-010717: Sample type. SO = Solid. AQ = aqueous;
- TRUAX-IDW-AQ-**010717**: Date in YYYYMMDD format.

### **2.10.4 Chain of Custody**

COC procedures will be used to establish, document, and maintain custody of field samples. A complete COC record will accompany samples while in the field, during shipment to the laboratory, and during analysis. When transferring samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC record. Two copies (including the original) of the COC record will accompany the samples to the laboratory. One copy of the COC record will remain with the field team. The following information will be provided on the COC form:

- Site name
- Sample identification

# NGB/A4OR

---

- Date and time of sample collection
- Name and signature of sampler
- Sample preservation
- Matrix
- Type of analysis
- Signature(s) of individual involved in sample transfers
- Delivery of samples to the laboratory and storage at 4°C or below

## **2.10.5 Photo Log**

Photographs will be taken to document field activities and site conditions. A description of each photograph will be recorded in the field logbook.

## **2.10.6 Project File**

Incoming materials related to the project including sketches, correspondence, authorization, and logs will be forwarded to the Project Manager. These documents will be placed in the project file as soon as is practical. If correspondence is required for reference by project personnel, a copy will be made rather than retaining the original. Records will be legible and easily identifiable. Examples of the types of records that will be maintained in the project file are:

- Field documents;
- Correspondences;
- Photographs;
- Laboratory data;
- Reports; and,
- Procurement agreements.

Outgoing project correspondences and reports will be reviewed and signed by the Project Manager prior to transmittal. The office copy of outgoing documents will bear distribution information.

## 3.0 REFERENCES

Amec Foster Wheeler, 2017. *Final Quality Assurance Project Plan - FY 16 Phase 1 Regional Site Inspections for Per-fluorinated Compounds, Multiple Air National Guard Installations.* November, 2017.

BB&E, 2015. *Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Wisconsin Air National Guard Truax Field Dane County Regional Airport,* December 2015.

Leidos, 2015. *Final Preliminary Assessment/Site Investigation, Dane County Regional Airport Truax Field, Compliance Restoration Program.* February 2015

USEPA, 2012. *Federal Register, Volume 77, No. 85, Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 3) for Public Water Systems; Final Rule.* May 2, 2012.

**TABLES**



**Table 1**  
**Site Inspection Summary**  
**Truax Field Air National Guard, Madison, Wisconsin**

Potential Release Location	Location type	SB	Wells		No. Samples				Comments
			EW	TW	S	GW	SW	SD	
1. Bldg. 430 (Current Fire Station)	Fire Station	3	0	1	6	1	0	0	FD vehicles filled and washed in fire station. Trench drains go to sanitary sewer
2. Bldg. 430	Fire Truck Equipment Testing	3	0	1	6	1	0	0	FD vehicle nozzle tests are performed every six months and discharged to the grassy area to the southwest of the current fire station.
3. Bldg. 430	Fire Truck Equipment Testing	3	0	1	6	1	0	0	FD vehicle nozzle tests are performed every six months and discharged to the grassy area to the northwest of the current fire station.
4. Former Bldg. 403	Fire Station	3	0	1	6	1	0	0	AFFF was stored in Bldg. 403 between 1988-1995
5. Hangar 400	Hangar with AFFF FSS	3	0	1	6	1	0	0	System was tested annually with AFFF discharged every other year
6. Hangar 406	Hangar with AFFF FSS	3	0	1	6	1	0	0	System was tested annually with AFFF discharged every other year
7. Hangar 414	Hangar with AFFF FSS	3	0	1	6	1	0	0	System was tested annually with AFFF discharged every other year
8. Fuel Spill Ditch	Fuel Emergency Response	3	0	1	6	1	0	0	FD foamed the fuel spill and flushed it toward the ditch. Soil was removed to 6 ft. bgs.
9. Bldg. 503 Parking Lot	Fuel Emergency Response	3	0	1	6	1	0	0	POL spill which could have been foamed, was relocated in piles to the Bldg. 503 parking lot
Base Boundary Wells		0	0	3		3	0	0	To determine if PFOA/PFOS/PFBS-contaminated groundwater has reached the base boundary.
<b>TOTAL</b>		<b>27</b>	<b>0</b>	<b>12</b>	<b>54</b>	<b>12</b>			

Notes:

- EW – Existing Well
- GW – Groundwater Sample
- S – Soil Sample
- SD – Sediment
- SW-Surface Water

\*Soil borings will be completed and soil samples collected in-lieu of sediment samples if drainage ditch is dry.

\*\*Temporary monitoring well will be installed and a groundwater sample will be collected in-lieu of surface water sample if drainage ditch is dry

**Table 2**  
**Sample Summary**  
**Truax Field Air National Guard, Madison, Wisconsin**

PRL	Sample Location Type	Location ID	Number of Samples <sup>1</sup>	Sample Collection Depth (feet below ground surface)	Analysis
1. Bldg. 430 (Current Fire Station)	Soil Borings	01SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		01SB02	2		
		01SB03	2		
	Temporary Monitoring Well	TW01	1	(TBD) middle of saturated well screen	
2. Bldg. 430	Soil Borings	02SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		02SB02	2		
		02SB03	2		
	Temporary Monitoring Well	TW02	1	(TBD) middle of saturated well screen	
3. Bldg. 430	Soil Borings	03SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		03SB02	2		
		03SB03	2		
	Temporary Monitoring Well	TW03	1	(TBD) middle of saturated well screen	
4. Former Bldg. 403	Soil Borings	04SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		04SB02	2		
		04SB03	2		
	Temporary Monitoring Well	TW04	1	(TBD) middle of saturated well screen	
5. Hanger 400	Soil Borings	05SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		05SB02	2		
		05SB03	2		
	Temporary Monitoring Well	TW05	1	(TBD) middle of saturated well screen	
6. Hanger 406	Soil Borings	06SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		06SB02	2		
		06SB03	2		
	Temporary Monitoring Well	TW06	1	(TBD) middle of saturated well screen	
7. Hanger 414	Soil Borings	07SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		07SB02	2		
		07SB03	2		
	Temporary Monitoring Well	TW07	1	(TBD) middle of saturated well screen	

**Table 2  
Sample Summary  
Truax Field Air National Guard, Madison, Wisconsin**

PRL	Sample Location Type	Location ID	Number of Samples <sup>1</sup>	Sample Collection Depth (ft. bgs)	Analysis
8. Fuel Spill Ditch	Soil Borings	08SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		08SB02	2		
		08SB03	2		
	Temporary Monitoring Well	TW08	1	(TBD) middle of saturated well screen	
9. Bldg. 503 Parking Lot	Soil Borings*	09SB01	2	0-2 and (TBD) directly above water table.	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		09SB02	2		
		09SB03	2		
	Temporary Monitoring Well**	TW09	1	(TBD) middle of saturated well screen	
Base Boundary Wells	Temporary Monitoring Well	TW10	1	(TBD) middle of saturated well screen	PFCs (UCMR 3 List) <sup>2</sup> Method 537.1 Modified
		TW11	1		
		TW12	1		

**Notes:**

1 - Sample count excludes QA/QC samples.

2 - Analysis includes the six per- and polyfluoroalkyl Substances (PFAS) congeners included on the Third Unregulated Contaminant Monitoring Rule (UCMR 3) list; including perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), perfluoroheptanoic acid (PFHpA), and perfluorobutanesulfonic acid (PFBS).

\*Soil borings will be completed and soil samples collected in-lieu of sediment samples if drainage ditch is dry.

\*\*Temporary monitoring well will be installed and a groundwater sample will be collected in-lieu of surface water sample if drainage ditch is dry

**ATTACHMENTS**

**ATTACHMENT A**

**Field Forms**



**ATTACHMENT 1 TO SOP AFW-01  
DAILY PFC PROTOCOL CHECKLIST**



<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>		<b>Weather (temp./precipitation):</b>	
<b>Site Name:</b>		<b>Date and Time:</b>	
<b>Field Manager:</b>			

<p><b>Field Clothing and PPE (as applicable):</b></p> <p><input type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01</p> <p><input type="checkbox"/> Field crew has not used fabric softener on clothing</p> <p><input type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning</p> <p><input type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent</p> <p><b>Field Equipment:</b></p> <p><input type="checkbox"/> No Teflon® containing materials on-site</p> <p><input type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene</p> <p><input type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products</p> <p><input type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site</p> <p><input type="checkbox"/> No adhesives (Post-it® Notes) on-site</p> <p><input type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession</p>	<p><b>Sample Containers:</b></p> <p><input type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE</p> <p><input type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene</p> <p><b>Wet Weather (as applicable):</b></p> <p><input type="checkbox"/> For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p><b>Equipment Decontamination:</b></p> <p><input type="checkbox"/> "PFC-free" water on-site for decontamination of sample equipment</p> <p><input type="checkbox"/> Alconox and Liquinox to be used as decontamination materials</p> <p><b>Food Considerations:</b></p> <p><input type="checkbox"/> No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area</p>
--	---

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:	<p><b>Field Manager Signature:</b></p>   <p><b>Field Manager Name (print):</b></p>
--	---

<b>QA/QC'd by:</b>	<b>QA/QC Date:</b>
--------------------	--------------------







# SCREENED WELL CONSTRUCTION FORM

**Project Name:** Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations

**Contract Number:** W9133L-14-D-0002

**Installation:** \_\_\_\_\_

**Drilling Subcontractor:** \_\_\_\_\_

**Drilling Personnel:** \_\_\_\_\_

**Technician Name:** \_\_\_\_\_

**Other Amec Foster Wheeler Representatives:** \_\_\_\_\_

**Project Number:** 291330006

**Task Order:** 0006

**Location ID:** \_\_\_\_\_

**Well ID:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Drilling Method:** \_\_\_\_\_

**Type of Well:** \_\_\_\_\_

**Measuring Point:** \_\_\_\_\_

**TOC/TOR Difference (in):** \_\_\_\_\_

**Approximate Diameter of Borehole (in):** \_\_\_\_\_

**Depth to Water (ft):** \_\_\_\_\_

**During Drilling:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Post Development:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Hydrologic Unit:** Unknown      Unsaturated Zone

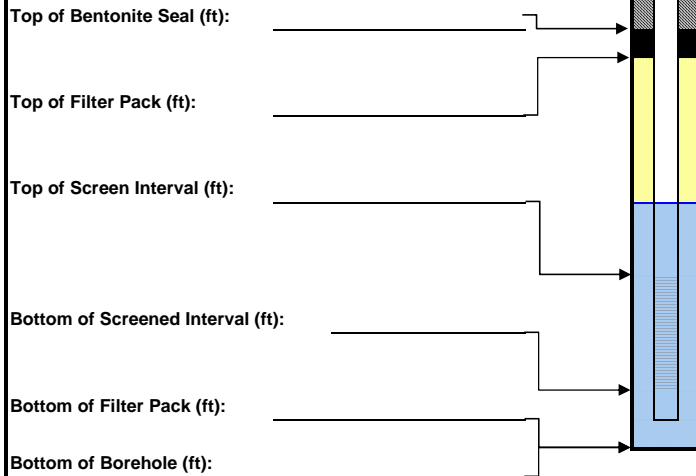
(circle one):      Aquifer      Water Table Aquifer

    Bedrock Aquifer      Confining Layer/Aquiclude

    Perched Aquifer      Lower/Confined Aquifer

**Water added during drilling (gal):** \_\_\_\_\_

**Water removed during development (gal):** \_\_\_\_\_



**Protective Casing:**

**Type:** \_\_\_\_\_

**Dimensions (in):** \_\_\_\_\_

**Stickup (ft):** \_\_\_\_\_

**Length (ft):** \_\_\_\_\_

**Guard Post:** \_\_\_\_\_

**Surface Pad:**

**Type:** \_\_\_\_\_

**Length (ft):** \_\_\_\_\_

**Width (ft):** \_\_\_\_\_

**Thickness (in):** \_\_\_\_\_

**Annular Seal (grout above well seal):**

**Material:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Bentonite Seal:**

**Manufacturer:** \_\_\_\_\_

**Material:** \_\_\_\_\_

**Type:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Hydration time (hrs):** \_\_\_\_\_

**Filter Pack Material:**

**Manufacturer:** \_\_\_\_\_

**Material:** \_\_\_\_\_

**Size:** \_\_\_\_\_

**Installation Method:** \_\_\_\_\_

**Surging time:** \_\_\_\_\_

**Well Casing (Riser):**

**Manufacturer:** \_\_\_\_\_

**Type/Material:** \_\_\_\_\_

**Length:** \_\_\_\_\_

**Diameter (in):** \_\_\_\_\_

**Well Screen:**

**Manufacturer:** \_\_\_\_\_

**Type/Material:** \_\_\_\_\_

**Diameter (in):** \_\_\_\_\_

**Slot Size (in):** \_\_\_\_\_

**Slot Type:** \_\_\_\_\_

**Sump/End Cap:** \_\_\_\_\_

**Notes:** \_\_\_\_\_

**Technician Signature:** \_\_\_\_\_

Depths and heights are referenced to ground surface unless specified TOC.  
All elevations are referenced to MSL (NAVD 88).

**Technician Name (print):** \_\_\_\_\_

**QA/QC'd by:** \_\_\_\_\_

**QA/QC Date:** \_\_\_\_\_





## SAMPLE COLLECTION LOG

### SEDIMENT / SURFACE SOIL / SURFACE WATER

<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>	_____	<b>Date:</b>	_____
<b>Location ID:</b>	_____	<b>Sample Technician:</b>	_____
<b>Northing:</b>	_____	<b>Easting:</b>	_____

#### SEDIMENT SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
<b>Sample Depth (ft):</b> _____	<b>Sample ID:</b> _____
<b>MS/MSD Collected:</b> _____	<b>Sample Date:</b> _____
<b>Duplicate ID:</b> _____	<b>Sample Collection Time:</b> _____
<b>Sample Container Type(s):</b> _____	<b>Sample Collection Methods:</b> _____
<b>Preservative(s):</b> _____	<b>Analysis/Method(s):</b> _____

#### SURFACE SOIL SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
<b>Sample Depth (ft):</b> _____	<b>Sample ID:</b> _____
<b>MS/MSD Collected:</b> _____	<b>Sample Date:</b> _____
<b>Duplicate ID:</b> _____	<b>Sample Collection Time:</b> _____
<b>Sample Container Type(s):</b> _____	<b>Sample Collection Methods:</b> _____
<b>Preservative(s):</b> _____	<b>Analysis/Method(s):</b> _____

#### SURFACE WATER SAMPLE

Time	Intake Depth (feet)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)

<b>Sample Depth (ft):</b> _____	<b>Sample Date:</b> _____
<b>Sample ID:</b> _____	<b>Sample Collection Time:</b> _____
<b>MS/MSD Collected:</b> _____	<b>Sample Collection Methods:</b> _____
<b>Duplicate ID:</b> _____	<b>Surface Water Depth (ft):</b> _____
<b>Sample Container Type(s):</b> _____	<b>Water Body and Water Quality Characteristics</b> (circle all that apply):
<b>Preservative(s):</b> _____	River      Stream      Pond      Flowing      Stagnant Clear      Cloudy      Turbid      Other:
<b>Analysis/Method(s):</b> _____	

<b>Location Sketch:</b>    	<b>Instruments (Manufacturer, Model, and Serial No.):</b>   				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; height: 80px; vertical-align: top;"><b>Notes:</b></td> <td style="width: 30%; height: 80px; vertical-align: top;"><b>Technician Signature:</b></td> </tr> <tr> <td> </td> <td> </td> </tr> </table>	<b>Notes:</b>	<b>Technician Signature:</b>		
<b>Notes:</b>	<b>Technician Signature:</b>				
	<b>Technician Name (print):</b>				

<b>QA/QC'd by:</b> _____	<b>QA/QC Date:</b> _____
--------------------------	--------------------------

# TAILGATE SAFETY MEETING REPORT



<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>		<b>Date and Time:</b>	
<b>Field Manager Name:</b>		<b>Site Health and Safety Officer (HSO):</b>	
<b>Safety Meeting Type (circle one):</b> Initial Kickoff Safety Meeting      Regular/Daily Tailgate Safety Meeting <u>    </u> Unscheduled Tailgate Safety Meeting			

Order of Business	
<p><b>Topics Discussed (check all that apply):</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Site History/Site Layout</li> <li><input type="checkbox"/> Scope of Work</li> <li><input type="checkbox"/> Personnel Responsibilities</li> <li><input type="checkbox"/> Medical Surveillance Requirements</li> <li><input type="checkbox"/> Training Requirements</li> <li><input type="checkbox"/> Safe Work Practices</li> <li><input type="checkbox"/> Logs, Reports, Recordkeeping</li> <li><input type="checkbox"/> Sanitation and Illumination</li> <li><input type="checkbox"/> Air Surveillance Type and Frequency</li> <li><input type="checkbox"/> Monitoring Instruments and Personal Monitoring</li> <li><input type="checkbox"/> Action Levels</li> <li><input type="checkbox"/> Accident Reporting Procedures</li> <li><input type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)</li> <li><input type="checkbox"/> Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Engineering Controls</li> <li><input type="checkbox"/> PPE Required/PPE Used</li> <li><input type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures</li> <li><input type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)</li> <li><input type="checkbox"/> Decontamination Procedures for Personnel and Equipment</li> <li><input type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)</li> <li><input type="checkbox"/> Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)</li> <li><input type="checkbox"/> Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)</li> <li><input type="checkbox"/> Hazardous Materials Spill Procedures</li> <li><input type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)</li> <li><input type="checkbox"/> Injury/Illness Reporting Procedures</li> <li><input type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines</li> <li><input type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)</li> </ul>

Safety suggestions by site workers: \_\_\_\_\_

Action taken on previous suggestions: \_\_\_\_\_

Injuries/accidents/personnel changes since previous meeting: \_\_\_\_\_

Observations of unsafe work practices/conditions that have developed since previous meeting: \_\_\_\_\_

Location of (or changes in the locations of) evacuation routes/safe refuge areas: \_\_\_\_\_

Other Safety Topics: \_\_\_\_\_

Additional comments: \_\_\_\_\_

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature

<b>Meeting Conducted By (print):</b>	<b>Company and Title</b>	<b>Signature</b>

QA/QC'd by: \_\_\_\_\_ QA/QC Date: \_\_\_\_\_

# WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



<b>Project Name:</b>	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	<b>Project Number:</b>	291330006
<b>Contract:</b>	W9133L-14-D-0002	<b>Task Order:</b>	0006
<b>Installation:</b>	_____	<b>Calibration Start Time:</b>	_____
<b>Sample Technician:</b>	_____	<b>Calibration End Time:</b>	_____

### Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (% mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments

### Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (% mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments

#### Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	_____	_____	Spec. Conductance	_____	_____	10	_____	_____
pH (7)	_____	_____	Salinity	_____	_____	20	_____	_____
pH (10)	_____	_____	D.O.	_____	_____	100	_____	_____
			ORP	_____	_____	800	_____	_____

<b>Instruments (Manufacturer, Model, and Serial No.):</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%; text-align: center;">Manufacturer/Model</td> <td style="width: 40%; text-align: center;">Serial No</td> </tr> </table> <b>Water Quality Meter:</b> _____ <b>Turbidity Meter:</b> _____ Calibrated Within Acceptance Criteria (Y/N): _____ If No, Provide Explanation: _____	Manufacturer/Model	Serial No	<b>Notes:</b> _____ _____ _____	<b>Technician Signature:</b> <div style="text-align: center; height: 40px;">(Signature)</div> <b>Technician Name (print):</b> _____
Manufacturer/Model	Serial No			

<b>QA/QC'd by:</b> _____	<b>QA/QC Date:</b> _____
--------------------------	--------------------------

