FINAL (REVISION 1)

QUALITY PROGRAM PLAN

Perfluorinated Compounds (PFCs) Release Determination at Multiple BRAC Bases

Contract FA8903-08-D-8766
Task Order 0177

Prepared for:

Air Force Civil Engineer Center
JBSA Lackland AFB, Texas
4PAE08 Contract

July 2014

Submitted by: amec

Environment & Infrastructure, Inc.

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ACRONYMS

°F	degrees Fahrenheit
AF	Air Force
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Engineering and the Environment
AFFF	Aqueous Film Forming Foam
AFHRA	Air Force Historical Research Agency
AFSC	Air Force Safety Center
AMEC	AMEC Environment & Infrastructure, Inc.
BEC	Base Environmental Coordinator
bgs	below ground surface
BPM	BRAC Program Management
BRAC	Base Realignment and Closure
CE2L	Certified Energy and Environmental Labs
CLP	Contract Laboratory Program
COCs	Constituents of Concern
COR	Contracting Officer Representative
CPSMR	Contractors Progress, Status and Management Report
CSM	Conceptual Site Model
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOT	Department of Transportation
DPT	Direct Push Technology
DQI	Data Quality Indicator
DQOs	Data Quality Objectives
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ERPIMS	Environmental Resources Program Information Management System
FMER	Funds and Man-Hours Expenditure Report
FY	Fiscal Year
GPS	Global Positioning System
HDPE	High Density Polyethylene
HSP	Health and Safety Plan

IDW	Investigation-Derived Waste
ISO	International Organization for Standardization
LC-MS-MS	Liquid Chromatography and Tandem Mass Spectrometry
LCS	Laboratory Control Sample
LDA	Land Development Authority
LOQ	Limit of Quantitation
MDL	Method Detection Llimit
mg/kg	milligrams per kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAD	North American Datum
NAVD	North American Vertical Datum
NFGs	National Functional Guidelines
ng/l	nanograms per liter
ORP	oxidation-reduction potential
PAL	Project Action Limits
PBC	Performance Based Contract
PFBS	Perfluorobutanesulfonic Acid
PFC	Perfluorinated Compounds
PFHPA	Perfluoroheptanoic Acid
PFHXS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PHA	Provisional Health Advisory
POC	Point of Contact
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QPP	Quality Program Plan
QSM	Quality Systems Manual
RPD	relative percent difference
SA/R	Site Assessment/Research
SM	Standard Method
SOP	Standard Operating Procedure

TAT	Turnaround Time
TO	Task Order
UFP	Uniform Federal Policy
μg/L	micrograms per liter
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
USCS	Unified Soil Classification System

INTRODUCTION

This Quality Program Plan (QPP) presents the activities and associated quality objectives to be conducted for perfluorinated compounds (PFCs) release determination, delineation, and remediation at 39 Base Realignment and Closure (BRAC) installations located nationwide. This is a general QPP designed to provide program-level information for release determination activities that will be conducted at each of the 39 BRAC installations. This QPP has been prepared under Contract No. FA8903-08-D-8766, Task Order (TO) 0177 between AMEC Environment & Infrastructure, Inc. (AMEC) and the Air Force Civil Engineering Center (AFCEC). The TO has two primary objectives: 1) to conduct research and evaluation of 39 BRAC installations to determine whether a reasonable basis exists to suspect PFC releases beyond those already identified at fire training areas (FTAs); and, 2) to conduct site investigation activities and obtain clear and defensible data to confirm if a release of PFCs has occurred to groundwater, surface water, soil, and/or sediment at 19 BRAC installations as a result of firefighting training activities in FTAs. This QPP addresses the second objective of the TO. The work associated with the first objective of the TO (research and evaluation at 39 BRAC installations) is detailed in the *Site Assessment/Research Work Plan*, finalized on 7 April 2014.

This QPP has been prepared to ensure: (1) the site investigation objectives and data quality objectives (DQOs) for this project are clearly identified; (2) the field sampling protocols are documented and reviewed in a consistent manner; and, (3) the data collected are scientifically valid and defensible. This QPP consists of the scope of activities that will be conducted under the contract and a general Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) in accordance with the July 2009 AFCEC (formerly the Air Force Center for Engineering and the Environment), memorandum detailing the implementation of the UFP-QAPP on Air Force Restoration Projects. This memorandum states that the UFP QAPP will replace the formerly required Work Plan, Field Sampling Plan, and QAPP on all new Air Force projects. The UFP QAPP integrates all technical and quality aspects for the life cycle of the project, including planning, implementation, assessment, and decision-making. A general Health and Safety Plan (HSP) is provided as **Appendix A** to this QPP (AMEC, 2014). Subsequent to this QPP, an installation-specific work plan addendum will be prepared for each of the 19 installations selected for sampling and analysis of PFCs in environmental media. These work plans will document the installation-specific field and HSP activities to be conducted at each of the 19 installations.

BACKGROUND

PFCs are a class of synthetic compounds formed from carbon chains with fluorine attached. The chemical structure of PFCs gives them unique properties, such as thermal stability and the ability to repel both water and oil, that make them useful components in a wide variety of consumer and industrial products, including non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as aqueous film forming foam (AFFF).

PFCs are under increased scrutiny from the regulatory community because they are environmentally persistent, tend to bioaccumulate in living organisms, and have demonstrated some toxicity in laboratory animals[1]. The United States (U.S.) Environmental Protection Agency (EPA) issued the Contaminant Candidate List 3 (CCL 3) in October 2009. The CCL 3 identified chemical or chemical groups not subject to any national primary drinking water regulations, that are known or anticipated to occur in public water systems and which may require regulation under the Safe Drinking Water Act[2]. Two PFCs, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), were identified on the CCL 3. Six PFCs as shown in **Table 1** are included in the EPA Proposed Unregulated Contaminant Monitoring Rule 3 (UCMR 3), which requires public water systems to monitor for these chemicals from 2013 through 2015.[3] The UCMR is the primary source of occurrence and exposure information used by the EPA to determine whether to regulate a contaminant.

Table 1. Perfluorinated Contaminants Included in the EPA UCMR 3

Contaminant	CAS Registry #
Perfluorooctane sulfonate (PFOS)	1763-23-1
Perfluorooctanoic acid (PFOA)	335-67-1
Perfluorononanoic acid (PFNA)	375-95-1
Perfluorohexane sulfonic acid (PFHxS)	355-46-4
Perfluoroheptanoic acid (PFHpA)	375-85-9
Perfluorobutane sulfonic acid (PFBS)	375-73-5

Notes: CAS = Chemical Abstract Service

The EPA has developed provisional health advisories for PFOS (0.2 micrograms per liter [µg/L]) and PFOA (0.4 µg/L) to protect against potential risk from exposure to these chemicals through drinking water.[4] **Table 2** summarizes the current federal regulatory advisory and screening values.

Initially, regulatory activity was primarily driven by concern over potential contamination near PFC manufacturing facilities. However, this concern has expanded to include other types of sites, such as firefighting training locations. Regulatory interest has focused on two PFCs: PFOS and PFOA, both of which have been identified in historically used AFFF. Large quantities of AFFF have been released into the environment as a result of fire training exercises, actual fire suppression activities, and tank and pipeline leaks and releases. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards (Department of Defense [DoD] Military Specification MIL-F-24385F [SH], Amendment 1, August 5, 1984). The surfactants provide the AFFF with the low surface tension needed to enable film formation on top of the fuel to help suffocate the fire. Historically, most AFFF contained

[1] U.S. Environmental Protection Agency (USEPA). 2009. Long-Chain Perfluorinated Chemicals (PFCs) Action Plan. December 30.
[2] USEPA. 2009. Drinking Water Contaminant Candidate List 3, Final. 74 FR 51850. October 8.
[3] USEPA. 2011. Revisions to the Unregulated Contaminant Monitoring Regulation (UCMR 3) for Public Water Systems, Proposed Rule. 76 FR 11713, March 3.
[4] See USEPA – Perfluorooctanoic Acid (PFOA) and Fluorinated Telomers. http://www.epa.gov/opptintr/pfoa/pubs/pfoainfo.html#provisional. Accessed April 21, 2014.

both PFOS and PFOA. Manufacturers now use a different process to produce fluorosurfactants for AFFF. However, the current AFFF agents may still contain trace levels of perfluorocarboxylic acids, such as PFOA.

Table 2. Federal Regulatory Guidance Values for PFOS and PFOA in Drinking Water and Soil

Agency	PFOS	PFOA
Molecular Formula	$C8HF_{17}O_3S$	$C8HF_{15}O_2$
CAS Registry #	1763-23-1	335-67-1
U.S. Environmental Protection Agency		
Provisional Drinking Water Health Advisory Values (USEPA Office of Water)	0.2 µg/L	0.4 µg/L
Residential Soil Screening Level (USEPA Region 4) [a]	6 mg/kg	16 mg/kg

Notes: CAS = Chemical Abstract Service µg/L = microgram per liter
mg/kg = milligram per kilogram
Footnotes:
[a] http://www.epa.gov/region4/water/documents/final_pfc_soil_screening_values11_20_09.pdf

From the early 1970s until 2002, the DoD purchased and used AFFF containing PFOS and/or PFOA for firefighting and firefighting training. Older training facilities were often not lined and were not constructed to prevent infiltration of firefighting foams and combustion products into the environment. Per DoD Instruction (DoDI) 4715.18, *Emerging Contaminants* (DoD, 2009)[5] and the *Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations* (USAF, 2012)[6], in the absence of an applicable legal driver, the Air Force (AF) may confirm a possible release of an emerging contaminant such as PFCs, followed by delineation, if: a reasonable basis exists to suspect a potential release associated with AF activities at an installation; an exposure pathway exists for the probable contamination to threaten public health; and/or potential for off-site migration is likely.

SITE INVESTIGATION PURPOSE AND SCOPE

The purpose of the site investigation is to determine if a confirmed release of PFCs has occurred at 19 of the BRAC installations. **Table 3** lists the 19 BRAC installations designated for site investigation activities. Please note that additional installations may be added to the list provided in **Table 3** depending on information learned during the project.

These objectives will be achieved through the following site investigation activities:

- Scoping Activities: Scoping activities will include the review of background documentation, current activities, and a site reconnaissance at each of the 19 BRAC installations.

[5] Department of Defense (DoD). 2009. DoD Instruction Number 4715.18, Emerging Contaminants (ECs). Certified current through June 11, 2016.
[6] United States Air Force. 2012. Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations. August 27.

- Installation-Specific Work Plan Addendum Documentation: The results of the scoping activities will be used to develop a unique sampling strategy for each of the 19 installations that will be presented in 19 separate Installation-Specific Work Plan Addendums.
- Site Investigation Field Activities: This will include sampling and analysis of soil, groundwater, sediment and/or surface water to determine the presence or absence of PFCs in environmental media from suspected release sites.
- Site Investigation Report Documentation: The results of site investigation field activities will be documented in the Installation-Specific Site Investigation Report.

Table 3. Installations Designated for PFC Site Investigations

Installation	Location	Installation	Location
Bergstrom AFB	Austin, Texas	Norton AFB	San Bernardino, California
Castle AFB	Atwater, California	Reese AFB	Lubbock, Texas
Chanute AFB	Ranoul, Illinois	George AFB	Victorville, California
England AFB	Alexandria, Louisiana	Grissom AFB	Kokomo, Indiana
General Mitchell ARS	Milwaukee, Wisconsin	March AFB	Moreno Valley, California
Griffiss AFB	Rome, New York	Mather AFB	Sacramento, California
K.I. Sawyer AFB	Marquette, Michigan	McClellan AFB	Sacramento, California
Kelly AFB	San Antonio, Texas	Plattsburgh AFB	Plattsburgh, New York
Lowry AFB	Denver, Colorado	Richards-Gebaur AFB	Kansas City, Missouri
Myrtle Beach AFB	Myrtle Beach, South Carolina		

Note: Additional installations may be added to this list depending on information learned during the project.

By achieving the site investigation objectives, accurate and defensible site research and site investigation reports will be developed, confirming if a release of PFCs has occurred to environmental media (analytical based data).

QAPP Worksheet #1 & 2, Title and Approval Page

Rev 1, Date: 07/21/2014

Site Name/Project Name: Perfluorinated Compounds (PFCs) Release Determination at Multiple BRAC Bases

Site Location: Nationwide

Contract Number: FA8903-08-D-8766, Delivery Order 0177

Lead Organization:

Air Force Civil Engineer Center
2261 Hughes Avenue, Suite 155
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TO 177 Technical Lead: Billy Claxton
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23 July 2014
Signature

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TO 177 Contracting Officer's Representative: David Farnsworth
david.farnsworth@us.af.mil

23 July 2014
Signature

Preparer:

AMEC Environment & Infrastructure, Inc.
9725 Cogdill Road
Knoxville, Tennessee 37932
AMEC Project Manager: Melissa Helton
melissa.helton@amec.com

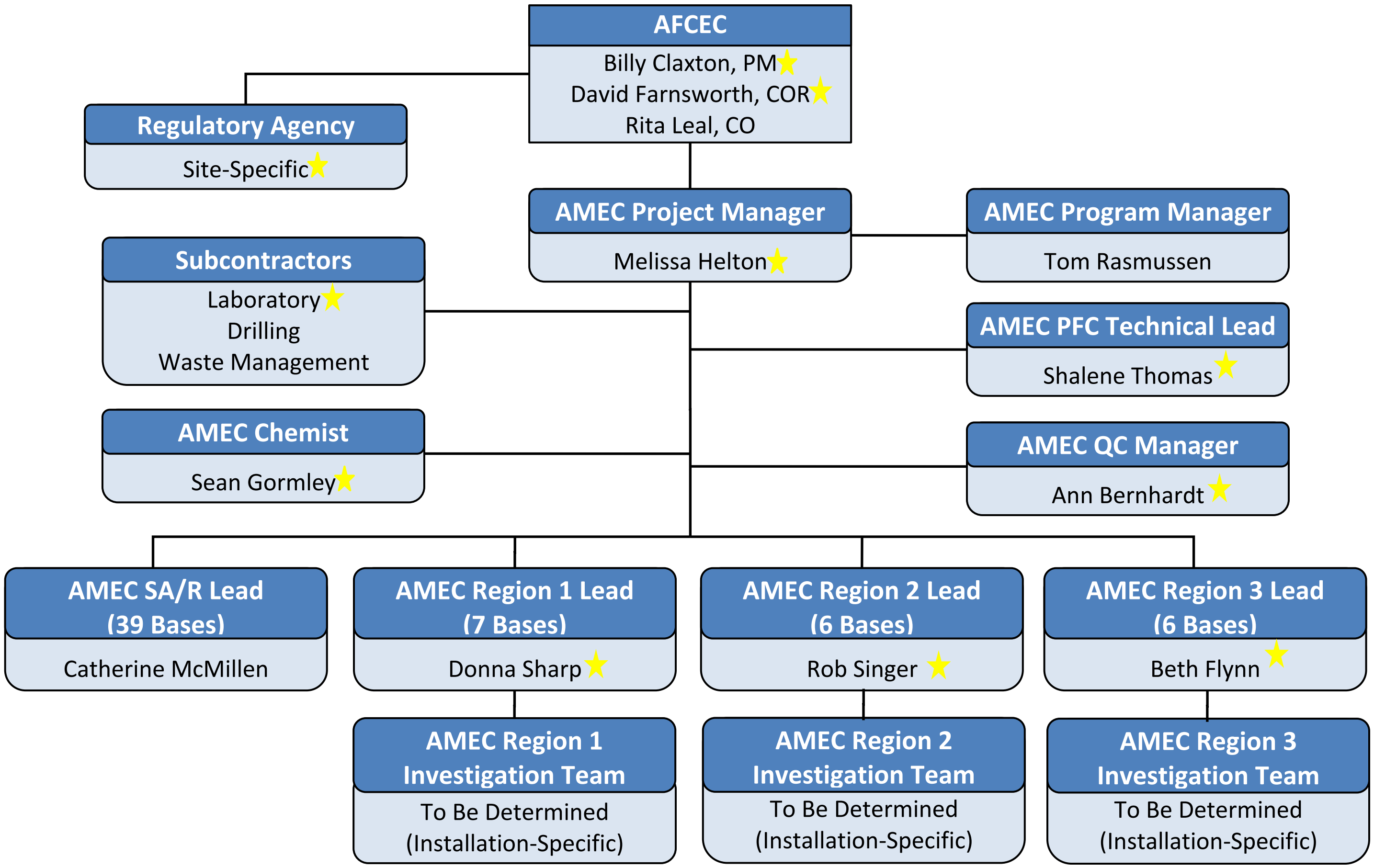
Melissa C. Helton 24 July 2014
Signature

Relevant Plans and Reports from Previous Investigations:

Not available at this time.

QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution

Rev 1, Date: 07/21/2014



Notes: ☆Indicates UFP-QAPP distribution List

Installation-specific organizational charts will be provided in the Installation-Specific Work Plan Addendums and will include the AMEC Regional Investigation Team Members.

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet

Rev 1, Date: 07/21/2014

Organization: AMEC Environment & Infrastructure, Inc. (AMEC)

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date*
Melissa Helton	Project Manager	B.S. Geology/21 years	PG (TN)	Melissa C. Helton
Shalene Thomas	PFC Technical Lead	M.S. Environmental Science and Management/16 years	PMP	Shalene M. Thomas
Sean Gormley	Chemist	B.S. Chemistry/29 years	EAC, CHMM	Sean Gormley
Marie Bevier	Laboratory Coordinator	B.S. Chemistry/ 20 years	EAC, CHMM	[illegible]
Donna Sharp	Region 1 Lead	B.S. Geology/19 years	PG (TN)	Donna Sharp
Rob Singer	Region 2 Lead	B.S. Civil Engineering/18 years	PE (MI, NH, KY)	[illegible]
Beth Flynn	Region 3 Lead	M.S Geology/25 years	PG (CA)	Bethany P. Flynn
Ann Bernhardt	Quality Control Manager	B.S. Environmental Science/ 22 years	Certified Manager of Quality/Organizational Excellence, ASQ 14430	[illegible]

Notes:
Signatures indicate personnel have read and agree to implement this QAPP as written.

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet (continued)

Rev 1, Date: 07/21/2014

Organization: Primary Analytical Laboratory – Certified Energy and Environmental Labs (CE2L)
Subcontractor to Primary Analytical Laboratory – Accutest Laboratories Southeast, Inc.

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Shawn Maxwell	CE2L Project Manager	M.B.A., B.S. Biology/6 years	Perkin-Elmer ICP-MS training	[signature] 24-Jul-2014
Andrea Colby	Accutest Project Manager	B.A. Biology/26 years	NA	[signature] 7/23/14

Notes:
NA – not applicable
Signatures indicate personnel have read and agree to implement this QAPP as written.
PFC analysis will be conducted by Accutest.
Waste characterization analysis will be conducted by CE2L.

Organization: Secondary Analytical Laboratory – Vista Analytical Laboratory
Subcontractor to Secondary Analytical Laboratory – Katahdin (Subcontractor to Vista) Analytical Services

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Martha Maier	Vista Laboratory Director	BS – Chemistry / 30 yr	NA	[signature] 7/25/14
Andrew Patterson	Vista Technical Director	BS – Microbiology / 13 yr	NA	[signature] 7/25/14
Calvin Tanaka	Vista Acting Quality Assurance Manager	BA – Chemistry / 41 yr	NA	[signature] 7/25/14
Jennifer Obrin	Katahdin (Subcontractor to Vista) Project Manager	BS – Ocean Studies / 13 yr	NA	Jennifer Obrin 7/25/14

Notes:
NA – not applicable
Signatures indicate personnel have read and agree to implement this QAPP as written.
PFC analysis will be conducted by Vista.
Waste characterization analysis will be conducted by Katahdin (Subcontractor to Vista).

QAPP Worksheet #6: Communication Pathways

Rev 1, Date: 07/21/2014

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Regulatory agency interface	AFCEC	Billy Claxton TO177 Technical Lead	210-395-9475	Is the primary point of contact for regulatory interface. Contact will be made by AMEC Project Manager through telephone or electronic mail and a record will be retained detailing the correspondence.
Stop work due to safety issues	AFCEC, AMEC, Subcontractors	On-site personnel	--	On-site personnel must notify the AMEC Site Health and Safety Officer, who in turn notifies the AMEC Regional Lead* and the AMEC Project Manager (verbal, electronic), who in turns notifies AFCEC (verbal, electronic).
Stop work due to quality issues	AFCEC, AMEC, Subcontractors	On-site personnel	--	On-site personnel must notify the AMEC Field Manager**, who in turn notifies the AMEC QC Manager, who will contact the AMEC Regional Lead and the AMEC Project Manager (verbal, electronic), who in turns notifies AFCEC (verbal, electronic).
QPP changes prior to field work	AMEC	Shalene Thomas PFC Technical Lead	612-252-3697	Notify the AMEC Project Manager, who in turn notifies AFCEC (verbal, electronic).
QPP changes during project execution	AMEC	Regional Leads	--	Will notify the AMEC Project Manager who in turn notifies AFCEC.
Field corrective actions	AMEC	Melissa Helton Project Manager	865-671-6774	Field corrective actions will be developed by the AMEC Project Manager and AMEC QC Manager within 24 hours and will be communicated to the AMEC Regional Leads, who in turn notifies the Field Manager, who will communicate corrective actions to the field team.
Sample receipt variances	CE2L	Shawn Maxwell CE2L Project Manager	816-389-8406	Will notify the AMEC Laboratory Coordinator within 24 hours of sample receipt, who will then notify the AMEC Regional Lead and the AMEC Project Manager.
	Accutest	Andrea Colby Accutest Project Manager	407-608-8062	
	Vista	Martha Maier Laboratory Director	906-673-1520	
	Katahdin (Subcontractor to Vista)	Jennifer Obrin Katahdin (Subcontractor to Vista) Project Manager	207-874-2400	

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Laboratory quality control variances	CE2L	Shawn Maxwell CE2L Project Manager	816-389-8406	Will notify the AMEC Laboratory Coordinator and AMEC QC Manager within 24 hours of variance. If quality control variances contradict the minimum requirements of the DoD Quality Systems Manual, then the AMEC QC Manager and AMEC Project Manager will contact AFCEC (COR and Technical Lead) to discuss and receive approval for the variances within 7 days of notice of variance.
	Accutest	Andrea Colby Accutest Project Manager	407-608-8062	
	Vista	Martha Maier Laboratory Director	906-673-1520	
	Katahdin (Subcontractor to Vista)	Jennifer Obrin Katahdin (Subcontractor to Vista) Project Manager	207-874-2400	
Analytical corrective actions	AMEC	Ann Bernhardt QC Manager	503-639-3400	Will respond to issue from laboratory with potential corrective action (verbal, written or electronic) within one week of notification.
Data verification issues, e.g., incomplete records	AMEC	Ann Bernhardt QC Manager	503-639-3400	The AMEC QC Manager will resolve any data verification issues with the contract laboratory within one week of issue being identified.
Data validation issues, non-compliance with procedures	AMEC	Ann Bernhardt QC Manager	503-639-3400	The AMEC QC Manager will resolve any data validation issues with the contract laboratory within one week of issue being identified.
Data review corrective actions	AMEC	Ann Bernhardt QC Manager	503-639-3400	The AMEC QC Manager will communicate necessary data review corrective actions with the contract laboratory within one week of corrective actions.

Notes: * Since the AMEC Regional Leads will be difference for each installation, they will be identified in the Installation-Specific Work Plan Addendums.
**Since the AMEC Field Managers will be different for each installation, they will be identified in the Installation-Specific Work Plan Addendums.

QAPP Worksheet #9: Project Planning Session Summary

Rev 1, Date: 07/21/2014

Date of planning session: 14-16 January 2014
Location: Joint Base San Antonio – Lackland AFB, Texas
Purpose: Project Kickoff Meeting

Attendees:

Val de la Fuente	(VF)	AFCEC CIBE, Chief, Program Execution Branch
David Farnsworth	(DF)	AFCEC CIBE, Contracting Officer Representative (COR)
Billy Claxton	(BC)	AFCEC CIBE, CIB Project Manager
Melissa Helton	(MH)	AMEC Project Manager
Tom Rasmussen	(TR)	AMEC Program Manager
Catherine McMillen	(CM)	AMEC Site Assessment/Research Lead

0845: TR began the meeting with introduction followed by a safety moment. The safety moment focused on cell phone theft and iterated that if a cell phone is stolen, it is best to report it immediately but not to put yourself in potential danger (i.e. don't chase down the thief).

General Project Discussion:

VF spoke about the nature of the project and discussed the need to look at each base and create a prioritization list. VF indicated that AFCEC is very interested to see any data we collect as soon as it is available.

MH confirmed that one of the goals of the project planning meeting was to create a priority list with AFCEC in order to schedule the first bases as soon as possible for research and/or field work. MH also confirmed that AMEC would inform AFCEC as soon as a potential release or impacts are identified.

Action Item #1: AMEC and AFCEC will create a priority list to determine schedule. [This action item was completed.]

DF stated that the data collected under this TO will be used to develop future requirements. For example, based on the results of investigation activities conducted at Plattsburgh Air Force Base (AFB) and Griffiss AFB, future requirements may be included in a Performance Based Contract (PBC) that will be solicited in Fiscal Year (FY) 15. Therefore, the field work at these two bases should be conducted in FY14 (higher on the priority list).

VF added that AFCEC would like to be ready to respond quickly in the event that the US Environmental Protection Agency (EPA) regulates PFCs in the near future. DF and BC agreed they would help AMEC create a priority list after speaking with the Base Environmental Coordinators (BECs).

VF stated that AFCEC looks forward to learning more about PFCs since they are an emerging contaminant and will be looking to AMEC for education. He stated that the BECs have been responsive in the initial information requests regarding PFCs. Any issues with unresponsiveness from BECs should be directed to DF and BC with David Strainge as backup (he is the alternate COR).

DF added that David Strainge is the BEC for Wurtsmith AFB and a Public Meeting is being held on 12 February 2014 to discuss PFC impacts to fish. At other bases, if sampling is conducted on surface water, what should be done with the data?

DF and VF agreed that while this is not a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) project, we should submit our findings to the regulators for each base. DF added that potential receptors and pathways should be identified where possible.

BC asked if the protein foam that was used as a predecessor to aqueous film forming foam (AFFF) in the 1960s should be addressed. It was agreed that AFCEC would send AMEC information on the protein foam for review, but it was unlikely it contained PFCs.

Action Item #2: DF will send copy of protein foam information to MH. [At a later date this action item was completed, the Air Force decided that the protein foam was not applicable to this task order.]

DF indicated that the investigation should look at the history of bases with training areas. For example, Chanute AFB had fire training school, including labs. We need to find out where the AFFF was used and disposed. A good source will be in the real property reports for each base. DF also stated that the research should identify any fire suppression systems because they sometimes malfunction and sprayed AFFF without a fire. The suppression systems were also tested with live fires. BC said that the AFFF was likely swept out of the buildings after these events.

DF said there may also be mixing tanks for AFFF and water that could show up in the as-built drawings. As-built drawings may or may not be available since many of them were transferred to the new property owners with the BRAC transfer.

MH asked if BC had a good response from the initial questionnaires sent to the BECs. BC indicated that the response was good and that he would send a copy of the completed forms to MH.

Action Item #3: BC will send copy of initial PFC questionnaires to MH.

0920: Ten minute break

0930: MH presented the Project Planning presentation.

MH asked if this project will only focus on AFFF and not other sources of PFCs. BC, DF and VF confirmed this.

DF stated that the original schedule indicated that one of the first draft research reports was scheduled to be submitted in June 2014. MH said she would check on this and also stated that the schedule would likely change after review of the priority list. A new schedule will be submitted with the first Contractor's Progress, Status and Management Report (CPSMR)/Funds and Man-Hours Expenditure Report (FMER).

DF asked if the SA/R reports would be sent to the regulators like the site investigation report would. MH confirmed that the research reports would not be sent to the regulators since there were no "sites" associated with these reports. VF added that the site investigation portion of the project will include regulator involvement.

[Note: After further discussions held after the initial Project Planning Session, AFCEC determined that the SA/R reports would be sent to the regulators as a courtesy.]

MH asked who the contacts were for scheduling records review visits to the Air Force Safety Center (AFSC) at Kirtland AFB and the Air Force Historical Research Agency (AFHRA) at Maxwell AFB, Alabama. DF and BC both indicated they would coordinate with the repositories and DF said he may need to check on any security issues.

Action Item #4: DF will check on security requirements for conducting research at Maxwell and Kirtland AFBs and BC/DF will provide contact information for each of the document repositories. [At a later date this contact information for each base was provided.]

DF also stated that AF fire fighting management office is located at Tyndall AFB. TR offered that he would be traveling to Tyndall AFB soon and could research there, if needed.

Action Item #5: DF will supply MH with Tyndall AFB contact for fire-fighting procedures. [This action item was completed.]

For the analytical portion of the work, DF asked what the turnaround times (TAT) were for the analytical laboratories and for the data validation. MH indicated that the TAT for the labs was 14 days and validation would take approximately one month.

MH asked who the various documents for the project should be distributed to. DF indicated that the general documents (such as the QPP) should be distributed to DF and BC. The site-specific reports should be distributed to DF, BC, the BEC and associated contractor support staff. MH confirmed that all comments received on the report should be sent through DF or BC and be consolidated then forwarded to AMEC.

MH asked if a HSP would be required for the scoping visits. DF stated that for administrative visits in which no intrusive work was conducted, a HSP would not be required. DF added that visitors may be subject to existing HSPs if a contractor is already working on that base. BC confirmed that and stated that coordination with the BEC and property owners should be conducted prior to arriving at each base.

Action Item #6: BC will supply deeds and available access information for each base to MH. [This action item was completed.]

MH discussed the proposed meeting for the project and said that a quarterly face-to-face meeting would probably be appropriate. VF also offered that BC and/or DF could come to the calibration sessions to occur in Knoxville, TN or at a base during scheduled field work.

MH discussed the CPSMR/FMER and offered an example to the group for this project. TR/DF also requested that an additional column labeled "Accrued" be added to the report. This addition is critical because we will need to watch and estimate closely since a large amount of field work (and subcontractor costs) will be conducted concurrently. MH agreed to include this information on the CPSMR.

1200: The meeting was adjourned.

QAPP Worksheet #10: Conceptual Site Model

Rev 1, Date: 07/21/2014

The preliminary Conceptual Site Model (CSM) for each Fire Training Area will be developed and presented in the Installation Specific Work Plan Addendums. The CSMs at a minimum will include the following information presented in table format.

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Installation Description: • Years of operation • Total area occupied by base (acres) • Investigation area (acres) • Description of historical activities on base • Installation mission **Fire Training Area History**: • Location(s) on base • Years of operation • Frequency of operation • Fire training activities	**Fire Training Area Site Characteristics**: • Total area (acres) **Topography**: • General topography across base • Topography in vicinity of FTA • Approximate elevation **Vegetation**: • General overview of vegetation at FTA • Stressed vegetation **Surface Water**: • Presence of streams, lakes, playas, oceans, etc. • Drainage pathways **Soils**: • Primary soil makeup (e.g. sand, silt, clay, etc.) **Geology**: • Formation information and name • Depth intervals **Hydrogeology**: • Aquifer formation name • Depth to groundwater • Saturated thickness • Confined, unconfined and/or perched aquifer • Groundwater flow direction • Hydraulic gradient, hydraulic conductivity and seepage velocity (if known) **Meteorology:** • Average annual precipitation • Wet and dry seasons • Average temperature / climate	**Contaminants of Potential Concern**: • PFCs primary concern • As determined from previous reports • Note historical contaminants (e.g. chlorinated solvents, fuels, etc.) associated with the FTA **Media of Potential Concern**: • Soil, groundwater, surface water and sediment **Confirmed AFFF Releases**: • Per FTA training records • Dates of AFFF release / use • Quantities of AFFF used (if known) **Primary Releases from FTA**: • Infiltration into groundwater (unconsolidated material, fracture flow, etc.) • Direct discharge into storm water sewer collection system • Direct discharge into drains, plumbing infrastructure and outfall locations • Adsorption to soil matrix near source **Secondary Releases**: • Soil excavations and disposal • Pump and treat systems discharges	**Current Landowners**: • Owner • Company name • Contact information **Current Land Use**: • FTA specific information **Future Land Use**: • Potential development • Land use restrictions **Potential Receptors**: • Surface water bodies • Municipal groundwater wells • Private groundwater wells • Humans • Biota	**Potential Ecological Receptors**: • High quality rivers, streams, lakes, etc. • Inland and marine plant species, fish, birds, insects, soil invertebrates, and mammals that inhabit or migrate through the site • Associated threatened and endangered species **Threatened and Endangered Species**: • Listed threatened and endangered species

QAPP Worksheet #11: Project/Data Quality Objectives

Rev 1, Date: 07/21/2014

Data quality objectives were developed using USEPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* USEPA QA/G-4 (USEPA, 2006).

Step 1: State the Problem

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 fire fighting foams. These chemicals were used by the US military, including the USAF, at sites where personnel used AFFF to extinguish fires. For purposes of this project, the term PFC refers to the specific compounds listed in USEPA's UCMR 3 and listed in Table 1 (PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFBS).

The chemical structures of PFCs make them very resistant to breakdown in the environment. Due to their persistence, bioaccumulation potential, and toxicity, PFCs have a potential impact on human health and the environment. Therefore, investigation activities are necessary to determine if potential releases of PFCs have occurred and to confirm the presence of these compounds at historical fire training areas.

Step 2: Identify the Goals of the Study

The objectives of this study are to determine if a confirmed release of PFCs has occurred at installations selected for site investigation. 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, a release will be defined if concentrations exceeding the following are identified:

PFOS: 0.2 ug/L in groundwater and/or surface water

5 mg/kg in soil and/or sediment

PFOA: 0.4 ug/L in groundwater and/or surface water

12 mg/kg in soil and/or sediment

Step 3: Identify Information Inputs

The following data and informational needs for the site investigations are required to achieve the project goals:

- Collection of historical and site-specific information through document reviews, site scoping visits, and post scoping conference calls;
- Soil boring advancement;
- Monitoring well installation, development, and/or rehabilitation;
- Collection of soil, sediment, surface water, and groundwater samples; and,

- Laboratory analysis of soil, sediment, surface water, and groundwater samples for PFCs by high-performance liquid chromatography with tandem mass spectrometry (LC/MS/MS).

Step 4: Define the Boundaries of Data Collection

Review of historical documents, site scoping visits, and post scoping conference calls will be used in determining the sampling locations. Sampling will be limited to facilities where use is documented and targeted to FTAs and surrounding areas where PFCs were used.

Analytical data will be limited to the analysis of the following PFCs:

- PFOS,
- PFOA,
- PFHXS,
- PFHPA,
- PFNA, and
- PFBS.

Step 5: Develop the Analytical Approach

Sampling of soil, sediment, surface water, and groundwater at potential source areas and along migration pathways is necessary to determine if PFCs are present. LC/MS/MS will be used to analyze the samples. If a release of PFCs is confirmed (see Step 2), the concentrations of those constituents will determine if further actions are necessary. Worksheet 15 identifies the project action limits (PAL) and method reporting limits for determining PFC presence in soil, sediment, surface water, and groundwater for PFOS and PFOA. The remaining PFCs do not have established PALs.

Step 6: Specify Performance or Acceptance Criteria

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

- Daily standardized PFC personal protective equipment (PPE)/equipment checklist (provided in the PFC protocol standard operating procedure [SOP]) will be completed by the AMEC Field Manager for each installation. The quality assurance (QA) manager will review and accept the final checklist.

- The field manager will verify that field procedures defined in the QPP and installation-specific work plan are properly followed on a daily basis during field work. The QA manager or designee will verify field procedures are being conducted appropriately through field audits. Any deviations will be promptly addressed and documented.

- The laboratories, each accredited under the DoD Environmental Laboratory Accreditation Program for PFC analysis, will analyze proficiency testing samples to demonstrate capability prior to the sampling program beginning. The laboratories will identify and quantify proficiency testing samples within acceptance limits to verify reporting of PFCs. Any findings or recommendations will be addressed prior to analysis of field samples.

- The project chemist will conduct an audit prior to sampling to evaluate laboratory procedures, quality program, and operations to verify the analytical procedure. Any findings or recommendations will be addressed prior to analysis of field samples.
- The laboratories will adhere to analytical performance/acceptance criteria per method as detailed in the DoD Quality Systems Manual (QSM) V5.0 and defined on Worksheets #12a and 12b.
- The LC/MS/MS method will provide acceptable detection limits to confirm presence of PFCs at concentrations defined in Step 5 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 percent of the analytical data by an experienced chemist to assess the data usability. The data usability will then be evaluated by AFCEC for final approval. Data completeness of 90 percent usable data is required.
- The Site Investigation Reports will be reviewed and accepted by AFCEC.

Step 7: Develop the Detailed Plan for Obtaining Data

Sampling plans may be revised based upon installation specific research and scoping. The final detailed sampling approach will be included in worksheets #13, #14/16, #17, #18, and #20 of the installation-specific work plan addendums. Additional sites may be added, if necessary, as an addendum to this plan.

QAPP Worksheet #12a: Measurement Performance Criteria
Primary Laboratory - Accutest (Subcontractor to CE2L)

Rev 1, Date: 07/21/2014

Matrix: Groundwater/Soil
Analytical Group or Method: PFC by LC/MS/MS
Concentration Level: Low

Data Quality Indicator (DQI)	Quality control (QC) sample or measurement performance activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 30% or difference between analytical results < LOQ
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	70-130% recovery, 30% RPD
Analytical Precision/Accuracy/Bias (matrix interference)	Matrix Spike and Matrix Spike Duplicates	70-130% recovery, 30% RPD
Overall accuracy/bias (contamination)	Equipment Blanks	No target analyte concentrations ≥ 1/2 LOQ
Sensitivity	LOQ verification sample (spiked at LOQ)	Recovery within ±50% of LOQ
Completeness	See Worksheet #34	See Worksheet #34

Notes: RPD = relative percent difference
LOQ = limit of quantitation

QAPP Worksheet #12b: Measurement Performance Criteria

Secondary Laboratory – Vista

Rev 1, Date: 07/21/2014

Matrix: Groundwater
Analytical Group or Method: PFC by LC/MS/MS
Concentration Level: Low

Data Quality Indicator (DQI)	Quality control (QC) sample or measurement performance activity	Measurement Performance Criteria
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples or OPR (Ongoing Precision & Recovery Samples)	PFBS, PFHPA, PFHXS, PFOA, PFOS, PFNA (RPD = 70 – 130%)
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	PFBS (RPD = 60 – 130%) PFHPA, PFHxS, PFOA, PFOS (RPD = 70 – 130%) PFNA (RPD 50 – 150%)
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates (MSD)	RPD ≤ 30%
Analytical Accuracy/Bias (matrix interference)	Matrix Spike (MS)	Recovery Limits = 50 – 150%.

Notes: RPD = relative percent difference LOQ = limit of quantitation

Matrix: Soil
Analytical Group or Method: PFC by LC/MS/MS
Concentration Level: Low

Data Quality Indicator (DQI)	Quality control (QC) sample or measurement performance activity	Measurement Performance Criteria
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples or OPR (Ongoing Precision & Recovery Samples)	PFBS (RPD = 60 – 130%) PFHPA, PFHXS, PFOA, PFOS (RPD = 70 – 130%) PFNA (RPD = 50 – 150%)
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	PFBS (RPD = 60 – 130%) PFHPA, PFHxS, PFOA, PFOS (70 – 130%) PFNA (RPD = 50 – 150%)
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates (MSD)	RPD ≤ 30%
Analytical Accuracy/Bias (matrix interference)	Matrix Spike (MS)	Recovery Limits 50 – 150%.

Notes: RPD = relative percent difference

QAPP Worksheet #13: Secondary Data Uses and Limitations

Rev 1, Date: 07/21/2014

The following worksheet will be included in the Installation-Specific Work Plan Addendums and will identify data used in the generation of the Installation-Specific Work Plan Addendums (i.e. previous environmental sampling reports, interviews with former fire chiefs, etc).

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use

QAPP Worksheet #14/16: Project Tasks & Schedule

Rev 1, Date: 07/21/2014

Activity	Responsible party	Planned start date	Planned completion date	Deliverable(s)	Deliverable due date
Installation scoping visits	AMEC	See schedule*	See schedule	Field notes (included in Site Investigation Report)	See schedule
Mobilization/demobilization	AMEC and subcontractors	See schedule	See schedule	Field notes (included in Site Investigation Report)	See schedule
Soil boring advancement/abandonment	AMEC and subcontractors	See schedule	See schedule	Field notes and boring logs (included in Site Investigation Report)	See schedule
Sample collection – surface soil	AMEC	See schedule	See schedule	Field notes (included in Site Investigation Report)	See schedule
Sample collection - subsurface soil	AMEC and subcontractors	See schedule	See schedule	Field notes (included in Site Investigation Report)	See schedule
Sample collection -sediment	AMEC and subcontractors	See schedule	See schedule	Field notes (included in Site Investigation Report)	See schedule
Sample collection – surface water	AMEC and subcontractors	See schedule	See schedule	Field notes (included in Site Investigation Report)	See schedule
Sample collection - groundwater from existing monitoring wells	AMEC	See schedule	See schedule	Field notes, monitoring well diagram, and field measurements (included in Site Investigation Report)	See schedule
Monitoring Well Installation, development, and sampling	AMEC and subcontractors	See schedule	See schedule	Field notes, monitoring well diagrams, and field measurements (included in Site Investigation Report)	See schedule
Analyses	CE2L, Accutest, Vista, Katahdin (Subcontractor to Vista)	See schedule	See schedule	Report of analyses/Data package (included in Site Investigation Report)	See schedule
Validation	AMEC	See schedule	See schedule	Validation Summary (included in Site Investigation Report)	See schedule
Environmental Resources Program Information Management System (ERPIMS) Data Submittal	AMEC	See schedule	90 days after Sampling Completed	Successful submittal of ERPIMS data for each installation and receipt of AFCEC ERPIMS Data Loading Notification	90 days after Sampling Completed
Site Investigation Report	AMEC	See schedule	See schedule	Site Investigation Report	See schedule

*The project schedule is provided as **Appendix B**.

PFC RELEASE DETERMINATION, DELINEATION, AND REMEDIATION- SITE INVESTIGATION

To meet the project goals defined in Worksheet #11, site investigations will be initiated at 19 BRAC installations as identified in **Table 3**. The site investigation will include site reconnaissance to determine the scope of sampling activities that will be conducted at 19 BRAC installations as well as the collection of soil, sediment, surface water, and groundwater samples to confirm if a release of PFCs has occurred. The specific procedures for implementing site investigations will be documented within 19 installation-specific work plans. The approach to conducting site investigations will include the activities identified in Worksheet #14/16 table and described below. Fieldwork will be conducted in accordance with the SOPs provided in **Appendix C**.

Installation Scoping Activities

Installation scoping visits will be conducted to develop the sampling plan for environmental sampling activities proposed at 19 BRAC installations. Scoping activities will include (1) site reconnaissance of the installations/sites where sampling is required and (2) implementation of soil, sediment, surface water and/or groundwater sampling activities.

A site reconnaissance will be conducted at each of the 19 BRAC installations scheduled for fieldwork to collect installation and site-specific information necessary to conduct sampling activities at these sites. Information that will be collected during site reconnaissance activities include, but are not limited to:

- Current site conditions;
- Access routes;
- Monitoring well inventory documenting condition and repairs needed;
- Conditions affecting the investigation approach (e.g., utilities, structures, etc.);
- Equipment and personnel requirements for investigation;
- Escort requirements;
- Dig permit process;
- Traffic considerations;
- Well construction requirements;
- Site restoration requirements; and,
- US Fish and Wildlife Services (USFWS) consultation requirements, where applicable.

Mobilization/Demobilization

Prior to site mobilization, it will be necessary to complete several pre-mobilization activities including coordinating with the point of contact (POC) for each installation, obtaining utility clearances and dig permits.

- Site Specific Regulations – Fieldwork conducted under this TO will be performed on a variety of installation types including active airports. All personnel must become familiar with and comply with site-specific regulations. All required badges, passes, and vehicle permits will be acquired with proper authority, as applicable.

- Site Access – Coordination with installation POCs, land development authorities (LDAs), and property owners/managers will be conducted to ensure that access onto sites will not be restricted during the proposed work schedule.
- Utility Clearances and Dig Permits – Prior to the commencement of drilling activities, embedded service lines shall be located and protected. Drilling operations will not begin until all underground hazards have been located. Utility maps will be requested detailing utilities and other infrastructure at each site to assist with utility location.

Once the above pre-mobilization activities are complete and proper coordination has been made with AFCEC and the current landowners, AMEC will mobilize to the site(s). Demobilization will occur once all site activities are completed and the sites have been restored to their original condition.

Environmental Sampling

To confirm releases of PFCs, soil, sediment (where applicable), surface water (where applicable), and groundwater sampling will be conducted at the pre-selected sites located at each of the 19 installations. The goal of site-specific sampling is to determine the presence or absence of PFCs within media of concern. Investigation requirements at each installation will vary based upon current site ownership, site layout and access, in-place remedies, and other unforeseen factors that will be identified during scoping activities and detailed within installation-specific work plans. SOPs (**Appendix C**) applicable to each installation/site should be reviewed prior to implementation of field activities and consist of:

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

A summary of the proposed field sampling activities is provided in **Table 4** and are described in the following sections. It should be noted that the number of proposed field samples may change after the scoping visits are conducted. **Table 4** is preliminary and the actual number of monitoring wells, soil borings, and samples for each media will be proposed in the Installation-Specific Work Plan Addendums.

Table 4. Preliminary PFC Release Determination Sampling Summary

Base	Site ID	Monitoring Well Install	Soil Boring Advance	*Soil	*Ground-water	*Sediment	*Surface Water
England AFB, LA	FT005P	4	0	20	16	4	4
	FT014P	4	0	20	16	4	4
Bergstrom AFB, TX	FT023P	4	0	20	16	4	4
Castle AFB, CA	FT001P	4	0	20	16	4	4
	FT003P	4	0	20	16	4	4
Lowry AFB, CO	FT001P	4	0	20	16	4	4
Reese AFB,TX	FT009P	4	0	20	16	4	4
George AFB, CA	FT019P	0	4	20	16	4	4
	FT020P	0	4	20	16	4	4
	FT082P	0	4	20	16	4	4
March AFB, CA	FT007P	0	4	20	16	4	4
Norton AFB, CA	AT005P	4	0	20	16	4	4
Mather AFB, CA	FT011P	0	4	20	16	4	4
McClellan AFB, CA	AOC313P	0	0	0	16	4	4
Chanute AFB, IL	FT058P	4	0	20	16	4	4
	FT059P	4	0	20	16	4	4
	FT060P	4	0	20	16	4	4
	FT061P	4	0	20	16	4	4
	FT062P	4	0	20	16	4	4
	FT021P	0	4	20	16	4	4
Kelly AFB, TX	FT024P	4	0	20	16	4	4
Grissom AFB, IN	FT001P	0	4	20	16	4	4
	FT002P	0	4	20	16	4	4
K.I. Sawyer AFB, MI	FT006P	2	2	10/10	8/8	4	4
	FT007P	2	2	10/10	8/8	4	4
Richards-Gebaur AFB, MO	FT002P	0	4	20	0	4	4
General Mitchell ARS, WI	FT001P	4	0	20	16	4	4
Griffiss AFB, NY	FT030P	6	0	30	24	4	4
Myrtle Beach AFB, SC	FT016P	4	0	20	16	4	4
Plattsburgh AFB, NY	FT002P	0	4	20	16	4	4
	Totals	74	44	590	472	120	120
		QA/QC Samples		177	142	36	36
		Grand Totals		**767**	**614**	**156**	**156**

Notes:
*Assume an additional 3 out of every 10 samples will be analyzed as QA/QC samples.
Please note that Table 4 is preliminary and the actual number of monitoring wells, soil borings, and samples for each media will be presented in the Installation-Specific Work Plan Addendums.

PFC Sampling Considerations

Given the low detection limits associated with PFC analysis and the many potential sources of trace levels of PFCs, field personnel are advised to err on the side of caution by strictly following 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 included in **Table 5**. Specific details and procedures related to sampling for analysis of PFCs can be found in SOP AMEC-01 (**Appendix C**). 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 AMEC-11.

Table 5. Summary of Prohibited and Acceptable Items for Sampling of PFCs

Prohibited Items	Acceptable Items
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate liners
	Silicon tubing
Waterproof field books	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
Field Clothing and Personal Protective Equipment (PPE)	
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	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics **Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
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

Soil Boring Advancement/Abandonment and Soil Sample Collection

To identify the presence or absence of PFCs at potential release sites, soil borings will be advanced to the top of the water table (assumed 50 feet [ft]) to collect soil samples. Soil boring locations will be selected based upon site assessments and site reconnaissance and will be biased toward potential source(s) areas, known spill locations, and downgradient migration pathways. Proposed soil boring locations will be presented in site-specific work plans.

Soil cores will be collected continuously, visually screened for evidence of impacts (e.g., discoloring or staining), and logged by a qualified professional in accordance with the Unified Soil Classification System (USCS). At the completion of soil boring advancement, discrete soil samples will be collected from each boring location at intervals determined based upon site assessments and field observations (e.g., visual evidence of impacts). Samples selected for laboratory analysis will be analyzed for PFOS, PFOA, PFHXS, PFHPA, PFNA, and PFBS.

Soil samples will be collected in accordance with SOP AMEC-02, *Soil Sampling* (**Appendix C**). Borings that will not be completed as monitoring wells will be abandoned in accordance with the state-specific regulatory requirements and SOP AMEC-06, *Borehole Abandonment* (**Appendix C**). Soil sample collection will be recorded in the field log and on soil sample collection forms, and boring logs will be recorded on drilling logs (**Appendix D**). A summary of proposed soil samples will be provided in the Installation-Specific Work Plan Addendums.

Sediment Sampling

Sediment samples will be collected, as applicable, to determine the presence or absence of PFCs within surface water bodies. A sample will be considered a sediment sample if it is collected within a surface water body; otherwise it will be considered a soil sample. For the purposes of this investigation, a surface water body will be defined as those bodies of water that support one or more of the following designated uses:

- Supports aquatic life;
- Supports recreational use; and,
- Supplies water for agricultural, industrial, or domestic use.

Sediment samples will be collected in accordance with SOP AMEC-07 (**Appendix C**) and will be analyzed for PFOS, PFOA, PFHxS, PFHpA, PFNA, and PFBS. Sample collection will be recorded in the field log and on sample collection forms (**Appendix D**). Proposed sediment sample locations and specific equipment to be used during sample collection will be presented in the Installation-Specific Work Plan Addendums.

Surface Water Sampling

Surface water samples will be collected, as applicable, to determine the presence or absence of PFCs within surface water bodies. Surface water samples may be collected from any flowing or free-standing water present at the site. Surface water will be analyzed for PFOS, PFOA, PFHxS, PFHpA, PFNA, and PFBS. Surface water samples will be collected in accordance with SOP AMEC-08 (**Appendix C**). Sample collection will be recorded in the field log and on sample collection forms (**Appendix D**). Proposed surface water sample locations and specific equipment to be used during sample collection will be presented in the Installation-Specific Work Plan Addendums.

<u>Monitoring Well Rehabilitation, Installation, Development and Sampling</u>

Existing monitoring wells at each installation may require repair and/or redevelopment. Actual locations and the types of well repairs will be based upon actual damage identified during the site reconnaissance. Repairs may include reconstruction of the concrete apron around the monitoring well, installation/replacement of locks and lids, replacement of monuments, etc. Proposed monitoring well repairs will be presented in installation-specific work plans.

Groundwater monitoring wells will be installed at locations determined based upon site reconnaissance, review of installation-specific data, and/or reports showing groundwater flow. The monitoring wells will be installed by state licensed drilling contractors in accordance with state-specific requirements and SOP, AMEC-04, *Monitoring Well Installation* (**Appendix C**). Where site conditions and state regulations allow, monitoring wells will be installed using a direct-push drill rig. Elsewhere, a hollow stem auger or sonic rig will be used. Proposed monitoring well locations will be presented in the installation-specific work plans.

Monitoring wells will be constructed with 2-inch, inside-diameter polyvinyl chloride (PVC) that will be flush-threaded and will have a threaded bottom cap installed. Well screens will be 2-inch inside diameter factory-cut 0.01-inch slotted pipe. Actual screen lengths and total well depths will be specified in the installation-specific work plans and adjusted as necessary in the field based on site-specific conditions. A filter pack consisting of 20/40 mesh, commercially available, clean silica sand with uniform sorting, or similar size compatible with the well slot size, will be installed in the annulus around the well screen to a minimum of 2 ft above the top of the screen. The auger/rotary drilling rods may be used as a tremie for filter pack placement. An annular seal will be placed above the filter pack to prevent grout intrusion, and will consist of a minimum of 2 ft of very fine, clean silica sand or granular bentonite that is hydrated. Above the grout barrier, the well annulus will be filled with granular bentonite that is hydrated during placement using the drilling rods as a tremie, or flowable grout (e.g., neat cement grout) that is placed from the bottom upward using a side-discharge, small-diameter tremie pipe. The remaining annular space will be filled with a bentonite/grout mixture also placed by tremie pipe. The bentonite/grout mixture will set for a minimum of 24 hours prior to surface completion of the well. Each monitoring well will be completed with a 2-ft by 2-ft concrete pad that is a minimum of 4 inch thick and a flush mount well cover. Boring logs and monitoring well completion diagrams will be generated for each well on forms provided in **Appendix D**.

A minimum of 24 hours following monitoring well installation and surface completion activities, each monitoring well will be developed to remove sediment from the well in accordance with SOP AMEC-05, *Monitoring Well Development* (**Appendix C**). Wells will be developed until water quality parameters (temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) have stabilized and turbidity has stabilized or is below 10 Nephelometric turbidity units (NTUs). Development water will be containerized in Department of Transportation (DOT)-approved 55-gallon drums pending characterization and offsite transportation and disposal. Following completion of well development, the wells will be allowed to stabilize prior to purging and sampling.

Prior to initiating groundwater sampling activities, static water levels will be collected from existing and newly installed monitoring wells at each site to evaluate the direction of groundwater flow. Water level measurements will be recorded to the nearest 0.01 ft from the top of casing in monitoring wells using an electronic water level indicator. Wells in which water levels are measured will be documented in the installation-specific work plans.

Groundwater samples will be collected from existing and newly installed monitoring wells to determine the presence or absence of PFCs within groundwater at each site. Wells will be purged and sampled using low flow purging and sampling techniques in accordance with SOP AMEC-03, *Groundwater Sampling* (**Appendix C**). During the purging process, water quality parameters (pH, specific conductance, temperature, oxidation-reduction potential [ORP], turbidity, and salinity) will be measured using a water quality meter or combination of meters. Well purging will be considered complete when stabilization of water quality parameters is achieved, as indicated in SOP AMEC-03. After achieving stabilization, the appropriate sample containers will be filled using direct fill sampling techniques. Groundwater samples will be analyzed for PFOS, PFOA, PFHXS, PFHPA, PFNA, and PFBS. Purge records, water quality parameters, and sampling details will be recorded on groundwater sample forms (**Appendix D**). Proposed groundwater sample locations and specific sampling equipment to be used will be presented in the installation-specific work plans.

Surveying

Initial surveying performed during scoping and any subsequent site visits will be performed by AMEC personnel with handheld global positioning system (GPS) units. After all fieldwork is completed, final surveying will be conducted by licensed surveyors for all newly installed monitoring wells and existing wells (if needed) that are part of the PFC sampling program to enable accurate placement of locations on a map and to allow the calculation of groundwater elevations. Horizontal coordinates will be measured to the nearest 0.1 foot and referenced to the relevant State Plane Coordinate System using the North American Datum (NAD) of 1983, as adjusted in 1991. Elevation measurements will be made both at ground surface and at a casing measurement point at each of the wells. Elevations will be measured to the nearest 0.01 foot and referenced to the North American Vertical Datum (NAVD) of 1988. The measurement point on the monitoring well casing will be marked for future reference with a survey reference point.

Investigation-Derived Waste Management

Investigation derived waste (IDW) will consist of soil cuttings from monitoring well installation, soil boring advancement, decontamination water, disposable PPE, and other trash. PPE and other trash will be placed in plastic bags and placed into sanitary trash containers and disposed of at a sanitary landfill. Soil and water IDW will be containerized in DOT-approved 55-gallon drums pending characterization. Based upon characterization results, IDW will be transported offsite and disposed at the appropriate facility. Waste characterization analyses will be based upon specific state and disposal facility requirements and will be presented in the installation-specific work plans.

Field Documentation

A field logbook will be maintained for documentation of pertinent field activities from each activity conducted during the investigation (e.g., sampling and surveying). Field sheets and other forms to be used to document pertinent information associated with the field activities are presented in **Appendix D**. In addition, digital photographs will be recorded to document significant observations during activities. Field documentation including field notes, photographs, and other forms (e.g., sampling forms, etc.) will be included in the Release Determination Reports.

Health and Safety

Fieldwork conducted during the Site Investigation will be conducted in accordance with the general HSP (**Appendix A**) and the installation-specific HSPs that will be developed and included in the Installation-Specific Work Plan Addendums.

Data Management

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 electronic data deliverable (EDD) format. Laboratory EDDs will be loaded to the ERPTools X software where it will be checked and supplemented with field-derived data. Final ERPIMS submittal will be complete after all data in ERPTools X have completed table, group, and submittal checks and final review by the AMEC ERPIMS staff.

QAPP Worksheet #15a: Action Limits and Laboratory-Specific Detection/Quantitation Limits

Primary Laboratory – Accutest (Subcontractor to CE2L)

Rev 1, Date: 07/21/2014

Matrix: Aqueous

Analytical Method: PFC by LC/MS/MS

Analyte	Project Action Limit (PAL)[1] (µg/L)	PAL Reference	Project Quantitation Limit Goal[1] (µg/L)	Limit of Quantitation (µg/L)	Limit of Detection (µg/L)	Method Detection Limit (µg/L)
Perfluoroheptanoic acid (PFHpA)	NA	NA	NA	0.020	0.016	0.0080
Perfluorooctanoic acid (PFOA)	0.4	1	0.040	0.020	0.016	0.0080
Perfluorononanoic acid (PFNA)	NA	NA	NA	0.020	0.016	0.0080
Perfluorobutanesulfonic acid (PFBS)	NA	NA	NA	0.020	0.016	0.0080
Perfluorohexanesulfonic acid (PFHxS)	NA	NA	NA	0.020	0.016	0.0080
Perfluorooctanesulfonic acid (PFOS)	0.2	1	0.020	0.020	0.016	0.0080

Notes:

[1] Interim Air Force Guidance On Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (27 Aug 2012)

Project Action Limit (PAL) – Constituent concentration at which risk may be present within the environmental media of concern. 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.

Limit of Quantitation – The lowest concentration that produces a quantitative result within specified limits of precision and bias. For Department of Defense projects, the limit of quantitation shall be set at or above the concentration of the lowest initial calibration standard.

Limit of Detection – 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 percent.

Detection Limit – 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 percent.

QAPP Worksheet #15b: Action Limits and Laboratory-Specific Detection/Quantitation Limits

Primary Laboratory – Accutest (Subcontractor to CE2L)

Rev 1, Date: 07/21/2014

Matrix: Solid

Analytical Method: PFC by LC/MS/MS

Analyte	Project Action Limit (PAL) (mg/kg)	PAL Reference	Project Quantitation Limit Goal[1] (mg/kg)	Limit of Quantitation (mg/kg)	Limit of Detection (mg/kg)	Method Detection Limit (mg/kg)
Perfluoroheptanoic acid (PFHpA)	NA	NA	NA	0.013	0.010	0.0050
Perfluorooctanoic acid (PFOA)	12	1	1.2	0.013	0.010	0.0050
Perfluorononanoic acid (PFNA)	NA	NA	NA	0.013	0.010	0.0058
Perfluorobutanesulfonic acid (PFBS)	NA	NA	NA	0.013	0.010	0.0050
Perfluorohexanesulfonic acid (PFHxS)	NA	NA	NA	0.013	0.010	0.0050
Perfluorooctanesulfonic acid (PFOS)	5	1	0.5	0.013	0.010	0.0050

Notes:

[1] Interim Air Force Guidance On Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (27 Aug 2012)

Project Action Limit (PAL) – Constituent concentration at which risk may be present within the environmental media of concern. 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.

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

Limit of Detection – 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 percent.

Detection Limit – 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 percent.

QAPP Worksheet #15c: Action Limits and Laboratory-Specific -Detection/Quantitation Limits

Secondary Laboratory – Vista

Rev 1, Date: 07/21/2014

Matrix: Aqueous

Analytical Method: PFC by LC/MS/MS

Analyte	Project Action Limit (PAL) (µg/L)[1]	PAL Reference	Project Quantitation Limit Goal (µg/L)[1]	Limit of Quantitation (µg/L)	Limit of Detection (µg/L)	Method Detection Limit (µg/L)
PFOS	0.2	1	0.020	0.020	0.0050	0.0050
PFOA	0.4	1	0.040	0.040	0.0050	0.0050
PFHXS	NA	NA	NA	0.020	0.0050	0.0050
PFHPA	NA	NA	NA	0.020	0.0050	0.0050
PFNA	NA	NA	NA	0.020	0.0050	0.0050
PFBS	NA	NA	NA	0.020	0.0050	0.0050

Notes:

[1] Interim Air Force Guidance On Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (27 Aug 2012)

Project Action Limit (PAL) – Constituent concentration at which risk may be present within the environmental media of concern. 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.

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

Limit of Detection – 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 percent.

Detection Limit – 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 percent.

QAPP Worksheet #15d: Action Limits and Laboratory-Specific Detection/Quantitation Limits

Secondary Laboratory – Vista

Rev 1, Date: 07/21/2014

Matrix: Solid

Analytical Method: PFC by LC/MS/MS

Analyte	Project Action Limit (PAL) (mg/kg)	PAL Reference	Project Quantitation Limit Goal (mg/kg)	Limit of Quantitation (mg/kg)	Limit of Detection (mg/kg)	Method Detection Limit (mg/kg)
PFOS	0.5	1	5	0.5	0.0050	0.0050
PFOA	1.2	1	12	1.2	0.0050	0.0050
PFHXS	NA	NA	NA	NA	0.0050	0.0050
PFHPA	NA	NA	NA	NA	0.0050	0.0050
PFNA	NA	NA	NA	NA	0.0050	0.0050
PFBS	NA	NA	NA	NA	0.0050	0.0050

Definitions:

Project Action Limit (PAL) – Constituent concentration at which risk may be present within the environmental media of concern. 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.

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

Limit of Detection – 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 percent.

Detection Limit – 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 percent.

QAPP Worksheet #17: Sampling Design and Rationale

Rev 1, Date: 07/21/2014

Sampling activities will be conducted at fire training areas operable after 1970 at the 19 BRAC installations. Soil, groundwater, surface water and sediment samples will be collected, as applicable, from each FTA to determine if release of PFCs has occurred. In accordance with Step 4 (Define the Boundaries of Data Collection) of the DQOs established in Worksheet #11, sample locations will target areas with the potential for the highest concentrations of:

Chemical Name	CAS* Number
• Perfluorooctanesulfonic acid (PFOS)	1763-23-1
• Perfluorohexane sulfonate (PFHxS)	108427-53-8
• Perfluorooctanoic acid (PFOA)	335-67-1
• Perfluoroheptanoic acid (PFHpA)	375-85-9
• Perfluorononanoic acid (PFNA)	375-95-1
• Perfluorobutane sulfonate (PFBS)	29420-43-3

*CAS = Chemical Abstract Service

Sample locations may include, but are not limited to:

- groundwater from the center of the FTA and downgradient;
- soil from the center of the FTA including vertical profile;
- surface water and/or sediment from stormwater and/or wastewater discharge areas associated with FTA; and,
- groundwater from the remediation system discharges impacting groundwater at the FTA.

Information inputs from the preliminary CSM (Worksheet #10) of the Installation Specific Work Plan Addendum will be the basis for sample design at each FTA.

Details of installation-specific sampling design and rationale will be presented in the Installation Specific Work Plan Addendums.

QAPP Worksheet #18: Sampling Locations and Methods

Rev 1, Date: 07/21/2014

Sampling locations and methods will be presented in the Installation-Specific Work Plan Addendums. As discussed on Worksheet #14/16, sample methodologies will strictly follow the protocols SOP AMEC-01 (**Appendix C**) to help mitigate the potential for false detections of PFCs. A list of prohibited and acceptable clothing/equipment for sampling at PFC sites is included in **Table 4** on Worksheet #14/16.

QAPP Worksheet #19a & 30a: Sample Containers, Preservation, and Hold Times

Primary Laboratory – Accutest (Subcontractor to CE2L)

Rev 1, Date: 07/21/2014

Laboratory for PFC and Waste Characterization Analysis: Accutest Laboratories Southeast, Inc, 4405 Vineland Rd, Ste C-15, Orlando, FL 32811, 407-425-6700

List any required accreditations/certifications: DOD Environmental Laboratory Accreditation Program (ELAP); International Organization for Standardization (ISO) 17025; FDOH (TNI)

Back-up Laboratory for PFC Analysis: Vista Analytical Laboratory

Back-up Laboratory for Waste Characterization Analysis: Katahdin (Subcontractor to Vista) (Vista)

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

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, 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]	Dec. 15th, 2015	8-oz wide-mouth HDPE jar with HDPE-lined cap	<6°C	14 days	28 days	28 days
Perfluorinated Alkyl Acids	Ground water	PFC by LC/MS/MS, SOP# MS014; OP058[3]	Dec. 15th, 2015	2- 125 ml HDPE bottles with HDPE-lined cap.	<6°C	14 days	28 days	28 days
Ignitability	Solid, Waste	SW-846 1010A, GN121	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	Not specified	Not specified	10 business days
Total Cyanide	Solid	SW-846 9012B, GN115	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	Analysis completed within 14 days		10 business days
Total Sulfide	Solid	SM4500S=F-11Mod, GN140	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	Analysis completed within 7 days		10 business days
TCLP Metals/Mercury	Solid	SW-846 6010C, 7470A	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	180 days, 28 if Hg required	180 days, 28 if Hg required	10 business days

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
TCLP VOC	Solid	SW-846 8260B, MS005	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	14 days for leaching	14 days	10 business days
TCLP SVOC	Solid	SW-846 8270D, MS006	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	14 days for leaching, 7 days for extraction	40 days	10 business days
TCLP Herbicides	Solid	SW-846 8151A, GC031	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	14 days for leaching, 7 days for extraction	40 days	10 business days
TCLP Pesticides	Solid	SW-846 8081B, GC015	DoD ELAP 12/2015	8 oz glass jar [4]	<6°C	14 days for leaching, 7 days for extraction	40 days	10 business days

Note: [1] SOPs from Accutest Laboratories Southeast, Inc. will be forwarded to the government upon request.
[2] SOP# MS014 is titled *Analysis of Perfluorinated Alkyl Acids by LC/MS/MS.*
[3] SOP# OP058 is titled *Extraction of Perfluorinated Alkyl Acids for analysis by LC/MS/MS*.
[4] *Multiple analyses may be performed from the same container as long as preservation requirements are identical and there is sufficient sample volume or mass available.*

QAPP Worksheet #19b & 30b: Sample Containers, Preservation, and Hold Times

Secondary Laboratory – Vista

Rev 1, Date: 07/21/2014

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

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

Back-up Laboratory for PFC Analysis: Accutest (CE2L)

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

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
PFCs	Soil	PFC by LC/MS/MS, SOP 49, rev2[2]	Sept. 30th, 2015	HDPE bottles and jars	<6°C	14 days	28 days	10 business days
PFCs	Ground-water	PFC by LC/MS/MS, SOP 49, rev2	Sept. 30th, 2015	HDPE bottles and jars	<6°C	14 days	28 days	10 business days

Note: [1] SOPs from Vista Analytical Laboratory will be forwarded to the government upon request.
[2] SOP 49 is titled *Preparation and Analysis of Perfluorinated Compounds*.

QAPP Worksheet #19c & 30c: Sample Containers, Preservation, and Hold Times

Primary Laboratory – CE2L

Rev 1, Date: 07/21/2014

Laboratory for Waste Characterization Analysis: CE2L, 324 NW Capital Drive, Lee's Summit, MO 64086, Shawn Maxwell, smaxwell@CE2L.com, (816) 389-8406

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

Back-up Laboratory for Waste Characterization Analysis: Katahdin (Subcontractor to Vista) (Vista)

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

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
pH	Solid Aqueous	SM4500-H+A and B, SW-846 91040C, SW-846 9045D, SW-846 9041A/ I-pH Rev 0.4	11/2014	250 mL HDPE, unpreserved	< 6°C	15 minutes	15 minutes	10 business days
VOC	Aqueous	O-VOCs Rev 1.3	11/2014	3 x 40 mL VOA vials	HCl, < 6°C	14 days		10 business days
VOC	Solid	O-SoilVOCs-5035A Rev 1.2	11/2014	3 x 40 mL VOA vials	$NaHSO_4$, MeOH, < 6°C	14 days		10 business days
SVOC	Aqueous	O-SVOCs-8270 Rev 2.3	11/2014	2 x 1-L Amber glass	< 6°C	7 days	40 days	10 business days
SVOC	Solid	O-SVOCs-8270 Rev 2.3	11/2014	4 oz glass jar [2]	< 6°C	14 days	40 days	10 business days
Metals	Aqueous	I-ICP-AES Rev 1.1, I-ICPMS Rev 1.3	11/2014	250 mL HDPE	HNO_3	180 days		10 business days
Metals	Solid	I-ICP-AES Rev 1.1, I-ICPMS Rev 1.3	11/2014	4 oz glass jar [2]	none	180 days		10 business days

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Mercury	Aqueous	I-Mercury-CVAA Rev 0.5	11/2014	250 mL HDPE	HNO_3, <6°C	28 days		10 business days
Mercury	Solid	I-Mercury-CVAA Rev 0.5	11/2014	4 oz glass jar [2]	< 6°C	28 days		10 business days
Pesticides	Aqueous	O-OCPesticides Rev 1.4	11/2014	2 x 1-L Amber glass	< 6°C	7 days	40 days	10 business days
Pesticides	Solid	O-OCPesticides Rev 1.4	11/2014	4 oz glass jar [2]	< 6°C	14 days	40 days	10 business days
DRO/ORO	Aqueous	O-DRO Rev 2.0	11/2014	2 x 1-L Amber glass	< 6°C	7 days	40 days	10 business days
DRO/ORO	Solid	O-DRO Rev 2.0	11/2014	4 oz glass jar [2]	< 6°C	14 days	40 days	10 business days
GRO	Aqueous	O-TPH Gasoline Rev 1.3	11/2014	3 x 40 mL VOA vials	HCl, < 6°C	14 days		10 business days
GRO	Solid	O-TPH Gasoline Rev 1.3	11/2014	3 x 40 mL VOA vials	$NaHSO_4$, MeOH, < 6°C	14 days		10 business days
TOC	Aqueous	I-TOC Rev 1.1	11/2014	2 x 40 mL VOA vials	H_2SO_4	28 days	28 days	10 business days

Note: [1] SOPs from CE2L will be forwarded to the government upon request.
[2] Multiple analyses may be performed from the same container as long as preservation requirements are identical and there is sufficient sample volume or mass available.
HCl = hydrochloric acid
HNO_3 = nitric acid
H_2SO_4 = sulfuric acid
MeOH = methanol
$NaHSO_4$ = sodium bisulfate

QAPP Worksheet #19d & 30d: Sample Containers, Preservation, and Hold Times

Primary Laboratory – Katahdin (Subcontractor to Vista)

Rev 1, Date: 07/21/2014

Laboratory for Waste Characterization Analysis: Katahdin (Subcontractor to Vista), 600 Technology Way, Scarborough, Maine 04074, Jennifer Obrin, jobrin@Katahdin (Subcontractor to Vista)lab.com, (207) 874-2400

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

Back-up Laboratory for Waste Characterization: CE2L

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

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
VOCs	Soil	SW846 5035, 8260B/ CA-202, CA-214	02/01/2016	Three 40-ml VOA vials	5 ml reagent water, cool to < 6 °C	48 hours to freezing	14 days to analysis	10 business days
				One 2-oz wide-mouth jar for percent moisture	Cool to < 6 °C			
				One 40-ml VOA vial	5 ml methanol, cool to < 6 °C			
SVOCs	Soil	SW846 3540C or 3550C, 8270D/ CA-204, CA-512, CA-526	02/01/2016	4-oz wide-mouth jar	Cool to ≤ 6 °C	14 days	40 days	10 business days
Pesticides	Soil	SW846 3540C or 3550C, 8081B/ CA-524, CA-500, CA-302	02/01/2016	4-oz wide-mouth jar	Cool to ≤ 6 °C	14 days	40 days	10 business days
Herbicides	Soil	SW846 3550, 8151 / CA-517, CA-305	02/01/2016	4-oz wide-mouth jar	Cool to ≤ 6 °C	14 days	40 days	10 business days

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Diesel Range Organics/ Residual Range Organics	Soil	SW846 3540C or 3550C, 8015C/ CA-315, CA-527, CA-535	02/01/2016	4-oz wide-mouth jar	Cool to ≤ 6 °C	14 days	40 days	10 business days
Gasoline Range Organics	Soil	SW846 5035A, 8015C/ CA-316	02/01/2016	Two 40-ml VOC vials	5 ml methanol, cool to ≤ 6 °C	None	14 days	10 business days
Residual Range Organics	Soil	SW846 3540C or 3550C, 8015C/ CA-315, CA-527, CA-535	02/01/2016	4-oz wide-mouth jar	Cool to ≤ 6 °C	14 days	40 days	10 business days
Oil and Grease	Soil	SW846 9071B/ CA-534	02/01/2016	2-oz wide-mouth jar	Cool to ≤ 6 °C	None	28 days	10 business days
Metals	Soil	SW846 3050B, 6010C/ CA-605, CA-608	02/01/2016	2-oz wide-mouth jar	None	None	6 months	10 business days
Mercury	Soil	SW846 7471A/ CA-611	02/01/2016	2-oz wide-mouth jar	Cool to ≤ 6 °C	None	28 days	10 business days
Ignitability	Soil	SW846 1010A / CA-735	02/01/2016	2-oz wide-mouth jar	Cool to ≤ 6 °C	None	14 days	10 business days
Total Cyanide	Soil	SW846 9012B/ CA-773	02/01/2016	2-oz wide-mouth jar	Cool to ≤ 6 °C	None	14 days	10 business days
TOC	Soil	Lloyd Kahn/ CA-741	02/01/2016	2-oz wide-mouth jar	Cool to ≤ 6 ° C	None	14 days	10 business days
Corrosivity	Soil	SW846 9045D / CA-709	02/01/2016	2-oz wide-mouth jar	Cool to ≤ 6 ° C	None	28 days	10 business days

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
VOCs	Ground-water	SW846 5030B, 8260B/ CA-202	02/01/2016	Three 40-ml VOA vials	Hydrochloric acid (HCl) to pH < 2, cool to ≤ 6 °C.	14 days	14 days	10 business days
SVOCs	Ground-water	SW846 3510C or 3520C, 8270D/ CA-204, CA-502	02/01/2016	Two 1-L amber glass bottles	Cool to ≤ 6 °C	7 days	40 days	10 business days
Pesticides	Ground water	SW846 3510C or 3520C, 8081 B/ CA-515, CA-302	02/01/2016	Two 1 - liter glass amber bottles	Cool to ≤ 6 °C	7 days	40 days	10 business days
Herbicides	Ground water	SW846 8151/ CA-516, CA-305	02/01/2016	Two 1 - liter glass amber bottles	Cool to ≤ 6 °C	7 days	40 days	10 business days
Diesel Range Organics/ Residual Range Organics	Ground water	SW846 3510C or 3520C, 8015C/ CA-315, CA-520	02/01/2016	Two 1-L amber glass bottles	HCl to pH < 2, cool to ≤ 6 °C	7 days	40 days	10 business days
Gasoline Range Organics	Ground water	SW846 5030B, 8015C/ CA-316	02/01/2016	Two 40-ml VOC vials	HCl to pH < 2, cool to ≤ 6 °C	None	14 days	10 business days
Residual Range Organics	Ground water	SW846 3510C or 3520C, 8015C/ CA-315, CA-520	02/01/2016	Two 1-L amber glass bottles	HCl to pH < 2, cool to ≤ 6 °C	7 days	40 days	10 business days
Oil and Grease	Ground water	EPA 1664A with SGT / CA-528		Two 1-liter (L) amber glass bottles	HCl to pH < 2, cool to ≤ 6 °C	None	28 days	10 business days
Metals	Ground water	SW846 3010A, 6010C/ CA-604, CA-608	02/01/2016	One 250-ml polyethylene bottle	Nitric Acid to pH<2.	None	6 months	10 business days
Mercury	Ground water	SW846 7470A/CA-615	02/01/2016	One 250-ml polyethylene bottle	Nitric Acid to pH<2.	None	28 days	10 business days

Analyte/ Analyte Group	Matrix	Method/ SOP[1]	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Cyanide	Ground water	SW846 9012B / CA-773	02/01/2016	One 250-ml polyethylene bottle	Sodium hydroxide (NaOH) to pH < 2, cool to ≤ 6°C	None	14 days	10 business days
pH	Ground water	SW846 9040B / CA-708	02/01/2016	One 100-ml polyethylene bottle	Cool to ≤ 6 °C	None	Immediate	10 business days
Sulfide	Ground water	SM 4500S2 E	02/01/2016	One 500-ml polyethylene bottle	2N ZnAc/L & NaOH, Cool to ≤ 6 °C	None	7 days	10 business days
Total Organic Carbon	Ground water	SM 5310 B/ CA-763	02/01/2016	Two 40-ml VOA vials	Cool to ≤ 6 °C	None	28 days	10 business days

Note: [1] SOPs from Katahdin (Subcontractor to Vista) will be forwarded to the government upon request.

QAPP Worksheet #20: Field QC Summary

Rev 1, Date: 07/21/2014

The following QC samples (and collection frequencies) will be collected during field activities:

- Field Duplicate (1:10 or 10%)
- Equipment Rinsates (1:10 for each piece of sampling equipment)
- Field Blank per lot of laboratory-provided "PFC-free" deionized water
- MS/MSDs (1:20 or 5%)

The Field QC summary will be presented in each of the 19 Installation-Specific Work Plan Addendums.

QAPP Worksheet #21: Field SOPs

Rev 1, Date: 07/21/2014

SOP # or reference[1]	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
AMEC-01	Field Sampling Protocols to Avoid Cross-Contamination At PFC Sites	AMEC	n/a	N	n/a
AMEC-02	Soil Sampling	AMEC	Core sampler, split-spoon sampler, Shelby Tube sampler	Y	Incorporates PFC protocols.
AMEC-03	Groundwater Sampling	AMEC	Bladder Pump, Peristaltic Pump, Electric Submersible Pump, Bailer	Y	Incorporates PFC protocols.
AMEC-04	Monitoring Well Installation	AMEC	DPT, HSA, rotary, dual-tube percussion	Y	Incorporates PFC protocols.
AMEC-05	Monitoring Well Development	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-06	Borehole Abandonment	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-07	Sediment Sampling	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-08	Surface Water Sampling	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-09	Influent and Effluent Sampling	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-10	Drilling, Development, and Heavy Equipment Decontamination	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-11	Sample Handling and Custody	AMEC	n/a	Y	Incorporates PFC protocols.
AMEC-12	Protocol to Provide Water Free of Perfluorinated Compounds for Collection of Field Blanks and Equipment Blanks	AMEC	n/a	Y	Incorporates PFC protocols.

Notes:
[1] AMEC SOPs included as Appendix C.

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

Rev 1, Date: 07/21/2014

Field Equipment	Activity	SOP Reference	Title or position of responsible person	Frequency	Acceptance Criteria	Corrective Action
Water Quality Meter (DO, temperature, pH, ORP, and specific conductivity meter)	Calibration, Testing, and Inspection	Manufacturer's User Guide	Environmental Field Team Lead	Daily, before groundwater monitoring	Most units: Verification of calibration passes if result is within ±20% certified/ expected value	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.
Turbidity Meter	Calibration, Testing, and Inspection	Manufacturer's User Guide	Field Manager	Daily, before groundwater monitoring	Most units: Verification of calibration passes if result is within +20% certified/ expected value	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.

Notes: DO = dissolved oxygen
ORP = oxidation reduction potential
Field quality audits will be conducted on a subset of the sites and will include inspection of the field equipment calibration records.

QAPP Worksheet #23a: Accutest (Subcontractor to CE2L) Analytical SOPs

Rev 1, Date: 07/21/2014

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
MS014	Analysis of Perfluorinated Alkyl Acids by LC/MS/MS	Definitive	Aqueous/Solid	Agilent 1200 LC/MS/MSD	N
OP058	Extraction of Perfluorinated Alkyl Acids for analysis by LC/MS/MS	Definitive	Aqueous	Solid Phase Extractor	N
GN121	Ignitability	Definitive	Solid, Aqueous	Pensky-Martens	N
GN115	Total Cyanide	Definitive	Solid, Aqueous	Lachat Autoanalyzer	N
GN140	Total Sulfide	Definitive	Solid, Aqueous	Microburette	N
MET101	Metals by ICP	Definitive	Solid, Aqueous	Trace 6000 series	N
MET105	Mercury in soil by CVAA	Definitive	Solid, Aqueous	Leeman Hydra II	N
MET106	Mercury in water by CVAA	Definitive	Solid, Aqueous	Leeman Hydra II	N
GC015	Chlorinated pesticides by GC/ECD	Definitive	Solid, Aqueous	Agilent GC/ECG	N
GC031	Chlorinated Hebicides by GC/ECD	Definitive	Solid, Aqueous	Agilent GC/ECG	N
MS005	Analysis of VOC by GC/MS	Definitive	Solid, Aqueous	Agilent GC/MS	N
MS006	Analysis of SVOC by GC/MS	Definitive	Solid, Aqueous	Agilent GC/MS	N

Note: SOPs from Accutest Laboratories Southeast, Inc. will be forwarded to the government upon request.

QAPP Worksheet #23b: Vista Analytical SOPs

Rev 1, Date: 07/21/2014

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
49	Preparation and Analysis of Perfluorinated Compounds, 01/27/14 - rev.1	Definitive	Groundwater/Soil/PFCs	UPLC/MS/MS	Y (calibration curve)

Note: SOPs from Vista Analytical Laboratory will be forwarded to the government upon request.

QAPP Worksheet #23c: CE2L Analytical SOPs

Rev 1, Date: 07/21/2014

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
I-pH Rev 0.4	Measurement of pH in Multimedia Samples	Definitive	Solid, aqueous	ISE	N
O-SoilVOCs-5035A Rev 1.2	Soil sample collection and Preservation Procedures for the Analysis of VOCs by Draft SW-846 Method 5035A	Definitive	Solid	GC-MS	N
O-VOCs Rev 1.3	Volatile Organic Compounds by GC/MS	Definitive	Aqueous	GC-MS	N
O-SVOCs-8270 Rev 2.3	Base Neutral and Acid (BNA) Semivolatile Organic Compounds (SVOCs) by GC/MS	Definitive	Solid, aqueous	GC-MS	N
O-3510Prep Rev 0.2	Separatory Funnel Liquid-Liquid Extraction 3510	NA	Aqueous	NA	N
O-3546Prep Rev 1.2	Microwave Extraction 3546	NA	Solid	Microwave	N
O-3535Prep Rev 0.1	Solid-Phase Extraction (SPE) 3535	NA	Aqueous	NA	N
I-ICP-AES Rev 1.1	Metals Analysis by Inductively Coupled Plasma Atomic emission Spectroscopy (ICP-AES)	Definitive	Solid, aqueous	ICP-AES	N
I-ICPMS Rev 1.3	Metals Analysis by ICP-MS	Definitive	Solid, aqueous	ICP-MS	N
I-3010-Prep Rev 0.4	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy 3010	NA	Aqueous	NA	N
I-3015APrep Rev 0.3	Microwave Assisted Acid Digestion of Aqueous Samples and Extracts 3015	NA	Aqueous	Microwave	N
I-3020A-Prep Rev 0.4	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by GFAA Spectroscopy 3020	NA	Aqueous	NA	N
I-3050B Prep	Acid Digestion of Sediments, Sludges, and Soils 3050	NA	Solid	NA	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
I-Mercury-CVAA Rev 0.5	Mercury in Soil and Water by Cold Vapor Atomic Absorption (CVAA) Technique	Definitive	Solid, aqueous	CVAA	N
O-OCPesticides Rev 1.4	Organochlorine Pesticides by GC/ECD	Definitive	Solid, aqueous	GC-ECD	N
O-DRO Rev 2.0	Diesel Range Organics (DRO) by GC/FID	Definitive	Solid, aqueous	GC-FID	N
O-TPHGasoline Rev 1.3	Total Petroleum Hydrocarbons - Gasoline Fraction (GRO) by GC/FID	Definitive	Solid, aqueous	GC-FID	N
I-TOC Rev 1.1	Total Organic Carbon (TOC)	Definitive	Aqueous	UV-Vis	N
W-TCLPRev 0.3	Toxicity Characteristic Leaching Procedure 1311 TCLP	NA	Solid	Tumbler	N

Note: SOPs from CE2L will be forwarded to the government upon request.

QAPP Worksheet #23d: Katahdin (Subcontractor to Vista) Analytical SOPs

Rev 1, Date: 07/21/2014

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
CA-202	Analysis of VOAs by Purge and Trap GC/MS: SW-846 Method 8260, 04/14, Revision 15.	Definitive	Groundwater and Soil/ VOCs	GC/MS	N
CA-209	Zero Headspace Extraction (ZHE) of Volatile Samples for Toxicity Characteristic Leaching Procedure (TCLP) Method 1311, 06/13, Revision 7.	Definitive	Groundwater and Soil / VOCs	Rotary Extractor	N
CA-214	Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil And Waste Samples Using SW846 Method 5035, 03/12, Revision 6.	Definitive	Soil/ VOCs	Not applicable (extraction)	N
CA-226	Analysis of SVOAs by Capillary Column GC/MS: SW-846 Method 8270D, 04/13, Revision 4.	Definitive	Groundwater and Soil/ SVOCs	GC/MS	N
CA-302	Analysis of Pesticides by Gas Chromatography/Electron Capture Detector (GC/ECD): SW-846 Method 8081. 06/14, Revision 14.	Definitive	Groundwater and Soil/ Pesticides	Gas Chromatography (GC)/ Electron Capture Detector (ECD)	N
CA-305	Analysis Of Chlorinated Herbicides By GC Using Methylation Derivatization: SW-846 Method 8151, 02/12, Revision 10.	Definitive	Groundwater and Soil/ Herbicides	GC/ECD	N
CA-315	Determination of Extractable Petroleum Hydrocarbons or Diesel Range Organics (DRO) by Modified Methods 8015 and 8100, 04/14, Revision 12.	Definitive	Groundwater and Soil/ DRO	GC/Flame Ionization Detector (FID)	N
CA-316	Method for Determining Volatile Petroleum Hydrocarbons or Gasoline Range Organics (GRO) by Modified Method 8015, 04/14, Revision 12.	Definitive	Groundwater and Soil/ GRO	GC/Flame Ionization Detector (FID)	N
CA-500	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Pesticides/PCBs Analysis, 04/14, Revision 9.	Definitive	Soil/ Pesticides	Not applicable (extraction)	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
CA-502	Preparation Of Aqueous Samples For Extractable Semivolatile Analysis, 06/14, Revision 9.	Definitive	Groundwater/ SVOCs	Not applicable (extraction)	N
CA-510	Toxicity Leaching Procedure (TCLP) for Inorganic and Non-Volatile Organic Analytes, 06/14, Revision 8.	Definitive	Groundwater and Soil/ Various	Rotary Extractor	N
CA-512	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Extractable Semi-Volatiles Analysis, 05/14, Revision 10.	Definitive	Soil/ SVOCs	Not applicable (extraction)	N
CA-515	Preparation of Aqueous Samples for Pesticides/PCBs Analysis, 05/13, Revision 9.	Definitive	Groundwater/ Pesticides	Not applicable (extraction)	N
CA-516	Preparation of Aqueous Samples for Herbicides by Method 8151, 05/13, Revision 8.	Definitive	Groundwater/ Herbicides	Not applicable (extraction)	N
CA-517	Preparation of Solid Samples for Herbicide Analysis by Method 8151, 05/13, Revision 6.	Definitive	Soil/ Herbicides	Not applicable (extraction)	N
CA-520	Preparation of Aqueous Samples for Analysis of Extractable Petroleum Hydrocarbons or Diesel Range Organics (DRO), 04/12, Revision 7.	Definitive	Groundwater/ DRO	Not applicable (extraction)	N
CA-524	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Pesticide/PCB Analysis, 04/12, Revision 8.	Definitive	Soil/ Pesticides	Not applicable (extraction)	N
CA-526	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Subsequent Extractable Semivolatile Analysis, 06/14, Revision 9.	Definitive	Soil/ SVOCs	Not applicable (extraction)	N
CA-527	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Subsequent Extractable Total Petroleum Hydrocarbon (TPH) or Diesel Range Organic (DRO) Analysis, 04/12, Revision 7.	Definitive	Soil/ DRO	Not applicable (extraction)	N
CA-528	Method 1664 – N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons), 06/14, Revision 9.	Definitive	Groundwater/ Oil and Grease	Balance	N
CA-534	Method 9071 – N-Hexane Extractable Material (HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons), 04/12, Revision 5.	Definitive	Soil/ Oil and Grease	Balance	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
CA-535	Preparation of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Diesel Range Organics (DRO) or Total Petroleum Hydrocarbons (TPH) Analysis, 04/12, Revision 8.	Definitive	Soil/ DRO	Not applicable (extraction)	N
CA-549	Preparation of Sediment/Soil Samples by Microwave Using Method 3546 for Subsequent Diesel Range Organics (DRO), Total Petroleum Hydrocarbons (TPH), Pesticides, PCBs, or Semi-Volatiles Analysis, 06/14, Revision 1.	Definitive	Soil/ DRO, Pesticides	Not applicable (extraction)	N
CA-604	Acid Digestion of Aqueous Samples by USEPA Method 3010 for ICP Analysis of Total or Dissolved Metals, 04/10, Revision 5.	Definitive	Groundwater/ Metals	Not applicable (digestion)	N
CA-605	Acid Digestion of Solid Samples by USEPA Method 3050 for Metals by ICP-AES and GFAA, 09/10, Revision 5.	Definitive	Soil/ Metals	Not applicable (digestion)	N
CA-608	Trace Metals Analysis By ICP-AES Using EPA Method 6010, 05/13, Revision 14.	Definitive	Groundwater and Soil/ Metals	Inductively Coupled Plasma (ICP) – Atomic Emission Spectroscopy (AES)	N
CA-611	Digestion and Analysis of Solid Samples for Mercury by USEPA Method 7471, 06/14, Revision 10.	Definitive	Soil/ Mercury	Mercury Analyzer	N
CA-615	Digestion and Analysis of Aqueous Samples for Mercury by USEPA Method 7470, 06/14, Revision 8.	Definitive	Groundwater/ Mercury	Mercury Analyzer	N
CA-708	pH Concentration Measurements In Aqueous Samples, 05/12, Revision 6.	Definitive	Groundwater/ pH	pH Meter	N
CA-709	pH Concentration Measurements In Soil Matrices – SW 846 Method 9045, 05/12, Revision 9.	Definitive	Soil/ Corrosivity	pH Meter	N
CA-722	Trimetric Determination of Sulfide Using EPA Method 376.1, SM4500S2- F, SW846 9034 ans SW846 7.3.4, 02/13, Revision 6.	Definitive	Groundwater/ Sulfide	Buret	N
CA-736	Test Method for Flash Point by Pensky-Martens Closed-Cup Tester, 05/12, Revision 5.	Definitive	Soil/ Ignitability	Pensky-Martens Closed-Cup Tester	N
CA-741	Determination of Total Organic Carbon in Solids Using the EPA Region II Lloyd Kahn Method, 02/13, Revision 5.	Definitive	Groundwater/ Total Organic Carbon	Total Organic Carbon Analyzer	N
CA-763	Analysis of TOC, DOC, and TIC in Aqueous Samples using the Shimadzu Carbon Analyzer: EPA Method 415.1, SW846 9060 and SM5310B, 05/12, Revision 7.	Definitive	Groundwater/ Total Organic Carbon	Total Organic Carbon Analyzer	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
CA-773	Colorimetric Analysis Of Total And Ammenable Cyanide Using The Automated Konelab Multiwavelength Photometric Analyzer, 07/11, Revision 5.	Definitive	Groundwater/ Cyanide	Konelab	N

Note: SOPs from Katahdin (Subcontractor to Vista) will be forwarded to the government upon request.

QAPP Worksheet #24a: Accutest (Subcontractor to CE2L) Analytical Instrument Calibration

Rev 1, Date: 07/21/2014

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Agilent 1200 series LC/MS/MS (Electrospray detector)	PFOS/PFOA, 5 points minimum, 6 points preferred to maximize calibration range	1 – 25 ppb on-column	Major maintenance (per method) or second consecutive failure of opening CCV warrants recalibration	Correlation coefficient R>0.995. Individual calibration points drift <25%, low standard <30%. ICV and CCV %D <25%;	Instrument maintenance, standard inspection, recalibration	Laboratory Analyst	MS014
GCMS - VOC	Tuning	50 ng on column	Every 12-hours before calibration	SOP criteria for ion abundance.	Perform instrument maintenance	Analyst, Supervisor	MS005
GCMS - VOC	Calibration verification (CCV)	50 ug/L	CV daily, before sample analysis, and every 12 hours of analysis time	All targets < 20%D	Repeat initial calibration and reanalyze all samples analyzed since the last successful Calibration verification	Analyst, Supervisor	MS005
GCMS - VOC	Minimum five-point initial calibration for all analytes (ICAL)	1 through 100 ug/L	Initial calibration prior to sample analysis	RSD <30 for RFs of the CCCs; Average %RSD < 15% for all compounds, linear or quadratic curve fit with COD ≥ 0.99	Repeat calibration if criterion is not met	Analyst, Supervisor	MS005

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GCMS - VOC	Second source calibration verification	50 ug/L	Once after each initial calibration	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	MS005
GCMS - VOC	Evaluation of relative retention times (RRT)	NA	Prior to sample analysis	Set at mid-point of ICAL; +/- 30 seconds each CCV	CCV fails, perform column maintenance, inspect pumps, and leak checks	Analyst, Supervisor	MS005
GCMS - VOC	LOD/LOQ verification	Various	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	MS005
GCMS - SVOC	Tuning	50 ng on column	Every 12-hours before calibration	SOP criteria for ion abundance.	Perform instrument maintenance	Analyst, Supervisor	MS006
GCMS - SVOC	Calibration verification (CCV)	50 ug/L	CV daily, before sample analysis, and every 12 hours of analysis time	All targets < 20%D	Repeat initial calibration and reanalyze all samples analyzed since the last successful Calibration verification	Analyst, Supervisor	MS006

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GCMS - SVOC	Minimum five-point initial calibration for all analytes (ICAL)	1 through 200 ug/L	Initial calibration prior to sample analysis	RSD <30 for RFs of the CCCs; Average %RSD < 15% for all compounds, linear or quadratic curve fit with COD ≥ 0.99	Repeat calibration if criterion is not met	Analyst, Supervisor	MS006
GCMS - SVOC	Second source calibration verification	50 ug/L	Once after each initial calibration	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	MS006
GCMS - SVOC	Evaluation of relative retention times (RRT)	NA	Prior to sample analysis	Set at mid-point of ICAL; +/- 30 seconds each CCV	CCV fails, perform column maintenance, inspect pumps, and leak checks	Analyst, Supervisor	MS006
GCMS - SVOC	LOD/LOQ verification	Various	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	MS006
GC-ECD	Calibration verification (CCV)	Various	Every 10 samples and at the end of the run	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	GC031, GC015

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC-ECD	Minimum five-point initial calibration for all analytes (ICAL)	Various	Initial calibration prior to sample analysis	Average RPD <20%	Repeat calibration if criterion is not met	Analyst, Supervisor	GC031, GC015
GC-ECD	Second source calibration verification	Various	Once after each initial calibration	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	GC031, GC015
GC-ECD	Evaluation of retention time windows	NA	Prior to sample analysis	Established over 72 hours	CCV fails, perform column maintenance, and leak checks	Analyst, Supervisor	GC031, GC015
GC-ECD	LOD/LOQ verification	Various	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	GC031, GC015
ICP - Metals	Continuing calibration verification	Various	CCV after every 10 samples and at the end of the analytical sequence	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	MET100

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
ICP - Metals	Initial calibration for all analytes (ICAL) ICP: minimum one high standard and a calibration blank	Various	Daily initial calibration prior to sample analysis	No acceptance criteria for blank and one standard	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	MET100
ICP - Metals	Linear Dynamic range/High level Check	Various	Every 6 months and with major maintenance	90-110% recovery	Perform maintenance and/or reanalyze at lower concentration	Analyst, Supervisor	MET100
ICP - Metals	Low-level calibration check standard	Various – at LOQ	Daily following calibration.	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	MET100
ICP - Metals	Second source calibration verification (ICV)	Various	Once after each initial calibration	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	MET100
CVAA - Mercury	Continuing calibration verification	3.0 ug/l	CCV after every 10 samples and at the end of the analytical sequence	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	MET106

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
CVAA - Mercury	Initial calibration for all analytes (ICAL) ICP: minimum one high standard and a calibration blank	0.2 – 6.0 ug/l	Daily initial calibration prior to sample analysis	No acceptance criteria for blank and one standard	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	MET106
CVAA - Mercury	Low-level calibration check standard	at LOQ	Daily following calibration.	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	MET106
CVAA - Mercury	Second source calibration verification (ICV)	3.0 ug/l	Once after each initial calibration	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	MET106
Lachat, Automated Colorimetry	Calibration verification (CCV)	Various	Every 10 samples and at the end of the run	All analytes within ± 10% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	GN115

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Lachat, Automated Colorimetry	Minimum five-point and a blank initial calibration for all analytes (ICAL)	Various	Initial calibration prior to sample analysis	COD>0.995	Repeat calibration if criterion is not met	Analyst, Supervisor	GN115
Lachat, Automated Colorimetry	Second source calibration verification	Various	Once after each initial calibration	All analytes within ± 10% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	GN115
Lachat, Automated Colorimetry	LOD/LOQ verification	Various	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	GN115
Penske-Marten Closed cup	2 sources of p-xylene	76 – 81 F	daily	within limits listed in certificate of analysis	Perform instrument maintenance, recalibrate the thermometer	Analyst, Supervisor	GN121

Note: SOPs from Accutest Laboratories Southeast, Inc. will be forwarded to the government upon request.

QAPP Worksheet #24b: Vista Analytical Instrument Calibration

Rev 1, Date: 07/21/2014

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Quattro Premier XE	NaICs calibration	22 – 1,500 amu	Annually or after major repairs	Internal (instrument) software acceptance	Clean sample/gas cones and repeat	Technical Director	SOP 54, rev0
Quattro Premier XE	Compound tuning	Within 22 – 1,500 amu	Before analysis of ICAL	+/- 0.3 amu from theoretical	Recalibrate with NaICs	Analyst	SOP 54, rev0
Quattro Premier XE	ICAL	NA	After prep. of standards	Linear, $\leq$20% RSD	Clean sample/gas cones and repeat	Analyst	SOP 49, rev2
Quattro Premier XE	CCV	NA	Before and after analytical sequence and every 10 samples	SOP 49, rev1 tables 3A – 3C	Clean sample/gas cones and repeat	Analyst	SOP 49, rev2

Note: SOPs from Vista Analytical Laboratory will be forwarded to the government upon request.

QAPP Worksheet #24c: CE2L Analytical Instrument Calibration

Rev 1, Date: 07/21/2014

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
pH Electrode	Per SOP	pH 4, 7, 10, unless noted	Per batch	ICV within 0.05 pH units of true value	Clean electrode, recalibrate	Technical director, Vice president of operations, Vice president of quality assurance	I-pH Rev 0.4
GC-MS	Per SOP, 5 point curve, low point set at LOQ	0.1-10,000 ppb	Every 12 hours, or after 2 consecutive CCV failures	ICAL %RSD <10%, CCV %RSD <20%	Purge, repair/replace gaskets if a leak, recalibrate.	Technical director, Vice president of operations, Vice president of quality assurance	O-SoilVOCs-5035A Rev 1.2 O-VOCs Rev 1.3 O-SVOCs-8270 Rev 2.3
ICP-AES	Per SOP, single point per metal, linear dynamic range	100-100,000 ppb	Per use, after 2 consecutive failed CCVs	<10%	Rinse/purge system, recalibrate	Technical director, Vice president of operations, Vice president of quality assurance	I-ICP-AES Rev 1.1

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
ICP-MS	Per SOP, single point per metal, linear dynamic range	LOD-1000 ppb	Per use, after 2 consecutive failed CCVs	<10%	Rinse/purge system, recalibrate	Technical director, Vice president of operations, Vice president of quality assurance	I-ICPMS Rev 1.3
GC-ECD	6 point curve, DDT-Endrin breakdown check	10-100 ppb	DDT check every 12 hours, CCV every 10 samples, recalibrate after 2 consecutive CCV failures	ICV <10% CCV <20%	Purge, repair/replace gaskets if a leak, recalibrate.	Technical director, Vice president of operations, Vice president of quality assurance	O-OCPesticides Rev 1.4
GC-FID	7 point curve, low point at LOQ	10-150 ppb	Retention time marker every 12 hours, recalibrate after 2 consecutive CCV failures	ICV <10% CCV <20%	Purge, repair/replace gaskets if a leak, recalibrate.	Technical director, Vice president of operations, Vice president of quality assurance	O-DRO Rev 2.0 O-TPHGasoline Rev 1.3
UV-Vis	6 point curve, low point at LOQ	1,000-20,000 ppb	Per batch	R^2>0.995 ICV <15% CCV <20%	Purge, repair/replace gaskets if a leak, recalibrate.	Technical director, Vice president of operations, Vice president of quality assurance	I-TOC Rev 1.1

Note: SOPs from CE2L will be forwarded to the government upon request.

QAPP Worksheet #24d: Katahdin (Subcontractor to Vista) Analytical Instrument Calibration

Rev 1, Date: 07/21/2014

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GCMS-VOCs	Initial Calibration (ICAL) - A minimum 5-point initial calibration is required for all VOCs.	1-200 µg/L	Instrument receipt, major instrument change, when continuing calibration verification does not meet criteria.	The average Response Factors (RFs) for System Performance Check Compound (SPCCs) must be ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorobenzene and ≥ 0.10 for chloromethane, 1,1-dichloroethane, and bromoform. The Percent Relative Standard Deviations (%RSDs) for RFs of Calibration Check Compound (CCCs) must be 30% and one option below for non CCC compounds: Option 1) %RSDs for all compounds must be < 15%. If not met: Option 2) Linear least squares regression: correlation coefficient (r) ≥ 0.995 Option 3) Non-linear regression: coefficient of determination (r2) ≥ 0.99 (6 points for second order).	Correct problem then repeat calibration.	Analyst, Department Manager	CA-202

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GCMS-VOCs	Second Source Calibration Verification (ICV)	1-200 µg/L	Once after each ICAL.	Percent Recovery (%R) must be within 80-120% for all project compounds.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Analyst, Department Manager	CA-202
GCMS-VOCs	Continuing Calibration (CCV)	1-200 µg/L	Daily before sample analysis and every 12 hours	Percent Drift or Difference (%D) must be ≤ 20% for all project compounds. RFs for SPCCs must be ≥0.10 & ≥0.30 (compounds as listed above in ICAL block).	DoD (Department of Defense) project level approval must be obtained for each of the failed analytes or corrective action must be taken. Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.	Analyst, Department Manager	CA-202

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GCMS-VOCs	BFB Tune	1-200 µg/L	Prior to ICAL and at the beginning of each 12-hour clock.	Must meet criteria listed in Section 7.3, current revision of SOP CA-202.	Retune and/or clean source.	Analyst, Department Manager	CA-202
GC/MS (full scan) SVOCs	ICAL - A minimum 5-point calibration is required for all SVOCs.	10-125 µg/mL	Instrument receipt, instrument change (new column, source cleaning, etc.), when CCV is out of criteria. Six-point initial calibration for all analytes.	SVOCs (except PAHs): The average RF for SPCCs must be $\geq$ 0.050; The %RSD for RFs for CCCs must be $\leq$30%, and one option below must be met: Option 1) %RSD < 15% for all compounds. If not met: Option 2) Linear least squares regression: r ≥ 0.995 Option 3) Non-linear regression: $r^2 \geq 0.99$ (6 points for second order)..	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst, Department Manager	CA-226
GC/MS (full scan) SVOCs	ICV	10-125 µg/mL	Once after each ICAL.	The %R must be within 80-120% for all project compounds.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Analyst, Department Manager	CA-226

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC/MS (full scan) SVOCs	CCV	10-125 µg/mL	Analyze a standard at the beginning of each 12-hour shift after a decafluoro-triphenyl-phosphine (DFTPP) tune.	SVOCs (except PAHs): The RF for SPCCs must be ≥0.050; The %D for all target compounds and surrogates must be ≤ 20%D (D = Difference or Drift)	DoD project level approval must be obtained for each of the failed analytes or corrective action must be taken. Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.	Analyst, Department Manager	CA-226
GC/MS (full scan) SVOCs	DFTPP Tune	10-125 µg/mL	Every 12 hours	Criteria listed in Section 7.4, current revision of SOP CA-226	Retune and/or clean source.	Analyst, Department Manager	CA-226

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC/ECD-Pesticides	ICAL - A minimum 5-point calibration for all individual pesticides, Toxaphene and Technical Chlordane	Individual : 0.005 to 0.25 µg/mL Tox.: 0.10 to 10 µg/mL T.C.: 0.05 to 2.5 µg/mL	Instrument receipt, major instrument change, when CCV does not meet criteria.	One of the options below: Option 1: %RSD for each analyte must be ≤ 20%; Option 2: linear least squares regression: r must be ≥ 0.995; Option 3: non-linear regression: r^2 must be ≥ 0.99 (6 points shall be used for second order).	Repeat ICAL and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Department Manager	CA-302
GC/ECD-Pesticides	ICV	Individual : 0.005 to 0.25 µg/mL Tox.: 0.10 to 10 µg/mL T.C.: 0.05 to 2.5 µg/mL	Immediately following ICAL.	%R must within 80%-120% for all project compounds.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Analyst, Department Manager	CA-302

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC/ECD-Pesticides	CCV	Individual : 0.005 to 0.25 µg/mL Tox.: 0.10 to 10 µg/mL T.C.: 0.05 to 2.5 µg/mL	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	%D must be ≤ 20% for all project compounds.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst, Department Manager	CA-302
GC/ECD-Pesticides	Breakdown Check	Individual : 0.005 to 0.25 µg/mL Tox.: 0.10 to 10 µg/mL T.C.: 0.05 to 2.5 µg/mL	Perform daily prior to sample analysis.	The degradation must be ≤ 15% for both Endrin and DDT.	Column maintenance; injection port maintenance.	Analyst, Department Manager	CA-302

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC/ECD-Herbicides	ICAL – A minimum 5-point calibration of all herbicides	0.1/10 to 2.0/200 µg/mL	Instrument receipt, major instrument change, when CCV does not meet criteria.	One of the options below: Option 1: %RSD for each analyte must be ≤ 20%; Option 2: linear least squares regression: r must be ≥ 0.995; Option 3: non-linear regression: r^2 must be ≥ 0.99 (6 points shall be used for second order).	Repeat ICAL and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Department Manager	CA-305
GC/ECD-Herbicides	ICV	0.1/10 to 2.0/200 µg/mL	Immediately following calibration.	%R must within 80%-120% for all project compounds.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Analyst, Department Manager	CA-305
GC/ECD-Herbicides	CCV	0.1/10 to 2.0/200 µg/mL	After every 10 samples; If calibration curve previously analyzed, analyze daily before samples.	%D must be ≤ 20% for all project compounds.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst, Department Manager	CA-305

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC/FID / Diesel Range Organics/ Residual Range Organics	ICAL	50-2000 µg/mL	Instrument receipt, major instrument change, when CCV does not meet criteria.	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order).	Correct problem then repeat ICAL.	Analyst, Department Manager	CA-315
GC/FID / Diesel Range Organics/ Residual Range Organics	ICV	50-2000 µg/mL	Once after each initial calibration.	%R must within 80%-120% for all project compounds.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Analyst, Department Manager	CA-315
GC/FID / Diesel Range Organics/ Residual Range Organics	CCV	50-2000 µg/mL	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	%D must be ≤ 20% for all project compounds.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst, Department Manager	CA-315

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
GC/FID Gasoline Range Organics	ICAL	10-2000 µg/L	Instrument receipt, major instrument change, when CCV does not meet criteria.	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order).	Correct problem then repeat ICAL.	Analyst, Department Manager	CA-316
GC/FID Gasoline Range Organics	ICV	10-2000 µg/L	Once after each initial calibration.	%R must within 80%-120% for all project compounds.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Analyst, Department Manager	CA-316
GC/FID Gasoline Range Organics	CCV	10-2000 µg/L	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	%D must be ≤ 20% for all project compounds.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst, Department Manager	CA-316

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
ICP-AES – TAL Metals	ICAL	1/25 µg/L	At the beginning of each day or if QC is out of criteria.	One point calibration plus a blank per manufacturer's guidelines.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst, Department Manager	CA-608
ICP-AES – TAL Metals	ICV	1/25 µg/L	Once after each ICAL, prior to beginning a sample run.	%R must be within 90-110% for all project compounds.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Analyst, Department Manager	CA-608
ICP-AES – TAL Metals	Calibration Blank (CB)	1/25 µg/L	Before beginning a sample sequence, after every 10 samples and at end of the analysis sequence.	No analytes detected > LOD. For negative blanks, absolute value < LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Analyst, Department Manager	CA-608

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
ICP-AES – TAL Metals	CCV	1/25 µg/L	After every 10 samples and at the end of each run sequence.	%R must be within 90-110% for all project compounds.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst, Department Manager	CA-608
ICP-AES – TAL Metals	Low-level Calibration Check Standard (if using one-point ICAL)	1/25 µg/L	Daily after one-point ICAL.	%R must within 80%-120% for all project compounds.	Correct problem, then reanalyze.	Analyst, Department Manager	CA-608
ICP-AES – TAL Metals	ICS - ICSA & ICSB	1/25 µg/L	Daily, before sample injections	ICSA recoveries must be less than the absolute value of the LOD and ICSB %Rs must be within 80-120%.	Correct the problem, then re-prepare checks and reanalyze all affected samples.	Analyst, Department Manager	CA-608

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Mercury analyzer	ICAL - 5 points plus a calibration blank	0.2-10 µg/L	Upon instrument receipt, major instrument change, at the start of each day.	Correlation coefficient (r) must be ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst, Department Manager	CA-611, CA-615
Mercury analyzer	ICV	0.2-10 µg/L	Once after each ICAL, prior to beginning a sample run.	%R must be within 90-110%	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Analyst, Department Manager	CA-611, CA-615
Mercury analyzer	CCB	0.2-10 µg/L	Before beginning a sample sequence, after every 10 samples and at end of the analysis sequence. For negative blanks, absolute value < LOD.	No analytes detected > LOD.	Correct problem. Re-prepare and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Analyst, Department Manager	CA-611, CA-615

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Mercury analyzer	CCV	0.2-10 µg/L	Beginning and end of each run sequence and every 10 samples.	%R must be within 80-120%	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst, Department Manager	CA-611, CA-615
Konelab – Cyanide	ICAL – Minimum of a 5-point calibration curve plus a blank is prepared.	10-250 µg/L	Daily ICAL prior to sample analysis.	Correlation coefficient (r) must be ≥ 0.995.	Correct problem, then repeat ICAL.	Analyst, Department Manager	CA-772
Konelab – Cyanide	Distilled Standards (Cyanide only)	10-250 µg/L	One low point and one low point per multipoint calibration.	%R must be within 85-115%.	Correct problem, then repeat distilled standards.	Analyst, Department Manager	CA-772

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Konelab – Cyanide	ICV	10-250 µg/L	Once after each ICAL, prior to beginning a sample run.	%R must be within 85-115%.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Analyst, Department Manager	CA-772
Konelab – Cyanide	CCV	10-250 µg/L	CCV (undistilled)	One after every 10 samples analyzed and at close of run	90%-110 % rcvy.	Analyst, Department Manager	CA-772
Balance / Oil and Grease	Balance Verification	NA	Every day before use.	Within criteria specified in KAS SOP CA-102.	Investigate problem. Do not use balance until verification has passed.	Analyst, Department Manager	CA-528, CA-534
Total Organic Carbon Analyzer / Total Organic Carbon	ICAL – Minimum of a 5-point calibration curve plus a blank is prepared.	1-200 mg/L 400-2400 µgC	Initially, when the daily CCV does not pass, but, no longer than every 3 months.	Correlation coefficient ≤ 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Department Manager	CA-763, CA741

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Total Organic Carbon Analyzer / Total Organic Carbon	ICV	1-200 mg/L 400-2400 µgC	Once after each ICAL, prior to beginning a sample run.	Lloyd Kahn: %R must within 80%-120% SM5310B: %R must within 90%-110%	(1) If the ICV fails high, report samples that are <PQL. (2) Redigest, recalibrate and/or reanalyze other samples.	Analyst, Department Manager	CA-763, CA741
Total Organic Carbon Analyzer / Total Organic Carbon	CCV	1-200 mg/L 400-2400 µgC	Every 10 samples and at the end of the run	Lloyd Kahn: %R must within 80%-120% SM5310B: %R must within 90%-110%	If the CCV fails high, report samples that are <PQL. Recalibrate and/or reanalyze samples back to last acceptable CCV recovery.	Analyst, Department Manager	CA-763, CA741
Probe	2-point calibration with pH buffers with a midrange cal. check	NA	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	Analyst, Department Manager	CA-708. CA-709
Probe	ICV	NA	One per batch of twenty or fewer samples	90-110%R	Correct problem, recalibrate	Analyst, Department Manager	CA-708. CA-709

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for Corrective Action	SOP Reference
Buret / Sulfide	Standardized using 0.0375 N Sodium thiosulfate	NA	Daily prior to sample analysis.	NA	An acceptable titrant is compared against an independent source identified as an LCS	Analyst, Supervisor	CA-722

Note: SOPs from Katahdin (Subcontractor to Vista) will be forwarded to the government upon request.

QAPP Worksheet #25a: Accutest (Subcontractor to CE2L) Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Rev 1, Date: 07/21/2014

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	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	SOP MS014
GC/MS	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	VOC	Monitor instrument performance via Continuing Calibration Verification	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Replace connections, clean source, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier	Analyst, Supervisor	MS005

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
GC/MS	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	SVOC	Monitor instrument performance via Continuing Calibration Verification	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Replace connections, clean source, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier	Analyst, Supervisor	MS006
HP5890, HP6890, Dual ECD	Injector port, column maintenance	SW-846 8151A, 8081B	Leak test, column and injector port inspection	Need for maintenance determined by passing calibration– see GC031, GC015	Passing CCV	Column clipping, seals and liners replacement, recalibrate and reanalyze affected samples	Laboratory Analyst	GC031; GC015

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
Lachat QuickChem 8500	Pump maintenance, photocell cleaning	SW-846 9012B	Clean or replace tubing, check connections	Frequency determined by instrument remaining in calibration and free of interference – GN115	Passing calibration	Reconnect tubes, check pump rate. Rerun calibration and samples	Laboratory Analyst	GN115
CVAA	Pump tubing, absorption cell, and lens cleaning.	Detector signal response review	Check connections, flush sample lines	Frequency determined by instrument remaining in calibration and free of interference –MET106,	CCV and ICV within 10% of true value	Reconnect sample pathways, recalibrate, reanalyze affected samples	Laboratory Analyst	MET106, MET 105
Inductively Coupled Plasma	Perform leak test, change pump tubing, change torch and window, clean filters	Metals	Monitor instrument performance via Continuing Calibration Verification and CCBlank	As needed, determined by remaining in calibration.	CCV and ICV within 10% of nominal value	Change pump tubing, change torch and window, clean filters; recalibrate and reanalyze affected data	Analyst, Supervisor	MET100

Note: SOPs from Accutest Laboratories Southeast, Inc. will be forwarded to the government upon request.

QAPP Worksheet #25b: Vista Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Rev 1, Date: 07/21/2014

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
Quattro Premier XE	Source cleaning	Sample/gas cone cleaning	Visual	As needed	NA	NA	Analyst	SOP 54, rev0
Aquity UPLC	Needle replacement	Contaminatio n Bent needle	Visual	As needed	Leak test in software	Repeat if leak test fails	Analyst	SOP 54, rev0
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, rev0

Note: SOPs from Vista Analytical Laboratory will be forwarded to the government upon request.

QAPP Worksheet #25c: CE2L Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Rev 1, Date: 07/21/2014

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
pH Electrode	Visual inspection		Per SOP	Per use and Quarterly	No breakage	Replace if necessary	VPO, TD, VPQA	I-pH Rev 0.4
GC-MS	Inspect lines, column, check pump oil, replace inlet liners.	Holds vacuum	No apparent damage	Per use visual inspection and Quarterly/as needed	Good connections, has oil	Replace lines, fill with oil.	VPO, TD, VPQA	O-SoilVOCs-5035A Rev 1.2 O-VOCs Rev 1.3 O-SVOCs-8270 Rev 2.3
ICP-AES	Inspect tubes, connections, replace tubing,	Passing results	Visual inspection	Weekly	Good connections	Consult manufacturer's troubleshooting guide	VPO, TD, VPQA	I-ICP-AES Rev 1.1
ICP-MS	Inspect tubes, connections, replace tubing, check pump oil	Passing results, good vacuum	Visual inspection	Weekly, check pump quarterly	Good connections, pump operates within manufacture specification	Consult manufacturer's troubleshooting guide	VPO, TD, VPQA	I-ICPMS Rev 1.3

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
GC-ECD	Inspect lines, column, check pump oil, replace inlet liners.	Holds vacuum	No apparent damage	Per use visual inspection and Quarterly/ as needed	Good connections, has oil	Replace lines, fill with oil.	VPO, TD, VPQA	O-OCPesticides Rev 1.4
GC-FID	Inspect lines, column, check pump oil, replace inlet liners.	Holds vacuum	No apparent damage	Per use visual inspection and Quarterly/ as needed	Good connections, has oil	Replace lines, fill with oil.	VPO, TD, VPQA	O-DRO Rev 2.0 O-TPHGasoline Rev 1.3
UV-Vis	Clean combustion tube and glassware	Passing values	Visual inspection	Quarterly	NA	Replace if necessary	VPO, TD, VPQA	I-TOC Rev 1.1

Note: SOPs from CE2L will be forwarded to the government upon request.

TD = technical director

VPQA = vice president of quality assurance

VPO = vice president of operations

QAPP Worksheet #25d: Katahdin (Subcontractor to Vista) Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Rev 1, Date: 07/21/2014

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
GC/MS VOCs	Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed. Other maintenance specified in lab Equipment Maintenance SOP.	VOCs	Ion source, injector liner, column, column flow, purge lines, purge flow, trap.	Prior to ICAL and/or as necessary.	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-202

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
GC/MS SVOCs	Check pressure and gas supply daily. Manual tune if DFTPP not in criteria, change septa as needed, change liner as needed, cut column as needed. Other maintenance specified in lab Equipment Maintenance SOP.	SVOCs	Ion source, injector liner, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-226
GC/ECD	Check pressure and gas supply daily. Change septa and/or liner as needed, replace or cut column as needed. Other maintenance specified in lab Equipment Maintenance SOP.	Pesticides	Injector liner, septa, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-302

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
GC/FID	Check pressure and gas supply daily. Change septa and/or GC injector glass liner as needed. Replace or cut GC column as needed. Other maintenance specified in lab Equipment Maintenance SOP.	Diesel Range Organics/ Residual Range Organics	Injector liner, septa, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable ICAL or CCV	Correct the problem and repeat ICAL or CCV.	Analyst, Department Manager	CA-315
GC/FID	Replace or cut GC column as needed. Bake out trap and column. Change trap as needed.	Gasoline Range Organics	Trap, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable ICAL or CCV	Correct the problem and repeat ICAL or CCV.	Analyst, Department Manager	CA-316

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
ICP-AES	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	Metals	Torch, nebulizer chamber, pump, pump tubing.	Prior to ICAL and as necessary.	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-608

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
Mercury Analyzer	Replace peristaltic pump tubing, replace mercury lamp, replace drying tube, clean optical cell and/or clean liquid/gas separator as needed. Other maintenance specified in lab Equipment Maintenance SOP.	Mercury	Tubing, sample probe, optical cell.	Prior to ICAL and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-611, CA-615
Buret - Hardness, Sulfide, Reactive Sulfide, Sulfite	N/A	Sulfide	Visual inspection for cracks or chips	Each use	N/A	Remove from service	Analyst, Department Manager	CA-722

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
Konelab	Check and clean segments weekly, clean reagent tubes monthly. Change lamp, change diluent and wash tubes, change mixing paddles and syringes, change dispensing needle, all as needed.	Cyanide	Reagent tubes, lamp, wash tubes, paddles, syringes, dispensin g needles.	Prior to initial calibration and/or as necessary.	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-772
Balance	Weights	Oil and Grease	Cleanlines s	Prior to sample weighing	Acceptable CCV	Correct the problem, reanalyze CCV.	Analyst, Department Manager	CA-528, CA-534
TOC Combustion Analyzer	Check level of dilution water, drain vessel water, humidifier water, auto sampler rinse water and phosphoric acid vessel and fill as needed. Replace oxygen cylinder.	Total Organic Carbon	Tubing, sample boat, syringe, humidifier , rinse reservoir, phosphori c acid vessel, oxygen pressure	Prior to initial calibration and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-763, CA-741

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	SOP Reference
Probe - pH	Clean, drain, and refill reference electrode as needed.	pH	Reference electrode for white crystals, Inspect electrode for damage.	Before use	pH 7 ± 0.05 pH units (pH)	Correct problem and repeat calibration.	Analyst, Department Manager	CA-708, CA-709

Note: SOPs from Katahdin (Subcontractor to Vista) will be forwarded to the government upon request.

QAPP Worksheet #26a & 27a: Sample Handling, Custody, and Disposal

Rev 1, Date: 07/21/2014

Sampling Organization: AMEC

Laboratory: Accutest (Subcontractor to CE2L)

Method of sample delivery (shipper/carrier): FedEx

Number 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 – Field Manager	AMEC-11
Chain-of-custody form completion	AMEC – Field Manager	AMEC-11
Packaging	AMEC – Field Manager	AMEC-11
Shipping coordination	AMEC – Field Manager	AMEC-11
Shipping coordination	Accutest Laboratories Southeast Project Manager and AMEC Field Manager	SAM102
Sample receipt, inspection, & log-in	Accutest Laboratories Southeast Sample Management	SAM101
Sample custody and storage	Accutest Laboratories Southeast Sample Management	SAM101, QA048
Sample disposal	Accutest Laboratories Southeast Sample Management	SAM101

QAPP Worksheet #26b & 27b: Sample Handling, Custody, and Disposal

Rev 1, Date: 07/21/2014

Sampling Organization: AMEC

Laboratory: Vista

Method of sample delivery (shipper/carrier): FedEx

Number 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 – Field Manager	AMEC-11
Chain-of-custody form completion	AMEC – Field Manager	AMEC-11
Packaging	AMEC – Field Manager	AMEC-11
Shipping coordination	AMEC – Field Manager	AMEC-10
Shipping coordination	Vista Analytical Laboratory/Sample Custodian	SOP 12, rev 9
Sample receipt, inspection, & log-in	Vista Analytical Laboratory/Sample Custodian	SOP 12, rev 9
Sample custody and storage	Vista Analytical Laboratory/Sample Custodian	SOP 12, rev 9
Sample disposal	Vista Analytical Laboratory/Sample Custodian	SOP 12, rev 9
Activity	**Organization and title or position of person responsible for the activity**	**SOP reference**
Sample labeling	AMEC – Field Manager	AMEC-11

Activity	Organization and title or position of person responsible for the activity	SOP reference
Chain-of-custody form completion	AMEC – Field Manager	AMEC-11
Packaging	AMEC – Field Manager	AMEC-11
Shipping coordination	AMEC – Field Manager	AMEC-11
Shipping coordination	CE2L – VPO, VPBD	CE2L – Q-SampleMgmt Rev 1.3
Sample receipt, inspection, & log-in	CE2L – PM, VPO	CE2L – Q-SampleMgmt Rev 1.3
Sample custody and storage	CE2L – PM, VPO	CE2L – Q-SampleMgmt Rev 1.3
Sample disposal	CE2L – VPO, VPQA	CE2L – Q-SampleMgmt Rev 1.3

QAPP Worksheet #26d & 27d: Sample Handling, Custody, and Disposal

Rev 1, Date: 07/21/2014

Sampling Organization: AMEC

Laboratory: Katahdin (Subcontractor to Vista)

Method of sample delivery (shipper/carrier): FedEx

Number 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 – Field Manager	AMEC-11
Chain-of-custody form completion	AMEC – Field Manager	AMEC-11
Packaging	AMEC – Field Manager	AMEC-11
Shipping coordination	AMEC – Field Manager	AMEC-11
Shipping coordination	Katahdin (Subcontractor to Vista) – Project Manager	SD-902
Sample receipt, inspection, & log-in	Katahdin (Subcontractor to Vista) - Sample receipt personnel	SD-902
Sample custody and storage	Katahdin (Subcontractor to Vista) - Sample receipt personnel	SD-902
Sample disposal	Katahdin (Subcontractor to Vista) - Sample	SD-903

Activity	Organization and title or position of person responsible for the activity	SOP reference
	disposal personnel	

QAPP Worksheet #28a: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: PFCs

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

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	1 per prep. batch of up to 20 samples.	No analytes detected > ½ reporting limit (RL)	Reprep and reanalyze the method blank and all samples processed with the contaminated blank. If problem persists, call PM.	Bench Analyst	All analytes in the method blank must be less than ½ the RL or 1/5 of the PALs 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	All analytes in samples with concentrations within 20% of the PALs on WS#15 must pass method/SOP criteria.
MS	One per preparatory batch of up to 20 samples.	Use LCS 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 LCS control limits
MSD	One per preparatory batch of up to 20 samples.	Use LCS control limits; %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 LCS control limits; %RPD <30
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	70% to 130%	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 #28b: Vista Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: PFCs

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

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	1 per prep. batch of up to 20 samples.	No analytes detected > 1/3 the reporting limit (RL) or the regulatory limit, whichever is greater.	Reprep and reanalyze the method blank and all samples processed with the contaminated blank. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All analytes in the method blank must be less than ½ the RL or 1/5 of the PAL's on WS#15, whichever is greater
LCS containing all analytes	One per preparatory batch of up to 20 samples.	70% to 130% for medium to high concentration LCSs, or 50% to 150% for low-concentration LCSs	Correct problem, reprep and reanalyze LCS and all samples in associated batch for failed analytes. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All analytes in samples with concentrations within 20% of the PALs on WS#15 must pass method/SOP criteria.
MS	One per preparatory batch of up to 20 samples.	Use LCS 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 LCS control limits
MSD	One per preparatory batch of up to 20 samples.	Use LCS control limits; %RPD <20	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 LCS control limits; %RPD <20
IS	Every standard and sample	Recoveries 70% to 130% for aqueous samples or 60% to 130% for water samples, +/- 50% of 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	Recoveries 70% to 130% for aqueous samples or 60% to 130% for water samples, +/- 50% of average areas measured during ICAL
Surrogate Spike	NA	NA	NA	NA	NA

QAPP Worksheet #28c: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: pH

Analytical Method/SOP: SM4500 H+A and B, SW-846 9040C, SW-846 9045D, SW-846 9041 A, EPA 150.2/I-pH, Revision 0.4

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
ICV	1/batch	Within 0.05 pH units	Clean electrode, recailbrate	VPO, TD, VPQA	NA
CCV	1/batch	Within 0.05 pH units	Clean electrode, recailbrate	VPO, TD, VPQA	NA

QAPP Worksheet #28d: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: VOCs

Analytical Method/SOP: VOCs by 8260B, O-SoilVOCs-5035A Rev 1.2, O-VOCs Rev 1.3

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	< 15%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<20%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<20%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28e: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: SVOCs

Analytical Method/SOP: SVOCs by 8270D, O-SVOCs-8270 Rev 2.3

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<30%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<20%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<20%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28f: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: ICP-AES Metals

Analytical Method/SOP: Metals by 6010B, I-ICP-AES Rev 1.1

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<25%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<10%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<10%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28g: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: ICP/MS Metals

Analytical Method/SOP: Metals by 6020A, I-ICPMS Rev 1.3

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<25%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<10%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<10%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28h: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Mercury

Analytical Method/SOP: Mercury by 7470/7471, I-Mercury-CVAA Rev 0.5

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<25%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<10%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<10%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28i: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Pesticides

Analytical Method/SOP: Pesticides by 8081, O-OCPesticides Rev 1.4

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<30%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<20%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<20%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28j: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: DRO/ORO

Analytical Method/SOP: Diesel/Oil range organics by 8015, O-DRO Rev 2.0

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<30%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<20%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<20%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28k: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: GRO

Analytical Method/SOP: Gasoline range organics by 8015, O-TPHGasoline Rev 1.3

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<15%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<20%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<10%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28l: CE2L Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Aqueous

Analytical Group: TOC

Analytical Method/SOP: Total organic carbon by 9060, I-TOC Rev 1.1

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Blank	1/batch	<1/2 LOQ	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
LCS/D	2/batch	<30%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
CCV	1/ batch or every 10 samples	<20%	Reanalyze, if still fails, rinse/purge system, recalibrate	VPO, TD, VPQA	NA
ICV	1/calibration	<15%	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA
MS/MSD	On request	Same as LCS/D	Rinse/purge system, recalibrate if necessary	VPO, TD, VPQA	NA

QAPP Worksheet #28m: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Leachate

Analytical Group: ICP Metals

Analytical Method/SOP: SW-846 6010C/MET100

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	One LCS per preparatory batch	80-120%	Reanalyze and/or reprep all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Same as SOP
Sample Duplicate or MSD	One per preparatory batch	RPD ≤ 20%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP
Matrix Spike	One per preparatory batch per matrix	80-120%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP
ICP Serial Dilution	One per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement for samples with concentrations > 50 x LOQ	Perform Post Digestion Spike	Analyst, Supervisor, QA Manager	Same as SOP

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
ICP Post Digestion Spike	When dilution test fails or analyte concentration in all samples < 50 x LOD	Recovery 75-125%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28n: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Leachate

Analytical Group: Mercury

Analytical Method/SOP: SW-846 7470A/MET106

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	One LCS per preparatory batch	80-120%	Reanalyze and/or reprep all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Same as SOP
Sample Duplicate or MSD	One per preparatory batch	RPD ≤ 20%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP
Matrix Spike	One per preparatory batch per matrix	80-120%	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP
Serial Dilution	One per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement for samples with concentrations > 50 x LOQ	Perform Post Digestion Spike	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28o: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Leachate

Analytical Group: Pesticides

Analytical Method/SOP: SW-846 8081B/GC015

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	1 per batch; maximum of 20 samples	No analytes detected > ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	1 per batch; maximum of 20 samples	QC acceptance criteria specified in QSM 4.2 Table G-16 and G-17 if available or laboratory limits.	Reanalyze all associated samples unless recoveries are high with no detection of analytes. If no sample available for analysis – qualify data.	Analyst, Supervisor, QA Manager	Same as SOP
MS/MSD	One pair per batch or as specified by client request	For matrix evaluation, use LCS recovery and RPD acceptance criteria	Evaluate data to determine if failure is due to matrix effects or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data.	Analyst, Supervisor, QA Manager	Same as SOP
Surrogates	In all field samples, calibrations and QC standards	QC acceptance criteria specified in QSM 4.2 Table G-3 if available or laboratory limits.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28p: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Leachate

Analytical Group: Chlorinated Herbicides

Analytical Method/SOP: SW-846 8151A/GC031

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	1 per batch; maximum of 20 samples	No analytes detected > ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	1 per batch; maximum of 20 samples	QC acceptance criteria specified in QSM 4.2 Table G-8 and G-9 if available or laboratory limits.	Reanalyze all associated samples unless recoveries are high with no detection of analytes. If no sample available for analysis – qualify data.	Analyst, Supervisor, QA Manager	Same as SOP
MS/MSD	One pair per batch or as specified by client request	For matrix evaluation, use LCS recovery and RPD acceptance criteria	Evaluate data to determine if failure is due to matrix effects or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data.	Analyst, Supervisor, QA Manager	Same as SOP
Surrogates	In all field samples, calibrations and QC standards	QC acceptance criteria specified in QSM 4.2 Table G-3 if available or laboratory limits.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28q: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Leachate

Analytical Group: Volatile Organics

Analytical Method/SOP: SW-846 8260B/MS005

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	1 per batch; maximum of 20 samples	No analytes detected > ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	1 per batch; maximum of 20 samples	QC acceptance criteria specified in QSM 4.2 Table G-4 and G-5 if available or laboratory limits.	Reanalyze all associated samples unless recoveries are high with no detection of analytes. If no sample available for analysis – qualify data.	Analyst, Supervisor, QA Manager	Same as SOP
MS/MSD	One pair per batch or as specified by client request	For matrix evaluation, use LCS recovery and RPD acceptance criteria	Evaluate data to determine if failure is due to matrix effects or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data.	Analyst, Supervisor, QA Manager	Same as SOP
Internal Standards	In all field samples, calibrations and QC standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; Extracted Ion Current Profile (EICP) area within -50% to +100% of ICAL midpoint standard	Inspect Mass spectrometer or GC for malfunctions. Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Same as SOP
Surrogates	In all field samples, calibrations and QC standards	QC acceptance criteria specified in QSM 4.2 Table G-3 if available or laboratory limits.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28r: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Leachate

Analytical Group: Semivolatile Organics

Analytical Method/SOP: SW-846 8270D/MS006

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	1 per batch; maximum of 20 samples	No analytes detected > ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	1 per batch; maximum of 20 samples	QC acceptance criteria specified in QSM 4.2 Table G-6 and G-7 if available or laboratory limits.	Reanalyze all associated samples unless recoveries are high with no detection of analytes. If no sample available for analysis – qualify data.	Analyst, Supervisor, QA Manager	Same as SOP
MS/MSD	One pair per batch or as specified by client request	For matrix evaluation, use LCS recovery and RPD acceptance criteria	Evaluate data to determine if failure is due to matrix effects or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data.	Analyst, Supervisor, QA Manager	Same as SOP
Internal Standards	In all field samples, calibrations and QC standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; Extracted Ion Current Profile (EICP) area within -50% to +100% of ICAL midpoint standard	Inspect Mass spectrometer or GC for malfunctions. Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Same as SOP
Surrogates	In all field samples, calibrations and QC standards	QC acceptance criteria specified in QSM 4.2 Table G-3 if available or laboratory limits.	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Reanalyze if sufficient sample is available when appropriate; include narrative with the data	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28s: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Solid

Analytical Group: Cyanide by Automated colorimetry

Analytical Method/SOP: SW-846 9012B/GN115

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per batch of 20 or fewer samples	No analytes detected > ½ LOQ	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Same as SOP
LCS	One per batch of 20 or fewer samples	Within statistically derived limits according to box D-3	Reanalyze all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Same as SOP
MS	One per every 20 samples	Same as LCS,	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP
MSD	One per 20 samples,	RPD ≤ 20%,	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28t: Accutest (Subcontractor to CE2L) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Solid

Analytical Group: Flashpoint

Analytical Method/SOP: SW-846 1010A/GN140

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Sample Duplicate	One per 20 samples,	Within 25% of each other	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error.	Analyst, Supervisor, QA Manager	Same as SOP

QAPP Worksheet #28u: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: VOC

Analytical Method/SOP: CA-202

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager, and Data Validator	Bias/Contamination
Surrogate	Four per sample: Dibromofluoromethane 1,2-Dichloroethane-d4 Toluene-d8 4-Bromofluorobenzene (BFB)	%R must be within DoD QSM limits.	For QC and field samples, correct problem then reprepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reanalyzed within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias
Laboratory Control Sample (LCS)	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits. Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be reanalyzed within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per sample delivery group (SDG) or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix; otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/ Bias
Internal Standard (IS)	Four per sample: Pentafluorobenzene Chlorobenzene-d_5 1,4-dichlorobenzene-d_4 1,4-difluorobenzene	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of the ICAL midpoint standard.	Inspect mass spectrometer or gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias

QAPP Worksheet #28v: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: SVOC

Analytical Method/SOP: CA-226

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
Surrogate	Six per sample: 2-Fluorophenol Phenol-d6 Nitrobenzene-d5 2-Fluorobiphenyl 2,4,6-Tribromophenol Terphenyl-d14	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits.	For QC and field samples, correct problem then reprepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reprepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits. Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix E-1). Contact Client if samples cannot be reprepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy / Bias
MS/MSD	One per sample delivery group (SDG) or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/ Bias
IS	Six per sample: 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	Retention times for internal standards must be $\pm$ 30 seconds and the responses within -50% to +100% of the ICAL midpoint.	Inspect mass spectrometer or gas chromatograph for malfunctions. Mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias

QAPP Worksheet #28w: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Pesticides

Analytical Method/SOP: CA-302

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix.	No target compounds > ½ LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager and Data Validator	Bias/ contamination
Surrogates	Two per sample: Decachloro-biphenyl Tetrachloro-m-xylene	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived or nominal QC limits.	For QC and field samples, correct problem then re-prepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
LCS	One per preparation batch of 20 or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits. Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias
MS/MSD	One per sample delivery group (SDG) or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/ Accuracy/ Bias
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be RPD ≤ 40%.	None. Apply qualifier if RPD >40% and discuss in the case narrative. The higher of the two results will be reported unless matrix interference is apparent.	Analyst, Laboratory Department Manager, and Data Validator	Precision

QAPP Worksheet #28x: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Herbicides

Analytical Method/SOP: CA-305

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix.	No target compounds > ½ LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager and Data Validator	Bias/ contamination
Surrogates	One per sample: 2,4-Dichlorophenyl acetic acid	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived or nominal QC limits.	For QC and field samples, correct problem then re-prepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
LCS	One per preparation batch of 20 or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits. Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias
MS/MSD	One per sample delivery group (SDG) or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/ Accuracy/ Bias
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be RPD ≤ 40%.	None. Apply qualifier if RPD >40% and discuss in the case narrative. The higher of the two results will be reported unless matrix interference is apparent.	Analyst, Laboratory Department Manager, and Data Validator	Precision

QAPP Worksheet #28y: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Gasoline Range Organics

Analytical Method/SOP: CA-316

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analytes detected >1/2 the PQL and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, report samples results which are < LOQ and >10X the blank. Otherwise, reprepare a blank and the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination
Surrogates	One per sample	%R must be within Katahdin (Subcontractor to Vista)'s statistically-derived QC limits.	For QC and field samples, correct problem then reprepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reprepared within hold time.	Analyst, Supervisor, QA Manager	Accuracy/Bias
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within Katahdin (Subcontractor to Vista)'s statistically-derived QC limits.	(1) Evaluate the samples and associated QC: i.e. If an MS/MSD was analyzed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the surrogate recoveries in the LCS are low but are acceptable in the blank and samples, narrate. If the LCS recovery is high but the sample results are < PQL, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
MS/MSD (not applicable for rinsate blanks)	One per sample delivery group (SDG) or every 20 samples.	%R should be within Katahdin (Subcontractor to Vista)'s statistically-derived QC limits. Groundwater and Soil Precision: RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Supervisor, QA Manager	Precision/Accuracy/Bias

QAPP Worksheet #28z: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Diesel Range Organics/ Residual Range Organics

Analytical Method/SOP: CA-315

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analytes detected >1/2 the PQL and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, report samples results which are < LOQ and >10X the blank. Otherwise, reprepare a blank and the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination
Surrogates	One per sample	%R must be within Katahdin (Subcontractor to Vista)'s statistically-derived QC limits.	For QC and field samples, correct problem then reprepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reprepared within hold time.	Analyst, Supervisor, QA Manager	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within Katahdin (Subcontractor to Vista)'s statistically-derived QC limits.	(1) Evaluate the samples and associated QC: i.e. If an MS/MSD was analyzed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the surrogate recoveries in the LCS are low but are acceptable in the blank and samples, narrate. If the LCS recovery is high but the sample results are < PQL, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias
MS/MSD (not applicable for rinsate blanks)	One per sample delivery group (SDG) or every 20 samples.	%R should be within Katahdin (Subcontractor to Vista)'s statistically-derived QC limits. Groundwater and Soil Precision: RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Supervisor, QA Manager	Precision/Accuracy/Bias

QAPP Worksheet #28aa: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Oil and Grease

Analytical Method/SOP: CA-528, CA-534

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per analytical batch of 20 or fewer samples.	No target analytes > LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
LCS	One per analytical batch of 20 or fewer samples.	%R must be within AQ HEM – 78-114 AQ SGT – 64-132 SL HEM – 78-114	(1) Investigate source of problem. (2) If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/ Contamination
MS	One for every set 20 samples	%R must be within AQ HEM – 78-114 RPD - 18 AQ HEM SGT – 64-132 RPD - 34 SL HEM – 78-114 RPD – 18 SL HEM SGT – 70- 130 RPD - 30	(1) Evaluate the samples and associated QC: i.e. If the LCS results are acceptable, narrate. (2) If both the LCS and MS are unacceptable reprep and reanalyze the samples and QC. (3) Notate sample result in raw data if matrix interference suspected.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QAPP Worksheet #28ab: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: RCRA Metals

Analytical Method/SOP: CA-608

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No target metals> ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater. For negative blanks, absolute value must be < LOD.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
LCS	One per digestion batch of 20 or fewer samples of similar matrix (varies by lot).	%R must be within DoD QSM limits, allowing for the marginal exceedances presented in DoD QSM Table G-1.	Re-digest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/ Contamination
Matrix Spike	One per sample delivery group (SDG) or every 20 samples.	%R should be within the DoD QSM limits for LCS, if sample < 4x spike added.	Flag results for affected analytes for all associated samples with ”N”.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias
Post-digestion Spike	When dilution test fails or analyte concentration in all samples < 50x LOD	%R should be within 75-125%.	Run associated samples by method of standard addition or flag results.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Laboratory Duplicate	One per sample delivery group (SDG) or every 20 samples.	Project-specific criteria: If values are ≥ 5x LOQ, RPD should be ≤ 20%. If values are < 5x LOQ, Absolute Difference should be ≤ LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Precision
ICP Serial Dilution	One per preparation batch of 20 or fewer samples of similar matrix.	If original sample result is at least 50x LOQ, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QAPP Worksheet #28ac: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Mercury

Analytical Method/SOP: CA-611, CA-615

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No mercury > ½ LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater. For negative blanks, absolute value < LOD.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
LCS	One per digestion batch of 20 or fewer samples of similar matrix.	Groundwater and Soil: %R must be within 80-120%.	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/ Contamination
MS	One per sample delivery group (SDG) or every 20 samples.	%R should be within 80-120% if sample < 4x spike added.	Flag results for affected analytes for all associated samples with"N".	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias
Laboratory Duplicate	One per sample delivery group (SDG) or every 20 samples.	Project-specific criteria: If values are ≥ 5x LOQ, RPD should be ≤ 20%. If values are < 5x LOQ, Absolute Difference should be ≤ LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Precision

QAPP Worksheet #28ad: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Cyanide

Analytical Method/SOP: CA-722

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No target analyte > ½ LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater. For negative blanks, absolute value must be < LOD.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
LCS	One per digestion batch of 20 or fewer samples of similar matrix (varies by lot).	%R must be within 88-115%.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch, if sufficient sample material is available	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/ Contamination
MS	One per sample delivery group (SDG) or every 20 samples.	%R should be within 85-115% if sample < 4x spike added.	If the matrix spike falls outside of criteria, the method of standard additions (post-digestion) shall be used for the analysis.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias
Laboratory Duplicate	One per 10 samples	Project-specific criteria: If values are ≥ 5x LOQ, RPD should be ≤ 20%. If values are < 5x LOQ, Absolute Difference should be ≤ LOQ.	(1) Investigate and correct problem and reanalyze sample in duplicate (2) If RPD still >20, report original result with flagging and narration.	Analyst, Laboratory Department Manager, and Data Validator	Precision

QAPP Worksheet #28ae: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous
Analytical Group: Total Organic Carbon
Analytical Method/SOP: CA-741, CA-763

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per analytical batch of 20 or fewer samples.	No target analytes > LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
LCS	One per analytical batch of 20 or fewer samples.	Lloyd Kahn: %R must within 80%-120% SM5310B: %R must within 90%-110%	(1) Investigate source of problem. (2) If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/ Contamination
MS	One for every set 10 samples (NA for TDS)	Lloyd Kahn: %R must within 75%-125% SM5310B: %R must within 80%-120%	(1) Evaluate the samples and associated QC: i.e. If the LCS results are acceptable, narrate. (2) If both the LCS and MS are unacceptable reprep and reanalyze the samples and QC. (3) Notate sample result in raw data if matrix interference suspected.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Laboratory Duplicate/ Quadruplicate	One sample Duplicate per 20 samples.	Lloyd Kahn (Quadruplicate): RPD ≤30 for samples >3X the PQL, <100% RPD for samples <3X the PQL. SM5310B: RPD ≤20 for samples >3X the PQL, <100% RPD for samples <3X the PQL.	(1) Investigate problem and reanalyze sample in duplicate (2) If RPD still >20/30, report original result with notation or narration.	Analyst, Laboratory Department Manager, and Data Validator	Precision

QAPP Worksheet #28af: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Sulfide

Analytical Method/SOP: CA-741, CA-763

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method Blank	One per analytical batch of 20 or fewer samples.	No target analytes > LOQ and > 1/10 the amount measured in any sample or 1/10 the PSL, whichever is greater.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination
LCS	One per analytical batch of 20 or fewer samples.	%R must be within 80-120	(1) Investigate source of problem. (2) If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/ Contamination
MS	One for every set 10 samples (NA for TDS)	%R must be within: 75-125	(1) Evaluate the samples and associated QC: i.e. If the LCS results are acceptable, narrate. (2) If both the LCS and MS are unacceptable reprep and reanalyze the samples and QC. (3) Notate sample result in raw data if matrix interference suspected.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias
Laboratory Duplicate	One sample duplicate per 20 samples.	RPD ≤20 for samples >3X the PQL, <100% RPD for samples <3X the PQL.	(1) Investigate problem and reanalyze sample in duplicate (2) If RPD still >20, report original result with notation or narration.	Analyst, Laboratory Department Manager, and Data Validator	Precision

QAPP Worksheet #28ag: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: Flashpoint

Analytical Method/SOP: CA-736

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
Method blank	One per prep batch	No flash	Investigate source of contamination. Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/bias-contamination
Sample Duplicate	One sample duplicate per ten samples	Results of sample and sample duplicate agree within ±2 °C – Report the lowest value.	If lab QC in criteria and duplicates do not agree within ±2 °C , report the lowest value and narrate the other values. Else, reanalyze	Analyst, Supervisor, QA Manager	Accuracy/bias
LCS (p-xylene)	In duplicate per batch of twenty samples or less	Flash point 27°C + 2°C	Repeat analysis of reference standard and associated samples	Analyst, Supervisor, QA Manager	Accuracy/bias

QAPP Worksheet #28ah: Katahdin (Subcontractor to Vista) Analytical Quality Control and Corrective Action

Rev 1, Date: 07/21/2014

Matrix: Soil/Aqueous

Analytical Group: pH

Analytical Method/SOP: CA-708, CA-709

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific Measurement Performance Criteria
LCS	One per batch of twenty or fewer samples	90-110% recovery	Correct problem, recalibrate	Analyst, Laboratory Supervisor	Accuracy, Bias
Sample duplicate	One sample duplicate per every ten field samples	RPD <20%	(1) Investigate problem and reanalyze sample in duplicate. (2) If RPD is still unacceptable, report original result with notation or narration.	Analyst, Laboratory Supervisor	Precision

QAPP Worksheet #29: Project Documents and Records

Rev 1, Date: 07/21/2014

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Field logbooks • Chain-of-custody forms • Sample labels • Shipping records • Variance Request Forms • Sample Location Coordinates	• Field logbooks • Chain-of-custody forms • Variance Request Forms	• Laboratory sample receipt logs • Chain-of-custody form • Standard traceability logs • Instrument calibration logs • Instrument maintenance logs • Sample preparation worksheets/logs • Sample analysis worksheets/run logs • Chromatograms/raw data/instrument printouts • Sample results/Form Is • QC sample results • Telephone/email logs • Corrective action documentation	• Laboratory data review checklists • Corrective action documentation • Data validation report • ERPIMS Error Logs	• Telephone/email logs • Corrective action documentation

QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action

Rev 1, Date: 07/21/2014

Assessments:

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Field Quality Control Audit	Once	Internal	AMEC	AMEC Quality Control Manager or Designee	AMEC Field Manager	AMEC Field Manager	AMEC QC Manager
Analytical Quality Control Audit	Once	Internal	AMEC	AMEC Quality Control Manager or Designee	Laboratory Project Manager	Laboratory Project Manager	AMEC QC Manager

Assessment Findings and Corrective Action:

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response
Field Quality Control Audit: Operational Readiness Review	Checklist or logbook entry	AMEC Field Manager	Immediately to within 24 hours of review	Checklist or logbook entry	AMEC Regional Lead
Field Quality Control Audit: Deviations from QPP	Logbook or Field Change Request	AMEC Project Manager and Regional Lead	Immediately to within 24 hours of deviation	Logbook or Field Change Request	AMEC Project Manager and Regional Lead
Analytical Quality Control Audit: Laboratory Technical Systems/Performance	E-mail followed by deficiency report	AMEC Project Manager AMEC Chemist, Accutest Project Manager, and/or Vista Project Manager	Immediately to within 24 hours of deviation	Corrective Action Report	AMEC Project Manager and AMEC Chemist

Quality Control Management Reports Table:

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Quality Control Audit	Once	January 2015	AMEC Quality Control Manager or Designee	AMEC Project Manager and AMEC Regional Lead
Data validation report	As performed	Up to 15 business days after receipt of data package	AMEC	Contents summarized in Installation-Specific Investigation Report
Laboratory Technical Systems/ Performance Audits	As per QSM V 5.0	Per certification requirements	Accutest and Vista	AMEC Project Manager and Laboratory Coordinator
Laboratory DoD ELAP Re-Certification*	Per certification or every two years.	March 2014/April 2014	CE2L, Accutest, Vista, and Katahdin (Subcontractor to Vista)	AMEC Project Manager and Laboratory Coordinator
Variance Request Form	As required per variance/field change	Prior to field change if feasible	AMEC	AFCEC Project Manager

Note: *Each laboratory was accredited for the EPA Method 537 (Modified for non-potable water and soil) as a part of their DoD ELAP accreditation. This is equivalent to the LC/MS/MS method.

QAPP Worksheet #34: Data Verification and Validation Inputs

Rev 1, Date: 07/21/2014

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

QAPP Worksheet #35: Data Verification Procedures

Rev 1, Date: 07/21/2014

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Field logbooks	Field notes will be reviewed periodically to determine completeness, appropriateness, ease of understanding, etc., of information recorded. Upon completion of field work, logbooks will be placed in the project files.	Internal	AMEC Project Manager or designee
Chain-of-custody forms	Chain-of-custody forms will be reviewed against the samples packed in the specific cooler prior to shipment. Original chain-of-custody forms will be sent with the samples to the laboratory, while a copy is retained for the project files.	Internal	AMEC Field Manager or designee
Sample receipt and log-ins	Sample receipt and log-in summaries will be reviewed to determine potential receipt issues that may impact data quality and for consistency with the chain-of-custody forms.	Internal and External	AMEC; CE2L, Accutest, Vista, or Katahdin (Subcontractor to Vista) Project Manager (or designee)
Laboratory analytical data package prior to release	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	External	CE2L, Accutest, Vista, or Katahdin (Subcontractor to Vista)
Laboratory analytical data package	Data packages will be reviewed by the project chemist. The data will undergo Level 2B/IV validation protocol.	Internal	AMEC Project Chemist or designee
Data validation report	Data validation reports will be reviewed by the AMEC Project Manager and the Quality Control Specialist.	Internal	AMEC Project Manager or designee
Electronic data	Electronic laboratory data and field data will be reviewed for consistency with the hardcopy information.	Internal	AMEC Database Manager or designee

QAPP Worksheet #36: Data Validation Procedures

Rev 1, Date: 07/21/2014

Data Validator: AMEC

Analytical Group/Method:	PFCs by EPA Method 527
Data deliverable requirements:	Level III/IV data package, ERPIMS deliverable
Analytical specifications:	WS 28
Measurement performance criteria:	WS 12
Percent of data packages to be validated:	100%
Percent of raw data reviewed:	10%
Percent of results to be recalculated:	10%
Validation procedure:	NFG for Superfund Organic Methods Data Review
Validation code (*see attached table):	S2BVEM (90%) S4VEM (10%)
Electronic validation program/version:	AMEC software

Validation Code	Validation Label	Description/Reference
S2BVEM	Stage 2B Validation Electronic and Manual	EPA 540-R-08-005
S4VEM	Stage 4 Validation Electronic and Manual	EPA 540-R-08-005
NV	Not Validated	EPA 540-R-08-005

AMEC chemists will perform validation on the data associated with this QPP. With the exception of waste samples, data will be validated 90% S2BVM and 10% S4VM. Data validation will be performed in accordance with the DoD Quality System Manual, and patterned after the EPA Contract Laboratory Program (CLP) National Functional Guidelines (NFGs) for Superfund Organic Data Review (USEPA 2008), and QC criteria specified in this document, modified for use with the specific method used for this project.

S2BVM and S4VM data validation follows the EPA protocols and CLP criteria as set forth in the functional guidelines for evaluating organic (EPA 2008) analyses. These guidelines 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). CLP or CLP-like data and QC summary forms are reviewed for compliance with method-specified QC criteria. For data that undergoes S4VM validation, analyte identification and reported concentrations are also checked. To assure that detection limits and data values are appropriate, instrument performance, method of calibration, and calibration standards are evaluated.

Analytical data may be qualified based on data validation reviews. Qualifiers will be consistent with the applicable EPA NFGs, and will be used to provide data users with an estimate of the level of uncertainty associated with the qualified result.

Data validation results will be evaluated with respect to the attached qualifiers to determine data usability issues, if any. The following qualifiers may be assigned during the validation process.

J – estimated concentration
N – presumed identity
U – not detected (e.g., not present based on blank contamination)
UJ – not detected and sample detection limit is estimated
R – rejected

Data validation will be patterned after CLP NFG. The objectives, evaluations, and actions employed during the data validation process will follow those outlined in the NFG. Differences between NFG and project validation procedures will include review items and data validation criteria. Due to the higher likelihood of the presence of PFCs in the quality samples, the following data validation guidelines will be followed.

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

- If the sample concentration is greater than LOQ and less than five times the concentration detected in the blank, then the sample concentration will be B-flagged during data validation.

The laboratory will be permitted to provide CLP-like forms in lieu of true CLP forms. The data validation criteria will not adhere to NFG but will be based on method criteria for preservation, holding times, instrument tuning, calibration, instrument performance checks, internal standard responses, serial dilutions, and target compound identification; laboratory-specified criteria for surrogate, laboratory control samples, laboratory duplicates, and matrix spikes; and the validator's professional judgment.

QAPP Worksheet #37: Data Usability Assessment

Rev 1, Date: 07/21/2014

The quality and usability of data obtained during the project will be determined by examining and inspecting various site/field logbooks, laboratory data packages, and data validation reports; and verifying that the sampling procedures and analytical results were obtained following the applicable protocols and satisfy project requirements, and can be relied upon for performing the determining the attainment of project quality objectives. The data assessment will determine possible effects on the data that result from project requirement failures (i.e., data quality), and their actual adequacy to fulfill the site-specific QA/QC requirements (i.e., data usability).

Efforts to evaluate and verify attainment of project requirements will enable data users to understand any usability limitations associated with project data. Procedures used to assess QA/QC objectives will be in accordance with the appropriate analytical methods, which were originally selected based on ability to meet project goals.

The data quality/usability and reconciliation evaluations will be performed by personnel with the appropriate training and/or experience to perform these reviews/evaluations. Evaluations will be performed by personnel with the appropriate training and/or experience to perform these evaluations. The results of the data quality/usability evaluation and project goal reconciliation will be presented in the Corrective Measures Implementation Work Plan.

Precision

Results of all laboratory duplicates will be presented separately in tabular format. For each duplicate pair, the RPD will be calculated for each analyte whose original and duplicate values are either greater than or equal to the quantitation limit. The RPDs will be checked against the measurement performance criteria presented on Worksheet #12. The RPDs exceeding criteria will be identified on the tables. A discussion will follow summarizing the results of the laboratory precision. Any conclusions about the precision of the analyses will be drawn and any limitations on the use of the data will be described.

Accuracy/Bias

Results for all laboratory method blanks and instrument blanks will be presented separately in tabular format. The results for each analyte will be checked against the measurement performance criteria presented on Worksheet #12. Results for analytes that exceed criteria will be identified on the tables. A discussion will follow summarizing the results of the laboratory accuracy/bias. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described.

Completeness

Completeness is defined as the percentage of laboratory measurements judged to be valid on a method-by-method basis. In addition to valid results (data not rejected), broken and/or spilled samples, and any other problems that may compromise sample representativeness are included in the assessment of completeness. Valid data are defined as all data and/or qualified data considered to meet the DQOs for this project. Data completeness is expressed as percent complete and should be ≥ 90 percent. The goal for meeting analytical holding times is 100 percent. At the end of each sampling event, the completeness of the data will be assessed. If any data omissions are apparent, the parameter in question will be resampled and/or reanalyzed, if feasible. Laboratory results will be monitored as they become available to assess laboratory performance and its effect on data completeness requirements.

Comparability

Comparability expresses the confidence with which data from one sample, sampling round, site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures. Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, and standard reporting methods, including consistent units. For example, concentrations will be reported in a manner consistent with general industry practice (e.g., soil data will be reported on a dry-weight basis). In addition, to support the comparability of fixed-base laboratory analytical results with those obtained from previous or future testing, all samples will be analyzed by EPA-approved methods, where available. The EPA-recommended maximum permissible sample holding times (Worksheet #19) for organic parameters will not be exceeded. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with EPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared to analyses by other laboratories and/or to analyses for other sites addressed by this investigation.

Representativeness

Representativeness expresses the extent to which collected data define site contamination. Where appropriate, sample results will be statistically characterized to determine the degree to which the data accurately and precisely represent a characteristic of a population, parameter variation at a sampling point, a process, or an environmental condition. Sample collection, handling, preservation, and analytical procedures are designed to obtain the most representative sample possible. Representative samples will be achieved by the following:

- Collection of samples from locations representing site conditions;
- Use of appropriate sample preservation techniques;
- Use of appropriate sampling procedures, including proper equipment;
- Use of appropriate analytical methods for the required parameters; and,
- Analysis of samples within the required holding times.

Sample representativeness is also affected by the portion of each sample chosen for analysis. The laboratory will adequately homogenize all samples prior to taking aliquots for analysis to ensure that the reported results are representative of the sample received.

Sensitivity

The concentration of any one target compound that can be detected and/or quantified is a measure of sensitivity for that compound. Sensitivity is instrument-, compound-, method-, and matrix-specific. The subcontract laboratory will flag (as an estimate, “J” flag) and report target compounds detected below the reporting limit down to the method detection limit (MDL) in an effort to meet applicable project decision-making criteria.

Raw data collected in the field will be verified and included in the final report. Data verification and validation procedures employed during this project will ensure data collected meet project DQOs and assure a reasonable basis for decision making.

APPENDIX A

General Health and Safety Plan

FINAL
GENERAL HEALTH AND SAFETY PLAN
FOR
PERFLUORINATED COMPOUNDS (PFCs) RELEASE DETERMINATION, DELINEATION AND REMEDIATION AT BRAC INSTALLATIONS

Prepared for:
Air Force Civil Engineer Center
Joint Base San Antonio – Lackland, Texas

Prepared by:

AMEC Environment & Infrastructure, Inc.

Contract FA8903-08-D-8766
Task Order 0177

July 2014

General Health and Safety Plan

PFC Release and Determination, Delineation and Remediation at BRAC Installations

General Information

Project Name:	PFC Release and Determination, Delineation and Remediation at BRAC Installations
Location:	Multiple Former Air Force Installations
Client:	Air Force Civil Engineering Center
Plan Prepared By:	Courtney Price, PE
Plan Reviewed By:	Toby Collins
Plan Approved By:	Melissa Helton, PG

Emergency Contacts

Ambulance	911	
Fire	911	
Police	911	
Poison Control Center	1-800-222-1222	
Hospital	See Site Specific HSP	
HAZMAT	1-800-424-8802	
AMEC Health and Safety Officer	Toby Collins:	Office: (615) 333-0630x7103) Mobile: (615) 305-6598
AMEC Project Manager	Melissa Helton:	Office: (865) 218-1062 Mobile: (865) 607-4829
AMEC Central Group's HSE Manager	John Mazur, CIH, CHMM	Office: (910) 452-1185 Mobile: (910) 431-2330
Air Force Contracting Officer Representative	Dave Farnsworth:	Office: (518) 563-2871 Mobile: (518) 420-2179

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TABLES

APPENDICES

ACRONYMS

AFB	Air Force Base
AMEC	AMEC Environment & Infrastructure, Inc.
ANSI	American National Standards Institute
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
dbA	decibels on A-weighted scale
°F	degrees Fahrenheit
FM	Field Manager
GFCI	ground fault circuit interrupter
HSP	Health and Safety Plan
HAZCOM	Hazardous Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSE	Health, Safety, and Environment
IDW	Investigation Derived Waste
IDLH	Immediately Dangerous to Life and Health
JHA	Job Hazard Analysis
kV	kilovolt
NIOH	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
PFC	perfluorinated compounds
PM	Project Manager
PPE	personal protective equipment
REL	recommended exposure limit
SAP	Sampling and Analysis Plan
SDS	safety data sheet
SHSO	Site Health and Safety Officer
STEL	short term exposure limit
SOP	Standard Operating Procedures
TWA	Time Weighted Average
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

AMEC Environment & Infrastructure, Inc. (AMEC) has prepared this general Health and Safety Plan (HSP) for safety and health requirements concerning potential chemical exposures and other hazards that may be encountered during implementation of the Perfluorinated Compounds (PFCs) Release Determination, Delineation and Remediation at 19 Base Realignment and Closure (BRAC) Installations. Installation-specific health and safety information will be included in the Installation-Specific Work Plan Addendums prior to beginning field work.

1.1 Purpose and Policy

The purpose of this HSP is to present the general health and safety policies, responsibilities, procedures, and controls that will be implemented during field activities at all 19 installations. This HSP presents the minimum requirements for health and safety that must be met by AMEC and all other contractor personnel. Field and contractor personnel shall read, understand, and comply with the requirements of this HSP and the installation-specific HSP for each installation. Visitors shall also be required to review, sign, and comply with this HSP to gain site entry.

This HSP is in compliance with applicable federal, state, and local health and safety requirements. Specific references consulted in assembling the HSP include:

- 29 Code of Federal Regulations (CFR) 1910 and 1926 (Occupational Safety and Health Administration [OSHA] General Industry and Construction Standards, respectively); and,
- AMEC Health, Safety, and Environment (HSE) program and field operating procedures.

1.2 Applicability

This HSP 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 the Site. 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, installation of monitoring wells, development of monitoring wells, collection of groundwater samples, collection of surface water samples, management of investigation derived waste (IDW), mobilization, project operations, and demobilization.

1.2.1 **Modification Plan**

Changing and/or unanticipated site conditions might require modification of this plan to maintain a safe and healthy work environment. Any proposed change must be reviewed by the Project Manager (PM) and Health, Safety, and Environment 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 under this HSP 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 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 HSP will be performed at 19 installations, listed in the table below. Additional installations may be added for evaluation and/or sampling beyond the 19 currently specified, however the work tasks addressed in this HSP will remain the same.

Table 1-1. Installations/Project Numbers Included in this Task Order

Installation	Project	Installation	Project
Bergstrom AFB, TX	BJHZ20147241	Myrtle Beach AFB, SC	RDRD20147241
Castle AFB, CA	DESR20147241	Norton AFB, CA	SCEY20147241
Chanute AFB, IL	DJDB20147241	Reese AFB, TX	UBNY20147241
England AFB, LA	GAMH20147241	George AFB, CA	HUUA20147241
General Mitchell ARS, WI	HTUX20147241	Grissom AFB, IN	CTGC20147241
Griffiss AFB, NY	JREZ20147241	March AFB, CA	PCZP20147241
K.I. Sawyer AFB, MI (includes Escanaba DFSP - GSU of KI)	LWRC20147241	Mather AFB, CA	PLXL20147241
Richards-Gebaur AFB, MO	UEBL20147241	McClellan AFB, CA	PRJY20147241
Kelly AFB, TX	MBPB20147241	Plattsburgh AFB, NY	THWA20147241
Lowry AFB, CO	NTMU20147241		

1.4 Scope of Work

The scope of work to be conducted under this HSP is based upon the technical approach presented in the general environmental Sampling and Analysis Plan (SAP) and 19 installation–specific Work Plans. Planned site activities include the following:

- Soil sample collection;
- Monitoring well installation;
- Monitoring well development and rehabilitation of existing wells;
- Groundwater sample collection;
- 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 HSP development. A formal site characterization must be completed by the 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 HSP or in the installation-specific HSP. 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 the Base. 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 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 HSP 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 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

The SHSO reports to the FM and is responsible for implementing this HSP 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 HSP (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 HSP, notifying the SHSO of suspected unsafe conditions, and reporting any accidents or injuries through the appropriate chain of command.

1.7 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 HSP.

2.0 TRAINING

2.1 General Training

The FM and SHSO are responsible for informing site personnel and visitors of the contents of this HSP 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 HSP and the appropriate installation-specific HSP. 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 HSP, and agree to perform work according to the requirements outlined in this HSP and the installation-specific HSP. During the HSP 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;
- 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 5.7 of this HSP.

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 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 SSHO for inclusion and retention in the project's 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).

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 HSP are associated with site investigations for releases of PFCs at 19 installations.

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). 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^3 REL-C 1800 mg/m^{3*} *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
PEL – Occupational Safety and Health Administration permissible exposure limits
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 traffic.

Control or protective measures for these physical hazards will be addressed during initial review of this HSP, during mandatory daily job safety meetings, and through the use of engineering controls (where applicable).

Personnel shall be aware of site control measures designed to minimize potential exposure from any PFC found during the assessment and characterization activities. 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 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. 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 all 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 operator 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.

3.2.6 Traffic Hazards

Driving a vehicle and working in areas of vehicle traffic both present hazards to employees. Safe driving rules and speed limits must be followed at all times, both on base and off base. Cell phone use is prohibited while driving at all times. High visibility traffic vests must be worn if working in areas with vehicle 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 the on-site activities, no confined spaces will be entered and 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°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 pail waxy skin

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 Medical Surveillance Program, Volume II of AMEC'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 III High Visibility Work Vest.

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

Exposure/Air monitoring is not required for the fieldwork to be conducted during the investigations.

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 UXO Program Manager.

4.3.3 Oxygen Monitoring

No confined space areas will be entered during the investigation; therefore, oxygen monitoring will not be required during the investigations.

4.4 Physical Monitoring

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°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 SSHO. **Table 4-1** 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.

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 60ºF) 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 and as 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 or workers wearing impervious clothing.

Table 4-1. 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 lace; give the patient half-strength electrolyte fluids; if cramps persist, or if more serious signs develop, seek medical attention
Heat Exhaustion	Rapid breathing, weak pulse, cold and clammy skin, heavy perspiration, total body weakness, dizziness that sometimes leads to unconsciousness	Move the patient to a nearby cool lace; keep the patient at rest, give the patient half-strength electrolyte fluids, treat for shock, seek medical attention. **DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT**
Heat Stroke	Deep breaths, then shallow breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils, loss of consciousness (possible coma); seizures or muscular twitching may be seen	Cool the patient rapidly; treat for shock; if cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck; seek medical attention as rapidly as possible; monitor the patient's vital signs constantly. **DO NOT ADMINISTER FLUIDS OF ANY KIND**

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 4-2 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 4-2. Summary of Cold-Related Illnesses

Cold Related Illness	Symptoms	Possible Underlying Causes	Treatment
Hypothermia	• Pain in the extremities • Uncomfortable shivering and the sensation of cold • Reduction of body core temperature • Cool skin • Rigid muscles • Slowing of heart rate • Weakening of pulse • Low blood pressure • Irritability of heart muscle • Sometimes heart beating abnormally in respect to strength and rhythm • Slow irregular breathing • Memory lapses • Vague slow slurred speech • Drowsiness • Incoherence • Diminished reaction time • Diminished coordination • Diminished dexterity	• Exposure to low air temperatures, high wind, inadequate clothing or water immersion • Underlying disease, such as heart or blood vessel disease • Old age • Allergies • Alcoholism • Recent alcohol consumption • Smoking • Medications that affect the temperature-regulation mechanism • Exhaustion • Sedative drugs • Dehydration	• Get the victim out of the wind, snow, or rain • Keep use of energy to a minimum • Keep person awake • Victim should be handled on a stretcher if movement is necessary • Strip off all wet clothes • Get person into dry clothes • Wrap blanket around victim • In conscious victims, body should be packed with heat packs or wet towels no warmer than 105˚F, behind the neck, groin, and armpits • Do not rewarm extremities and the core at the same time • Provide lifesaving actions as necessary - mouth-to-mouth resuscitation or cardiopulmonary resuscitation (CPR), if trained • If blankets, sleeping bag, newspapers, heat packs, or wet towels are not available, rewarm victim with body heat • Give sweet warm drinks to conscious victims • Do not immerse victim in a warm water bath • Take victim to the hospital by calling an ambulance and telling them that a cold illness emergency exists
Raynaud's Syndrome	• Fingers turn white and stiff • Intermittent blanching and reddening of the fingers and toes • Affected area tingles and becomes very red or reddish purple	• Exposure to low air temperature, high winds • Inadequate clothing • Underlying disease such as blood vessel disease	• Remove to warmer area • Consult physician
Acrocyanosis	• Hands and feet are cold, blue, and sweaty	• Exposure to cold • Inadequate clothing • Underlying disease such as blood vessel disease	• Remove to warmer area • Loosen tight clothing • Consult physician
Frostnip	• Skin turns white	• Exposure to cold	• Remove to warmer area • Refer to treatment for frostbite
Chilblain	• Recurrent localized itching, swelling, and painful inflammation of the fingers, toes, or ears • Severe spasms	• Inadequate clothing • Exposure to cold and moisture • Underlying disease such as blood vessel disease	• Remove to warmer area • Consult physician

Cold Related Illness	Symptoms	Possible Underlying Causes	Treatment
Frostbite	• Skin changes color to white or grayish yellow, progresses to reddish violet, and ultimately turns black • Burns at first • Blisters • Affected part cold, numb, and tingling	• Exposure to cold • Lack of acclimatization • Age (very young or old) • Physically disabled or mentally impaired • Underlying diseases, such as heart and blood vessel disease	• Cover the frozen part • Provide extra clothing and blankets • Bring victim indoors as soon as possible • Place the frozen part in warm water at a temperature of 102°F to 105°F or re-warm with warm packs • If affected part has been thawed and refrozen, do not use water, re-warm at room temperature • If no water is available, wrap gently in a sheet and blanket • Discontinue warming the victim as soon as the affected part becomes flushed and swelling develops after thawing • Exercise part after re-warming, but do not allow victim to walk after the affected part thaws • Place dry sterile gauze between affected fingers and toes, do not apply other dressings unless victim is to be transported for medical aid • If travel is necessary, warm affected parts with sterile or clean cloths during transportation • Elevate the frostbitten parts and protect them from contact with bedclothes • Give sweet, warm fluid if victim is conscious and not vomiting; no alcoholic or caffeine beverages • In absence of warm water, frostbitten fingers should be placed uncovered under the armpits next to skin • If the toes or heels are affected, footwear should be covered with dry socks • If above measures for feet are not possible, place bare frostbitten feet against the belly of a companion or under clothing • If the cheeks are frostbitten, cover the affected areas with warm hands until the pain returns • Following re-warming, wounds should be treated in open and sterile manner; bandages hamper the circulation • Deep frostbite should not be thawed in the field • Do not rub the part with anything (including snow and ice), apply heat lamp or hot water bottles, place injured part near a hot stove, or break blisters • Obtain medical assistance as soon as possible

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 HSP. 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 HSP 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 HSP and the appropriate installation-specific HSP. 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. 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 HSP are communicated to all personnel who work on the site. In addition to following AMEC's "Six Safety Essentials", the following actions will be used to prevent accidents at the Site:

- **Educate personnel** as to the requirements of the HSP;
- **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 HSP will assist with accident prevention. JHA forms are included in **Appendix B**.

5.5 Accident Prevention

Slips, Trips, and Falls

The following preventive measures will reduce the potential for these hazards:

- 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.

5.5.1 **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 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.

5.5.2 Noise

Personnel shall use protective devices per the following guidelines:

- The direction of the FM/SSHO; 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.

5.5.3 Severe Weather

Personnel will receive information regarding severe weather during Tailgate Safety Meetings. The following are examples of typical weather alerts:

- 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 National Weather Service (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.

5.5.4 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 running is exempt from this requirement.
- 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.

5.5.5 Utilities

The minimum clearance from overhead power lines, up to 50 kilovolts (kVs), is 10 feet. For voltages over 50kV, add four 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
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.

5.6 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 HSP acceptance form.

5.7 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 (**Appendix A**);
- 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 SSHO 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 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 on-site prior to mobilization. The AMEC 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 HSP (**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 SSHO 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 HSP 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.).

5.8 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 HSP. A hospital map is provided in the installation-specific HSP.

5.8.1 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.

5.8.2 Chemical Exposure

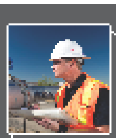
Chemical exposures are not anticipated during installation investigations; however, if a member of the field crew demonstrates symptoms of chemical exposure, the procedures outlined below should be followed:

- 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.

5.8.3 **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 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 USEPA within 24 hours after occurrence, provided the spill is greater than the reportable quantity.

5.8.4 Incident Reporting Procedures



Incident Flow Chart

Call Immediatley

Emergency → Incident Occurs → Non-Emergency

Emergency → CALL 911 Emergency → Supervisor Immediately Calls After Medical Attention is Sought and Provided → Contact Supervisor, HSE Coordinator and WorkCare 24/7 Hotline (888) 449-7787

Non-Emergency → Contact Supervisor, HSE Coordinator and WorkCare 24/7 Hotline (888) 449-7787

Verbally Contact One HSE Representative Below Within 2 Hours

E&I Corporate HSE Department Contact List

Name/Email	Office Location	Contact Information
Bruce Voss bruce.voss@amec.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@amec.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@amec.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Don Kubik don.kubik@amec.com	Oakland, CA	510.663.4100 (office) 510.368.6433 (cell)
Gabe Sandholm gabe.sandholm@amec.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
John Mazur john.mazur@amec.com	Wilmington, NC	910.452.1185 (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 247) vladimir.ivensky@amec.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)

**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.*

Revised 3 Apr 2013-hb

5.8.5 **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.

5.9 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:

- 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.

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.

Health and Safety Plan Acceptance

I have had the opportunity to read and ask questions regarding the information presented in this HSP. I understand the procedures, equipment, and restrictions of this plan and agree to abide by them. Be 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 corporate health and safety policies.

Signature	Printed Name	Company	Date

APPENDIX A

HEALTH AND SAFETY FIELD FORMS

AMEC Environment and Infrastructure
Tailgate Safety Meeting Report

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):

- ❑ 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: ____

____

____

AMEC Environment and Infrastructure
Tailgate Safety Meeting Report *(continued)*

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: ____ Title: _________________________
(print)

Signature: ____ Time: _________________________

Completed by: ____________________

Date: ____________________

Chemical Inventory Form - Hazard Communication

Job Number: ____________	Project: ____________		Date: ____________
Chemical Name	**Quantity**	**Is it labeled?**	**Do you have the MSDS?**

Record of Change
Site-Specific Health and Safety Plan

GENERAL SITE INFORMATION

Site Name: ______________________________ Date: __________

Project Number: ______________________________

Site Health and Safety Coordinator: ______________________________

Project Manager: ______________ Field Manager: ______________

DESCRIPTION OF AND JUSTIFICATION FOR CHANGE

SHSC Signature: ______________________________ Date: __________

Authorization: ______________ Title: ______________ Date: __________

APPENDIX B

JOB HAZARD ANALYSES

amec	**JOB HAZARD ANALYSIS (JHA)** **FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES**

Risk Assessment Code (RAC) Table						
		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
Noted in "Potential Hazard" Column

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
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. Eye wash station capable of providing 15 minutes of continuous service when corrosive materials are used on site.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Completion of Equipment Inspection Form before subsequent daily use.	Only trained and qualified personnel will be allowed to work within work area. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	**POTENTIAL HAZARD**	**REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE**
Collect and confirm required worker training and medical compliance documentation.	Acceptable worker knowledge and fit-for-duty status (RAC: M)	• 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). • Visitors not meeting the above requirements shall be escorted throughout their visit by an AMEC representative.
Perform site survey and initial inspections of intended work areas	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • 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. • Maintain work area clear and in good order.

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)	• Stay clear of the designated contractor's route, use signals, horns, etc. when entering site where workers are present. • Post "Men at Work" signage to notify vehicular traffic of activity being performed adjacent to roadway. • Use traffic cones to demarcate work zone entrance near roadway. • Designated traffic pattern shall be used to ensure safe movement of trucks in and out of loading zone. • Use escort vehicles with flashing lights to warn and control local traffic when moving large equipment to support area. • A spotter shall guide drivers when backing up into congested and narrow path areas.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks and equipment or structures. • 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.
Perform inspections of vehicles and equipment arriving/preparing to depart the site	Operating vehicles and heavy equipment unsafely (RAC: M)	• Prior to operating a vehicle, the driver shall perform daily inspections using the Safety Inspection Form. • Prior to operating equipment, operator shall perform daily inspection using Safety Inspection Form. • Personnel working near heavy equipment shall wear high visibility vests. • 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. • Equipment operators shall operate equipment in a safe manner at all times and wear seatbelts while operating heavy equipment. • Check/test all emergency stop controls. Personnel shall only operate equipment that is in good condition and safe to operate. • 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. • Loads shall be lowered and power shut off when equipment is left unattended. Heavy equipment shall be equipped with backup alarms. • Equipment shall have properly functioning: brake system, brake lights, audible horn, and all other safety systems specified in the operator's manual. • Fire extinguishers shall be mounted on diesel and propane powered mobile equipment. • Equipment shall be shut-off prior to refueling. • No smoking or spark sources shall be allowed near refueling or battery maintenance areas.

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)	• Equipment shall be inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design. • Only manufacturer-approved parts may be used in repair of site equipment. • An equipment inspection checklist will be completed prior to the use of project vehicles, machinery and equipment. • Equipment shall be operated by knowledgeable ground crew. • 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). • 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). • Hand signals with the light equipment operator will be established prior to the commencement of activities. • Work areas will be kept clear of clutter. • Secure all loose articles to avoid possible entanglement. • Self-propelled equipment shall be equipped with movement warning systems. • 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. • Damaged or questionable equipment shall not be used and labeled with "Do Not Use".
	Noise hazard (RAC: M)	• 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. • 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.

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)	• 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. • 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. • Never cut with tip of the chain saw blade. • Plan the cut. Know where the tree will fall. Have a clear escape plan when dropping trees greater than 2 inches in diameter. • 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. • Do not cut over your head. • Do not cut materials other than wood with the chain saw. • Wear prescribed safety equipment (hard hat with mesh face shield, chainsaw chaps, etc.). • Monitor, the condition of the saw during use, make adjustments as necessary. • When limbing a tree, to the extent possible cut from the other side of the trunk, which will serve as a shield. • Be attentive as to which way the trunk may move when removing limbs, place yourself out of the anticipated pathway when cutting. • Be attentive to movement of the trunk as an indication of the stability of the tree and brush pile. • Keep the work area free from clutter to avoid potential slip, trip, and fall hazards.
Set up material and equipment lay-down areas	Injuries from hand and power tools (RAC: L)	• All hand and power tools shall be used in accordance with the HASP. • Keep any machine guarding in place. • 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.
	Crushing injuries from unstable loads (RAC: M)	• Inspect staging areas prior to placing materials. • Utilize traffic cones to demarcate loading/unloading zone for delivery of support materials • 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. • Rigging equipment rating to load ratio shall be 4 to 1 as a minimum. Ensures stability of load during transport. • No load shall be transported above any individual. Maintain load as close to the ground when transporting from one location to the other. • Personnel shall not stand underneath loads handled by lifting or digging equipment. • Damaged, unrated, or questionable rigging equipment shall not be used and labeled with "Do Not Use".
	Noise hazard (RAC: L)	• 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.

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)	• Wear leather work gloves when handling support materials. • Never place hands into bind spots of equipment.
	Heavy Lifting, Strains, Sprains (RAC: L)	• 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: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Chemical hazards from chemicals utilized on site (RAC: L)	• The on-site Hazard Communication Program will be followed. All chemicals brought onto the site by AMEC and subcontractor personnel will be inventoried and have an MSDS on-site, on file. This effort shall include: - Maintain an accurate chemical inventory list (entries will match chemicals brought on-site, as the names appear on the MSDS) - MSDSs will be maintained in a central location, accessible to all personnel. • All containers will have labels specifying the following information: - Chemical Identity (As it appears on the label, MSDS, and Chemical Inventory List) - Appropriate Warning (i.e., eye and skin irritation, flammable, etc.) - Manufacturer's Name, Address, and Phone Number • It will be the SM and/or the SSO's responsibility to insure this is completed.
Establish excavation locations and arrange for utility clearances prior to intrusive activities. Secure permits from appropriate authorities	Potential to strike existing utility lines (RAC: H)	• Pre-inspect vehicle moving lanes noting overhead utilities. • Do not approach within 10' of any overhead electric line of 50 kV or less. Additional clearance distance is required for lines of > 50kV. Reference Section 5.8.2. • Pre-survey the height of equipment and height of utility lines to determine which lines must be removed or raised. • Pre-plan the move with the local utility companies if utility lines must be moved.
	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.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• 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. • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. • 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.

amec	**JOB HAZARD ANALYSIS (JHA)** **FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES**

Risk Assessment Code (RAC) Table						
		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
Noted in "Potential Hazard" Column

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
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. Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves, and cotton coveralls. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly.	Only trained and qualified personnel will be allowed to work within work area. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	**POTENTIAL HAZARD**	**REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE**
Set up work area.	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • 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. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

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)	• 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: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Use of sharp edge hand tools to cut material (e.g. heavy duty liner, boxes) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. • All personnel will maintain a 10-foot perimeter around persons clearing brush.
	Traffic safety (RAC: M)	• Designated traffic pattern shall be used to ensure safe movement of trucks in and out of support zone. • A spotter shall guide drivers when backing up into congested and narrow path areas. • 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.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • 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.
Personal decontamination	Cross contamination while doffing personal protective equipment (PPE) (RAC:H)	• 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. • Place all disposable PPE items into commercial heavy duty plastic liners.

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)	• 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. • Clear debris from work area prior to commencing work in the area. Maintain work area clear and in good order.
	Injuries from hand and power tools (RAC: L)	• All hand and power tools shall be used in accordance with the HASP. • Keep any machine guarding in place. • 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.
	Injury due to misuse or accidental contact (system is operating at pressures up to 3000 psi) (RAC: M)	• **Caution!** This equipment operates at high pressure. Accidental contact with pressurized water could cause serious injury. The spray nozzle should never be directed towards personnel. • 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. • 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. • Protect hoses and cords from traffic. Do NOT allow machinery or equipment to drive over them. • 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. • 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. • 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. • 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. • Fuel powered tools (generators, tamps, pumps, etc.) shall be turned off during refueling.
	Electric Shock (RAC: M)	• Electric tools with missing ground prongs or cut or frayed cords shall be removed from service and tagged. • Electric tools used in highly conductive locations, such as where the employee may contact water, shall be approved for use in those locations. • Power for portable electric tools shall be supplied from a GFCI receptacle. • Electric tools must be grounded, except tools, which are equipped with double insulation. • Electric tools shall not be used in hazardous locations such as flammable or explosive atmospheres unless they are approved for such locations.
	Injury to unqualified operators/on-lookers (RAC: M)	• Only trained and qualified personnel shall operate this equipment • Non-essential personnel shall remain a safe distance (at least 25 feet) from pressure washing activities. Barricade areas.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Decontamination of heavy equipment using pressure washer (cont.)	Portable energized sources (RAC: M)	• 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. • Keep the exhaust and air intake free from obstructions such as clothing, furniture or other material. • Always operate the generator in an area where the wind will carry away the exhaust fumes. • Do not overload the generator. • 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. • 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.
	Noise hazard (RAC: M)	• 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. • Place hazardous noise warning signs at least 15 feet from generators.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) and faceshield to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • 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. • Personnel shall wear PPE for pressure washing activities.

amec	**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)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • 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).
	Potential contact and ingestion hazards from COCs in potentially contaminated soils (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.
	Cross-contamination personnel or clean areas (RAC: M)	• Decontamination tools using the following procedures: - Wash with Citraonox - Rinse with "PFC-free" water - Rinse with methanol - Final rinse with "PFC-free" water - Air dry
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• 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. • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. • 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.
	Struck by hazards (RAC: M)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between support materials and equipment or structures. Personnel shall not stand next to vehicles being loaded or unloaded. • 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.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity (cont.)	Insects, Spiders, and Ticks (RAC: L)	• 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 & chiggers). Check body thoroughly after work to detect ticks and chiggers. Take hot shower after field work and wash thoroughly. • Avoid nesting areas. • Report any insect bite to the SHSO.
	Hypersensitivity or Allergic Reactions (RAC: L)	• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken.
	Personnel Injury (RAC: L)	• Wear appropriate PPE. • Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts. • Keep non-essential personnel out of the work zone. Barricade as necessary.

	JOB HAZARD ANALYSIS (JHA) FOR DRILLING/BORING AND ASSOCIATED SOIL SAMPLING

Risk Assessment Code (RAC) Table							
		Probability					
		Frequent	Likely	Occasional	Seldom	Unlikely	
Severity	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**
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. Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves, and cotton coveralls. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.	Only trained and qualified personnel will be allowed to work within exclusion zone. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
All Drilling/ Boring Activities	Slips, trips, and falls	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • 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. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

amec	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	• Take breaks if feeling faint or overexerted • Consume adequate food/beverages (water, sports drinks) • If possible, adjust work schedule to avoid temperature extremes.
	Biological Hazards: Insects, Snakes, Wildlife, Vegetation	• Inspect work areas when arrive at site to identify hazard(s) • Open enclosures slowly • Survey site for presence of biological hazards and maintain safe distance • Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions
	Traffic (including pedestrian)	• Notify attendant or site owner/manager of work activities and location • Use cones, signs, flags or other traffic control devices as necessary to establish work area • Wear appropriate PPE including high visibility clothing such as reflective vest • Inspect area behind vehicle prior to backing and use spotter
	Fire/ Explosion	• Post No Smoking signs around work area • Establish designated smoking area away from work area • Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period • As site conditions/activities warrant, establish Hot Work Permit • Stop work if hazardous conditions (explosive atmosphere) are identified
Concrete Coring	Ignition Sources	• Ensure electrical equipment properly grounded • Apply water as necessary to address surface sparking potential
	High Noise Levels	• Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a distance of 3 ft to be heard, likely exceeding 85 dBA).
	Airborne Particulates and Debris	• Use water as necessary to control dust in area • Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves
	Sharp Rough Materials	• Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots
	Impact to Subsurface Lines	• Ensure all underground features have been identified in area prior to start of activities

amec	**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	• Do not move rig with mast raised • Cross all hills and obstructions head on • Set riggers prior to raising mast • 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
	Contact with Electric Lines and Other Overhead Obstacles	• Position rig to avoid overhead utility lines by distance defined by voltage and local regulations • Use a spotter when raising mast to confirm clearance of overhead lines and other obstructions
	Rig Movement	• Heavy equipment should be equipped with back-up alarm or use horn when backing - use spotter when available • Stay clear of operating equipment and rig when moving
	Heavy Equipment Lifting/Carrying	• 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
	Sharp or Elevated Equipment	• Wear appropriate PPE including steel-toed safety boots, leather gloves and hard hat • Establish communication system between workers involved in moving/attaching sections
Ground Disturbance: Auger/Boring Advancement	Faulty or Inappropriate Equipment	• Qualified driller must inspect drill rig prior to use, if faulty or inappropriate, do not proceed until repaired or replaced • Inspect all hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced
	Moving Equipment	• Clear area of obstructions and communicate with all workers involved that drilling is beginning • 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 • Stay clear of rotating auger • Use long-handled shovel to clear away cuttings when auger has stopped • Do not wear loose clothing • Wear appropriate PPE including leather gloves and steel-toed boots
	Suspended Loads	• Do not walk under suspended loads • When possible, remove overhead hazards promptly • Wear appropriate PPE including hard hat and steel-toed boots
	High Noise Levels	• Use hearing protection if within 20 feet of active drill rig

WORK	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Ground Disturbance: Auger/Boring Advancement (cont.)	Impact to Subsurface Lines/Tanks	• Only drill in areas where underground features have been identified and if hole has to be moved, clear new location first • Wear appropriate PPE including insulating gloves or stand on an insulating mat when in contact with drill rig • Ensure first aid responders are trained to deal with electric shock and flash burns
Ground Intrusion: Split Spoon	Faulty Equipment	• Inspect rope/cable/rod for wear, fraying, oils and moisture prior to use, do not use if faulty until repaired or replaced • Inspect cathead for rust and rope grooves prior to use, do not use if faulty until repaired or replaced
	Moving Equipment	• Do not wrap rope around any part of the hand or body • Maintain distance of at least 18-inches from in-running points on running/reciprocating equipment • Eliminate excess rope • Do not wear loose clothing • Wear appropriate PPE including leather gloves
Soil Sampling	Sharp Sampling Tools	• Use correct tools for opening sleeves • When opening sleeve, cut away from body • Place soil core on sturdy surface prior to cutting • Wear appropriate PPE including respirator if conditions warrant • Double-check sample labels to ensure accuracy and adhesion to containers
	Heavy Materials and Containers Lifting/ Moving	• Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings • Do not lift or move heavy containers without assistance • Use proper bending/lifting techniques by lifting with arms and legs and not with back • Take breaks if feeling faint or overexerted • Wear appropriate PPE including leather gloves and steel-toed boots
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• 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. • Wear hats and other protective garments to provide shade.

JOB HAZARD ANALYSIS (JHA)
FOR GROUNDWATER SAMPLING ACTIVITIES

Risk Assessment Code (RAC) Table							
		Probability					
		Frequent	Likely	Occasional	Seldom	Unlikely	
Severity	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**
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. Contact with groundwater: Standard PPE plus nitrile gloves and cotton coveralls. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Prior to equipment demobilization, equipment used in work areas shall be decontaminated appropriately.	Only trained and qualified personnel will be allowed to work within work area Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

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)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • 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. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

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)	• 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: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Use of sharp edge hand tools to cut tubing (RAC: M)	• Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. • All personnel will maintain a 10-foot perimeter around persons clearing brush.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • 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.
Collecting purge water from wells using submersible pump connected to 110 W generator	Portable energized sources (RAC: M)	• 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. • Keep the exhaust and air intake free from obstructions such as clothing, furniture or other material. • Always operate the generator in an area where the wind will carry away the exhaust fumes. • Do not overload the generator. • 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. • 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.

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)	• 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. • 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. • Position generator at least 20 feet way from sample collection area.
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.	• It is not anticipated that potential contaminant concentrations at outdoor sample locations will present an inhalation hazard. • Personnel shall receive training on the elements of each of the identified COCs.
	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	• Personnel shall wear nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Transfer of contamination into clean areas (RAC: M)	• Decontaminate all equipment and supplies if they become contaminated, between locations and prior to leaving the site. • Dispose of all supplies in direct contact with groundwater into heavy duty plastic liners with 6 mm thickness. (e.g. tubing, disposable PPE). • 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). • Personnel shall ensure spray bottles are properly label in accordance with Hazard Communication requirements. • Ensure all transport containers (e.g. polyethylene tanks) are not filled to the top. Secure transport container lids when in transit. • All transport containers shall be label with “Non Potable Water” stickers or hand written. • Transport containers shall have camlock fittings and ball valve to control flow of water.

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)	• Bailers are used to collect groundwater. Personnel use a 3/8 inch breaded nylon rope or nylon masonry string to lower bailers into well screen. The following measures should reduce repetitive trauma to arms and hands: - Wear two layers of nitrile rubber gloves to minimize contact with contaminated material. - Rotate team members between sampling events. - Maintain a good posture position when lifting bailer out of the well casing.
Transporting purge water from transport containers into frac tank	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed. • Due to the greater potential for splash during transfer of purge water into the frac tank, personnel shall don a full face shield.
	Transfer of contamination into clean areas (RAC: M)	• Personnel shall adequately secure hose to frac tank. • Ensure cam locks are secure. • Frac containers shall be label with “Non Potable Water” stickers or hand written. • Maintain a small spill kit to handle incidental spill of purge water at the storage lay down area.
	Fall hazard (RAC: M)	• Inspect hand railing of frac tank regularly to ensure pins are secured and integrity of railing. • If railing is bent, cracked, or heavily rust, report to SM or SSO. • Always utilize a “three-point” contact when climbing railing. Do not jump off railing at anytime.
	Noise hazard while using trash pump during transfer from container to frac tank (RAC: M)	• 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. • 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. • Position trash pump at least 20 feet way from railing.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• 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. • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. • 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.
	Struck by hazards (RAC: M)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between support materials and equipment or structures. • Personnel shall not stand next to vehicles being loaded or unloaded. • 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.
	Insects, Spiders, and Ticks (RAC: L)	• 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 & chiggers).
	Hypersensitivity or Allergic Reactions (RAC: L)	• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken.
	Personnel Injury (RAC: L)	• Wear appropriate PPE. • Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts. • Keep non-essential personnel out of the work zone. Barricade as necessary.

APPENDIX C

SAFETY DATA SHEETS

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 (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.

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.

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, CO2, 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.

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/m3 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)

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/m3 TWA
NIOSH:	10 ppm TWA; 50 mg/m3 TWA
	15 ppm STEL; 75 mg/m3 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 * * *

Appearance:	Clear, straw-yellow.	**Odor:**	Mild, petroleum distillate odor
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	**Vapor Density:**	>1.0
Boiling Point:	320 to 690 °F (160 to 366 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible	**Specific Gravity:**	0.83-0.876 @ 60°F (16°C)
Evaporation Rate:	Slow; varies with conditions	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	>125 °F (>52 °C) minimum	**Flash Point Method:**	PMCC
Upper Flammability Limit (UFL):	7.5	**Lower Flammability Limit (LFL):**	0.6
Burning Rate:	ND	**Auto Ignition:**	494°F (257°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).

* * * 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/m3 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.

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		Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow-through]	

Naphthalene (91-20-3)

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]	

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

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right- To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

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

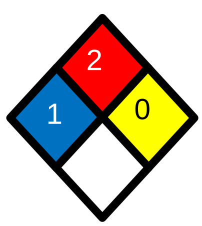
Component Analysis - Inventory

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

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 (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.

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

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 nitrocresols that can decompose violently.

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, 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

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.

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/m3 TWA
150 ppm STEL; 560 mg/m3 STEL
NIOSH: 100 ppm TWA; 375 mg/m3 TWA
150 ppm STEL; 560 mg/m3 STEL

Butane (106-97-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases: Alkane C1-4)
OSHA: 800 ppm TWA; 1900 mg/m3 TWA
NIOSH: 800 ppm TWA; 1900 mg/m3 TWA

Xylenes (o-, m-, p- isomers) (1330-20-7)

ACGIH: 100 ppm TWA
150 ppm STEL
OSHA: 100 ppm TWA; 435 mg/m3 TWA
150 ppm STEL; 655 mg/m3 STEL

Benzene, 1,2,4-trimethyl- (95-63-6)

NIOSH: 25 ppm TWA; 125 mg/m3 TWA

Ethyl alcohol (64-17-5)

ACGIH: 1000 ppm STEL
OSHA: 1000 ppm TWA; 1900 mg/m3 TWA
NIOSH: 1000 ppm TWA; 1900 mg/m3 TWA

Ethylbenzene (100-41-4)

ACGIH: 20 ppm TWA
OSHA: 100 ppm TWA; 435 mg/m3 TWA
125 ppm STEL; 545 mg/m3 STEL
NIOSH: 100 ppm TWA; 435 mg/m3 TWA
125 ppm STEL; 545 mg/m3 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/m3 TWA
NIOSH: 50 ppm TWA; 180 mg/m3 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.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Translucent, straw-colored or light yellow	**Odor:**	Strong, characteristic aromatic hydrocarbon odor. Sweet-ether like
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)	**Vapor Density:**	AP 3-4
Boiling Point:	85-437 °F (39-200 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible to Slight	**Specific Gravity:**	0.70-0.78
Evaporation Rate:	10-11	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	-45 °F (-43 °C)	**Flash Point Method:**	PMCC
Upper Flammability Limit (UFL):	7.6%	**Lower Flammability Limit (LFL):**	1.4%
Burning Rate:	ND	**Auto Ignition:**	>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

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/m3 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.

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.

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 Alburnus alburnus	119 mg/L [static]	
96 Hr LC50 Cyprinodon variegatus	82 mg/L [static]	
72 Hr EC50 Pseudokirchneriella subcapitata	56 mg/L	
24 Hr EC50 Daphnia magna	170 mg/L	

Toluene (108-88-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	15.22-19.05 mg/L [flow-through]	1 day old
96 Hr LC50 Pimephales promelas	12.6 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	5.89-7.81 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	14.1-17.16 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	5.8 mg/L [semi-static]	
96 Hr LC50 Lepomis macrochirus	11.0-15.0 mg/L [static]	
96 Hr LC50 Oryzias latipes	54 mg/L [static]	
96 Hr LC50 Poecilia reticulata	28.2 mg/L [semi-static]	
96 Hr LC50 Poecilia reticulata	50.87-70.34 mg/L [static]	
96 Hr EC50 Pseudokirchneriella subcapitata	>433 mg/L	
72 Hr EC50 Pseudokirchneriella subcapitata	12.5 mg/L [static]	
48 Hr EC50 Daphnia magna	5.46 - 9.83 mg/L [Static]	
48 Hr EC50 Daphnia magna	11.5 mg/L	

Xylenes (o-, m-, p- isomers) (1330-20-7)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	13.4 mg/L [flow-through]	

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]	

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.

* * * 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)

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	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

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.

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

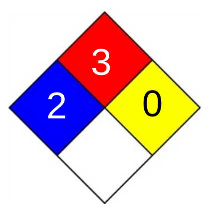
Component Analysis - Inventory

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

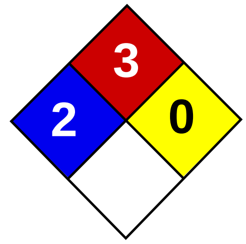
None

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

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, CO2).

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 powfeful 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. Virgorous 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, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful 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/m3) 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/m3) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m3) [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, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful 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

MATERIAL SAFETY DATA SHEET

3M
3M Center
St. Paul, Minnesota
55144-1000
1-800-364-3577 or (651) 737-6501 (24 hours)

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

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1. INGREDIENT

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

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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.

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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.

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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

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4. REACTIVITY DATA (continued)

Thermal decomposition of usage concentrations does not present a hazard.

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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 mgO2/l
5-Day Biochemical Oxygen Demand (BOD5): 6250 mgO2/l
%BOD5/COD = 56.8

AQUATIC TOXICITY:

Fathead minnow (Pimephales promelas) 96-hr LC50: > 1000 mg/L
Water flea (Daphnia magna) 48-hr EC50: 308 mg/L

REGULATORY INFORMATION:
Volatile Organic Compounds: 396 gms/liter South Coast Air Quality Mgmt Dist Method.
VOC Less H2O & 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.

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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)

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5. ENVIRONMENTAL INFORMATION (continued)

Perfluorinated: Perfluoroalkyl Sulfonate Salts(5)+(5885P)

Log Kow <3: Diethylene Glycol Butyl Ether, Triethanolamine, Tolyl Triazole

EPCRA HAZARD CLASS:
FIRE HAZARD: No PRESSURE: No REACTIVITY: No ACUTE: Yes CHRONIC: No

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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.

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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.

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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 (O 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.

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

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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

MATERIAL SAFETY DATA SHEET

3M
3M Center
St. Paul, Minnesota
55144-1000
1-800-364-3577 or (651) 737-6501 (24 hours)

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

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1. INGREDIENT

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.

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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

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2. PHYSICAL DATA (continued)

APPEARANCE AND ODOR:
Clear liquid.

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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.

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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.

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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.

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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:

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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.

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*
PERFLUOROOCTANESULFONYL 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.

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 similiar 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

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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 (mmHg): @ 20°C (68°F).
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.

Section 8 : CONTROL MEASURES

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.

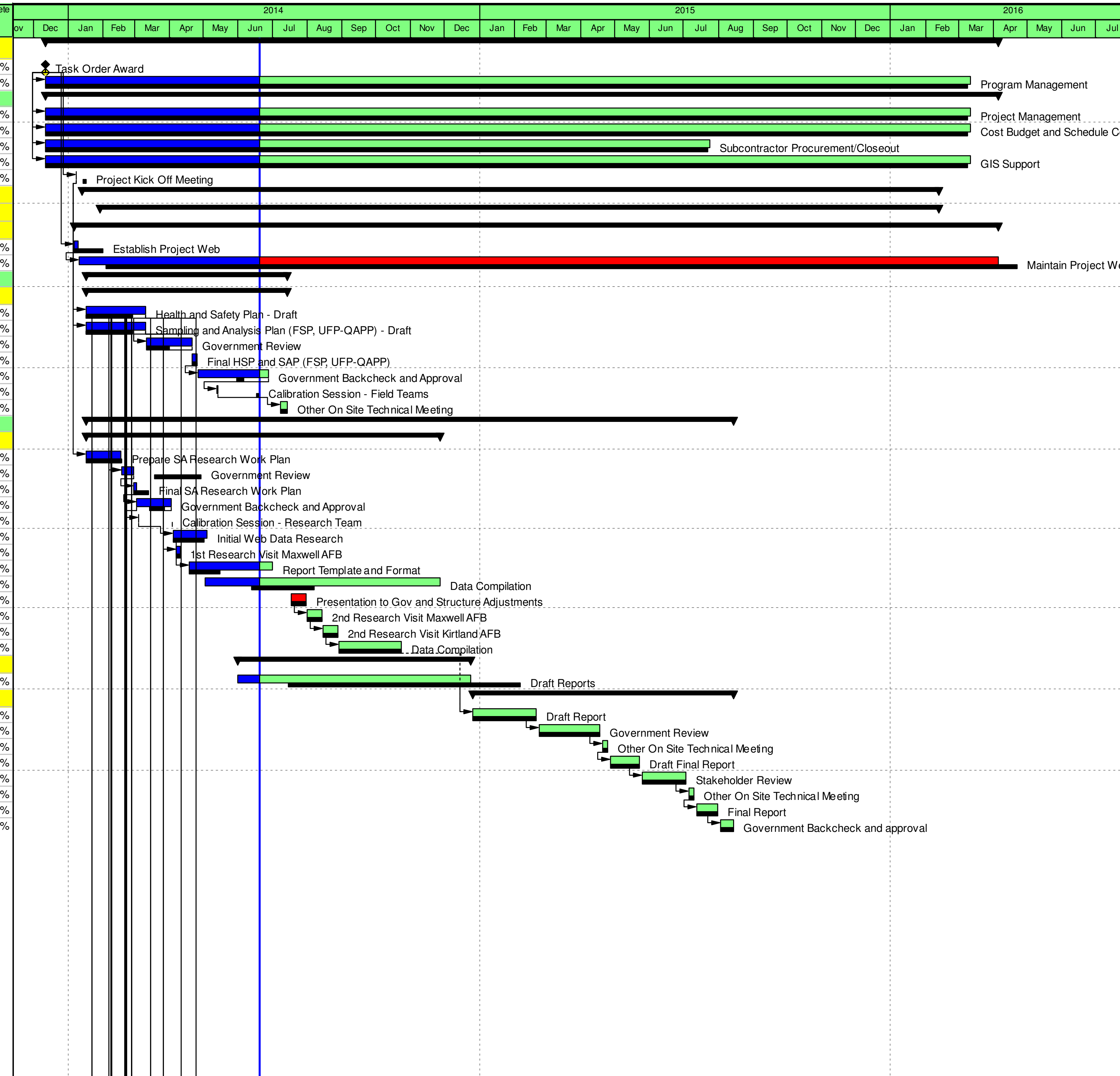
APPENDIX B

Project Schedule

Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
TO-177		613	464	12-Dec-13 A	05-Apr-16	
1	Task Order Award	0	0	12-Dec-13 A		100%
2	Program Management	585	447	12-Dec-13 A	11-Mar-16	23.59%
Project Management & Support		613	464	12-Dec-13 A	05-Apr-16	
4	Project Management	585	447	12-Dec-13 A	11-Mar-16	23.59%
6	Cost Budget and Schedule Controls	585	447	12-Dec-13 A	11-Mar-16	23.59%
64	Subcontractor Procurement/Closeout	420	282	12-Dec-13 A	24-Jul-15	32.86%
65	GIS Support	585	447	12-Dec-13 A	11-Mar-16	23.59%
5	Project Kick Off Meeting	3	0	08-Jan-14 A	08-Jan-14 A	100%
CPSMR/FMER Report Submission		541	411	13-Jan-14 A	12-Feb-16	
Monthly Technical/Contract Teleconference		541	411	29-Jan-14 A	12-Feb-16	
Project Web		596	464	06-Jan-14 A	05-Apr-16	
62	Establish Project Web	20	0	06-Jan-14 A	10-Jan-14 A	100%
63	Maintain Project Website	580	464	11-Jan-14 A	05-Apr-16	20%
Preparation of Plans		127	17	17-Jan-14 A	14-Jul-14	
Quality Program Plan		127	17	17-Jan-14 A	14-Jul-14	
68	Health and Safety Plan - Draft	30	0	17-Jan-14 A	10-Mar-14 A	100%
69	Sampling and Analysis Plan (FSP, UFP-QAPP) - Draft	30	0	17-Jan-14 A	10-Mar-14 A	100%
70	Government Review	15	0	11-Mar-14 A	21-Apr-14 A	100%
74	Final HSP and SAP (FSP, UFP-QAPP)	5	0	21-Apr-14 A	25-Apr-14 A	100%
75	Government Backcheck and Approval	5	6	26-Apr-14 A	27-Jun-14	0%
76	Calibration Session - Field Teams	2	0	13-May-14 A	14-May-14 A	100%
71	Other On Site Technical Meeting	5	5	08-Jul-14	14-Jul-14	0%
Studies/Design and Documentation		407	297	17-Jan-14 A	14-Aug-15	
Site Assessment and Research		200	114	17-Jan-14 A	26-Nov-14	
79	Prepare SA Research Work Plan	22	0	17-Jan-14 A	17-Feb-14 A	100%
80	Government Review	30	0	18-Feb-14 A	28-Feb-14 A	100%
81	Final SA Research Work Plan	10	0	28-Feb-14 A	03-Mar-14 A	100%
82	Government Backcheck and Approval	10	0	03-Mar-14 A	03-Apr-14 A	100%
83	Calibration Session - Research Team	1	0	05-Mar-14 A	05-Mar-14 A	100%
84	Initial Web Data Research	20	0	04-Apr-14 A	04-May-14 A	100%
85	1st Research Visit Maxwell AFB	4	0	07-Apr-14 A	10-Apr-14 A	100%
88	Report Template and Format	20	8	18-Apr-14 A	01-Jul-14	60%
87	Data Compilation	40	114	03-May-14 A	26-Nov-14	0%
89	Presentation to Gov and Structure Adjustments	10	10	18-Jul-14*	31-Jul-14	0%
90	2nd Research Visit Maxwell AFB	10	10	01-Aug-14	14-Aug-14	0%
91	2nd Research Visit Kirtland AFB	10	10	15-Aug-14	28-Aug-14	0%
92	Data Compilation	40	40	29-Aug-14	23-Oct-14	0%
Site Assessment Reports (39 Individual)		145	132	01-Jun-14 A	24-Dec-14	
976	Draft Reports	149	132	01-Jun-14 A	24-Dec-14	11.41%
Multi-Installation PFC Research Report		165	165	26-Dec-14	14-Aug-15	
94	Draft Report	40	40	26-Dec-14	20-Feb-15	0%
95	Government Review	40	40	23-Feb-15	17-Apr-15	0%
96	Other On Site Technical Meeting	5	5	20-Apr-15	24-Apr-15	0%
97	Draft Final Report	20	20	27-Apr-15	22-May-15	0%
98	Stakeholder Review	30	30	25-May-15	03-Jul-15	0%
99	Other On Site Technical Meeting	5	5	06-Jul-15	10-Jul-15	0%
100	Final Report	15	15	13-Jul-15	31-Jul-15	0%
101	Government Backcheck and approval	10	10	03-Aug-15	14-Aug-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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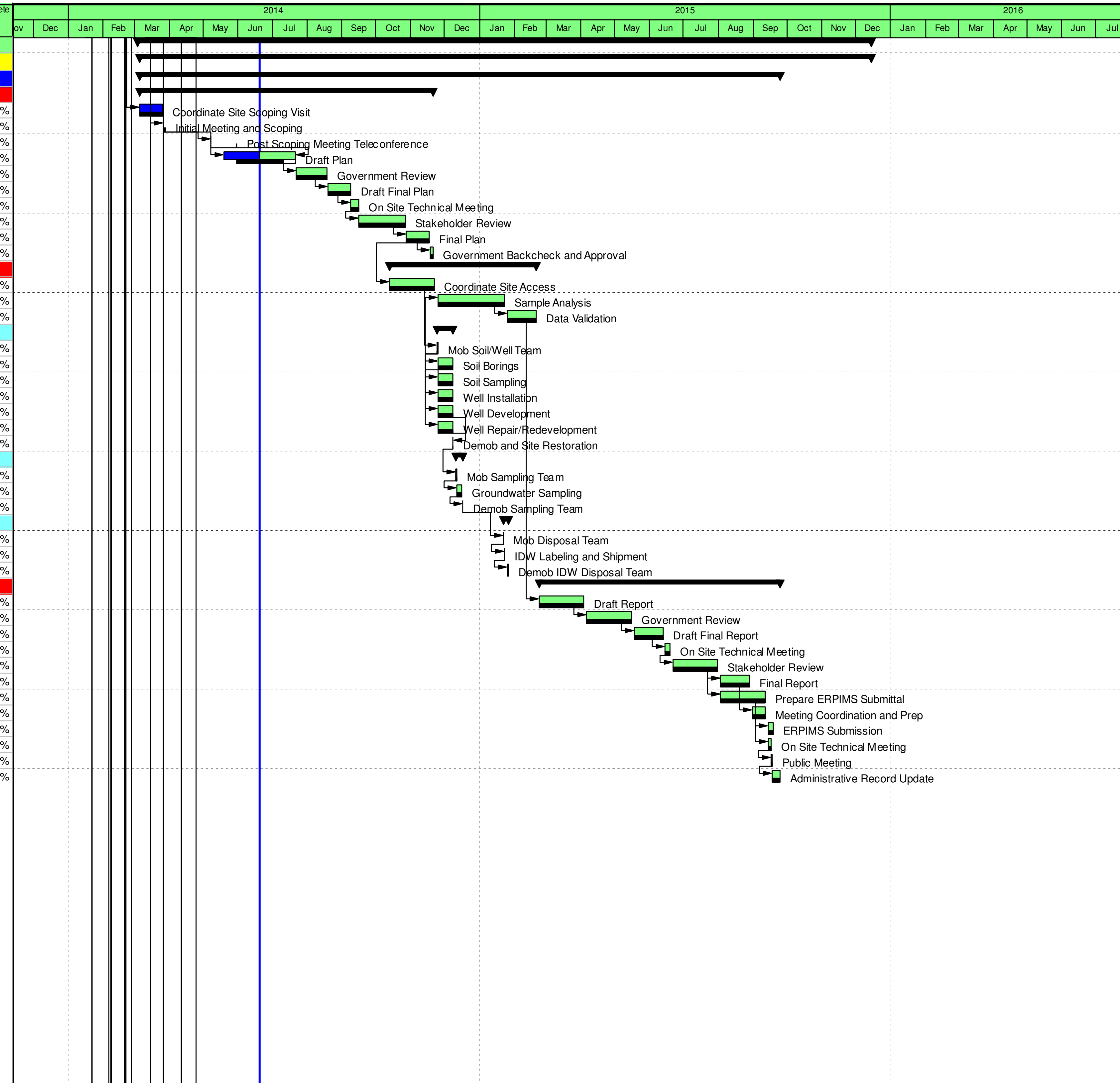
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Region 1		462	383	03-Mar-14 A	14-Dec-15	
Team 1A - Knoxville Field Team		460	383	05-Mar-14 A	14-Dec-15	
Lowry AFB, CO		403	326	05-Mar-14 A	24-Sep-15	
Installation Specific Work Plan		187	110	05-Mar-14 A	20-Nov-14	
106	Coordinate Site Scoping Visit	15	0	05-Mar-14 A	25-Mar-14 A	100%
107	Initial Meeting and Scoping	3	0	27-Mar-14 A	27-Mar-14 A	100%
977	Post Scoping Meeting Teleconference	1	0	08-May-14 A	08-May-14 A	100%
108	Draft Plan	30	22	19-May-14 A	21-Jul-14	26.67%
109	Government Review	20	20	22-Jul-14	18-Aug-14	0%
110	Draft Final Plan	15	15	19-Aug-14	08-Sep-14	0%
111	On Site Technical Meeting	5	5	09-Sep-14	15-Sep-14	0%
112	Stakeholder Review	30	30	16-Sep-14	27-Oct-14	0%
113	Final Plan	15	15	28-Oct-14	17-Nov-14	0%
114	Government Backcheck and Approval	3	3	18-Nov-14	20-Nov-14	0%
Investigations Monitoring and Sample Collection		91	91	13-Oct-14	20-Feb-15	
116	Coordinate Site Access	30	30	13-Oct-14	21-Nov-14	0%
135	Sample Analysis	40	40	25-Nov-14	23-Jan-15	0%
136	Data Validation	20	20	26-Jan-15	20-Feb-15	0%
Soil Sampling and Wells		9	9	24-Nov-14	08-Dec-14	
118	Mob Soil/Well Team	2	2	24-Nov-14	25-Nov-14	0%
119	Soil Borings	8	8	25-Nov-14	08-Dec-14	0%
120	Soil Sampling	8	8	25-Nov-14	08-Dec-14	0%
121	Well Installation	8	8	25-Nov-14	08-Dec-14	0%
122	Well Development	8	8	25-Nov-14	08-Dec-14	0%
123	Well Repair/Redevelopment	8	8	25-Nov-14	08-Dec-14	0%
124	Demob and Site Restoration	1	1	08-Dec-14	08-Dec-14	0%
GW, Sediment and SW Sampling		5	5	11-Dec-14	17-Dec-14	
126	Mob Sampling Team	1	1	11-Dec-14	11-Dec-14	0%
127	Groundwater Sampling	3	3	12-Dec-14	16-Dec-14	0%
130	Demob Sampling Team	1	1	17-Dec-14	17-Dec-14	0%
IDW Handling and Disposal		3	3	22-Jan-15	26-Jan-15	
132	Mob Disposal Team	1	1	22-Jan-15	22-Jan-15	0%
133	IDW Labeling and Shipment	1	1	23-Jan-15	23-Jan-15	0%
134	Demob IDW Disposal Team	1	1	26-Jan-15	26-Jan-15	0%
Studies/Designs and Documentation		154	154	23-Feb-15	24-Sep-15	
138	Draft Report	30	30	23-Feb-15	03-Apr-15	0%
139	Government Review	30	30	06-Apr-15	15-May-15	0%
140	Draft Final Report	20	20	18-May-15	12-Jun-15	0%
141	On Site Technical Meeting	5	5	15-Jun-15	19-Jun-15	0%
142	Stakeholder Review	30	30	22-Jun-15	31-Jul-15	0%
143	Final Report	20	20	03-Aug-15	28-Aug-15	0%
144	Prepare ERPIMS Submittal	30	30	03-Aug-15	11-Sep-15	0%
146	Meeting Coordination and Prep	10	10	31-Aug-15	11-Sep-15	0%
145	ERPIMS Submission	5	5	14-Sep-15	18-Sep-15	0%
147	On Site Technical Meeting	3	3	14-Sep-15	16-Sep-15	0%
148	Public Meeting	1	1	17-Sep-15	17-Sep-15	0%
149	Administrative Record Update	5	5	18-Sep-15	24-Sep-15	0%



Remaining Level of Effort · Actual Work · Critical Remaining Work · Summary · Primary Bas...
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Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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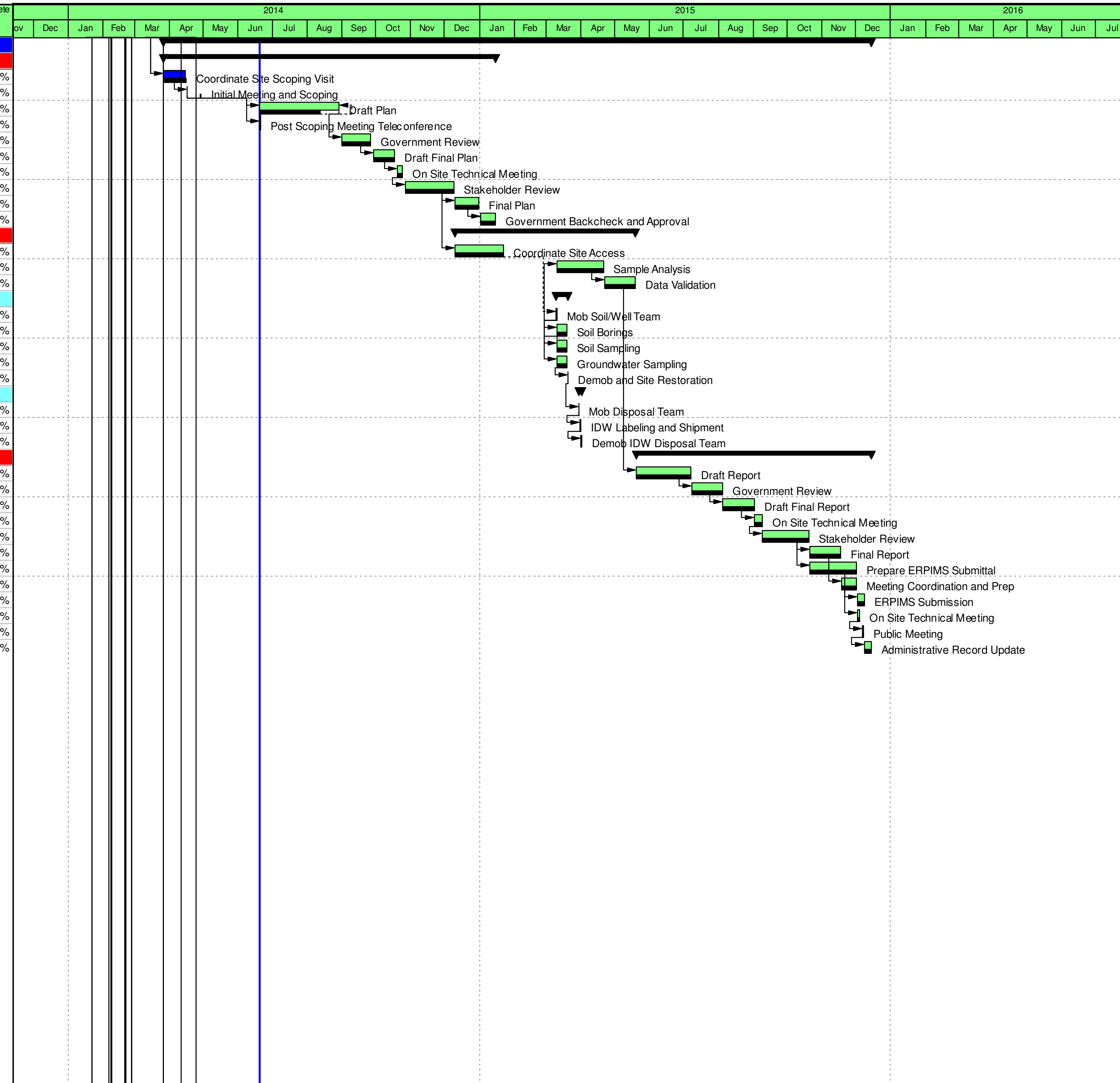
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	Richards-Gebaur AFB, MO	445	383	26-Mar-14 A	14-Dec-15	
	Installation Specific Work Plan	208	146	26-Mar-14 A	15-Jan-15	
152	Coordinate Site Scoping Visit	15	0	26-Mar-14 A	15-Apr-14 A	100%
153	Initial Meeting and Scoping	1	0	17-Apr-14 A	17-Apr-14 A	100%
154	Draft Plan	38	51	20-Jun-14	29-Aug-14	0%
978	Post Scoping Meeting Teleconference	1	1	20-Jun-14	20-Jun-14	0%
155	Government Review	20	20	01-Sep-14	26-Sep-14	0%
156	Draft Final Plan	15	15	29-Sep-14	17-Oct-14	0%
157	On Site Technical Meeting	5	5	20-Oct-14	24-Oct-14	0%
158	Stakeholder Review	30	30	27-Oct-14	09-Dec-14	0%
159	Final Plan	15	15	10-Dec-14	31-Dec-14	0%
160	Government Backcheck and Approval	10	10	02-Jan-15	15-Jan-15	0%
	Investigations Monitoring and Sample Collection	113	113	10-Dec-14	19-May-15	
162	Coordinate Site Access	30	30	10-Dec-14	22-Jan-15	0%
175	Sample Analysis	30	30	11-Mar-15	21-Apr-15	0%
176	Data Validation	20	20	22-Apr-15	19-May-15	0%
	Soil, Water and Sediment Sampling	9	9	10-Mar-15	20-Mar-15	
164	Mob Soil/Well Team	1	1	10-Mar-15*	10-Mar-15	0%
165	Soil Borings	7	7	11-Mar-15	19-Mar-15	0%
166	Soil Sampling	7	7	11-Mar-15	19-Mar-15	0%
167	Groundwater Sampling	7	7	11-Mar-15	19-Mar-15	0%
170	Demob and Site Restoration	1	1	20-Mar-15	20-Mar-15	0%
	IDW Handling and Disposal	3	3	30-Mar-15	01-Apr-15	
172	Mob Disposal Team	1	1	30-Mar-15	30-Mar-15	0%
173	IDW Labeling and Shipment	1	1	31-Mar-15	31-Mar-15	0%
174	Demob IDW Disposal Team	1	1	01-Apr-15	01-Apr-15	0%
	Studies/Designs and Documentation	149	149	20-May-15	14-Dec-15	
178	Draft Report	35	35	20-May-15	07-Jul-15	0%
179	Government Review	20	20	08-Jul-15	04-Aug-15	0%
180	Draft Final Report	20	20	05-Aug-15	01-Sep-15	0%
181	On Site Technical Meeting	5	5	02-Sep-15	08-Sep-15	0%
182	Stakeholder Review	30	30	09-Sep-15	20-Oct-15	0%
183	Final Report	20	20	21-Oct-15	17-Nov-15	0%
184	Prepare ERPIMS Submittal	30	30	21-Oct-15	01-Dec-15	0%
186	Meeting Coordination and Prep	10	10	18-Nov-15	01-Dec-15	0%
185	ERPIMS Submission	5	5	02-Dec-15	08-Dec-15	0%
187	On Site Technical Meeting	3	3	02-Dec-15	04-Dec-15	0%
188	Public Meeting	1	1	07-Dec-15	07-Dec-15	0%
189	Administrative Record Update	5	5	08-Dec-15	14-Dec-15	0%



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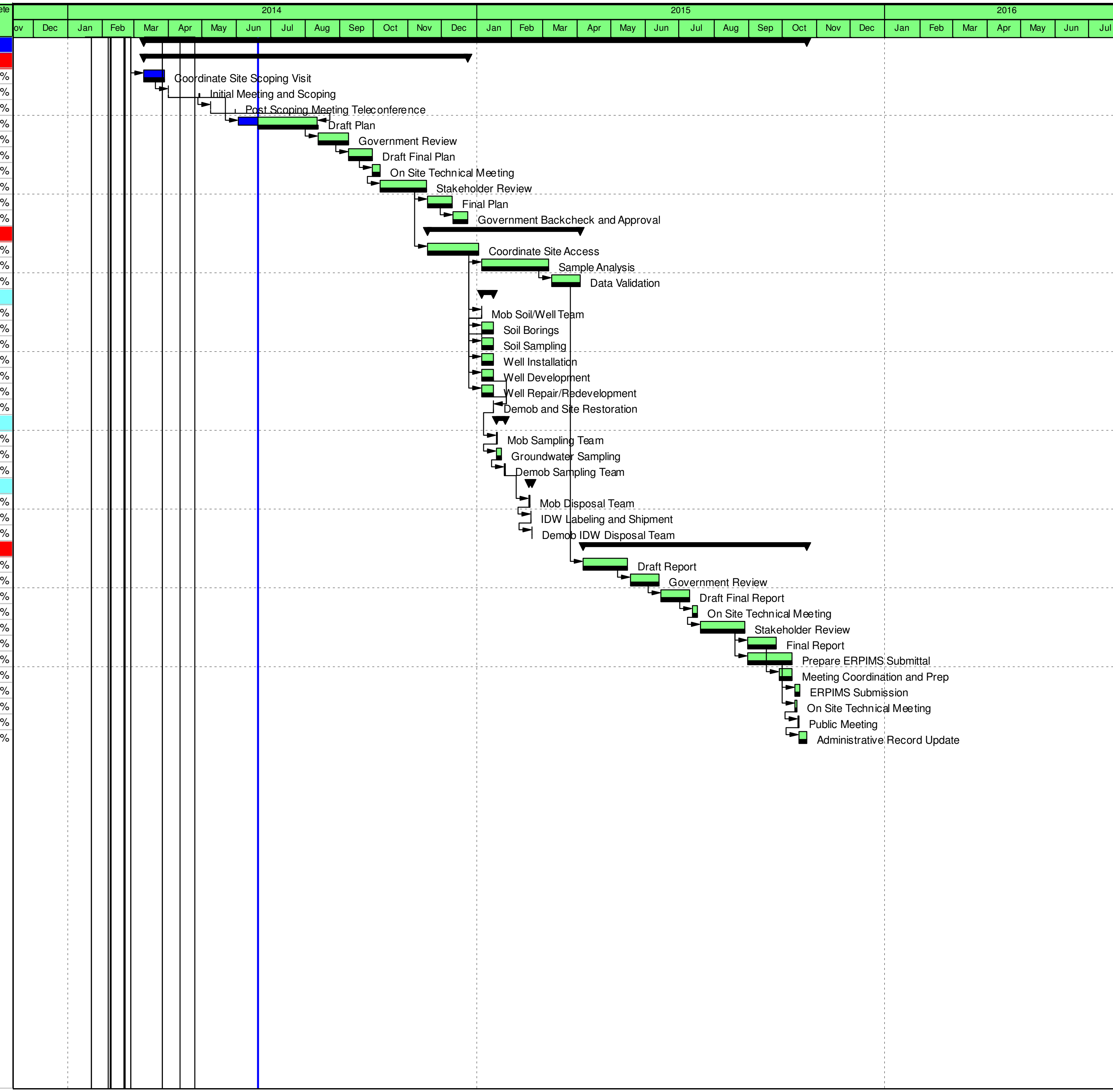
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	England AFB, LA	420	346	10-Mar-14 A	22-Oct-15	
	Installation Specific Work Plan	206	132	10-Mar-14 A	24-Dec-14	
192	Coordinate Site Scoping Visit	15	0	10-Mar-14 A	28-Mar-14 A	100%
193	Initial Meeting and Scoping	1	0	01-Apr-14 A	01-Apr-14 A	100%
979	Post Scoping Meeting Teleconference	1	0	09-May-14 A	09-May-14 A	100%
194	Draft Plan	38	37	02-Jun-14 A	11-Aug-14	2.63%
195	Government Review	20	20	12-Aug-14	08-Sep-14	0%
196	Draft Final Plan	15	15	09-Sep-14	29-Sep-14	0%
197	On Site Technical Meeting	5	5	30-Sep-14	06-Oct-14	0%
198	Stakeholder Review	30	30	07-Oct-14	17-Nov-14	0%
199	Final Plan	15	15	18-Nov-14	10-Dec-14	0%
200	Government Backcheck and Approval	10	10	11-Dec-14	24-Dec-14	0%
	Investigations Monitoring and Sample Collection	95	95	18-Nov-14	03-Apr-15	
202	Coordinate Site Access	30	30	18-Nov-14	02-Jan-15	0%
221	Sample Analysis	45	45	05-Jan-15	06-Mar-15	0%
222	Data Validation	20	20	09-Mar-15	03-Apr-15	0%
	Soil Sampling and Wells	10	10	05-Jan-15	16-Jan-15	
204	Mob Soil/Well Team	1	1	05-Jan-15*	05-Jan-15	0%
205	Soil Borings	10	10	05-Jan-15	16-Jan-15	0%
206	Soil Sampling	10	10	05-Jan-15	16-Jan-15	0%
207	Well Installation	10	10	05-Jan-15	16-Jan-15	0%
208	Well Development	10	10	05-Jan-15	16-Jan-15	0%
209	Well Repair/Redevelopment	10	10	05-Jan-15	16-Jan-15	0%
210	Demob and Site Restoration	1	1	16-Jan-15	16-Jan-15	0%
	GW, Sediment and SW Sampling	6	6	19-Jan-15	26-Jan-15	
212	Mob Sampling Team	1	1	19-Jan-15	19-Jan-15	0%
213	Groundwater Sampling	5	5	19-Jan-15	23-Jan-15	0%
216	Demob Sampling Team	1	1	26-Jan-15	26-Jan-15	0%
	IDW Handling and Disposal	3	3	17-Feb-15	19-Feb-15	
218	Mob Disposal Team	1	1	17-Feb-15	17-Feb-15	0%
219	IDW Labeling and Shipment	1	1	18-Feb-15	18-Feb-15	0%
220	Demob IDW Disposal Team	1	1	19-Feb-15	19-Feb-15	0%
	Studies/Designs and Documentation	144	144	06-Apr-15	22-Oct-15	
224	Draft Report	30	30	06-Apr-15	15-May-15	0%
225	Government Review	20	20	18-May-15	12-Jun-15	0%
226	Draft Final Report	20	20	15-Jun-15	10-Jul-15	0%
227	On Site Technical Meeting	5	5	13-Jul-15	17-Jul-15	0%
228	Stakeholder Review	30	30	20-Jul-15	28-Aug-15	0%
229	Final Report	20	20	31-Aug-15	25-Sep-15	0%
230	Prepare ERPIMS Submittal	30	30	31-Aug-15	09-Oct-15	0%
232	Meeting Coordination and Prep	10	10	28-Sep-15	09-Oct-15	0%
231	ERPIMS Submission	5	5	12-Oct-15	16-Oct-15	0%
233	On Site Technical Meeting	3	3	12-Oct-15	14-Oct-15	0%
234	Public Meeting	1	1	15-Oct-15	15-Oct-15	0%
235	Administrative Record Update	5	5	16-Oct-15	22-Oct-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

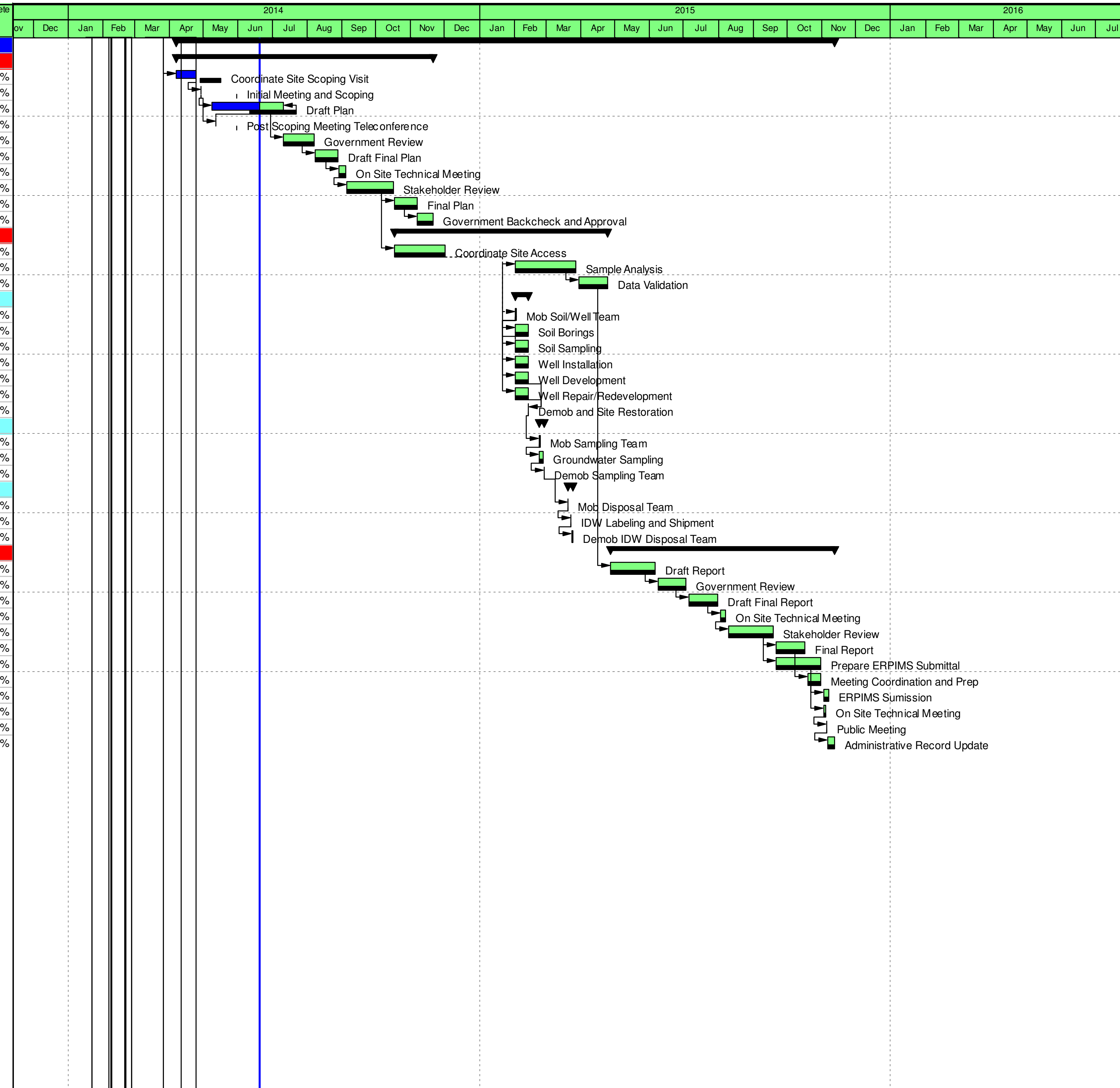
Data Date: 20-Jun-14

Print Date: 14-Jul-14

Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Myrtle Beach AFB, SC		400	361	07-Apr-14 A	12-Nov-15	
Installation Specific Work Plan		149	110	07-Apr-14 A	20-Nov-14	
238	Coordinate Site Scoping Visit	15	0	07-Apr-14 A	25-Apr-14 A	100%
239	Initial Meeting and Scoping	1	0	29-Apr-14 A	29-Apr-14 A	100%
240	Draft Plan	30	15	09-May-14 A	10-Jul-14	50%
980	Post Scoping Meeting Teleconference	1	0	12-May-14 A	12-May-14 A	100%
241	Government Review	20	20	11-Jul-14	07-Aug-14	0%
242	Draft Final Plan	15	15	08-Aug-14	28-Aug-14	0%
243	On Site Technical Meeting	5	5	29-Aug-14	04-Sep-14	0%
244	Stakeholder Review	30	30	05-Sep-14	16-Oct-14	0%
245	Final Plan	15	15	17-Oct-14	06-Nov-14	0%
246	Government Backcheck and Approval	10	10	07-Nov-14	20-Nov-14	0%
Investigations Monitoring and Sample Collection		132	132	17-Oct-14	24-Apr-15	
248	Coordinate Site Access	30	30	17-Oct-14	01-Dec-14	0%
267	Sample Analysis	40	40	02-Feb-15	27-Mar-15	0%
268	Data Validation	20	20	30-Mar-15	24-Apr-15	0%
Soil Sampling and Wells		10	10	02-Feb-15	13-Feb-15	
250	Mob Soil/Well Team	1	1	02-Feb-15*	02-Feb-15	0%
251	Soil Borings	10	10	02-Feb-15	13-Feb-15	0%
252	Soil Sampling	10	10	02-Feb-15	13-Feb-15	0%
253	Well Installation	10	10	02-Feb-15	13-Feb-15	0%
254	Well Development	10	10	02-Feb-15	13-Feb-15	0%
255	Well Repair/Redevelopment	10	10	02-Feb-15	13-Feb-15	0%
256	Demob and Site Restoration	1	1	13-Feb-15	13-Feb-15	0%
GW, Sediment and SW Sampling		5	5	23-Feb-15	27-Feb-15	
258	Mob Sampling Team	1	1	23-Feb-15	23-Feb-15	0%
259	Groundwater Sampling	4	4	23-Feb-15	26-Feb-15	0%
262	Demob Sampling Team	1	1	27-Feb-15	27-Feb-15	0%
IDW Handling and Disposal		3	3	20-Mar-15	24-Mar-15	
264	Mob Disposal Team	1	1	20-Mar-15	20-Mar-15	0%
265	IDW Labeling and Shipment	1	1	23-Mar-15	23-Mar-15	0%
266	Demob IDW Disposal Team	1	1	24-Mar-15	24-Mar-15	0%
Studies/Designs and Documentation		144	144	27-Apr-15	12-Nov-15	
270	Draft Report	30	30	27-Apr-15	05-Jun-15	0%
271	Government Review	20	20	08-Jun-15	03-Jul-15	0%
272	Draft Final Report	20	20	06-Jul-15	31-Jul-15	0%
273	On Site Technical Meeting	5	5	03-Aug-15	07-Aug-15	0%
274	Stakeholder Review	30	30	10-Aug-15	18-Sep-15	0%
275	Final Report	20	20	21-Sep-15	16-Oct-15	0%
276	Prepare ERPIMS Submittal	30	30	21-Sep-15	30-Oct-15	0%
278	Meeting Coordination and Prep	10	10	19-Oct-15	30-Oct-15	0%
277	ERPIMS Sumission	5	5	02-Nov-15	06-Nov-15	0%
279	On Site Technical Meeting	3	3	02-Nov-15	04-Nov-15	0%
280	Public Meeting	1	1	05-Nov-15	05-Nov-15	0%
281	Administrative Record Update	5	5	06-Nov-15	12-Nov-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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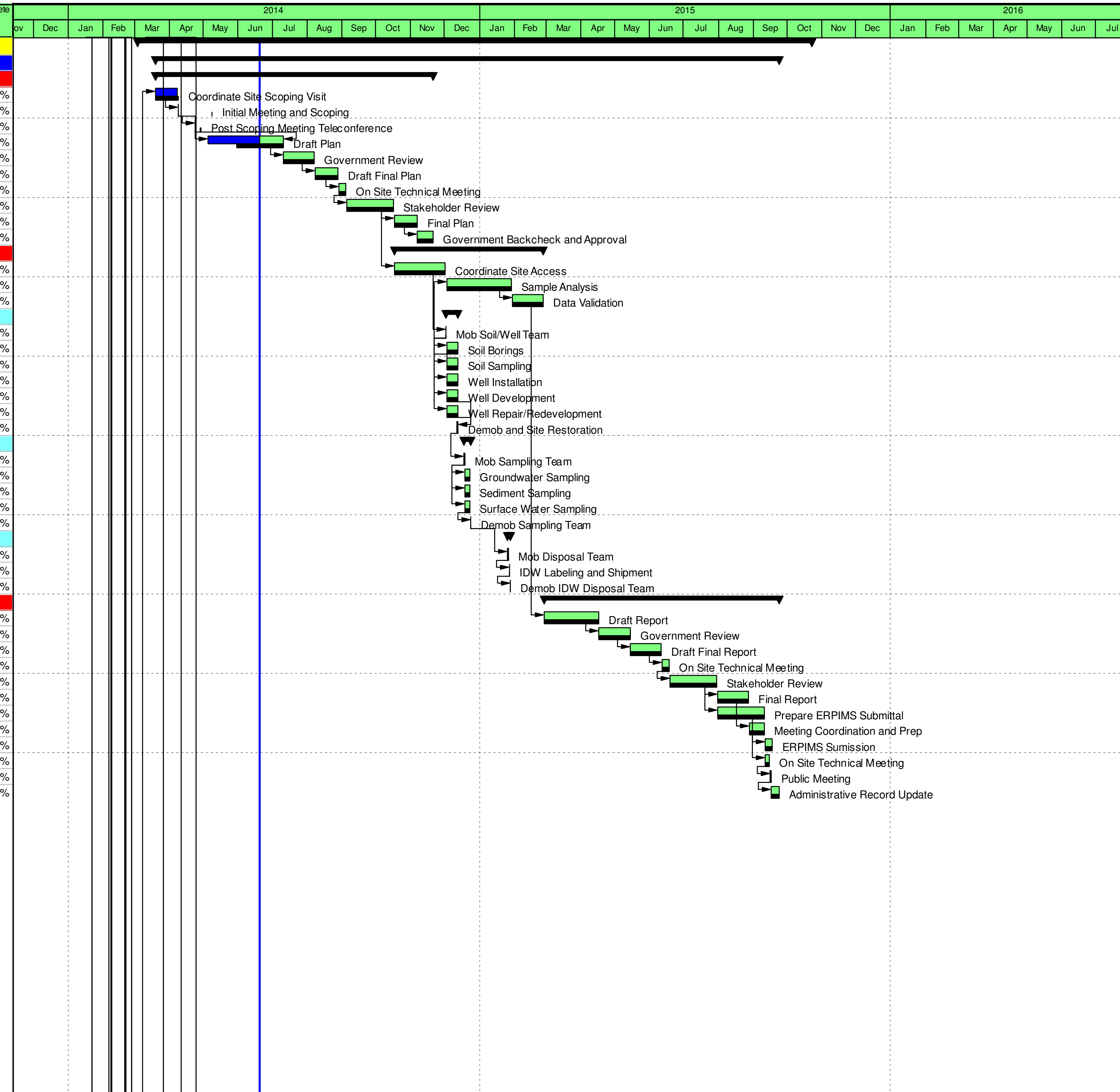
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Team 1B - Austin Field Team		425	346	03-Mar-14 A	22-Oct-15	
Kelly AFB, TX		392	325	19-Mar-14 A	23-Sep-15	
Installation Specific Work Plan		177	110	19-Mar-14 A	20-Nov-14	
285	Coordinate Site Scoping Visit	15	0	19-Mar-14 A	08-Apr-14 A	100%
286	Initial Meeting and Scoping	1	0	09-Apr-14 A	09-Apr-14 A	100%
981	Post Scoping Meeting Teleconference	1	0	24-Apr-14 A	24-Apr-14 A	100%
287	Draft Plan	30	15	05-May-14 A	10-Jul-14	50%
288	Government Review	20	20	11-Jul-14	07-Aug-14	0%
289	Draft Final Plan	15	15	08-Aug-14	28-Aug-14	0%
290	On Site Technical Meeting	5	5	29-Aug-14	04-Sep-14	0%
291	Stakeholder Review	30	30	05-Sep-14	16-Oct-14	0%
292	Final Plan	15	15	17-Oct-14	06-Nov-14	0%
293	Government Backcheck and Approval	10	10	07-Nov-14	20-Nov-14	0%
Investigations Monitoring and Sample Collection		91	91	17-Oct-14	26-Feb-15	
295	Coordinate Site Access	30	30	17-Oct-14	01-Dec-14	0%
314	Sample Analysis	40	40	03-Dec-14	29-Jan-15	0%
315	Data Validation	20	20	30-Jan-15	26-Feb-15	0%
Soil Sampling and Wells		9	9	02-Dec-14	12-Dec-14	
297	Mob Soil/Well Team	1	1	02-Dec-14	02-Dec-14	0%
298	Soil Borings	8	8	03-Dec-14	12-Dec-14	0%
299	Soil Sampling	8	8	03-Dec-14	12-Dec-14	0%
300	Well Installation	8	8	03-Dec-14	12-Dec-14	0%
301	Well Development	8	8	03-Dec-14	12-Dec-14	0%
302	Well Repair/Redevelopment	8	8	03-Dec-14	12-Dec-14	0%
303	Demob and Site Restoration	1	1	12-Dec-14	12-Dec-14	0%
GW, Sediment and SW Sampling		5	5	18-Dec-14	24-Dec-14	
305	Mob Sampling Team	1	1	18-Dec-14	18-Dec-14	0%
306	Groundwater Sampling	3	3	19-Dec-14	23-Dec-14	0%
307	Sediment Sampling	3	3	19-Dec-14	23-Dec-14	0%
308	Surface Water Sampling	3	3	19-Dec-14	23-Dec-14	0%
309	Demob Sampling Team	1	1	24-Dec-14	24-Dec-14	0%
IDW Handling and Disposal		3	3	26-Jan-15	28-Jan-15	
311	Mob Disposal Team	1	1	26-Jan-15	26-Jan-15	0%
312	IDW Labeling and Shipment	1	1	27-Jan-15	27-Jan-15	0%
313	Demob IDW Disposal Team	1	1	28-Jan-15	28-Jan-15	0%
Studies/Designs and Documentation		149	149	27-Feb-15	23-Sep-15	
317	Draft Report	35	35	27-Feb-15	16-Apr-15	0%
318	Government Review	20	20	17-Apr-15	14-May-15	0%
319	Draft Final Report	20	20	15-May-15	11-Jun-15	0%
320	On Site Technical Meeting	5	5	12-Jun-15	18-Jun-15	0%
321	Stakeholder Review	30	30	19-Jun-15	30-Jul-15	0%
322	Final Report	20	20	31-Jul-15	27-Aug-15	0%
323	Prepare ERPIMS Submittal	30	30	31-Jul-15	10-Sep-15	0%
325	Meeting Coordination and Prep	10	10	28-Aug-15	10-Sep-15	0%
324	ERPIMS Sumission	5	5	11-Sep-15	17-Sep-15	0%
326	On Site Technical Meeting	3	3	11-Sep-15	15-Sep-15	0%
327	Public Meeting	1	1	16-Sep-15	16-Sep-15	0%
328	Administrative Record Update	5	5	17-Sep-15	23-Sep-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
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Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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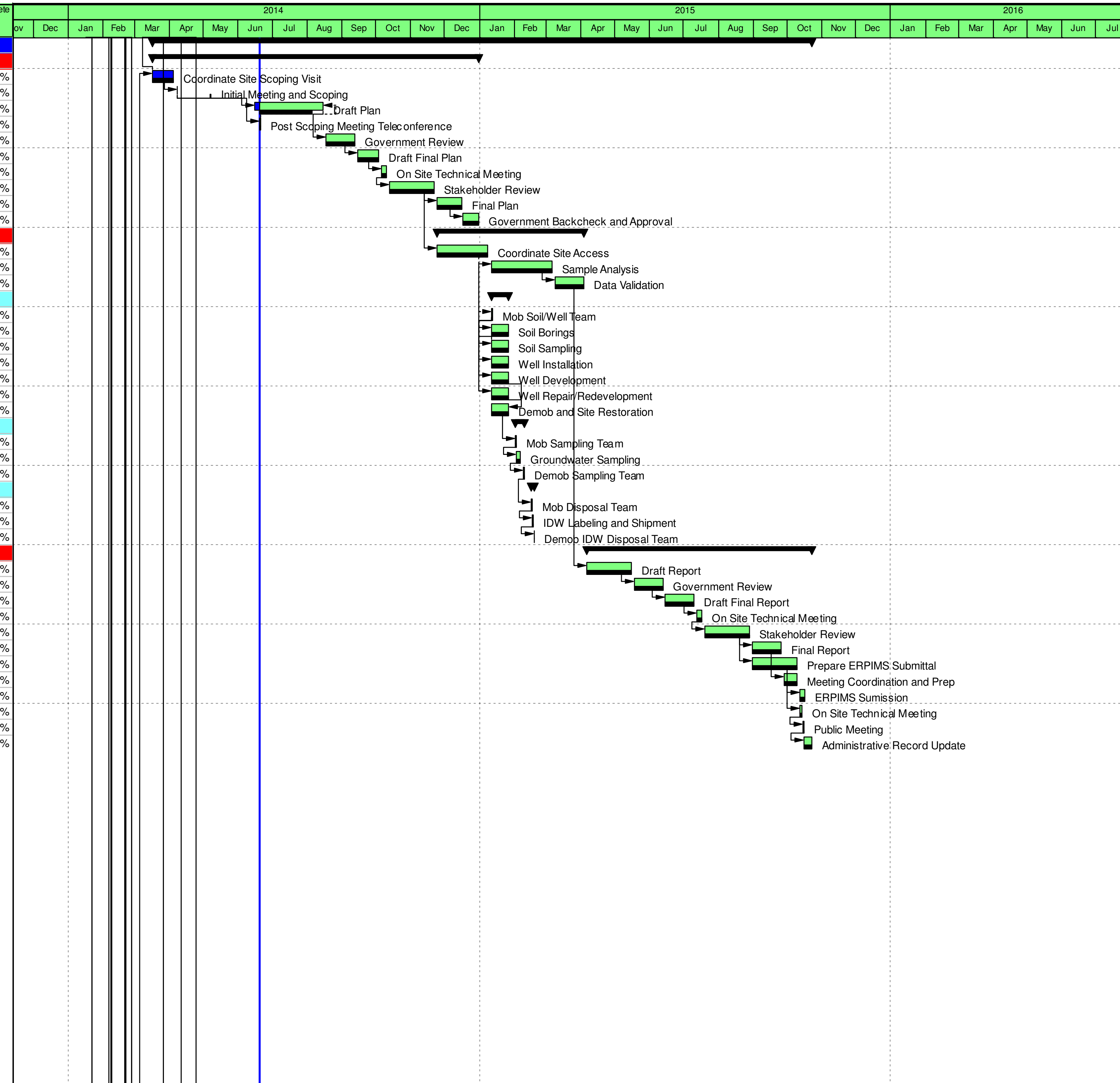
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Bergstrom AFB, TX		415	346	17-Mar-14 A	22-Oct-15	
Installation Specific Work Plan		205	136	17-Mar-14 A	31-Dec-14	
331	Coordinate Site Scoping Visit	15	0	17-Mar-14 A	04-Apr-14 A	100%
332	Initial Meeting and Scoping	1	0	08-Apr-14 A	08-Apr-14 A	100%
333	Draft Plan	33	41	16-Jun-14 A	15-Aug-14	0%
982	Post Scoping Meeting Teleconference	1	1	20-Jun-14	20-Jun-14	0%
334	Government Review	20	20	18-Aug-14	12-Sep-14	0%
335	Draft Final Plan	15	15	15-Sep-14	03-Oct-14	0%
336	On Site Technical Meeting	5	5	06-Oct-14	10-Oct-14	0%
337	Stakeholder Review	30	30	13-Oct-14	21-Nov-14	0%
338	Final Plan	15	15	24-Nov-14	16-Dec-14	0%
339	Government Backcheck and Approval	10	10	17-Dec-14	31-Dec-14	0%
Investigations Monitoring and Sample Collection		91	91	24-Nov-14	03-Apr-15	
341	Coordinate Site Access	30	30	24-Nov-14	08-Jan-15	0%
360	Sample Analysis	40	40	12-Jan-15	06-Mar-15	0%
361	Data Validation	20	20	09-Mar-15	03-Apr-15	0%
Soil Sampling and Wells		11	11	12-Jan-15	26-Jan-15	
343	Mob Soil/Well Team	1	1	12-Jan-15*	12-Jan-15	0%
344	Soil Borings	11	11	12-Jan-15	26-Jan-15	0%
345	Soil Sampling	11	11	12-Jan-15	26-Jan-15	0%
346	Well Installation	11	11	12-Jan-15	26-Jan-15	0%
347	Well Development	11	11	12-Jan-15	26-Jan-15	0%
348	Well Repair/Redevelopment	11	11	12-Jan-15	26-Jan-15	0%
349	Demob and Site Restoration	11	11	12-Jan-15	26-Jan-15	0%
GW, Sediment and SW Sampling		6	6	02-Feb-15	09-Feb-15	
351	Mob Sampling Team	1	1	02-Feb-15	02-Feb-15	0%
352	Groundwater Sampling	4	4	03-Feb-15	06-Feb-15	0%
355	Demob Sampling Team	1	1	09-Feb-15	09-Feb-15	0%
IDW Handling and Disposal		3	3	16-Feb-15	18-Feb-15	
357	Mob Disposal Team	1	1	16-Feb-15	16-Feb-15	0%
358	IDW Labeling and Shipment	1	1	17-Feb-15	17-Feb-15	0%
359	Demob IDW Disposal Team	1	1	18-Feb-15	18-Feb-15	0%
Studies/Designs and Documentation		144	144	06-Apr-15	22-Oct-15	
363	Draft Report	30	30	06-Apr-15	15-May-15	0%
364	Government Review	20	20	18-May-15	12-Jun-15	0%
365	Draft Final Report	20	20	15-Jun-15	10-Jul-15	0%
366	On Site Technical Meeting	5	5	13-Jul-15	17-Jul-15	0%
367	Stakeholder Review	30	30	20-Jul-15	28-Aug-15	0%
368	Final Report	20	20	31-Aug-15	25-Sep-15	0%
369	Prepare ERPIMS Submittal	30	30	31-Aug-15	09-Oct-15	0%
371	Meeting Coordination and Prep	10	10	28-Sep-15	09-Oct-15	0%
370	ERPIMS Sumission	5	5	12-Oct-15	16-Oct-15	0%
372	On Site Technical Meeting	3	3	12-Oct-15	14-Oct-15	0%
373	Public Meeting	1	1	15-Oct-15	15-Oct-15	0%
374	Administrative Record Update	5	5	16-Oct-15	22-Oct-15	0%



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Project Schedule

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Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Reese AFB, TX		414	335	03-Mar-14 A	07-Oct-15	
Installation Specific Work Plan		204	125	03-Mar-14 A	15-Dec-14	
377	Coordinate Site Scoping Visit	15	0	03-Mar-14 A	21-Mar-14 A	100%
378	Initial Meeting and Scoping	3	0	25-Mar-14 A	25-Mar-14 A	100%
983	Post Scoping Meeting Teleconference	1	0	02-May-14 A	02-May-14 A	100%
379	Draft Plan	30	30	23-May-14 A	31-Jul-14	0%
380	Government Review	20	20	01-Aug-14	28-Aug-14	0%
381	Draft Final Plan	15	15	29-Aug-14	18-Sep-14	0%
382	On Site Technical Meeting	5	5	19-Sep-14	25-Sep-14	0%
383	Stakeholder Review	30	30	26-Sep-14	06-Nov-14	0%
384	Final Plan	15	15	07-Nov-14	01-Dec-14	0%
385	Government Backcheck and Approval	10	10	02-Dec-14	15-Dec-14	0%
Investigations Monitoring and Sample Collection		91	91	07-Nov-14	19-Mar-15	
387	Coordinate Site Access	30	30	07-Nov-14	22-Dec-14	0%
406	Sample Analysis	40	40	24-Dec-14	19-Feb-15	0%
407	Data Validation	20	20	20-Feb-15	19-Mar-15	0%
Soil Sampling and Wells		12	12	23-Dec-14	09-Jan-15	
389	Mob Soil/Well Team	1	1	23-Dec-14*	23-Dec-14	0%
390	Soil Borings	10	10	24-Dec-14	08-Jan-15	0%
391	Soil Sampling	10	10	24-Dec-14	08-Jan-15	0%
392	Well Installation	10	10	24-Dec-14	08-Jan-15	0%
393	Well Development	10	10	24-Dec-14	08-Jan-15	0%
394	Well Repair/Redevelopment	10	10	24-Dec-14	08-Jan-15	0%
395	Demob and Site Restoration	1	1	09-Jan-15	09-Jan-15	0%
GW, Sediment and SW Sampling		5	5	22-Jan-15	28-Jan-15	
397	Mob Sampling Team	1	1	22-Jan-15	22-Jan-15	0%
398	Groundwater Sampling	3	3	23-Jan-15	27-Jan-15	0%
401	Demob Sampling Team	1	1	28-Jan-15	28-Jan-15	0%
IDW Handling and Disposal		3	3	16-Feb-15	18-Feb-15	
403	Mob Disposal Team	1	1	16-Feb-15	16-Feb-15	0%
404	IDW Labeling and Shipment	1	1	17-Feb-15	17-Feb-15	0%
405	Demob IDW Disposal Team	1	1	18-Feb-15	18-Feb-15	0%
Studies/Designs and Documentation		144	144	20-Mar-15	07-Oct-15	
409	Draft Report	30	30	20-Mar-15	30-Apr-15	0%
410	Government Review	20	20	01-May-15	28-May-15	0%
411	Draft Final Report	20	20	29-May-15	25-Jun-15	0%
412	On Site Technical Meeting	5	5	26-Jun-15	02-Jul-15	0%
413	Stakeholder Review	30	30	03-Jul-15	13-Aug-15	0%
414	Final Report	20	20	14-Aug-15	10-Sep-15	0%
415	Prepare ERPIMS Submittal	30	30	14-Aug-15	24-Sep-15	0%
417	Meeting Coordination and Prep	10	10	11-Sep-15	24-Sep-15	0%
416	ERPIMS Sumission	5	5	25-Sep-15	01-Oct-15	0%
418	On Site Technical Meeting	3	3	25-Sep-15	29-Sep-15	0%
419	Public Meeting	1	1	30-Sep-15	30-Sep-15	0%
420	Administrative Record Update	5	5	01-Oct-15	07-Oct-15	0%

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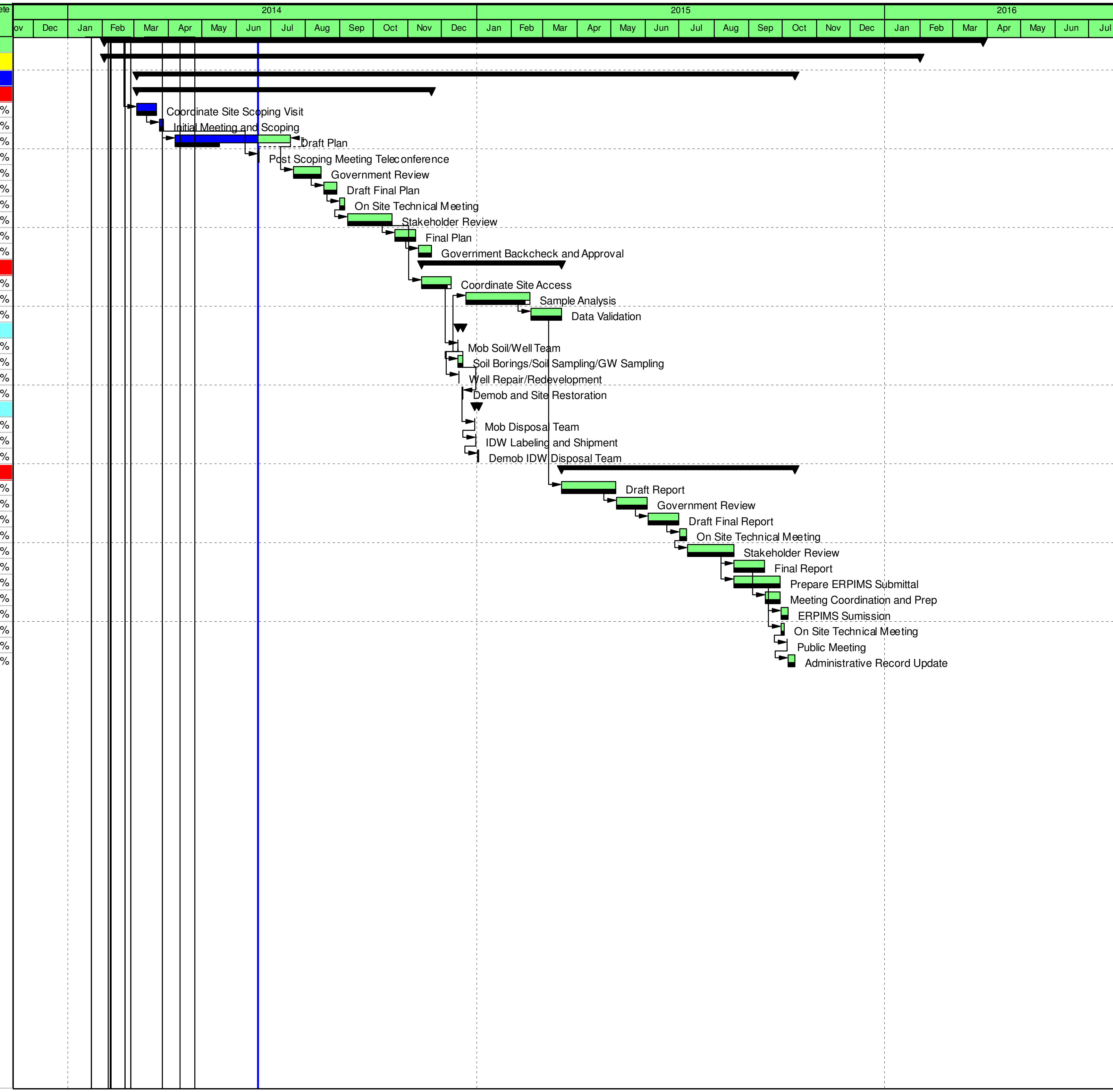
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Region 2		538	458	03-Feb-14 A	28-Mar-16	
Team 2A - Portland Field Team		498	418	03-Feb-14 A	01-Feb-16	
Griffiss AFB, NY		417	338	03-Mar-14 A	12-Oct-15	
Installation Specific Work Plan		190	111	03-Mar-14 A	21-Nov-14	
425	Coordinate Site Scoping Visit	15	0	03-Mar-14 A	21-Mar-14 A	100%
426	Initial Meeting and Scoping	4	0	24-Mar-14 A	27-Mar-14 A	100%
427	Draft Plan	30	21	07-Apr-14 A	18-Jul-14	30%
984	Post Scoping Meeting Teleconference	1	1	20-Jun-14	20-Jun-14	0%
428	Government Review	20	20	21-Jul-14	15-Aug-14	0%
429	Draft Final Plan	10	10	18-Aug-14	29-Aug-14	0%
430	On Site Technical Meeting	5	5	01-Sep-14	05-Sep-14	0%
431	Stakeholder Review	30	30	08-Sep-14	17-Oct-14	0%
432	Final Plan	15	15	20-Oct-14	07-Nov-14	0%
433	Government Backcheck and Approval	10	10	10-Nov-14	21-Nov-14	0%
Investigations Monitoring and Sample Collection		85	85	13-Nov-14	17-Mar-15	
435	Coordinate Site Access	17	17	13-Nov-14	09-Dec-14	0%
454	Sample Analysis	40	40	22-Dec-14	17-Feb-15	0%
455	Data Validation	20	20	18-Feb-15	17-Mar-15	0%
Soil Sampling and Groundwater Sampling		5	5	15-Dec-14	19-Dec-14	
437	Mob Soil/Well Team	1	1	15-Dec-14	15-Dec-14	0%
438	Soil Borings/Soil Sampling/GW Sampling	5	5	15-Dec-14	19-Dec-14	0%
442	Well Repair/Redevelopment	1	1	16-Dec-14	16-Dec-14	0%
443	Demob and Site Restoration	1	1	19-Dec-14	19-Dec-14	0%
IDW Handling and Disposal		3	3	30-Dec-14	02-Jan-15	
451	Mob Disposal Team	1	1	30-Dec-14	30-Dec-14	0%
452	IDW Labeling and Shipment	1	1	31-Dec-14	31-Dec-14	0%
453	Demob IDW Disposal Team	1	1	02-Jan-15	02-Jan-15	0%
Studies/Designs and Documentation		149	149	18-Mar-15	12-Oct-15	
457	Draft Report	35	35	18-Mar-15	05-May-15	0%
458	Government Review	20	20	06-May-15	02-Jun-15	0%
459	Draft Final Report	20	20	03-Jun-15	30-Jun-15	0%
460	On Site Technical Meeting	5	5	01-Jul-15	07-Jul-15	0%
461	Stakeholder Review	30	30	08-Jul-15	18-Aug-15	0%
462	Final Report	20	20	19-Aug-15	15-Sep-15	0%
463	Prepare ERPIMS Submittal	30	30	19-Aug-15	29-Sep-15	0%
465	Meeting Coordination and Prep	10	10	16-Sep-15	29-Sep-15	0%
464	ERPIMS Sumission	5	5	30-Sep-15	06-Oct-15	0%
466	On Site Technical Meeting	3	3	30-Sep-15	02-Oct-15	0%
467	Public Meeting	1	1	05-Oct-15	05-Oct-15	0%
468	Administrative Record Update	5	5	06-Oct-15	12-Oct-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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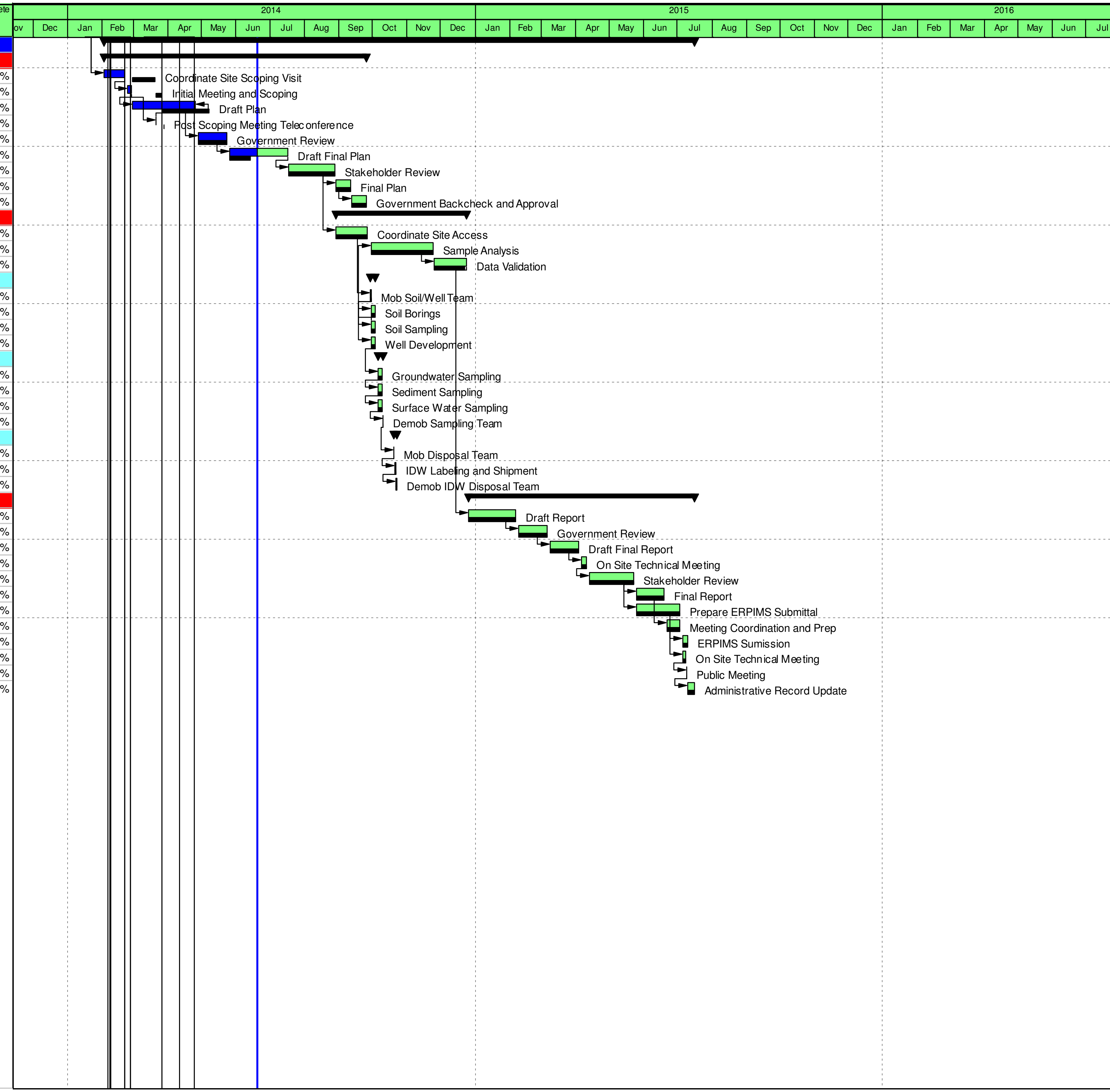
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Plattsburgh AFB, NY		356	276	03-Feb-14 A	16-Jul-15	
Installation Specific Work Plan		150	70	03-Feb-14 A	25-Sep-14	
471	Coordinate Site Scoping Visit	15	0	03-Feb-14 A	21-Feb-14 A	100%
472	Initial Meeting and Scoping	4	0	24-Feb-14 A	27-Feb-14 A	100%
473	Draft Plan	30	0	28-Feb-14 A	25-Apr-14 A	100%
985	Post Scoping Meeting Teleconference	1	0	21-Mar-14 A	21-Mar-14 A	100%
474	Government Review	20	0	28-Apr-14 A	23-May-14 A	100%
475	Draft Final Plan	15	20	26-May-14 A	17-Jul-14	0%
477	Stakeholder Review	30	30	18-Jul-14	28-Aug-14	0%
478	Final Plan	10	10	29-Aug-14	11-Sep-14	0%
479	Government Backcheck and Approval	10	10	12-Sep-14	25-Sep-14	0%
Investigations Monitoring and Sample Collection		80	82	29-Aug-14	24-Dec-14	
481	Coordinate Site Access	21	21	29-Aug-14	26-Sep-14	0%
500	Sample Analysis	40	40	30-Sep-14	24-Nov-14	0%
501	Data Validation	20	20	25-Nov-14	24-Dec-14	0%
Soil Sampling and Wells		5	5	29-Sep-14	03-Oct-14	
483	Mob Soil/Well Team	1	1	29-Sep-14	29-Sep-14	0%
484	Soil Borings	4	4	30-Sep-14	03-Oct-14	0%
485	Soil Sampling	4	4	30-Sep-14	03-Oct-14	0%
487	Well Development	4	4	30-Sep-14	03-Oct-14	0%
GW, Sediment and SW Sampling		5	5	06-Oct-14	10-Oct-14	
492	Groundwater Sampling	4	4	06-Oct-14	09-Oct-14	0%
493	Sediment Sampling	4	4	06-Oct-14	09-Oct-14	0%
494	Surface Water Sampling	4	4	06-Oct-14	09-Oct-14	0%
495	Demob Sampling Team	1	1	10-Oct-14	10-Oct-14	0%
IDW Handling and Disposal		3	3	20-Oct-14	22-Oct-14	
497	Mob Disposal Team	1	1	20-Oct-14	20-Oct-14	0%
498	IDW Labeling and Shipment	1	1	21-Oct-14	21-Oct-14	0%
499	Demob IDW Disposal Team	1	1	22-Oct-14	22-Oct-14	0%
Studies/Designs and Documentation		144	144	26-Dec-14	16-Jul-15	
503	Draft Report	30	30	26-Dec-14	06-Feb-15	0%
504	Government Review	20	20	09-Feb-15	06-Mar-15	0%
505	Draft Final Report	20	20	09-Mar-15	03-Apr-15	0%
506	On Site Technical Meeting	5	5	06-Apr-15	10-Apr-15	0%
507	Stakeholder Review	30	30	13-Apr-15	22-May-15	0%
508	Final Report	20	20	25-May-15	19-Jun-15	0%
509	Prepare ERPIMS Submittal	30	30	25-May-15	03-Jul-15	0%
511	Meeting Coordination and Prep	10	10	22-Jun-15	03-Jul-15	0%
510	ERPIMS Sumission	5	5	06-Jul-15	10-Jul-15	0%
512	On Site Technical Meeting	3	3	06-Jul-15	08-Jul-15	0%
513	Public Meeting	1	1	09-Jul-15	09-Jul-15	0%
514	Administrative Record Update	5	5	10-Jul-15	16-Jul-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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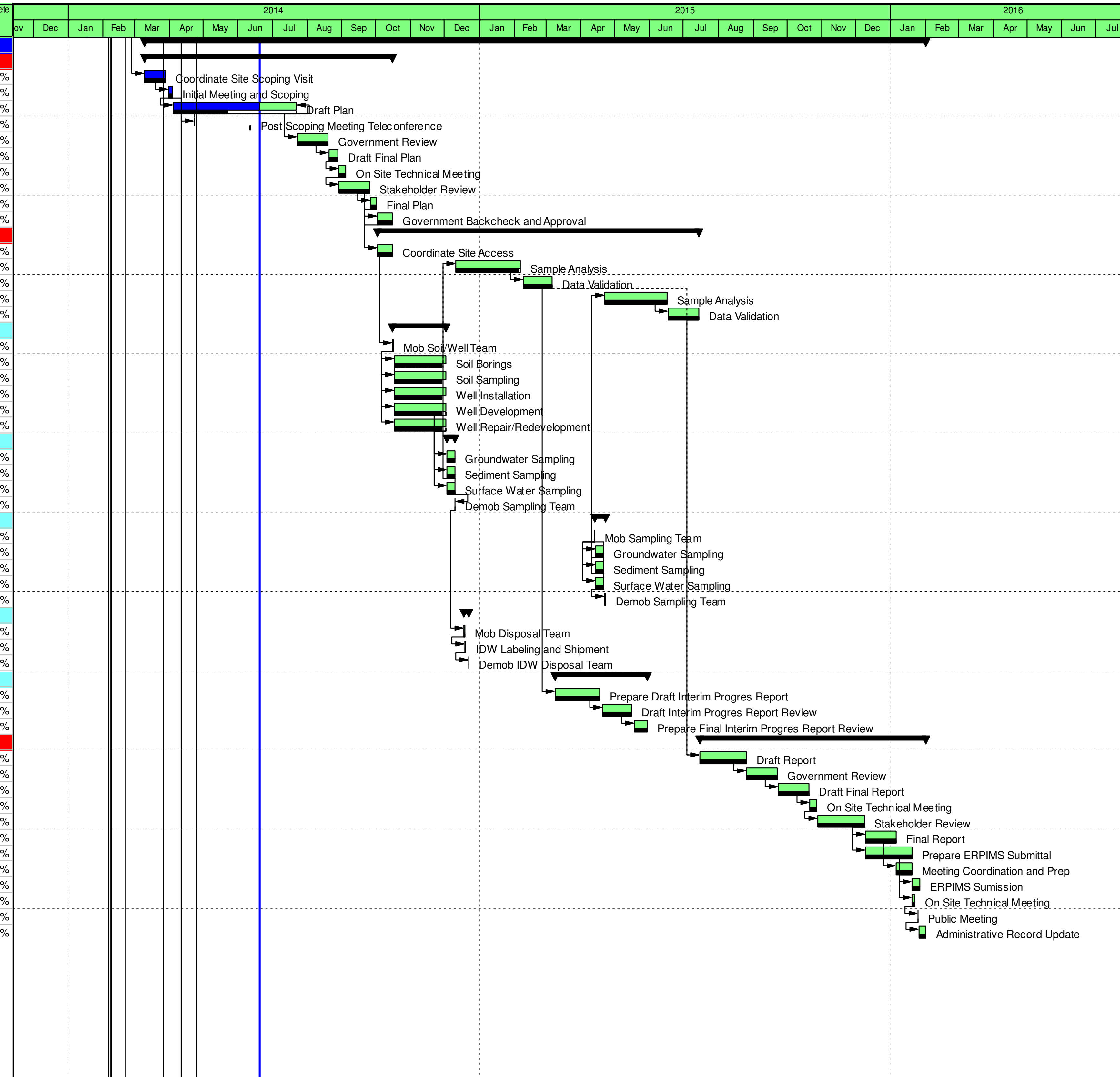
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Chanute AFB, IL		492	418	10-Mar-14 A	01-Feb-16	
Installation Specific Work Plan		158	84	10-Mar-14 A	15-Oct-14	
517	Coordinate Site Scoping Visit	15	0	10-Mar-14 A	28-Mar-14 A	100%
518	Initial Meeting and Scoping	4	0	31-Mar-14 A	03-Apr-14 A	100%
519	Draft Plan	35	23	04-Apr-14 A	22-Jul-14	34.29%
986	Post Scoping Meeting Teleconference	1	0	23-Apr-14 A	23-Apr-14 A	100%
520	Government Review	20	20	23-Jul-14	19-Aug-14	0%
521	Draft Final Plan	7	7	20-Aug-14	28-Aug-14	0%
522	On Site Technical Meeting	5	5	29-Aug-14	04-Sep-14	0%
523	Stakeholder Review	20	20	29-Aug-14	25-Sep-14	0%
524	Final Plan	4	4	26-Sep-14	01-Oct-14	0%
525	Government Backcheck and Approval	10	10	02-Oct-14	15-Oct-14	0%
Investigations Monitoring and Sample Collection		200	200	02-Oct-14	14-Jul-15	
527	Coordinate Site Access	10	10	02-Oct-14	15-Oct-14	0%
546	Sample Analysis	40	40	11-Dec-14	06-Feb-15	0%
547	Data Validation	20	20	09-Feb-15	06-Mar-15	0%
1005	Sample Analysis	40	40	22-Apr-15	16-Jun-15	0%
1015	Data Validation	20	20	17-Jun-15	14-Jul-15	0%
Soil Sampling and Wells		30	32	16-Oct-14	02-Dec-14	
529	Mob Soil/Well Team	1	1	16-Oct-14	16-Oct-14	0%
530	Soil Borings	31	31	17-Oct-14	02-Dec-14	0%
531	Soil Sampling	31	31	17-Oct-14	02-Dec-14	0%
532	Well Installation	31	31	17-Oct-14	02-Dec-14	0%
533	Well Development	31	31	17-Oct-14	02-Dec-14	0%
534	Well Repair/Redevelopment	31	31	17-Oct-14	02-Dec-14	0%
GW, Sediment and SW Sampling		6	6	03-Dec-14	10-Dec-14	
538	Groundwater Sampling	6	6	03-Dec-14	10-Dec-14	0%
539	Sediment Sampling	6	6	03-Dec-14	10-Dec-14	0%
540	Surface Water Sampling	6	6	03-Dec-14	10-Dec-14	0%
541	Demob Sampling Team	1	1	10-Dec-14	10-Dec-14	0%
Spring 2015 GW, Sediment and SW Sampling		8	8	13-Apr-15	22-Apr-15	
1050	Mob Sampling Team	1	1	13-Apr-15*	13-Apr-15	0%
1010	Groundwater Sampling	6	6	14-Apr-15	21-Apr-15	0%
1020	Sediment Sampling	6	6	14-Apr-15	21-Apr-15	0%
1030	Surface Water Sampling	6	6	14-Apr-15	21-Apr-15	0%
1040	Demob Sampling Team	1	1	22-Apr-15	22-Apr-15	0%
IDW Handling and Disposal		3	3	18-Dec-14	22-Dec-14	
543	Mob Disposal Team	1	1	18-Dec-14	18-Dec-14	0%
544	IDW Labeling and Shipment	1	1	19-Dec-14	19-Dec-14	0%
545	Demob IDW Disposal Team	1	1	22-Dec-14	22-Dec-14	0%
Interim Progress Report and Data Transmittal		60	60	09-Mar-15	29-May-15	
1060	Prepare Draft Interim Progres Report	30	30	09-Mar-15	17-Apr-15	0%
1070	Draft Interim Progres Report Review	20	20	20-Apr-15	15-May-15	0%
1080	Prepare Final Interim Progres Report Review	10	10	18-May-15	29-May-15	0%
Studies/Designs and Documentation		144	144	15-Jul-15	01-Feb-16	
549	Draft Report	30	30	15-Jul-15	25-Aug-15	0%
550	Government Review	20	20	26-Aug-15	22-Sep-15	0%
551	Draft Final Report	20	20	23-Sep-15	20-Oct-15	0%
552	On Site Technical Meeting	5	5	21-Oct-15	27-Oct-15	0%
553	Stakeholder Review	30	30	28-Oct-15	08-Dec-15	0%
554	Final Report	20	20	09-Dec-15	05-Jan-16	0%
555	Prepare ERPIMS Submittal	30	30	09-Dec-15	19-Jan-16	0%
557	Meeting Coordination and Prep	10	10	06-Jan-16	19-Jan-16	0%
556	ERPIMS Sumission	5	5	20-Jan-16	26-Jan-16	0%
558	On Site Technical Meeting	3	3	20-Jan-16	22-Jan-16	0%
559	Public Meeting	1	1	25-Jan-16	25-Jan-16	0%
560	Administrative Record Update	5	5	26-Jan-16	01-Feb-16	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

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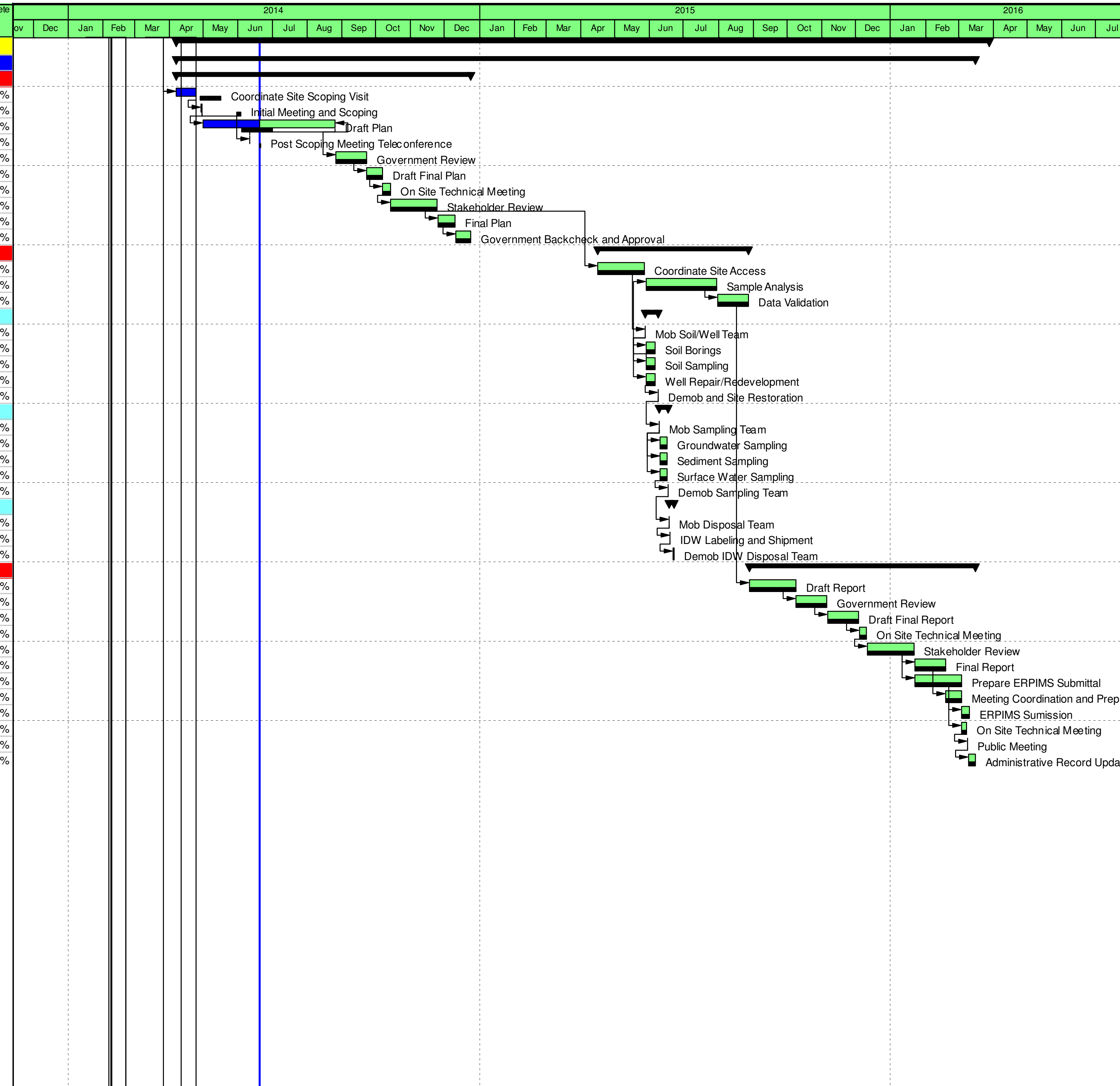
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	Team 2B - Novi Field Team	497	458	07-Apr-14 A	28-Mar-16	
	Grissom AFB, IN	489	450	07-Apr-14 A	16-Mar-16	
	Installation Specific Work Plan	171	132	07-Apr-14 A	24-Dec-14	
564	Coordinate Site Scoping Visit	15	0	07-Apr-14 A	25-Apr-14 A	100%
565	Initial Meeting and Scoping	3	0	29-Apr-14 A	30-Apr-14 A	100%
566	Draft Plan	20	47	01-May-14 A	25-Aug-14	0%
987	Post Scoping Meeting Teleconference	1	0	11-Jun-14 A	11-Jun-14 A	100%
567	Government Review	20	20	26-Aug-14	22-Sep-14	0%
568	Draft Final Plan	10	10	23-Sep-14	06-Oct-14	0%
569	On Site Technical Meeting	5	5	07-Oct-14	13-Oct-14	0%
570	Stakeholder Review	30	30	14-Oct-14	24-Nov-14	0%
571	Final Plan	10	10	25-Nov-14	10-Dec-14	0%
572	Government Backcheck and Approval	10	10	11-Dec-14	24-Dec-14	0%
	Investigations Monitoring and Sample Collection	96	96	16-Apr-15	27-Aug-15	
574	Coordinate Site Access	30	30	16-Apr-15	27-May-15	0%
593	Sample Analysis	45	45	29-May-15	30-Jul-15	0%
594	Data Validation	20	20	31-Jul-15	27-Aug-15	0%
	Soil Sampling and Wells	8	8	28-May-15	08-Jun-15	
576	Mob Soil/Well Team	1	1	28-May-15	28-May-15	0%
577	Soil Borings	6	6	29-May-15	05-Jun-15	0%
578	Soil Sampling	6	6	29-May-15	05-Jun-15	0%
581	Well Repair/Redevelopment	6	6	29-May-15	05-Jun-15	0%
582	Demob and Site Restoration	1	1	08-Jun-15	08-Jun-15	0%
	GW, Sediment and SW Sampling	7	7	09-Jun-15	17-Jun-15	
584	Mob Sampling Team	1	1	09-Jun-15	09-Jun-15	0%
585	Groundwater Sampling	5	5	10-Jun-15	16-Jun-15	0%
586	Sediment Sampling	5	5	10-Jun-15	16-Jun-15	0%
587	Surface Water Sampling	5	5	10-Jun-15	16-Jun-15	0%
588	Demob Sampling Team	1	1	17-Jun-15	17-Jun-15	0%
	IDW Handling and Disposal	3	3	18-Jun-15	22-Jun-15	
590	Mob Disposal Team	1	1	18-Jun-15	18-Jun-15	0%
591	IDW Labeling and Shipment	1	1	19-Jun-15	19-Jun-15	0%
592	Demob IDW Disposal Team	1	1	22-Jun-15	22-Jun-15	0%
	Studies/Designs and Documentation	144	144	28-Aug-15	16-Mar-16	
596	Draft Report	30	30	28-Aug-15	08-Oct-15	0%
597	Government Review	20	20	09-Oct-15	05-Nov-15	0%
598	Draft Final Report	20	20	06-Nov-15	03-Dec-15	0%
599	On Site Technical Meeting	5	5	04-Dec-15	10-Dec-15	0%
600	Stakeholder Review	30	30	11-Dec-15	21-Jan-16	0%
601	Final Report	20	20	22-Jan-16	18-Feb-16	0%
602	Prepare ERPIMS Submittal	30	30	22-Jan-16	03-Mar-16	0%
604	Meeting Coordination and Prep	10	10	19-Feb-16	03-Mar-16	0%
603	ERPIMS Sumission	5	5	04-Mar-16	10-Mar-16	0%
605	On Site Technical Meeting	3	3	04-Mar-16	08-Mar-16	0%
606	Public Meeting	1	1	09-Mar-16	09-Mar-16	0%
607	Administrative Record Update	5	5	10-Mar-16	16-Mar-16	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

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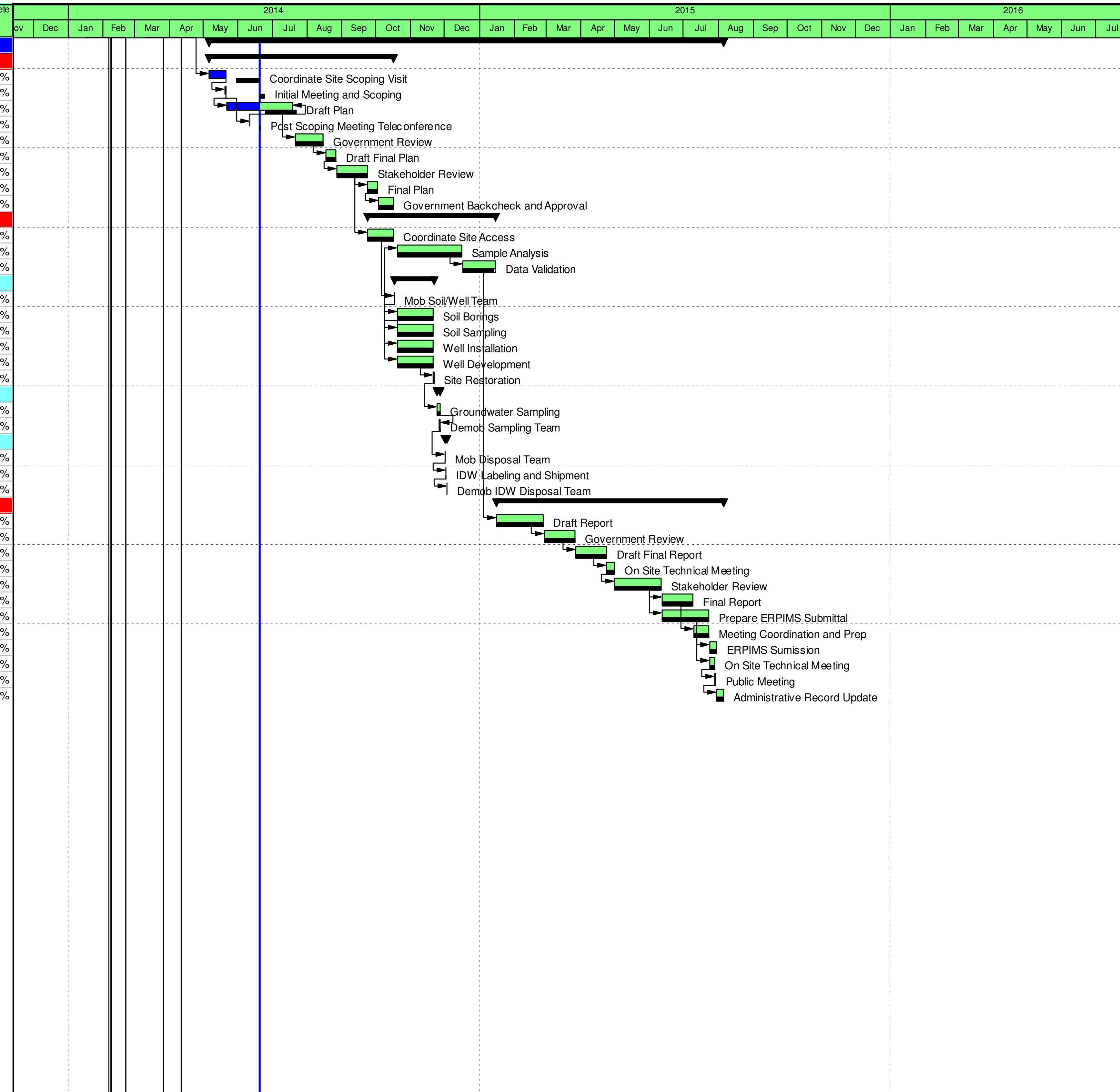
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	K.I. Sawyer AFB, MI	305	290	06-May-14 A	05-Aug-15	
	Installation Specific Work Plan	100	85	06-May-14 A	16-Oct-14	
610	Coordinate Site Scoping Visit	15	0	06-May-14 A	21-May-14 A	100%
611	Initial Meeting and Scoping	3	0	20-May-14 A	21-May-14 A	100%
612	Draft Plan	20	21	22-May-14 A	18-Jul-14	0%
988	Post Scoping Meeting Teleconference	1	0	11-Jun-14 A	11-Jun-14 A	100%
613	Government Review	20	20	21-Jul-14	15-Aug-14	0%
614	Draft Final Plan	7	7	18-Aug-14	26-Aug-14	0%
616	Stakeholder Review	20	20	27-Aug-14	23-Sep-14	0%
617	Final Plan	7	7	24-Sep-14	02-Oct-14	0%
618	Government Backcheck and Approval	10	10	03-Oct-14	16-Oct-14	0%
	Investigations Monitoring and Sample Collection	76	78	24-Sep-14	15-Jan-15	
620	Coordinate Site Access	17	17	24-Sep-14	16-Oct-14	0%
639	Sample Analysis	40	40	20-Oct-14	16-Dec-14	0%
640	Data Validation	20	20	17-Dec-14	15-Jan-15	0%
	Soil Sampling and Wells	26	26	17-Oct-14	21-Nov-14	
622	Mob Soil/Well Team	1	1	17-Oct-14	17-Oct-14	0%
623	Soil Borings	24	24	20-Oct-14	20-Nov-14	0%
624	Soil Sampling	24	24	20-Oct-14	20-Nov-14	0%
625	Well Installation	24	24	20-Oct-14	20-Nov-14	0%
626	Well Development	24	24	20-Oct-14	20-Nov-14	0%
628	Site Restoration	1	1	21-Nov-14	21-Nov-14	0%
	GW Sampling	3	3	24-Nov-14	26-Nov-14	
631	Groundwater Sampling	3	3	24-Nov-14	26-Nov-14	0%
634	Demob Sampling Team	1	1	26-Nov-14	26-Nov-14	0%
	IDW Handling and Disposal	3	3	01-Dec-14	03-Dec-14	
636	Mob Disposal Team	1	1	01-Dec-14	01-Dec-14	0%
637	IDW Labeling and Shipment	1	1	02-Dec-14	02-Dec-14	0%
638	Demob IDW Disposal Team	1	1	03-Dec-14	03-Dec-14	0%
	Studies/Designs and Documentation	144	144	16-Jan-15	05-Aug-15	
642	Draft Report	30	30	16-Jan-15	26-Feb-15	0%
643	Government Review	20	20	27-Feb-15	26-Mar-15	0%
644	Draft Final Report	20	20	27-Mar-15	23-Apr-15	0%
645	On Site Technical Meeting	5	5	24-Apr-15	30-Apr-15	0%
646	Stakeholder Review	30	30	01-May-15	11-Jun-15	0%
647	Final Report	20	20	12-Jun-15	09-Jul-15	0%
648	Prepare ERPIMS Submittal	30	30	12-Jun-15	23-Jul-15	0%
650	Meeting Coordination and Prep	10	10	10-Jul-15	23-Jul-15	0%
649	ERPIMS Sumission	5	5	24-Jul-15	30-Jul-15	0%
651	On Site Technical Meeting	3	3	24-Jul-15	28-Jul-15	0%
652	Public Meeting	1	1	29-Jul-15	29-Jul-15	0%
653	Administrative Record Update	5	5	30-Jul-15	05-Aug-15	0%



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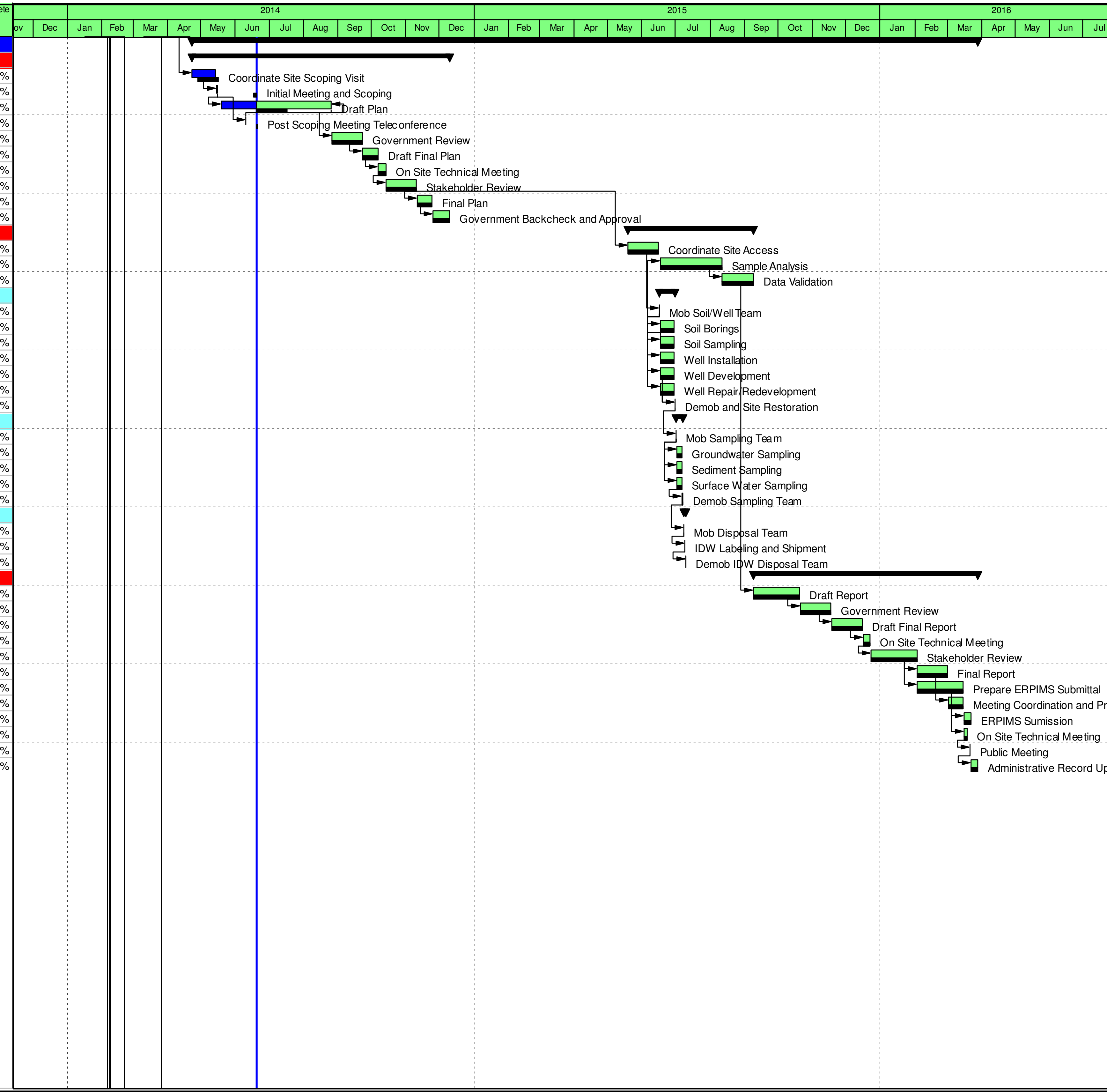
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	General Mitchell ARS, WI	497	458	23-Apr-14 A	28-Mar-16	
	Installation Specific Work Plan	161	122	23-Apr-14 A	10-Dec-14	
656	Coordinate Site Scoping Visit	15	0	23-Apr-14 A	14-May-14 A	100%
657	Initial Meeting and Scoping	3	0	15-May-14 A	16-May-14 A	100%
658	Draft Plan	20	47	19-May-14 A	25-Aug-14	0%
989	Post Scoping Meeting Teleconference	1	0	10-Jun-14 A	10-Jun-14 A	100%
659	Government Review	20	20	26-Aug-14	22-Sep-14	0%
660	Draft Final Plan	10	10	23-Sep-14	06-Oct-14	0%
661	On Site Technical Meeting	5	5	07-Oct-14	13-Oct-14	0%
662	Stakeholder Review	20	20	14-Oct-14	10-Nov-14	0%
663	Final Plan	10	10	11-Nov-14	24-Nov-14	0%
664	Government Backcheck and Approval	10	10	25-Nov-14	10-Dec-14	0%
	Investigations Monitoring and Sample Collection	81	81	19-May-15	08-Sep-15	
666	Coordinate Site Access	20	20	19-May-15	15-Jun-15	0%
685	Sample Analysis	40	40	17-Jun-15	11-Aug-15	0%
686	Data Validation	20	20	12-Aug-15	08-Sep-15	0%
	Soil Sampling and Wells	11	11	16-Jun-15	30-Jun-15	
668	Mob Soil/Well Team	1	1	16-Jun-15	16-Jun-15	0%
669	Soil Borings	9	9	17-Jun-15	29-Jun-15	0%
670	Soil Sampling	9	9	17-Jun-15	29-Jun-15	0%
671	Well Installation	9	9	17-Jun-15	29-Jun-15	0%
672	Well Development	9	9	17-Jun-15	29-Jun-15	0%
673	Well Repair/Redevelopment	9	9	17-Jun-15	29-Jun-15	0%
674	Demob and Site Restoration	1	1	30-Jun-15	30-Jun-15	0%
	GW, Sediment and SW Sampling	5	5	01-Jul-15	07-Jul-15	
676	Mob Sampling Team	1	1	01-Jul-15	01-Jul-15	0%
677	Groundwater Sampling	3	3	02-Jul-15	06-Jul-15	0%
678	Sediment Sampling	3	3	02-Jul-15	06-Jul-15	0%
679	Surface Water Sampling	3	3	02-Jul-15	06-Jul-15	0%
680	Demob Sampling Team	1	1	07-Jul-15	07-Jul-15	0%
	IDW Handling and Disposal	3	3	08-Jul-15	10-Jul-15	
682	Mob Disposal Team	1	1	08-Jul-15	08-Jul-15	0%
683	IDW Labeling and Shipment	1	1	09-Jul-15	09-Jul-15	0%
684	Demob IDW Disposal Team	1	1	10-Jul-15	10-Jul-15	0%
	Studies/Designs and Documentation	144	144	09-Sep-15	28-Mar-16	
688	Draft Report	30	30	09-Sep-15	20-Oct-15	0%
689	Government Review	20	20	21-Oct-15	17-Nov-15	0%
690	Draft Final Report	20	20	18-Nov-15	15-Dec-15	0%
691	On Site Technical Meeting	5	5	16-Dec-15	22-Dec-15	0%
692	Stakeholder Review	30	30	23-Dec-15	02-Feb-16	0%
693	Final Report	20	20	03-Feb-16	01-Mar-16	0%
694	Prepare ERPIMS Submittal	30	30	03-Feb-16	15-Mar-16	0%
696	Meeting Coordination and Prep	10	10	02-Mar-16	15-Mar-16	0%
695	ERPIMS Sumission	5	5	16-Mar-16	22-Mar-16	0%
697	On Site Technical Meeting	3	3	16-Mar-16	18-Mar-16	0%
698	Public Meeting	1	1	21-Mar-16	21-Mar-16	0%
699	Administrative Record Update	5	5	22-Mar-16	28-Mar-16	0%



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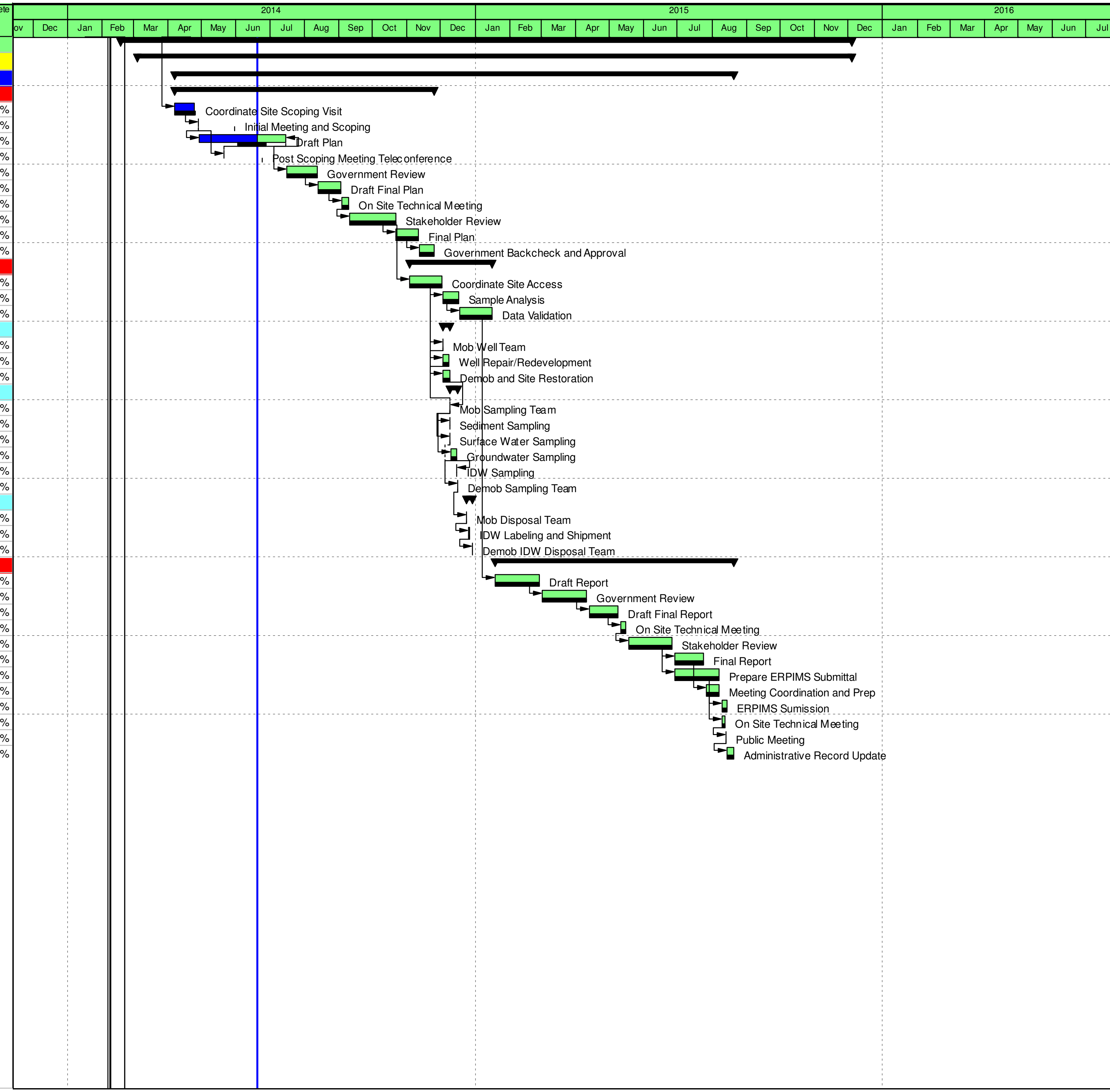
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	Region 3	457	377	18-Feb-14 A	04-Dec-15	
	Team 3A - Frenso Field Team	455	377	04-Mar-14 A	04-Dec-15	
	McClellan AFB, CA	355	301	07-Apr-14 A	20-Aug-15	
	Installation Specific Work Plan	167	113	07-Apr-14 A	25-Nov-14	
704	Coordinate Site Scoping Visit	15	0	07-Apr-14 A	25-Apr-14 A	100%
705	Initial Meeting and Scoping	1	0	28-Apr-14 A	28-Apr-14 A	100%
706	Draft Plan	20	18	29-Apr-14 A	15-Jul-14	75%
990	Post Scoping Meeting Teleconference	1	0	21-May-14 A	21-May-14 A	100%
707	Government Review	20	20	16-Jul-14	12-Aug-14	0%
708	Draft Final Plan	15	15	13-Aug-14	02-Sep-14	0%
709	On Site Technical Meeting	5	5	03-Sep-14	09-Sep-14	0%
710	Stakeholder Review	30	30	10-Sep-14	21-Oct-14	0%
711	Final Plan	15	15	22-Oct-14	11-Nov-14	0%
712	Government Backcheck and Approval	10	10	12-Nov-14	25-Nov-14	0%
	Investigations Monitoring and Sample Collection	51	51	03-Nov-14	16-Jan-15	
714	Coordinate Site Access	20	20	03-Nov-14	02-Dec-14	0%
729	Sample Analysis	11	11	03-Dec-14	17-Dec-14	0%
730	Data Validation	20	20	18-Dec-14	16-Jan-15	0%
	Well Redevelopment	5	5	03-Dec-14	09-Dec-14	
716	Mob Well Team	1	1	03-Dec-14	03-Dec-14	0%
717	Well Repair/Redevelopment	4	4	03-Dec-14	08-Dec-14	0%
718	Demob and Site Restoration	5	5	03-Dec-14	09-Dec-14	0%
	GW, Sediment and SW Sampling	6	6	09-Dec-14	16-Dec-14	
720	Mob Sampling Team	1	1	09-Dec-14	09-Dec-14	0%
722	Sediment Sampling	1	1	09-Dec-14	09-Dec-14	0%
723	Surface Water Sampling	1	1	09-Dec-14	09-Dec-14	0%
721	Groundwater Sampling	4	4	10-Dec-14	15-Dec-14	0%
1090	IDW Sampling	1	1	15-Dec-14	15-Dec-14	0%
724	Demob Sampling Team	1	1	16-Dec-14	16-Dec-14	0%
	IDW Handling and Disposal	3	3	24-Dec-14	29-Dec-14	
726	Mob Disposal Team	1	1	24-Dec-14	24-Dec-14	0%
727	IDW Labeling and Shipment	1	1	26-Dec-14	26-Dec-14	0%
728	Demob IDW Disposal Team	1	1	29-Dec-14	29-Dec-14	0%
	Studies/Designs and Documentation	154	154	19-Jan-15	20-Aug-15	
732	Draft Report	30	30	19-Jan-15	27-Feb-15	0%
733	Government Review	30	30	02-Mar-15	10-Apr-15	0%
734	Draft Final Report	20	20	13-Apr-15	08-May-15	0%
735	On Site Technical Meeting	5	5	11-May-15	15-May-15	0%
736	Stakeholder Review	30	30	18-May-15	26-Jun-15	0%
737	Final Report	20	20	29-Jun-15	24-Jul-15	0%
738	Prepare ERPIMS Submittal	30	30	29-Jun-15	07-Aug-15	0%
740	Meeting Coordination and Prep	10	10	27-Jul-15	07-Aug-15	0%
739	ERPIMS Sumission	5	5	10-Aug-15	14-Aug-15	0%
741	On Site Technical Meeting	3	3	10-Aug-15	12-Aug-15	0%
742	Public Meeting	1	1	13-Aug-15	13-Aug-15	0%
743	Administrative Record Update	5	5	14-Aug-15	20-Aug-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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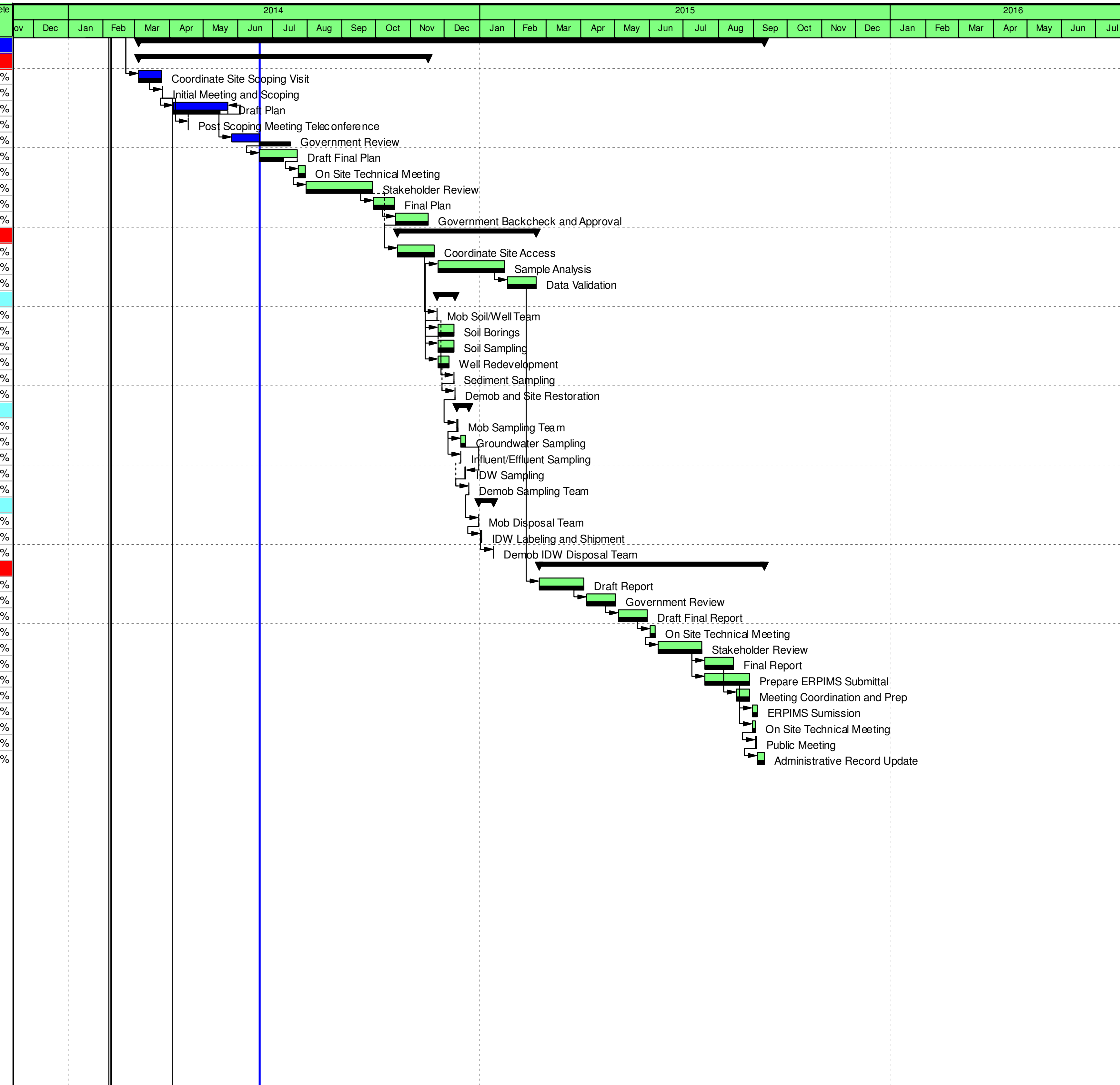
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Mather AFB, CA		394	316	04-Mar-14 A	10-Sep-15	
Installation Specific Work Plan		184	106	04-Mar-14 A	16-Nov-14	
746	Coordinate Site Scoping Visit	15	0	04-Mar-14 A	24-Mar-14 A	100%
747	Initial Meeting and Scoping	1	0	25-Mar-14 A	25-Mar-14 A	100%
748	Draft Plan	30	0	04-Apr-14 A	23-May-14 A	100%
991	Post Scoping Meeting Teleconference	1	0	17-Apr-14 A	17-Apr-14 A	100%
749	Government Review	20	0	26-May-14 A	20-Jun-14 A	100%
750	Draft Final Plan	15	24	20-Jun-14	23-Jul-14	0%
751	On Site Technical Meeting	5	5	24-Jul-14	30-Jul-14	0%
752	Stakeholder Review	60	60	31-Jul-14	28-Sep-14	0%
753	Final Plan	15	15	29-Sep-14	17-Oct-14	0%
754	Government Backcheck and Approval	30	30	18-Oct-14	16-Nov-14	0%
Investigations Monitoring and Sample Collection		86	86	20-Oct-14	20-Feb-15	
756	Coordinate Site Access	25	25	20-Oct-14	21-Nov-14	0%
775	Sample Analysis	40	40	25-Nov-14	23-Jan-15	0%
776	Data Validation	20	20	26-Jan-15	20-Feb-15	0%
Soil Sampling and Wells		11	11	24-Nov-14	10-Dec-14	
758	Mob Soil/Well Team	1	1	24-Nov-14	24-Nov-14	0%
759	Soil Borings	9	9	25-Nov-14	09-Dec-14	0%
760	Soil Sampling	9	9	25-Nov-14	09-Dec-14	0%
763	Well Redevelopment	6	6	25-Nov-14	04-Dec-14	0%
761	Sediment Sampling	1	1	09-Dec-14	09-Dec-14	0%
764	Demob and Site Restoration	1	1	10-Dec-14	10-Dec-14	0%
GW, Sediment and SW Sampling		7	7	12-Dec-14	22-Dec-14	
766	Mob Sampling Team	1	1	12-Dec-14	12-Dec-14	0%
767	Groundwater Sampling	5	5	15-Dec-14	19-Dec-14	0%
769	Influent/Effluent Sampling	1	1	15-Dec-14	15-Dec-14	0%
762	IDW Sampling	1	1	19-Dec-14	19-Dec-14	0%
770	Demob Sampling Team	1	1	22-Dec-14	22-Dec-14	0%
IDW Handling and Disposal		9	9	31-Dec-14	13-Jan-15	
772	Mob Disposal Team	1	1	31-Dec-14	31-Dec-14	0%
773	IDW Labeling and Shipment	1	1	02-Jan-15	02-Jan-15	0%
774	Demob IDW Disposal Team	1	1	13-Jan-15	13-Jan-15	0%
Studies/Designs and Documentation		144	144	23-Feb-15	10-Sep-15	
778	Draft Report	30	30	23-Feb-15	03-Apr-15	0%
779	Government Review	20	20	06-Apr-15	01-May-15	0%
780	Draft Final Report	20	20	04-May-15	29-May-15	0%
781	On Site Technical Meeting	5	5	01-Jun-15	05-Jun-15	0%
782	Stakeholder Review	30	30	08-Jun-15	17-Jul-15	0%
783	Final Report	20	20	20-Jul-15	14-Aug-15	0%
784	Prepare ERPIMS Submittal	30	30	20-Jul-15	28-Aug-15	0%
786	Meeting Coordination and Prep	10	10	17-Aug-15	28-Aug-15	0%
785	ERPIMS Sumission	5	5	31-Aug-15	04-Sep-15	0%
787	On Site Technical Meeting	3	3	31-Aug-15	02-Sep-15	0%
788	Public Meeting	1	1	03-Sep-15	03-Sep-15	0%
789	Administrative Record Update	5	5	04-Sep-15	10-Sep-15	0%



Remaining Level of Effort · Actual Work · Critical Remaining Work · Summary · Primary Bas...
Actual Level of Effort · Remaining Work · Milestone · WBS Summary · Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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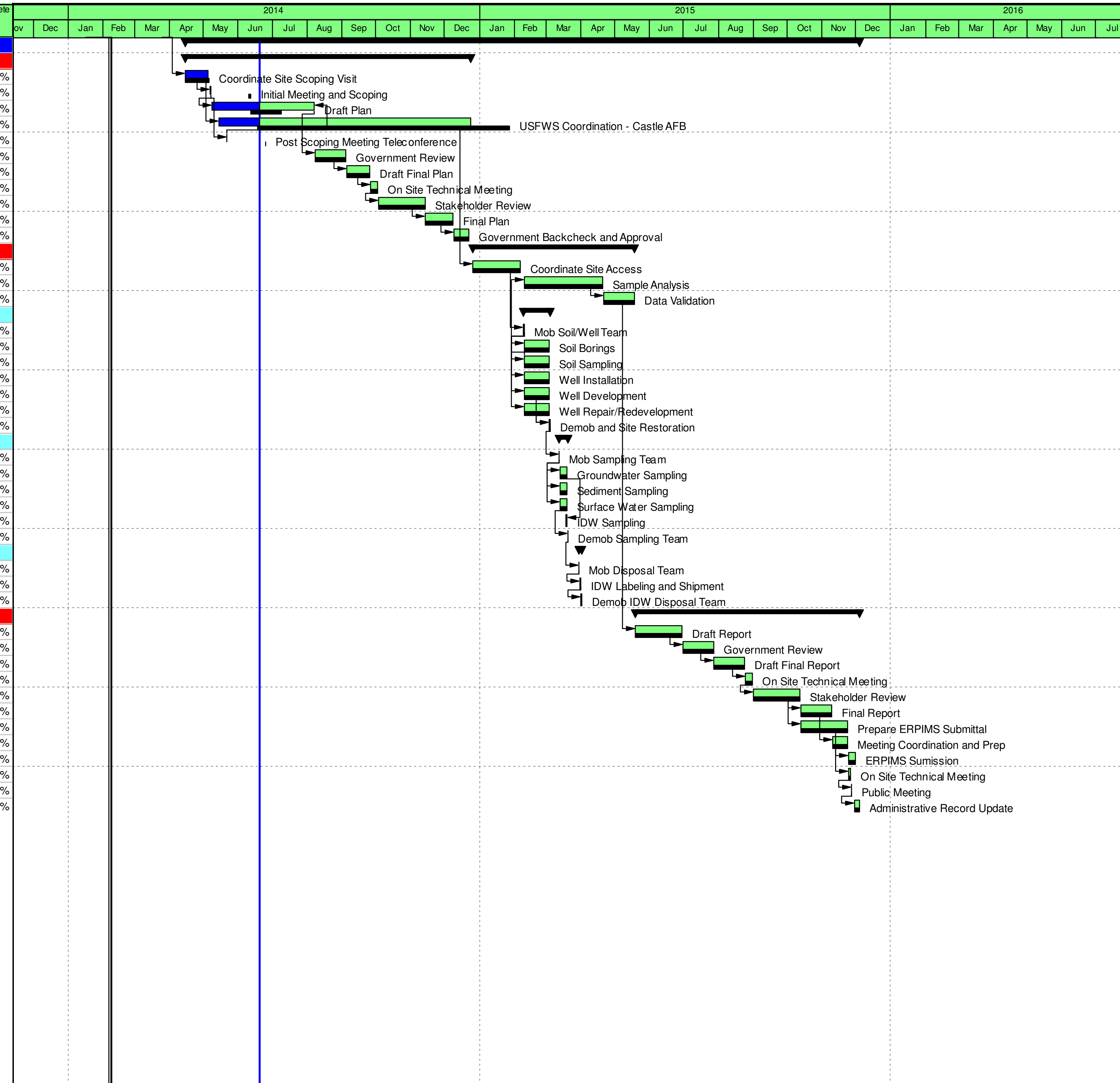
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	Castle AFB, CA	425	377	15-Apr-14 A	04-Dec-15	
	Installation Specific Work Plan	202	132	15-Apr-14 A	24-Dec-14	
792	Coordinate Site Scoping Visit	15	0	15-Apr-14 A	05-May-14 A	100%
793	Initial Meeting and Scoping	2	0	07-May-14 A	08-May-14 A	100%
794	Draft Plan	20	35	09-May-14 A	07-Aug-14	0%
801	USFWS Coordination - Castle AFB	160	132	15-May-14 A	24-Dec-14	17.5%
992	Post Scoping Meeting Teleconference	1	0	22-May-14 A	22-May-14 A	100%
795	Government Review	20	20	08-Aug-14	04-Sep-14	0%
796	Draft Final Plan	15	15	05-Sep-14	25-Sep-14	0%
797	On Site Technical Meeting	5	5	26-Sep-14	02-Oct-14	0%
798	Stakeholder Review	30	30	03-Oct-14	13-Nov-14	0%
799	Final Plan	15	15	14-Nov-14	08-Dec-14	0%
800	Government Backcheck and Approval	10	10	09-Dec-14	22-Dec-14	0%
	Investigations Monitoring and Sample Collection	101	101	26-Dec-14	18-May-15	
803	Coordinate Site Access	30	30	26-Dec-14	06-Feb-15	0%
822	Sample Analysis	50	50	10-Feb-15	20-Apr-15	0%
823	Data Validation	20	20	21-Apr-15	18-May-15	0%
	Soil Sampling and Wells	18	18	09-Feb-15	04-Mar-15	
805	Mob Soil/Well Team	1	1	09-Feb-15	09-Feb-15	0%
806	Soil Borings	16	16	10-Feb-15	03-Mar-15	0%
807	Soil Sampling	16	16	10-Feb-15	03-Mar-15	0%
808	Well Installation	16	16	10-Feb-15	03-Mar-15	0%
809	Well Development	16	16	10-Feb-15	03-Mar-15	0%
810	Well Repair/Redevelopment	16	16	10-Feb-15	03-Mar-15	0%
811	Demob and Site Restoration	1	1	04-Mar-15	04-Mar-15	0%
	GW, Sediment and SW Sampling	7	7	12-Mar-15	20-Mar-15	
813	Mob Sampling Team	1	1	12-Mar-15	12-Mar-15	0%
814	Groundwater Sampling	5	5	13-Mar-15	19-Mar-15	0%
815	Sediment Sampling	5	5	13-Mar-15	19-Mar-15	0%
816	Surface Water Sampling	5	5	13-Mar-15	19-Mar-15	0%
1100	IDW Sampling	1	1	19-Mar-15	19-Mar-15	0%
817	Demob Sampling Team	1	1	20-Mar-15	20-Mar-15	0%
	IDW Handling and Disposal	3	3	30-Mar-15	01-Apr-15	
819	Mob Disposal Team	1	1	30-Mar-15	30-Mar-15	0%
820	IDW Labeling and Shipment	1	1	31-Mar-15	31-Mar-15	0%
821	Demob IDW Disposal Team	1	1	01-Apr-15	01-Apr-15	0%
	Studies/Designs and Documentation	144	144	19-May-15	04-Dec-15	
825	Draft Report	30	30	19-May-15	29-Jun-15	0%
826	Government Review	20	20	30-Jun-15	27-Jul-15	0%
827	Draft Final Report	20	20	28-Jul-15	24-Aug-15	0%
828	On Site Technical Meeting	5	5	25-Aug-15	31-Aug-15	0%
829	Stakeholder Review	30	30	01-Sep-15	12-Oct-15	0%
830	Final Report	20	20	13-Oct-15	09-Nov-15	0%
831	Prepare ERPIMS Submittal	30	30	13-Oct-15	23-Nov-15	0%
833	Meeting Coordination and Prep	10	10	10-Nov-15	23-Nov-15	0%
832	ERPIMS Sumission	5	5	24-Nov-15	30-Nov-15	0%
834	On Site Technical Meeting	3	3	24-Nov-15	26-Nov-15	0%
835	Public Meeting	1	1	27-Nov-15	27-Nov-15	0%
836	Administrative Record Update	5	5	30-Nov-15	04-Dec-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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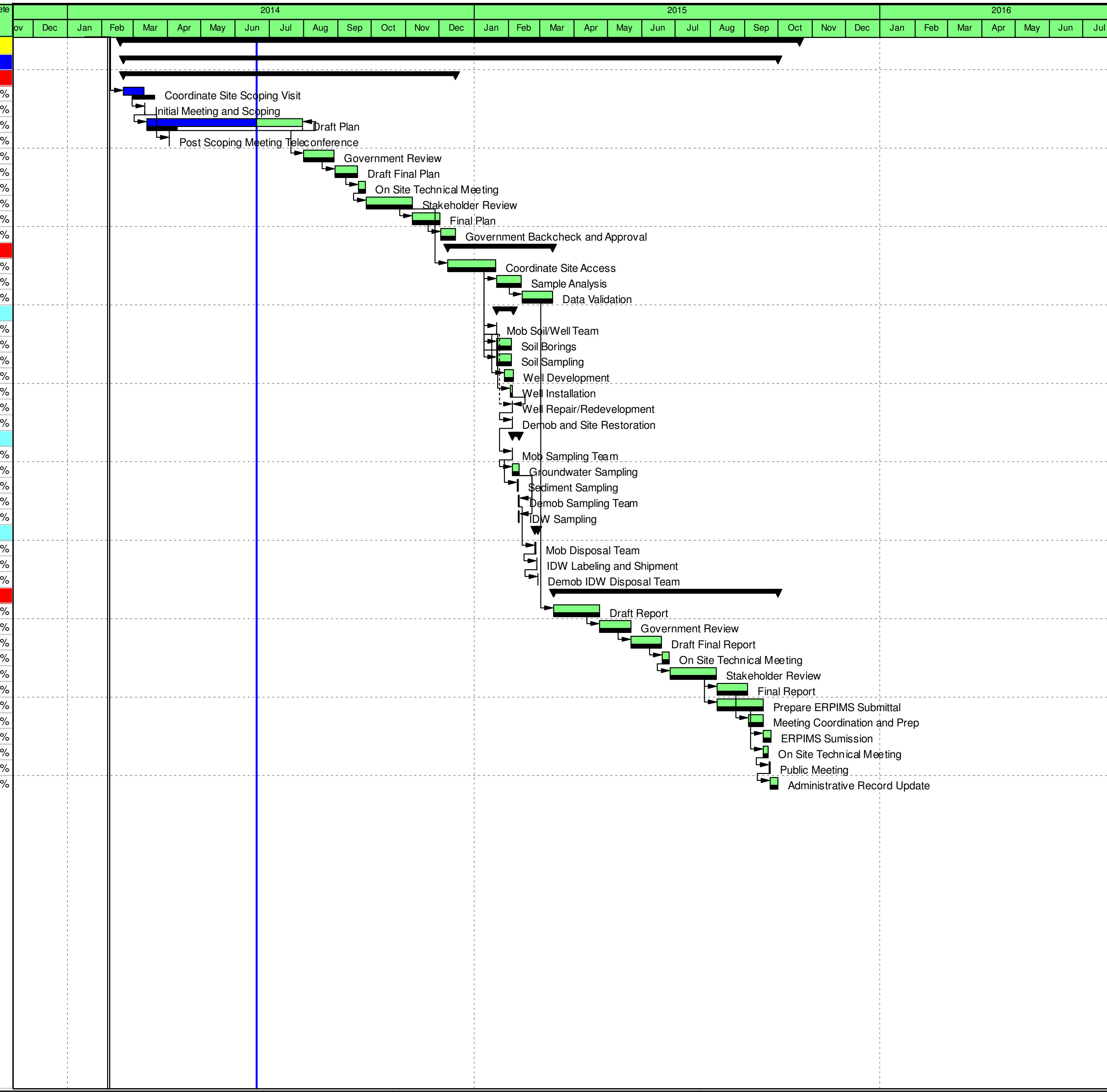
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	Team 3B - Irvine Field Team	424	344	18-Feb-14 A	20-Oct-15	
	George AFB, CA	410	330	20-Feb-14 A	30-Sep-15	
	Installation Specific Work Plan	205	125	20-Feb-14 A	15-Dec-14	
840	Coordinate Site Scoping Visit	15	0	20-Feb-14 A	10-Mar-14 A	100%
841	Initial Meeting and Scoping	1	0	11-Mar-14 A	11-Mar-14 A	100%
842	Draft Plan	20	30	13-Mar-14 A	31-Jul-14	75%
993	Post Scoping Meeting Teleconference	1	0	02-Apr-14 A	02-Apr-14 A	100%
843	Government Review	20	20	01-Aug-14	28-Aug-14	0%
844	Draft Final Plan	15	15	29-Aug-14	18-Sep-14	0%
845	On Site Technical Meeting	5	5	19-Sep-14	25-Sep-14	0%
846	Stakeholder Review	30	30	26-Sep-14	06-Nov-14	0%
847	Final Plan	15	15	07-Nov-14	01-Dec-14	0%
848	Government Backcheck and Approval	10	10	02-Dec-14	15-Dec-14	0%
	Investigations Monitoring and Sample Collection	67	67	08-Dec-14	12-Mar-15	
850	Coordinate Site Access	30	30	08-Dec-14	20-Jan-15	0%
869	Sample Analysis	17	17	21-Jan-15	12-Feb-15	0%
870	Data Validation	20	20	13-Feb-15	12-Mar-15	0%
	Soil Sampling and Wells	12	12	21-Jan-15	05-Feb-15	
852	Mob Soil/Well Team	1	1	21-Jan-15	21-Jan-15	0%
853	Soil Borings	10	10	21-Jan-15	03-Feb-15	0%
854	Soil Sampling	10	10	21-Jan-15	03-Feb-15	0%
856	Well Development	7	7	28-Jan-15	05-Feb-15	0%
855	Well Installation	2	2	03-Feb-15	04-Feb-15	0%
857	Well Repair/Redevelopment	1	1	04-Feb-15	04-Feb-15	0%
858	Demob and Site Restoration	1	1	04-Feb-15	04-Feb-15	0%
	GW, Sediment and SW Sampling	5	5	04-Feb-15	10-Feb-15	
860	Mob Sampling Team	1	1	04-Feb-15	04-Feb-15	0%
861	Groundwater Sampling	5	5	04-Feb-15	10-Feb-15	0%
862	Sediment Sampling	1	1	09-Feb-15	09-Feb-15	0%
864	Demob Sampling Team	1	1	10-Feb-15	10-Feb-15	0%
1110	IDW Sampling	1	1	10-Feb-15	10-Feb-15	0%
	IDW Handling and Disposal	3	3	25-Feb-15	27-Feb-15	
866	Mob Disposal Team	1	1	25-Feb-15	25-Feb-15	0%
867	IDW Labeling and Shipment	1	1	26-Feb-15	26-Feb-15	0%
868	Demob IDW Disposal Team	1	1	27-Feb-15	27-Feb-15	0%
	Studies/Designs and Documentation	144	144	13-Mar-15	30-Sep-15	
872	Draft Report	30	30	13-Mar-15	23-Apr-15	0%
873	Government Review	20	20	24-Apr-15	21-May-15	0%
874	Draft Final Report	20	20	22-May-15	18-Jun-15	0%
875	On Site Technical Meeting	5	5	19-Jun-15	25-Jun-15	0%
876	Stakeholder Review	30	30	26-Jun-15	06-Aug-15	0%
877	Final Report	20	20	07-Aug-15	03-Sep-15	0%
878	Prepare ERPIMS Submittal	30	30	07-Aug-15	17-Sep-15	0%
880	Meeting Coordination and Prep	10	10	04-Sep-15	17-Sep-15	0%
879	ERPIMS Sumission	5	5	18-Sep-15	24-Sep-15	0%
881	On Site Technical Meeting	3	3	18-Sep-15	22-Sep-15	0%
882	Public Meeting	1	1	23-Sep-15	23-Sep-15	0%
883	Administrative Record Update	5	5	24-Sep-15	30-Sep-15	0%



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Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

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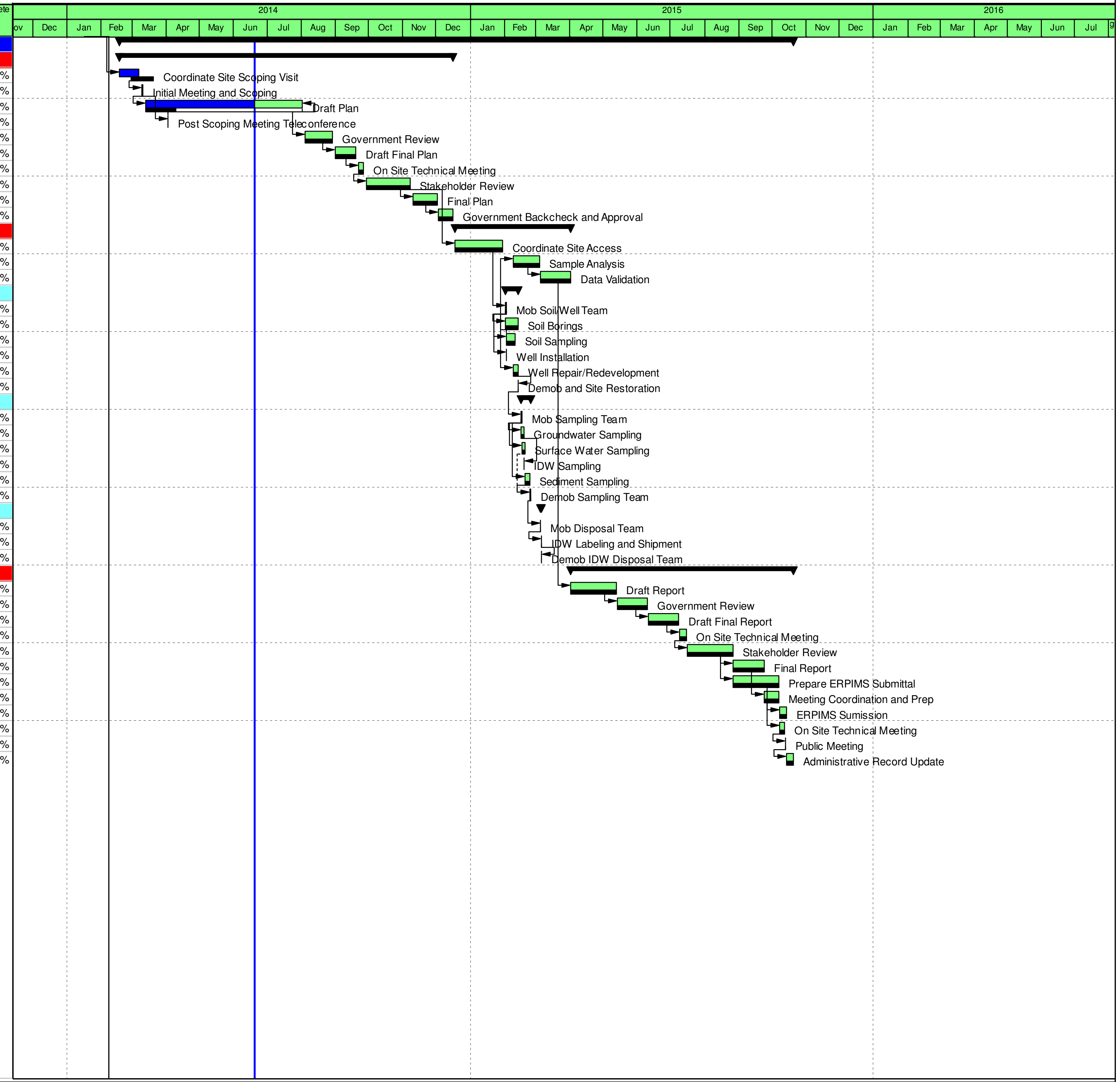
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
	March AFB, CA	424	344	18-Feb-14 A	20-Oct-15	
	Installation Specific Work Plan	206	126	18-Feb-14 A	16-Dec-14	
886	Coordinate Site Scoping Visit	15	0	18-Feb-14 A	07-Mar-14 A	100%
887	Initial Meeting and Scoping	1	0	10-Mar-14 A	10-Mar-14 A	100%
888	Draft Plan	20	31	13-Mar-14 A	01-Aug-14	0%
994	Post Scoping Meeting Teleconference	1	0	02-Apr-14 A	02-Apr-14 A	100%
889	Government Review	20	20	04-Aug-14	29-Aug-14	0%
890	Draft Final Plan	15	15	01-Sep-14	19-Sep-14	0%
891	On Site Technical Meeting	5	5	22-Sep-14	26-Sep-14	0%
892	Stakeholder Review	30	30	29-Sep-14	07-Nov-14	0%
893	Final Plan	15	15	10-Nov-14	02-Dec-14	0%
894	Government Backcheck and Approval	10	10	03-Dec-14	16-Dec-14	0%
	Investigations Monitoring and Sample Collection	73	73	18-Dec-14	01-Apr-15	
896	Coordinate Site Access	30	30	18-Dec-14	30-Jan-15	0%
915	Sample Analysis	18	18	09-Feb-15	04-Mar-15	0%
916	Data Validation	20	20	05-Mar-15	01-Apr-15	0%
	Soil Sampling and Wells	10	10	02-Feb-15	13-Feb-15	
898	Mob Soil/Well Team	1	1	02-Feb-15	02-Feb-15	0%
899	Soil Borings	10	10	02-Feb-15	13-Feb-15	0%
900	Soil Sampling	6	6	03-Feb-15	10-Feb-15	0%
901	Well Installation	0	0	03-Feb-15	03-Feb-15	0%
903	Well Repair/Redevelopment	5	5	09-Feb-15	13-Feb-15	0%
904	Demob and Site Restoration	1	1	13-Feb-15	13-Feb-15	0%
	GW, Sediment and SW Sampling	7	7	16-Feb-15	24-Feb-15	
906	Mob Sampling Team	1	1	16-Feb-15	16-Feb-15	0%
907	Groundwater Sampling	3	3	16-Feb-15	18-Feb-15	0%
909	Surface Water Sampling	3	3	17-Feb-15	19-Feb-15	0%
1120	IDW Sampling	1	1	18-Feb-15	18-Feb-15	0%
908	Sediment Sampling	3	3	19-Feb-15	23-Feb-15	0%
910	Demob Sampling Team	1	1	24-Feb-15	24-Feb-15	0%
	IDW Handling and Disposal	2	2	05-Mar-15	06-Mar-15	
912	Mob Disposal Team	1	1	05-Mar-15	05-Mar-15	0%
913	IDW Labeling and Shipment	1	1	06-Mar-15	06-Mar-15	0%
914	Demob IDW Disposal Team	1	1	06-Mar-15	06-Mar-15	0%
	Studies/Designs and Documentation	144	144	02-Apr-15	20-Oct-15	
918	Draft Report	30	30	02-Apr-15	13-May-15	0%
919	Government Review	20	20	14-May-15	10-Jun-15	0%
920	Draft Final Report	20	20	11-Jun-15	08-Jul-15	0%
921	On Site Technical Meeting	5	5	09-Jul-15	15-Jul-15	0%
922	Stakeholder Review	30	30	16-Jul-15	26-Aug-15	0%
923	Final Report	20	20	27-Aug-15	23-Sep-15	0%
924	Prepare ERPIMS Submittal	30	30	27-Aug-15	07-Oct-15	0%
926	Meeting Coordination and Prep	10	10	24-Sep-15	07-Oct-15	0%
925	ERPIMS Sumission	5	5	08-Oct-15	14-Oct-15	0%
927	On Site Technical Meeting	3	3	08-Oct-15	12-Oct-15	0%
928	Public Meeting	1	1	13-Oct-15	13-Oct-15	0%
929	Administrative Record Update	5	5	14-Oct-15	20-Oct-15	0%



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Project Schedule

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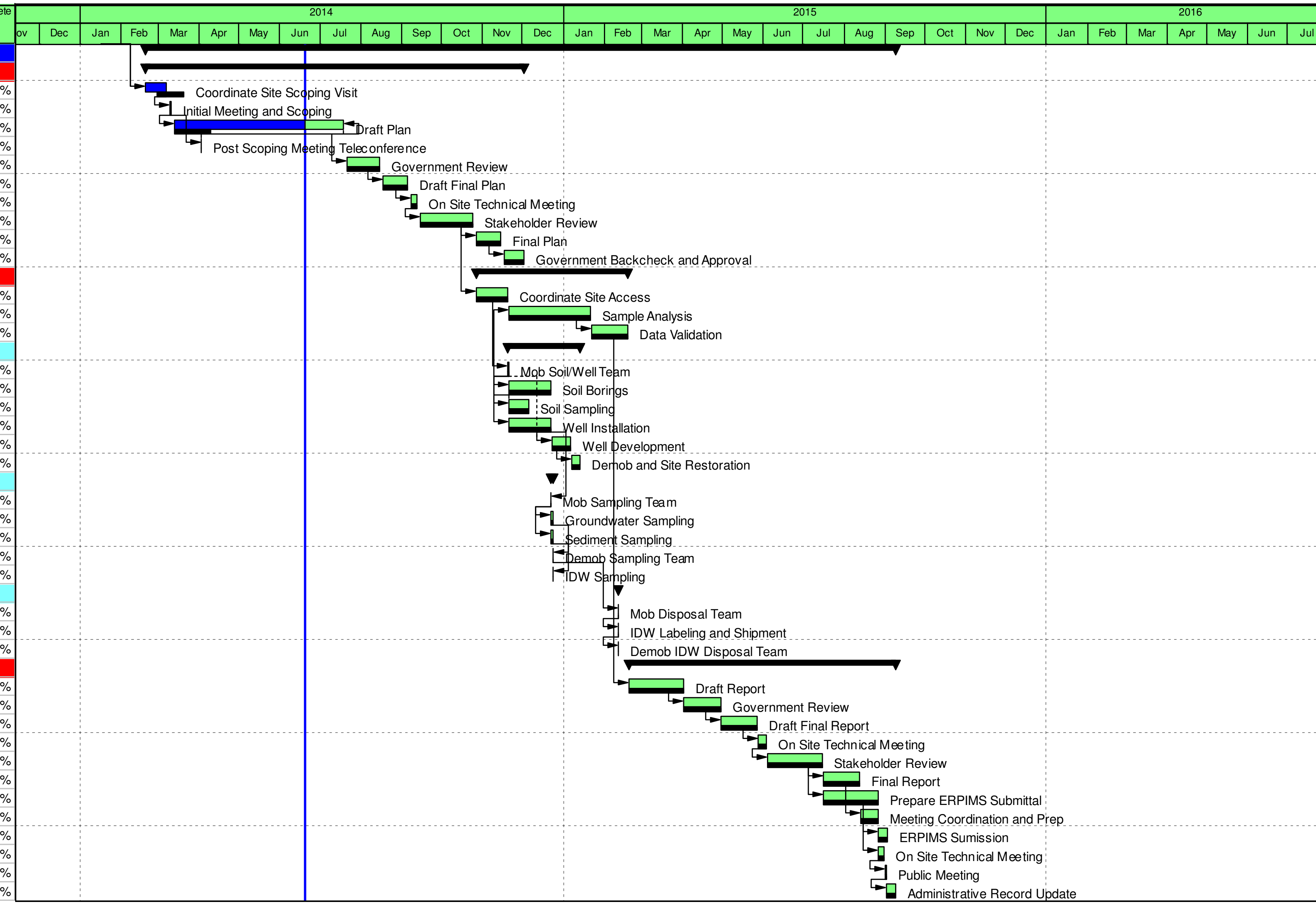
Perfluorinated Compounds (PFCs) Release Determination, Delineation, and Remediation at Multiple BRAC Bases

Contract FA8903-08-8766 Task Order 0177

Activity ID	Activity Name	Original Duration	Rem Duration	Start	Finish	Activity % Complete
Norton AFB, CA		394	314	19-Feb-14 A	08-Sep-15	
Installation Specific Work Plan		196	116	19-Feb-14 A	02-Dec-14	
932	Coordinate Site Scoping Visit	15	0	19-Feb-14 A	07-Mar-14 A	100%
933	Initial Meeting and Scoping	1	0	10-Mar-14 A	10-Mar-14 A	100%
934	Draft Plan	20	21	13-Mar-14 A	18-Jul-14	60%
995	Post Scoping Meeting Teleconference	1	0	02-Apr-14 A	02-Apr-14 A	100%
935	Government Review	20	20	21-Jul-14	15-Aug-14	0%
936	Draft Final Plan	15	15	18-Aug-14	05-Sep-14	0%
937	On Site Technical Meeting	5	5	08-Sep-14	12-Sep-14	0%
938	Stakeholder Review	30	30	15-Sep-14	24-Oct-14	0%
939	Final Plan	15	15	27-Oct-14	14-Nov-14	0%
940	Government Backcheck and Approval	10	10	17-Nov-14	02-Dec-14	0%
Investigations Monitoring and Sample Collection		79	79	27-Oct-14	18-Feb-15	
942	Coordinate Site Access	18	18	27-Oct-14	19-Nov-14	0%
961	Sample Analysis	40	40	21-Nov-14	21-Jan-15	0%
962	Data Validation	20	20	22-Jan-15	18-Feb-15	0%
Soil Sampling and Wells		35	35	20-Nov-14	13-Jan-15	
944	Mob Soil/Well Team	1	1	20-Nov-14	20-Nov-14	0%
945	Soil Borings	20	20	21-Nov-14	22-Dec-14	0%
946	Soil Sampling	9	9	21-Nov-14	05-Dec-14	0%
947	Well Installation	20	20	21-Nov-14	22-Dec-14	0%
948	Well Development	9	9	23-Dec-14	06-Jan-15	0%
950	Demob and Site Restoration	5	5	07-Jan-15	13-Jan-15	0%
GW, Sediment and SW Sampling		3	3	22-Dec-14	24-Dec-14	
952	Mob Sampling Team	1	1	22-Dec-14	22-Dec-14	0%
953	Groundwater Sampling	3	3	22-Dec-14	24-Dec-14	0%
955	Sediment Sampling	3	3	22-Dec-14	24-Dec-14	0%
956	Demob Sampling Team	1	1	24-Dec-14	24-Dec-14	0%
1130	IDW Sampling	1	1	24-Dec-14	24-Dec-14	0%
IDW Handling and Disposal		1	1	11-Feb-15	11-Feb-15	
958	Mob Disposal Team	1	1	11-Feb-15	11-Feb-15	0%
959	IDW Labeling and Shipment	1	1	11-Feb-15	11-Feb-15	0%
960	Demob IDW Disposal Team	1	1	11-Feb-15	11-Feb-15	0%
Studies/Designs and Documentation		144	144	19-Feb-15	08-Sep-15	
964	Draft Report	30	30	19-Feb-15	01-Apr-15	0%
965	Government Review	20	20	02-Apr-15	29-Apr-15	0%
966	Draft Final Report	20	20	30-Apr-15	27-May-15	0%
967	On Site Technical Meeting	5	5	28-May-15	03-Jun-15	0%
968	Stakeholder Review	30	30	04-Jun-15	15-Jul-15	0%
969	Final Report	20	20	16-Jul-15	12-Aug-15	0%
970	Prepare ERPIMS Submittal	30	30	16-Jul-15	26-Aug-15	0%
972	Meeting Coordination and Prep	10	10	13-Aug-15	26-Aug-15	0%
971	ERPIMS Sumission	5	5	27-Aug-15	02-Sep-15	0%
973	On Site Technical Meeting	3	3	27-Aug-15	31-Aug-15	0%
974	Public Meeting	1	1	01-Sep-15	01-Sep-15	0%
975	Administrative Record Update	5	5	02-Sep-15	08-Sep-15	0%



Remaining Level of Effort | Actual Work | Critical Remaining Work | Summary | Primary Bas...
Actual Level of Effort | Remaining Work | Milestone | WBS Summary | Baseline Mi...

Project Schedule

Data Date: 20-Jun-14

Print Date: 14-Jul-14

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APPENDIX C

Standard Operating Procedures

FIELD SAMPLING PROTOCOLS TO AVOID CROSS-CONTAMINATION AT PERFLUORINATED COMPOUNDS (PFCs) SITES
SOP AMEC-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 PFC release sites. Sampling specific SOPs should also be reviewed prior to conducting field sampling activities at PFC sites. The information contained within this SOP is included within sampling specific SOPs as applicable.

2.0 SCOPE

This procedure applies to all AMEC 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 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 these 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 RESPONSIBILITIES

Project Manager

The Project Manager shall provide the Quality Project Plan (QPP) and installation-specific work plan, which shall include the sampling requirements for each site. The Project Manager will report deviations to this procedure to the Quality Control (QC) Manager and the AFCEC Contracting Office Representative (COR).

Field Manager

The Field Manager shall ensure that samples are collected in accordance with the QPP, installation-specific work plans, and applicable SOPs. The Field Manager 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 Project Manager.

Quality Control Manager

The QC Manager will be responsible for conducting field audits during sampling activities. During these audits, the QC Manager will ensure that field crews are adhering to the QPP including sampling techniques, field documentation, 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 Manager.

6.0 PROCEDURES/CONSIDERATIONS

The following are procedures/considerations to be made during field activities at potential PFC release sites. A summary of the prohibited and acceptable items for PFC sites is included in Table 1. A checklist, provided as Attachment 1, shall be used 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.
- **Do not use low-density polyethylene (LDPE) materials** during sampling. High-density polyethylene (HDPE) and silicon materials are acceptable.
- AMEC will use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. AMEC will use ProActive SS Pumps with PVC leads or Geotech SS Geosub pumps for groundwater sample collection at depths greater than 25 feet. These pumps are stainless steel and will minimize introductions of PFCs.
- When using liners to collect soil samples during direct-push technology (DPT) or conventional drilling methodologies, acetate liners are to be used.

- To avoid plastic coating or glue materials, **do not use waterproof field books**. Field reports will be documented on loose paper 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 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 synthetic water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing to be worn on-site should be restricted to natural fibers (preferably cotton) and not synthetic. Field clothing should be laundered avoiding the use of fabric softener. Preferably, field gear should be cotton construction and well laundered (a minimum of 6 times from time of purchase). New cotton 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 consists of a PFC membrane.
- All safety footwear will consist of steel-toed boots made with polyurethane and polyvinyl chloride (PVC).
- **Do not wear Tyvek® clothing** on-site since it contains fluorinated compounds.
- 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 dependant on the type of media to be sampled (e.g., soil, groundwater, etc.). However, all samples should be collected in polypropylene or HDPE bottles fitted with an unlined (no Teflon®), polypropylene HDPE screw cap.
- Container labels will be completed using pen after the caps have been placed back on each bottle.
- Glass containers should also be avoided 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 and wax-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 treated as such; therefore, gloves should be worn when 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, that are utilized at each sample location will require cleaning between uses. Alconox® and Liquinox® soap is acceptable for use since the Material 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 rigs), 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, as 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. A list of acceptable sunscreens and insect repellents are listed 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 site are asked to remain outside of the exclusion zone during sampling activities.

Table 1. Summary of Prohibited and Acceptable Items for PFC Sampling

Prohibited Items	Acceptable Items
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate liners
	Silicon tubing
Waterproof field books	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
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softner	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and 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	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics **Sunscreen and insect repellant** - Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
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

Date: ______________________ Installation Name: ______________________________________

Weather (*temp./precipitation*): _______________________ Site Name: _______________________________

Field Clothing and PPE:

- ☐ No clothing or boots containing Gore-Tex™
- ☐ All safety boots made from polyurethane and PVC
- ☐ No materials containing Tyvek®
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- ☐ Field crew has not applied unauthorized sunscreen or insect repellant

Field Equipment:

- ☐ No Teflon® or LDPE containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-It Notes) on-site
- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☐ All sample containers made of HDPE or polypropylene
- ☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ Wet weather gear made of polyurethane and PVC only

Equipment Decontamination:

- ☐ “PFC-free” water on-site for decontamination of sample equipment. No other water sources to be used.
- ☐ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☐ 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

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 site 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 site.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

____

____

____

Field Manager Name: ________________________________

Field Manager Signature: ________________________________ Time: _____________________

SOIL SAMPLING
SOP AMEC-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 investigation sampling.

2.0 SCOPE

This procedure applies to all AMEC 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.

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.

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.

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

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.

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.

5.0 GENERAL

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 site 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.

6.0 RESPONSIBILITIES

Project Manager

The Project Manager shall provide the project work plan, which shall include the sampling requirements, locations and depths for the project.

Field Manager

The Field Manager shall ensure that soil samples are collected according to this technical procedure. The Field Manager 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 Project Manager or the Field Manager.

7.0 PROCEDURES

7.1 Equipment

Equipment used to collect surface or subsurface soil samples may include, but is not limited to, the following items:

- 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;
- Sample cooler with ice;
- Sample jars and labels;
- Bubble wrap;
- Chain-of-Custody forms;
- Munsell Soil Color charts;
- Grain size charts;
- Hand lens;
- Brass sleeves;
- Brass caps;
- Ziplock freezer bags; and,
- Two stainless steel deionized water spraying devices.
- Non PFC plastic sheeting
- Non PFC tape

7.2 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 each site as needed. Spent decontamination fluids will be containerized properly labeled and appropriately disposed of according to the IDW plans addressed in the project specific work plan.

7.3 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 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 location, 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.

7.4 Subsurface Soil Sampling

7.4.1 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 AMEC-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 drilling 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 soil 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, package, handle, and ship the sample in accordance with the procedures outlined in SOP AMEC-10 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 AMEC-10.
- 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.

7.4.2 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 AMEC-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 PVC 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, package, handle, and ship the sample in accordance with the procedures outlined in SOP AMEC-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 AMEC-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 AMEC-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 perfluorinated compound (PFC) 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 project work plans, as necessary.

2.0 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.

3.0 DEFINITIONS

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-value 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. (Note: Bladder pumps have either low density polyethylene or Teflon liners, and will not be used for PFC sampling).

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. The peristaltic pump is limited to sampling at depths of less than 25 feet. (Note: AMEC will use peristaltic pumps for all well sampling at depths 25 feet or shallower, utilizing silicon and HDPE sample tubing only).

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. (Note: Grundfos pumps have Teflon internals and Teflon coatings on the leads and will not be used to sample for PFCs. For water sampling done at depths below 25 ft bgs, only Proactive SS pumps with PVC leads or Geotech SS Geosub pumps will be used for PFC sampling, as these pumps are stainless steel and will minimize the introduction of PFCs due to sample collection.)

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 causes the ball to settle, creating a seal to trap the water so that it can be brought to the surface. (Note: bailers containing Teflon or LDPE will not be utilized for PFC sampling.)

Dedicated Groundwater Monitoring Equipment – Dedicated groundwater monitoring equipment is used to purge and sample only one well. The equipment is installed and remains in the well for the duration of the monitoring program. Dedicated equipment does not need to be decontaminated between sampling events.

4.0 PROCEDURE

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 project work plans. The project 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;
- Any additional groundwater sampling requirements or procedures beyond those covered in this SOP, as necessary; and,
- At a minimum, the procedures outlined in this SOP for groundwater sampling will be followed.

4.1 RESPONSIBILITIES

Project Manager

The Project Manager 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 Manager

The Field Manager is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Manager 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 Project Manager or Field Manager.

4.2 GROUNDWATER SAMPLING REQUIREMENTS

4.2.1 Equipment Selection and Sampling Considerations

Purging and sampling equipment is constructed from a variety of materials. The most inert material [e.g., silicone and high-density polyethylene (HDPE)], 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 Groundwater 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).

For PFC sampling AMEC will use peristaltic pumps (with silicon and HDPE tubing) for groundwater sample collection at depths shallower than 25 feet. AMEC will use Proactive SS Pumps with PVC leads or Geotech SS Geosub pumps for groundwater collection at depths greater than 25 feet. These pumps are stainless steel and will minimize introductions of PFCs, and have been successfully utilized at other PFC sites.

If non-dedicated sampling 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 last.

4.2.2 Groundwater Purging and Sampling with a Bladder Pump

Bladder pumps have either low density polyethylene or Teflon liners, and will not be used for PFC sampling.

4.2.3 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.
- 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.

$$\pi\left(\frac{d}{2}\right)^2 (h_1 - h_2)\, x\, 7.48 = \text{cased well volume (in gallons)}$$

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.

- 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 well screen. The depth of the tubing intake will be recorded on the field 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 and conduct purging.
- 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).

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 (ºC)	± 0.5 ^{o}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

- If stability is not reached within the removal of three cased well volumes then purging is continued until a maximum of five cased well volumes have been removed. For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow rates. In this case, purging will be considered complete when one well volume (well casing plus filter pack volume) has been purged from the well and the well goes dry.

- The well will 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. If VOC analysis is required, the sample aliquot should be collected during the first sample collection event (i.e., first recharge volume). 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 rotor speed 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 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 AMEC-10.

4.2.4 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.

- If non-dedicated equipment is being used, decontaminate the equipment as described in SOP AMEC-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.
- Obtain a static water level measurement and calculate the cased well volume.

$$\pi \left(\frac{d}{2}\right)^2 (h_1 - h_2) \times 7.48 = \text{cased well volume (in gallons)}$$

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)

- 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 screen 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. 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 cased well volumes then purging is continued until a maximum of five cased well volumes have been removed. For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow rates. In this case, purging will be considered complete when

one well volume (well casing plus filter pack volume) has been purged from the well and the well goes dry.

- The well will 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.
- 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.
- Document the sampling event on the Groundwater Sample Collection Form.
- Appropriately seal, store, handle and ship the samples per SOP AMEC-11.

4.2.5 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. <u>(Note: bailers containing Teflon or LDPE will not be utilized for PFC sampling.)</u>

- 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.

- Decontaminate purging and sampling 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.
- Obtain a static water level measurement and calculate the cased well volume.
- 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 may 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 in the Field Log and brought to the immediate attention of the Field Manager.
- The well will 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.
- Appropriately seal, store, handle, and ship the samples per SOP AMEC-11.

MONITORING WELL INSTALLATION
SOP AMEC-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 (HSA), rotary, sonic or dual-tube percussion for the assessment of PFC compounds in groundwater. The details within this SOP should be used in conjunction with specific project work plans.

2.0 REFERENCES

ASTM International (ASTM), 2010 *Standard Guide for Installation of Direct Push Ground Water monitoring Wells, Method D-6724-04*

ASTM International (ASTM), 2010 *Standard Practice for Design and Installation of Groundwater Monitoring Wells, Method D-5092-04*

ASTM International (ASTM), *Standard Guide for the Use of Hollow Stem Auger Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5784/5784M-13*

ASTM International (ASTM, 2012 *Standard Guide for the Use of Direct Air Rotary Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5782-95*

ASTM International (ASTM), *Standard Guide for the Use of Dual Wall Reverse Circulation Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5781/5781M-13*

ASTM International (ASTM), *Standard Guide for the Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5872/5872M-13*

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.

3.0 DEFINITIONS

Cuttings – Pieces of soil, sediment, or rock cut by a bit in the process of drilling borings.

Borehole – Any hole drilled into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing groundwater wells.

Grout – For the purposes of this SOP, the term "grout" consists of a neat cement grout generally containing one 94 pound bag of Portland cement mixed with clean water and bentonite. The grout is emplaced as a slurry, and once properly set and cured, is capable of restricting movement of water.

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.

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.

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 removes cuttings from the bottom of the borehole.

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 to the surface.

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 up the center of the inner drill pipe.

Sonic Drilling – Sonic drilling is a drilling technique that incorporates the use of high frequency vibrations to facilitate the drilling process. Sonic drills can penetrate very quickly and cope with a wide variety of substrates and formations. For core sampling, sonic drilling can be a highly effective tool allowing for the collection of very large continuous core samples.

Monitoring Well – A well that provides for the collection of representative groundwater samples, (including the detection and collection of representative light and dense non-aqueous phase organic liquids), and the measurement of fluid levels.

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.

Filter Pack – Granular filter material (sand, gravel, etc.) placed in the annular space between the well screen and the borehole to increase the effective diameter of the well and prevent fine-grained material from entering the well.

Well Screen – A commercially available, factory-perforated, wire wound, continuous wrap, or slotted casing segment used in a well to maximize the entry of water from the producing zone and to minimize the entrance of sand.

Tremie – A tubular device or pipe used to place grout, bentonite, or filter pack in the annular space.

4.0 PROCEDURE

This section contains both main responsibilities and procedures for monitoring well installation activities. The procedures described herein are applicable as requirements for monitoring well installations using DPT, HSA, 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 well drilling methods. These factors will be incorporated in project planning activities and the compilation of specific project work plans. The project 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 this SOP.

4.1 RESPONSIBILITIES

Project Manager

The Project Manager is responsible for ensuring that all monitoring well installation activities are conducted and documented in accordance with this and any other appropriate procedures. This will be accomplished through staff training and by quality assurance/quality control (QA/QC) monitoring activities.

Field Manager

The Field Manager is responsible for periodic observation of well installation activities to assure implementation of this SOP. The Field Manager 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 Project Manager or the Field Manager.

4.2 WELL INSTALLATION PROCEDURES

Before mobilization of a rig to the well site, ensure that the monitoring well location has been appropriately cleared of all underground utilities and buried objects, and that drill 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 or other buried objects.

All water used for decontamination, boring completion, and well installation shall be PFC free or from municipal supply.

Decontaminate down-hole equipment and well construction materials before monitoring well installation. Decontaminate the drilling rig and all drilling equipment before monitoring well installation.

Clear the work site of brush and minor obstructions and then mobilize the rig to the monitoring well location. The rig geologist or engineer should then review with the driller the proposed well design and details of the well installation 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 project work plans. Typically, the minimum personal protection will include a hard hat, safety glasses, gloves and steel-toed boots.

Commence drilling and advance the borehole while conducting health and safety monitoring according to the project work plans. Perform readings 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 project work plans. Record other pertinent information (date, site, well or boring number, and location) in the field log and/or on other appropriate form(s) as specified by the project work plans. In addition, note and record observed field conditions, any unusual circumstances, and weather conditions.

During drilling, collect representative cutting and soil samples as required by the project work plans. Compile a boring log or lithologic log from the cuttings and samples (see SOP AMEC-02 Soil Sampling).

At total depth, remove soil cuttings through circulation or rapidly spinning the augers prior to constructing the well (as applicable to site conditions). Review logs and notes with the driller for any zones or depths exhibiting drilling problems that may affect the 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 rotary techniques, or remove the center bit boring 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 heaved to fill the borehole. If heaving has taken place, 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 hole was over-drilled, bentonite pellets, or bentonite chips (as specified in the project work plans) may be added to the bottom of the boring to raise the bottom of the hole to the desired depth. The bentonite should be pumped through a tremie pipe and fill from the bottom of the boring upward. During pumping of bentonite slurry, the tremie pipe should be submerged below the top of the bentonite column in the borehole to prevent free-fall and bridging. If bentonite chips or pellets are used, it should be added gradually to prevent bridging. Bentonite addition will stop when its level has reached approximately one foot below the desired base of the well string (casing, screen, end plug or sump, etc.). The bentonite plug will be hydrated for at least one hour before installation of a filter pack.

Calculate volumes of filter pack, bentonite pellets/slurry, and grout required, based on borehole and well casing dimensions. If required by the project 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 (typically 10 slot screen and 20/40 sieve sands).

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.

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 (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 the following information on the appropriate forms per the project work plans:

- Length of well screen;
- Total depth of well boring;
- Depth from ground surface to top of grout or bentonite plug in bottom of borehole (if present);
- Depth to base of well string; and,
- 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 project 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 (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 project 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.

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 project work plans.

A three-foot thick (unless otherwise specified in the project 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. Granular bentonite must be used if the seal is placed above the water table.

After hydration of the bentonite seal, neat cement grout (mixture consisting of approximately 9 gallons of water and 94 pounds of Portland cement with bentonite to aid seal, 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 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 one to 2 feet of the ground surface. 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.

After the protective casing has set, a drainage hole may be drilled into the protective casing if required by the project 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 number, depth, and date of installation.

A minimum of 24 hours after grouting should elapse before installation of the concrete pad and street boxes or vaults for flush mount completions.

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.

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 project work plans. All investigation-derived waste (IDW) generated at the well site should be appropriately contained and managed per the project work plans.

MONITORING WELL DEVELOPMENT
SOP AMEC-05 (PFCs)

1.0 Purpose

This Standard Operating Procedure (SOP) establishes general guidelines for developing groundwater monitoring wells to support perfluorinated compound (PFC) sampling. Additional site-specific well development procedures and requirements may be provided in the project work plans.

2.0 Definitions

Well Development – The act of removing fine grained sediment and drilling fluids from the filter pack and formation in the immediate vicinity of the well, thus increasing the porosity and permeability of the materials surrounding the intake portion of the well.

3.0 Procedure

3.1 General

The most common methods used to develop monitoring wells consist of surging and bailing, surging and pumping, or combinations of these processes.

The project work plans will identify the specific well development procedure to be followed. 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.

3.2 Responsibilities

Project Manager

The Project Manager 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 Manager

The Field Manager is responsible for periodic inspections and review of field generated documentation associated with well development. If deviations from project requirements occur, the Field Manager 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 by the project work plans.

3.3 Well Development

Decontaminate the rig and development equipment as defined in AMEC SOP-10. For a newly installed monitoring well, allow the grout to cure for a maximum of 24 hours prior to development.

Calibrate all field analytical test equipment (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, tagged with an out of calibration label, and segregated (when possible) from the calibrated equipment area.

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.

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_1 = depth of well from top of casing, ft

h_2 = depth to water from top of casing, ft.

The depth to the bottom of the well should be measured and then compared to the completion form or diagram for the well. If sand or sediment is present inside the well, it should first be removed by bailing. Only a PFC free bailer such as a stainless stell reusable bailer shall be used for well development purposes. 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 (ensure that no Teflon tape or other PFC laden material is included with the surging materials), followed by bailing or pumping. Only PFC free bailers (no Teflon or LDPE materials) will be permitted for bailing operations AMEC will use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. AMEC will use Proactive SS Pumps with PVC leads or Geotech SS Geosub pumps for groundwater sample collection at depths greater than 25 feet. These pumps are stainless steel and will minimize introductions of PFCs. Pumps should not be utilized until sediments are removed from the well, as free sediments can foul and damage the pump systems.

Development 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 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 is typically though not always required in the development of a well, particularly small diameter wells (i.e., 2 inches or less). Document well development direction that would vary from surge block usage in the field log.

While developing the well, periodic water level measurements (at least one every five minutes) will be made to determine drawdown. Water level measurements and pump rates as well as volumes removed should be recorded on the well development record. If a well is pumped to dryness, then development will cease and not resume until the water level in the well recovers to approximately 80 percent of static aquifer conditions.

While developing, water samples are 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 nephelometric turbidity units (NTUs) or less, or the well develops dry.

Parameter	Units	Requirement
pH	Standard Units	± 10 percent
Specific Conductivity	Micromhos/centimeter (umho/cm, or µS/cm)	± 10 percent
Temperature	Degrees Celcius (ºC)	± 0.5 ^{o}C
Oxidation-Reduction Potential (ORP)	Millivolts (mV)	± 10 percent
Dissolved Oxygen	Milligrams/liter (mg/L)	± 10 percent
Turbidity	Nephelometric Turbidity Units (NTUs)	Maximum of 50 NTUs

At minimum three times the amount of water used but not recovered during drilling and well installation activities will be removed during development operations.

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) and 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;
- Location ID;
- 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.

3.4 Well Re-Development

For redevelopment of existing monitoring wells to be used in the analyses for PFC constituents the well will be developed as if it were a new well (as addressed in 3.3 above). Evaluation of current and historical site conditions if know shall be recorded in the field log.

Data including but not limited to the following shall be recorded on redeveloped wells:

- Well construction information
  - Depth
  - Water level
  - Filter pack
  - Screen zone
  - Flow rate if known
  - Etc
- Sampling equipment left in well including types
- Date of last sampling event if known
- Materials with known PFC constituents found at the site or in contact with the water.
- State the well was left in following our sampling – i.e. all dedicated materials returned to well unless otherwise directed by client.

BOREHOLE ABANDONMENT
SOP AMEC-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 DEFINITIONS

Borehole Abandonment – The process whereby boreholes or soil borings are grouted or sealed following completion of drilling, sampling and/or logging.

3.0 PROCEDURE

This section contains responsibilities, procedures and requirements for borehole abandonment. Abandonment procedures to be used at a particular site must incorporate project-specific regulatory requirements. Consequently, the project work plans will identify the following:

- Abandonment objectives,
- Boreholes to be abandoned,
- Specific procedures for borehole abandonment beyond those covered in this SOP; and,
- Applicable site-specific regulatory requirements for borehole abandonment.

3.1 Responsibilities

Project Manager

The Project Manager is responsible for ensuring that all abandonment activities are conducted and documented 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 Manager

The Field Manager is responsible for periodically observing field activities and review of field generated documentation associated with this SOP. The Field Manger 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 Project Manager or Field Manager.

3.2 Abandonment of Boreholes

After drilling, logging and/or sampling, boreholes should be backfilled by the method required by the applicable agency and described in the project 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 two 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 five 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 should be calculated and compared to the grout volume used during grouting to aid in verifying that bridging did not occur.
- When using a tremie 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 project work plans.

SEDIMENT SAMPLING
SOP AMEC-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 for biological analysis, which is very specific to the aquatic environment and type of analysis (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 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.

3.0 DEFINITIONS

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 from the top 6 inches of sediment material. Surficial grab samples (single or composited) are preferred when the source of contamination is recent or 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 will not be collected for this project.

Disturbed Sediment Sample – A sediment sample whose in situ physical structure and fabric has been disturbed as the direct result of sample collection. Disturbed sediment samples can be collected using hand augers, spoons, or scoops as described in Section 4.2.

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.

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.

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 result typically is considered an average concentration of the area or column of sediment sampled.

4.0 PROCEDURE

This section contains both the 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.

The text below describes the general procedures for sediment sampling.

4.1 RESPONSIBILITIES

Project Manager

The Project Manager is responsible for ensuring that all 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.

Field Manager

The Field Manager is responsible for observing sampling activities and periodic review of field generated documentation. The Field Manager 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 Field Manager.

4.2 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 high density polyethylene [HDPE] or acetate – Teflon or low density polyethylene (LDPE) should not be used) 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, both grab and composite samples, may be conducted with a core sampler. The advantage of a core sampler over a grab sampler is that discrete and less disturbed samples can be collected if needed and 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. For deeper submerged sediments (> 2 feet), usually collected from a boat, handle extensions can be added to the top of the hand core sampler. For this project it is anticipated that all sediment samples will be collected from 0 to 6 inches deep.

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. All sample sleeves or core liners shall be comprised of a PFC free material and approved prior to use.

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, or scoops, or the sample containers themselves. If sampling shallow submerged sediment (< 6 inches deep), 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), usually collected from a boat, a Ponar grab sampler or equivalent 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 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 is not successful using a grab sampler, then use of a core sampler may be required.

4.3 SEDIMENT SAMPLE COLLECTION

Pre-Sample Planning

- Review carefully the Health and Safety Plan (HSP) 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 (strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.), sediment accumulation points to flag for sampling (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 sites must be considered before attempting to sample.
- 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) each time.
- 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 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 tauntness 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 prior to the sediment sample (which will suspend the fines), no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column as specified in the site-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 or a motor's propeller. 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 AMEC-10 and procedures outlined in the installation-specific work plan.

4.3.1 GENERAL SAMPLING PROCEDURES

- Review carefully the HSP and/or the Hazard Assessment.
- Don appropriate personal protection equipment (PPE), such as tall rubber boots or waders and personal floatation devices, as specified in the installation-specific work plan, prior to entering the water. 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 (currents, holes, ice, drowning, etc.), hazardous biota (snakes, spiders, stinging nettles, etc.), remoteness, and the hauling of equipment, gear, and sample containers, always sediment sample 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 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 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.
- 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.
- 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
  - Location ID

- 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 in the field log. Any encountered problems (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 AMEC-11, or the installation-specific work plan.

SURFACE WATER SAMPLING
SOP AMEC-08 (PFCs)

1.0 PURPOSE

The purpose of this technical procedure is to describe the methodology for collecting surface water samples for PFC laboratory analyses and the associated water quality measurements.

2.0 SCOPE

This procedure applies to all AMEC personnel and subcontractors with the responsibility for determining water quality 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 GENERAL

This section contains both the responsibilities and procedures involved with surface water sampling. Surface water samples may be collected either as composite or discrete samples, as described. The selection of sampling locations will be detailed in the installation-specific work plan. Actual sampling locations will be confirmed in the field prior to initiation of the sampling program. Samplers should anticipate accommodating on-site adjustment. When surface water and sediment samples are collected from the same location, water samples shall be collected first.

6.0 RESPONSIBILITIES

Project Manager

The Project Manager is responsible for ensuring that all sample collection activities are conducted in accordance with this standard operating procedure (SOP) and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QC/QC).

Field Manager

The Field Manager is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Manager 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 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 Project Manager or the Field Manager.

7.0 PROCEDURE

7.1 Equipment Selection

For most sites, a decontaminated bottle sampler attached to a pole (e.g., polyvinyl chloride [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, Kemmerer). However, for most routine site investigations of shallow lakes, ponds, and streams, this equipment is not necessary.

The following equipment will typically be used during surface water sampling:

- Water Quality Meter;
- Laboratory-provided sample containers;
- Self-adhesive sample bottle labels (Ensure PFC free);
- High-density polyethylene (HDPE) or stainless-steel, 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 (PFC free);
- Cooler with ice (No chemical (aka "blue") ice); and,
- GPS receiver.

7.2 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 current information is not available, conduct a reconnaissance of all surface water sample locations to determine accessibility to the water body, depth of water, dangerous conditions (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 sites 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 (which will suspend the fines), no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column. If samples are collected in a stratified water column, the samples 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.

7.2.1 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 (ASTM, 2007).

Stagnated areas or pools in a stream or creek could contain different contaminant concentrations 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.

7.2.2 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 (ASTM, 2007).

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.

7.3 Sampling Procedures

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. PFC free bailers (no Teflon or LDPE) may be used if direct access to the sampling point can be reached. Sample transfer containers must be disposable or decontaminated (AMEC SOP-10) prior to each use. Discrete depth sampling devices may be used when the installation-specific work plan directs that specific depth intervals be sampled.

7.3.1 Equipment Decontamination

Before sampling begins, sampling devices (e.g., metal 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 AMEC SOP-10.

7.3.2 General Surface Water 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 global positioning system (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.
- Don a clean pair of nitrile or equivalent PFC free 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 7.3.3.
- Identify, handle, and document the samples in accordance with SOP AMEC-11.
- Document the sampling event on the sample collection form.

Note: Collection of surface water samples in deep-water areas may require the use of a boat. The Health and Safety Manager or Site Coordinator shall be consulted for additional health and safety requirements.

7.3.3 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, 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.

8.0 RECORDS

Field notes shall be kept following the format specified in the site work plan and project QPPP. 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 site conditions (e.g., floating oil or debris, gassing);
- Location of any discharge pipes, sewers, or tributaries;
- Instrument calibration;
- Required site maps (If a staff gauge is measured and not co-located with surface water location it must be included in the site 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 AMEC-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 site specific information or procedures and applicable site and system specific requirements will be provided in the installation specific project work plan addendums, as necessary.

2.0 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.

3.0 DEFINITIONS

Effluent – Treated groundwater exiting a groundwater treatment system.

Influent - Un-treated groundwater entering into a groundwater treatment system.

4.0 PROCEDURE

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.

4.1 RESPONSIBILITIES

Project Manager

The Project Manager 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 Manager

The Field Manager is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Manager 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 Project Manager or Field Manager.

4.2 GROUNDWATER TREATMENT SYSTEM SAMPLING REQUIREMENTS

4.2.1 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.

4.2.2 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

Parameter	Units
pH	Standard Units
Specific Conductivity	Micromhos/centimeter (umho/cm, or µS/cm)
Temperature	Degrees Celcius (ºC)
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 AMEC-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.

DRILLING, DEVELOPMENT, AND HEAVY EQUIPMENT DECONTAMINATION
SOP AMEC-10 (PFCs)

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines for use by field personnel in the decontamination of drilling, development, and heavy equipment when conducting PFC environmental assessments. The details within this SOP are applicable as general requirements for drilling and heavy equipment decontamination, and should also be used in conjunction with project work plans.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

U.S. Environmental Protection Agency (EPA), 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

U.S. Environmental Protection Agency (EPA), 1991, *Management of Investigation Derived Wastes During Site Inspections*, EPA 540/G-191/009, May.

3.0 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” that does not contain PFC components. Decon 90 or other detergents containing PFCs and will not be utilized for decontamination.

Potable Water – Water dispensed from a municipal water system or well used and approved for drinking.

4.0 PROCEDURE

4.1 Responsibilities

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the project work plans should be reviewed before implementing drilling, development, and heavy equipment decontamination at the project site.

The Project Manager has the responsibility for ensuring that decontamination of drilling and heavy equipment is properly performed through staff training and by maintaining quality assurance/quality control (QA/QC).

The Field Manager has the responsibility for periodic review of procedures and documentation associated with the decontamination of drilling and heavy equipment. If perceived variances occur, the Field Manager is also responsible for issuing notices of nonconformances and requesting corrective actions. Additionally, the Field Manager will perform inspections and monitoring of the decontamination activities.

Project staff assigned to drilling, development, trenching, or construction activities are responsible for ensuring that subcontractors or equipment operators properly decontaminate drilling, development, and heavy equipment associated with those tasks. Project staff are also responsible for documenting the decontamination activities in a field log and/or appropriate form(s) as specified in the project work plans.

4.2 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 project work plans will provide specific 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 project work plans prior to implementation of related decontamination activities.

4.3 Decontamination Facility

A decontamination facility will be set up in an area exclusively for decontamination of drilling, well development, and/or heavy equipment. Decontamination of drilling, development, and heavy 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 approved PFC free high density 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 project work plans.

4.4 Decontamination of Downhole Equipment

Downhole drilling 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 site and between borings or wells at each site or as required in the project work plans. The standard procedure will be performed as described below. Decontamination will be performed in accordance with this SOP and the project work plans.

- Appropriate personal protective equipment (as specified in the project work plans) must be worn by all personnel involved with the 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 that will be used to collect the samples or will come into contact with the sampled media (such as the non disposable stainless bailer used for well development) will then be "final" rinsed with lab provided "PFC-free" water.
- Decontaminated downhole equipment (such as drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean PFC free high density polyethylene (HDPE) 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 PFC free, approved plastic sheeting to minimize airborne contamination.
- Decontamination activities will be documented by the Field Manager, lead geologist, or lead engineer in the field log and/or appropriate form(s), as specified in the project work plans.

4.5 Decontamination of Heavy Equipment

Heavy equipment (e.g., drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling sites or inside the contaminant reduction area prior to entering and leaving an exclusion zone. Decontamination will be performed in accordance with the project 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.

- Heavy equipment will then be moved to the decontamination pad and sprayed with potable water using a high pressure washer.
- Those portions of the heavy equipment that will potentially contact the sample will be rinsed in a final rinse with lab provided “PFC-free” water.
- During the decontamination effort, fluid systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the site, thereby contributing to the volume of waste or contamination. Decontamination of heavy equipment should be performed before moving equipment between sites or before leaving the site.
- Decontamination activities will be documented in the field log and/or appropriate form(s), as specified in the project work plans.
- Between boreholes at the same site, 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 AMEC-11 (PFCs)

1.0 PURPOSE

The purpose of this technical procedure is to delineate protocols for sample handling and custody.

2.0 SCOPE

This procedure applies to all AMEC 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

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.

Chain-of-Custody Record – legal documentation of custody of sample materials and instructions for analytical laboratory.

5.0 GENERAL

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 environment. 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.

6.0 RESPONSIBILITIES

6.1 Project Manager

The Project Manager is responsible for overall compliance with this technical procedure.

6.2 Field Manager

The Field Manager 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).

6.3 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.)

6.4 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.

7.0 PROCEDURE

7.1 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 site 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.

7.2 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;
- 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.

7.3 Chain-of-Custody Record

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, chain of custody forms will be filled out for each sample/analysis at each sampling location. 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 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 or sample custodian 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.

7.4 Overnight Sample Storage

In some cases, samples that cannot be shipped immediately to a laboratory must be temporarily stored in an AMEC controlled sample refrigerator until arrangements can be made for delivery. The sample custodian 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 custodian at a time. A temperature blank must accompany samples overnight.

Samples temporarily stored in the refrigerator must be received by the custodian 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).

8.0 RECORDS

Distribution of the chain of custody record:

- Original sealed in a plastic bag and taped inside the top of the shipping container; and,
- Copies to the Project Manager.

PROTOCOL TO PROVIDE WATER FREE OF PERFLUORINATED COMPOUNDS FOR COLLECTION OF FIELD BLANKS AND EQUIPMENT BLANKS
SOP AMEC-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 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	-

Analytes	Synonym	LOD (ng/L)	LOQ (ng/L)	Action Limits (ng/L)
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 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, 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 for equipment decontamination and blanks, the laboratory must analyze an aliquot of each manufacturer's batch before the water is shipped to AMEC. 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. 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. The laboratory must provide a certificate of analysis with results for the water batch to the AMEC'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

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 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 Chemist will maintain records and will chart results of the source water, equipment blank, and field blank analytical data. AMEC 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 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's overall quality control assessment of ambient sources of PFC contamination relative to sample concentrations.

APPENDIX D

Field Forms

FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE			
	NO.			
	SHEET		OF	

Project Name: PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177	**Project No.** 775290177.

Installation/Site:

Description of daily activities and events:

List Samples Collected:

Visitors on Site:	**Deviation from plans:**
Weather conditions:	**Important telephone calls / photos taken:**

Personnel on Site:

Name/Signature:	**Date:**
QA/QC'd by:	**Date:**

Attachment 1 to SOP AMEC-01
AMEC Environment & Infrastructure, Inc.
Daily PFC Protocol Checklist

Date: _____________________ Installation Name: _____________________________________

Weather (*temp./precipitation*): ______________________ Site Name: ______________________________

Field Clothing and PPE:

- ☐ No clothing or boots containing Gore-Tex™
- ☐ All safety boots made from polyurethane and PVC
- ☐ No materials containing Tyvek®
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- ☐ Field crew has not applied unauthorized sunscreen or insect repellant

Field Equipment:

- ☐ No Teflon® or LDPE containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-It Notes) on-site
- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☐ All sample containers made of HDPE or polypropylene
- ☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ Wet weather gear made of polyurethane and PVC only

Equipment Decontamination:

- ☐ "PFC-free" water on-site for decontamination of sample equipment. No other water sources to be used.
- ☐ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☐ 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

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 site 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 site.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

____

____

____

Field Manager Name: ________________________________

Field Manager Signature: ________________________________ Time: _____________________

Calibration Form

PFCs Release Determinationat Multiple BRAC Bases
Contract FA8903-08-8766 Task Order 0177

Project Number: 775290177.

Instrument:

Installation/Site:

		Before Calibration							After Calibration							
Date	Time (24hr)	pH (SU)	Conductivity (mS/m)	Turbidity (NTU)	Temp (C)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	Temp (C)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Initials of Person Calibrating
QAQC'd by:									Date:							

DRILLING LOG

amec			LOCATION ID	INSTALLATION/SITE	
			DRILL SUBCONTRACTOR	SHEET of	SHEETS
PROJECT / PROJECT NUMBER PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177 775290177.			DATE STARTED	DATE COMPLETED	
NAME OF DRILLER(S)			SURFACE ELEVATION		
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT			SURFACE ELEVATION		
			TOTAL DEPTH OF BOREHOLE	DEPTH OF GROUNDWATER ENCOUNTERED	
			OVERBURDEN THICKNESS	DEPTH DRILLED INTO ROCK	
DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED			OTHER WATER LEVEL MEASUREMENTS (SPECIFY)		
DISPOSITION OF BORE HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)		
LOCATION SKETCH/COMMENTS				SCALE	

Name/Signature:	Date:
QAQC'd by:	Date:

DRILLING LOG (Page 2)

INSTALLATION/SITE	LOCATION ID

PROJECT / PROJECT NUMBER PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766
Task Order 0177 / 775290177.

SHEET of SHEETS

ELEV (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	HNU SCREENING RESULTS (PPM) (d)	PUSH / SAMPLE INTERVAL (e)	ANALYTICAL SAMPLE NO (f)	USCS (g)	REMARKS (h)

NAME/SIGNATURE: DATE:

QAQC'd by: DATE:

amec

WELL CONSTRUCTION FORM

Project: PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177

Installation/Site: ________

Location ID: ________

Well ID: ________

Drilling Subcontractor: ________

Installation Date: ________

Drilling Personnel: ________

Project Number: 775290177.

AMEC Field Representative(s): ________

Protective Cover Elevation (ft): ________

Top of Casing Elevation (ft): ________

Top of Casing Stickup (ft): ________

Land Surface Elevation (ft): ________

Approximate Diameter of Borehole (in): ________

Well Casing Diameter (in): ________

Depth to Water (ft): ________
- During Drilling: ________
  - Date: ________
- Post Development: ________
  - Date: ________

Filter Pack Material:
- Manufacturer: ________
- Product Name: ________
- Size: ________
- Volume Added (ft^3): ________
- Installation Type: Gravity Tremie
- Surging time:

Top of Bentonite Seal (ft):

Bottom of Bentonite Seal (ft):

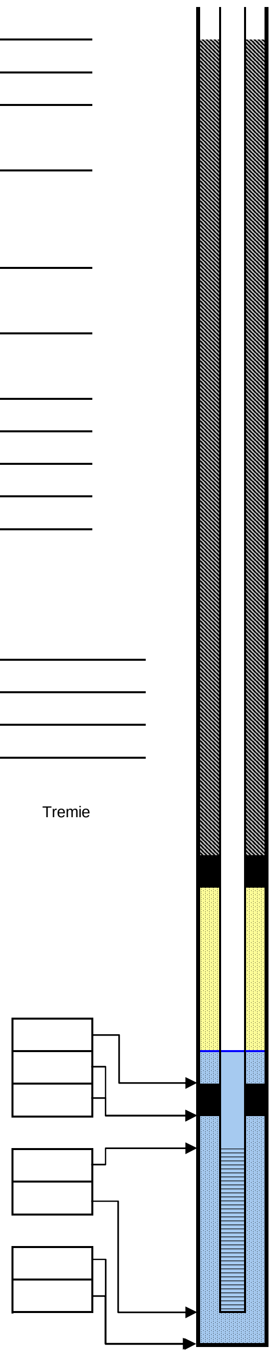
Top of Filter Pack (ft):

Top of Screen Interval (ft):

Bottom of Screened Interval (ft):

Bottom of Filter Pack (ft):

Bottom of Borehole (ft):



Protective Casing:
- Type: ________
- Dimensions (in): ________
- Length (ft): ________
- Guard Post: ________

Surface Pad:
- Dimensions: ________
- Type: ________

Annular Space Seal:
- Type: ________
- Installation: Gravity Tremie Pumped

Bentonite Seal:
- Manufacturer: ________
- Type: Chips Slurry
- Installation: 6-in lifts One Section
  - Gravity Tremie Pumped
- Hydration time (hrs): ________

Well Casing (riser):
- Manufacturer: ________
- Type/Material: ________
- Diameter (in): ________

Well Screen:
- Manufacturer: ________
- Type/Material: ________
- Slot Size (in): ________
- Slot Type: Continous Factory slot

Sump/End Cap: ________

Backfill Material: ________

Depths and heights are referenced to ground surface unless specified TOC.

All elevations are referenced to MSL (NAVD 88).

QAQC'd by:	Date:

WELL DEVELOPMENT LOG

Project Name: PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177
AMEC Proj No: 775290177.
Installation/Site:
Date:
Sample Technician:
Location ID (Well ID):

Measurements

Well Total Depth: ____________ ft below TOC
Initial Water Level: ________________ ft below TOC
Final Water Level: ________________ ft below TOC

Calculated Well Volume: ____________ Gallons
Well Diameter: ________________ inches

Calculations: 1" diameter = 0.041 gal/ft 2" diameter = 0.163 gal/ft 4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): ______________________________ Flow rate (incl. units): __________________________________

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (^{o}C)	Cond. (mS/Cm)	pH	Salinity (%)	DO (mg/l)	ORP	Total Gal Pumped	Comments
Results At End Of Purging:										

COMMENTS:

QAQC'd by:	Date:

GROUNDWATER SAMPLE COLLECTION LOG

Project Name: PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177

AMEC Proj No: 775290177.

Installation/Site: ______

Date: ______

Sample Technician: ______

Location ID (Well ID): ______

Measurements

Well Total Depth: ______ ft below TOC

Initial Water Level: ______ ft below TOC

Final Water Level: ______ ft below TOC

Calculated Well Volume: ______ Gallons

Well Diameter: ______ inches

Calculations: 1" diameter = 0.041 gal/ft 2" diameter = 0.163 gal/ft 4" diameter = 0.653 gal/ft

Well Purging Activites

Sampling Method (pump type): ______

Flow rate (incl. units): ______

Time	Flow Rate (ml/min)	Depth to Water (ft, TOC)	Turbidity (NTUs)	Temp (^{o}C)	Cond. (mS/Cm)	pH	Salinity (%)	DO (mg/l)	ORP	Total Gal Pumped	Comments
Results During Sample Collection:											

Sample ID: ______

Sample Collection Time: ______

Sample bottle type: ______

Analysis/Method: ______

Preservative: ______

Water Quality (circle one): **Clear** **Cloudy** **Turbid** **Other** ______

COMMENTS:

QAQC'd by: Date:

SOIL SAMPLE COLLECTION LOG

Project Name: PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177

AMEC Proj No: 775290177.

Installation: ______

Date: ______

Sample Technician(s): ______

Location ID: ______

SOIL SAMPLE

Sample ID:		Sample Collection Time:	
Sample Depth:		UCSC Description:	
Munsell Description:		Plasticity:	
Collection Method:		Analysis/Method:	
Sample Container:		Preservative:	

COMMENTS:

QAQC'd by:	Date:

SEDIMENT AND SURFACE WATER SAMPLE COLLECTION LOG

Project Name: PFCs Release Determination at Multiple BRAC Bases, Contract FA8903-08-8766 Task Order 0177

AMEC Proj No: 775290177.

Installation/Site: ____________________

Date: ____________________

Sample Technician(s): ____________________

Location ID: ____________________

Type(s) of Sample (circle all that apply): Sediment Surface Water

SEDIMENT SAMPLE

Sample ID:		Sample Collection Time:	
Sample Depth:		Sediment Description:	
Collection Method:		Analysis/Method:	
Sample Container:		Preservative:	

SURFACE WATER SAMPLE

Sample ID:		Sample Collection Time:	
Sample Depth:		Collection Method:	
Analysis/Method:		Sample Container:	
Preservative:		Water Quality (circle one):	Clear Cloudy Turbid Other

COMMENTS:

QAQC'd by:	Date:

Photograph Log

PFCs Release Determinationm at Multiple BRAC Bases
Contract FA8903-08-8766 Task Order 0177

Project Number: 775290177 **Installation:** ______________

Picture #	Site/FTA #	Description	Date/Time
QAQC'd by:		Date:	