APPENDIX E

Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP)

(Pending Review)

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QAPP Worksheet #1 – Title and Approval Page

Quality Assurance Project Plan
Sampling and Analysis Plan
for
Bulk Fuels Facility Spill Solid Waste Management Units ST-106 and SS-111
Kirtland Air Force Base, Albuquerque
New Mexico

USACE CONTRACT NO. W912DY-10-D-0014
Delivery Order No. 0002

October 29, 2010
DCN: KAFB-010-0009

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Prepared for:
U.S. Army Corps of Engineers
Albuquerque District

APPROVALS & CONCURRENCES:

Tom Cooper, PG, PMP Project Manager, Shaw Environmental & Infrastructure, Inc.	Signature	Date
Pamela Moss Technical Manager, Shaw Environmental & Infrastructure, Inc.	Signature	Date
Mark Lyons Quality Control Manager, Shaw Environmental and Infrastructure, Inc.	Signature	Date

EXECUTIVE SUMMARY

This Quality Assurance Project Plan (QAPP)/Sampling and Analysis Plan (SAP) has been developed by Shaw Environmental & Infrastructure, Inc. (Shaw) under the U.S. Army Corps of Engineers (USACE), Huntsville Center, Contract No. W912DY-10-D-0014, Delivery Order No. 0002. This QAPP/SAP presents pre-remedy quarterly monitoring, groundwater, vadose zone, and interim measure (IM) investigation requirements for the Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units (SWMUs) ST-106 and SS-111, Kirtland Air Force Base (AFB). Albuquerque, New Mexico.

An underground fuel pipeline delivery system failure occurred over several decades at the BFF (SWMUs ST-106 and ST-111). The fuels aviation gasoline (Avgas), Jet Propellant-4 fuel (JP-4), and Jet Propellant-8 fuel (JP-8) have percolated to the groundwater table, resulting in a light dense non-aqueous phase liquid (LNAPL) plume and a dissolved-phase groundwater plume that is migrating off-base toward the City of Albuquerque municipal water supply wells. The leaks have been investigated since the 1990s, but the fuel plume was not discovered until 2007.

In 2005 an inter-governmental task force devised and recommended use of a new QAPP/SAP standard format called the Uniform Federal Policy for QAPPs. Also beginning in 2003 the U.S. Department of Defense (DoD) Environmental Workshop developed the DoD Quality Systems Manual (QSM) which provides baseline requirements for the establishment of quality systems for environmental laboratories. Therefore, this QAPP/SAP has been developed for the Kirtland AFB BFF Spill remediation to meet the 2005 Uniform Federal Policy format requirements and the quality control requirements defined in the DoD QSM for environmental laboratories (version 4.1, April 22, 2009).

This QAPP/SAP covers pre-remedy quarterly groundwater monitoring, quarterly vadose zone monitoring, quarterly vapor monitoring associated with the existing soil vapor extraction (SVE) systems, soil sampling associated with the groundwater and vadose zone investigations and well installation, and the soil sampling activities for the IM investigation at the Former Fuel Offloading Rack (FFOR). The QAPP/SAP describes the sampling field procedures, laboratory analytical methods, quality assurance/quality control protocols, and reporting requirements to address the BFF Spill sampling and analysis results for the period of 2011 through 2014.

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Laboratory In-House Control Limits – Soil

Acronyms and Abbreviations

µg/L	microgram(s) per liter
°C	degrees Celsius
ADR	automated data review
APH	air phased petroleum hydrocarbon
AvGas	aviation gasoline
BFF	Bulk Fuels Facility
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAS	chemical abstract service
CCV	continuing calibration verification
COC	chain of custody
DoD	U.S. Department of Defense
DOT	U.S. Department of Transportation
DQA	data quality assessment
DQO	data quality objective
EDB	ethylene dibromide
EDD	electronic data deliverable
ELAP	environmental laboratory accreditation program
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbon
FFOR	Former Fuel Offloading Rack
GC/MS	gas chromatography/mass spectrometry
HNO_3	nitric acid
IC	ion chromatography
ICE	internal combustion engine
IDW	investigation-derived waste
IM	interim measure
IIa	compliance with methods, procedures, and contracts
IIb	comparison with measurement performance criteria in the QAPP/SAP
JP-4	Jet Propellant-4 fuel
JP-8	Jet Propellant-8 fuel
KAFB	Kirtland Air Force Base
L	liter(s)
LCS	laboratory control sample
LCSD	laboratory control sample duplicate

Acronyms and Abbreviations (Continued)

LNAPL	light dense non-aqueous phase liquid
LOD	limit of detection
LOQ	limit of quantitation
MA DEP	Massachusetts Department of Environmental Protection
MCL	maximum contaminant level
MDL	method detection limit
mg/L	milligram(s) per liter
mL	milliliter(s)
MNA	monitored natural attenuation
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
ND	not detected
NE	not established
NELAP	National Environmental Laboratory Accreditation Program
NM	New Mexico
NMED	New Mexico Environmental Department
NMWQCC	New Mexico Water Quality Control Commission standards
NOD	Notice of Deficiency (NOD)
OSHA	Occupational Safety and Health Administration
PDF	portable document format
QA	quality assurance
QAO	quality assurance officer
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RCI	reactivity, corrosivity, ignitability
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
RPD	relative percent difference
RSD	relative standard deviation
RSL	regional screening level
RT	retention time
SAP	Sampling and Analysis Plan
SEDD	staged electronic data deliverable
Shaw	Shaw Environmental, Inc.
SOP	standard operating procedure
SSL	soil screening level
SVE	soil vapor extraction
SVM	soil vapor monitoring

Acronyms and Abbreviations (Concluded)

SVOC	semivolatile organic compound
SWMU	solid waste management unit
TBD	to be determined
TCLP	toxicity characteristic leaching procedure
TKN	total kjeldahi nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSA	technical systems audit
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
WERS	Worldwide Environmental Remediation Services

QAPP Worksheet #2 – QAPP Identifying Information

Name/Number:	Kirtland AFB BFF Spill at SWMUs ST-106 and SS-111
Operable Unit:	Not Applicable (NA)
Contractor Name:	Shaw
Contract Number:	W912DY-10-D-0014, Delivery Order 0002
Contract Title:	USACE, Huntsville Center, Worldwide Environmental Remediation Services (WERS)

1. This QAPP/SAP has been prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans, Final, Version 1* (U.S. Environmental Protection Agency [EPA], 2005); *Guidance for Quality Assurance Project Plans* (EPA, 2002a); *DoD Quality System Manual for Environmental Laboratories, Version 4.1* (DoD, 2009); and New Mexico Administrative Codes.

2. Identify regulatory program: NMED, Hazardous Waste Bureau Notice of Deficiency (NOD) letter

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session was held on July 9, 2010. The provisions for the scope of this work and the level of effort are established based on the scoping section and the following documents:

- Letters from NMED dated April 2, June 4, and August 6, 2010
- Shaw's proposal for Kirtland AFB BFF Spill SWMUs ST-106 and SS-111, Albuquerque, New Mexico, August and September 2010

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

- Title: *Base-Wide Plans for Investigations Under the Environmental Restoration Program,* Kirtland AFB, Albuquerque, New Mexico (Tetra Tech, 2004)

QAPP Worksheet #2 – QAPP Identifying Information (Continued)

6. List organizational partners (stakeholders) and connection with lead organization:

   - NMED Hazardous Waste Bureau - Regulatory oversight
   - Air Force/Kirtland AFB - End Customer
   - USACE Albuquerque District - Client
   - City of Albuquerque, New Mexico (Public Water Supply) - representing affected community (the public).

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7. Lead organization

   - USACE Albuquerque District – Contract and technical management

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8. If any required SAP elements or required information are NA to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

None

QAPP Worksheet #3 – Distribution List

Name of QAPP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Walter Migdal	USACE Project Manager	USACE	505-301-2923	Walter.migdal@usace.army.mil
Mark Phaneuf	USACE Technical Lead	USACE	505-342-3295	Mark.j.phaneuf@usace.army.mil
Michael D'Auben	USACE Quality Assurance (QA) Chemist	USACE	256-895-1460	Michael.J.D'Auben@usace.army.mil
James Bearzi William Moats William McDonald Sid Brandwein	New Mexico (NM) State Regulator	NMED-Hazardous Waste Branch	505-476-6000 505-222-9557 505-222-9582 505-222-9504	James.bearzi@state.nm.us William.moats@state.nm.us William.mcdonald@state.nm.us Sid.brandwein@state.nm.us
Tom Cooper, PG, PMP	Shaw Project Manager	Shaw	720-554-8163	Thomas.Cooper@shawgrp.com
Pamela Moss	Shaw Field Team Manager - Chemistry	Shaw	720-554-8252	Pamela.Moss@shawgrp.com
Dr. David Cacciatore, PE, PMP	Shaw Field Team Manager - SVE	Shaw	925-288-2299	Dave.Cacciatore@shawgrp.com
Dr. Gary Hecox, PG,CGWP	Shaw Field Team Manager – In Situ	Shaw	785-218-8782	Gary.Hecox@shawgrp.com
Tim Deignan, PGP	Shaw Field Team Manager – Geophysics	Shaw	720-554-8273	Timothy.Deignan@shawgrp.com
Dr. Charles Schaefer	Shaw Field Team Manager – Bioremediation	Shaw	609-895-5372	Charles.Schaefer@shawgrp.com
Susan Huang	Shaw Project Chemist	Shaw	925-288-2099	Susan.Huang@Shawgrp.com
Terry Rulon	Shaw Site Supervisor	Shaw	303-793-5264	Terry.Rulon@shawgrp.com
Mark Lyons	Shaw Field QA/QC	Shaw	505-262-8920	Mark.Lyons@shawgrp.com
Kimberly Kostzer	Project Manager	Empirical Laboratories, LLC	877-345-1113 x 240	kkostzer@empirlabs.com

Mike Truchan	Project Manager	RTI Laboratories	734-422-8000 x217	mtruchan@rtilab.com
Dana Merrill	Project Manager	Gulf Coast Analytical Laboratories, Inc.	225-214-7044	DanaM@GCAL.com
To Be Determined (TBD)	Project Manager	Microseeps Inc.	412- 826- 5245	TBD

QAPP Worksheet #4 – Project Personnel Sign-Off Sheet

The Project Personnel Sign-Off Sheet will be used to document that all key project personnel performing site work have read the applicable sections of the QAPP/SAP and will perform the sampling and analysis tasks as described.

Project Personnel	Organization/Title/ Role	Telephone Number	Signature	Date QAPP Read
Pamela Moss	Shaw FieldTeam Manager – Chemistry	720-554-8252		
Susan Huang	Shaw Project Chemist	925-288-2099		
Mark Lyons	Shaw Field Quality Control (QC) Manager	505-262-8920		
Tom Cooper, PG, PMP	Shaw Project Manager	509-735-9736		
Terry Rulon	Shaw Site Supervisor	303-793-5264		
Kimberly Kostzer	Empirical Laboratories Project Manager	877-345-1113 x240		
Michael Truchan	RTI Laboratories Project Manager	734-422-8000 x217		
Dana Merrilll	Gulf Coast Analytical Laboratories, Inc. Project Manager	225-214-7044		
Microseeps Project Manager	Microseeps Project Manager	412-826-5245		

QAPP Worksheet #6 – Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Telephone Number and/or Email	Procedure
Point of Contact with USACE Project Manager	Shaw Project Manager	Tom Cooper	720-554-8163	All materials and information about the project will be forwarded to the USACE Project Manager by the Shaw Project Manager
Manage all field phases of project	Shaw Project Manager	Tom Cooper	720-554-8163	Point-of-contact for all field-related activities
QAPP/SAP changes in the field	Shaw Field Team Manager – Chemistry	Pam Moss	720-554-8252	Point-of-contact for all field-related sampling activities, will notify the Shaw Project Chemist or other technical leads of any necessary field sampling changes
Reporting laboratory data quality issues and corrective actions	Shaw Project Chemist	Susan Huang	925-288-2099	Point-of-contact for laboratory, Shaw Project Manager, or Shaw Quality Assurance Officer (QAO) if any laboratory quality assurance/quality control (QA/QC) issues arise with field samples
Field corrective actions	Shaw QC Manager	Mark Lyons	505-262-8920	Based on QA oversight of field work the need for corrective actions will be determined by Shaw QC Manager
Major changes to QAPP/SAP	USACE Chemist	Michael D'Auben	256-895-1460	All major changes to the final QAPP/SAP must in compliance with *Uniform Federal Policy for Quality Assurance Project Plans* and be approved by USACE

SOURCE:

EPA. 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual, Final, Version 1,* EPA-505-B-04-900A, DoD DTIC ADA 427785. Prepared by the Intergovernmental Data Quality Task Force. March.

QAPP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibility	Education and Experience Qualification
Walter Migdal	USACE Project Manager	USACE	• Manages governmental oversight of the project • Manages project funding and scope	NA
Michael D'Auben	USACE QA Manager	USACE	• Provides governmental oversight of the Shaw QA Program • Provides quality-related directives through Contracting Officer's Technical Representative • Provides technical and administrative oversight of Shaw surveillance audit activities • Acts as point-of-contact on all matters concerning QA and the client's laboratory QA program • Authorized to suspend project execution if QA requirements are not adequately followed	NA
Mark Phaneuf	USACE Technical Lead	USACE	• Provides technical oversight of groundwater monitoring activities • Point of contact for technical matters	NA
Tom Cooper	Project Manager	Shaw	• Manages oversight of the project for Shaw • Ensures that all requirements of project contract are attained in a manner consistent with project plans • Manages project budgets and schedules	MS, Geology 11+ years experience
Pamela Moss	Field Team Manager – Chemistry	Shaw	• Reviews and approves the QAPP/SAP • Guides the selection of subcontract analytical laboratories • Serves as a point-of-contact for the USACE QAO • Develops corrective action as required • Serves as a technical advisor to the project	BS, Chemistry 32+ years experience
Gary Hecox	Shaw Field Team Manager – In Situ	Shaw	• Develops work plans to address project scope of work • Prepares work plan variances, if necessary • Manages technical project elements • Reports to Project Manager	PhD, Geology 32+ years experience
Terry Rulon	Site Supervisor	Shaw	• Advises field personnel on any technical issues that arise during work execution • Reviews field and laboratory data • Authors Quarterly Monitoring Reports and makes recommendations	AS, Construction Management 20 years experience

QAPP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title	Organizational Affiliation	Responsibility	Education and Experience Qualification
Susan Huang	Project Chemist	Shaw	• Develops the project data quality objectives (DQOs) and prepares the QAPP/SAP • Selects qualified subcontract laboratories • Implements chemical data QC procedures and audits field performance • Coordinates laboratory and field sampling activities • Reviews laboratory data prior to use • Performs automated EPA Level III data review • Prepares the appropriate sections of the report summarizing the project activities	BS, Chemical Engineering 15+ years experience
Mark Lyons	QC Manager	Shaw	• Develops the project QC objectives and prepares the QC Plan • Administers the QC Plan • Manages QC documentation and QC deliverables • Lists definable features of work • Conducts inspections (preparatory, initial, follow-up, final)	MA, Geography 23+ years of experience
James Vigerust	Health and Safety Officer	Shaw	• Develops and administers the Site Health and Safety Plan • Manages personnel and environmental monitoring • Coordinates preparation of Job Safety Analyses • Selects appropriate personal protective equipment • Reviews essential health and safety requirements with onsite personnel • Facilitates daily safety meetings	MS, Industrial Safety 19+ years of experience
TBD	Sampling Technician	Shaw	• Performs all sampling in accordance with approved QAPP/SAP • Ensures that field QC samples are collected as specified in the QAPP/SAP • Completes field documentation • Implements field corrective actions as required • Must have Occupational Safety and Health Administration (OSHA) certification • Must have 8-hour OSHA refresher certification	High School Diploma Or Equivalent

Note(s):

DQO denotes data quality objective.

OSHA denotes Occupational Safety and Health Administration.

QAPP Worksheet #8 – Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/Organizational Affiliation	Location of Training Records and Certificates
Field Team Samplers	OSHA 40 Hour HAZWOPER with Current 8-Hour Refresher	Shaw	Annual	Shaw Field Personnel	Shaw Health and Safety Training Personnel or approved vendor	Shaw Training Web Site & Health Safety Records at project site
Field Team Samplers	Sampling Procedures	Shaw	Preparatory meeting and daily tailgate meeting	Shaw Field Personnel	Shaw Project Chemist/Geologist/Engineer Personnel or approved vendor	Project Files
Shaw Sample Shipping Person(s)	DOT105 - Air Shipment of Dangerous Goods - IATA with Current Refresher	Shaw	Every 3 Years	Shaw Field Personnel	Shaw Shipping Training Personnel	Shaw Training Web Site & Health Safety Records at Project Site

Note(s):

DOT denotes U.S. Department of Transportation.

HAZWOPER denotes hazardous waste operations and emergency response.

IATA denotes International Air Transportation Association.

QAPP Worksheet #9 – Project Scoping Session Participants Sheet

Project Name: Kirtland AFB, BFF, SWMUs ST-106 and SS-111	Site Name: BFF Spill
Projected Date(s) of Sampling: 2011 to 2014 groundwater monitoring, soil vapor, and soil sampling	
	Site Location:
Project Manager: Mr. Tom Cooper, PG, PMP	Kirtland AFB, New Mexico
Date of Session: July 9, 2010	
Scoping Session Purpose: Planning meeting prior to meetings with representatives of NMED and Kirtland AFB	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Pat McGinnis, PE, PMP	DoD Program Manager	Shaw	720-554-8187	Patrick.mcginnis@shawgrp.com	Program oversight
Steve Moran, PG, PMP	WERS Contract Program Manager	Shaw	865-694-7361	Steve.G.Moran@shawgrp.com	Contract Manager
Tom Cooper, PG, PMP	Project Manager	Shaw	720-554-8163	Thomas.Cooper@shawgrp.com	Project Manager
Gary Hecox	Field Team Manager – In Situ	Shaw	785-218-8782	Gary.Hecox@shawgrp.com	Sr. Technical Lead
Charles Schaefer	Field Team Manager – Bioremediation	Shaw	609-895-5372	Charles.Schaefer@shawgrp.com	Technical Lead
David Cacciatore, PE, PMP	Field Team Manager – SVE	Shaw	925-288-2299	Dave.Cacciatore@shawgrp.com	Technical Lead
Tim Deignan, PGP	Field Team Manager - Geophysics	Shaw	720-554-8273	Timothy.Deignan@shawgrp.com	Technical Lead
Pam Moss	Field Team Manager - Chemistry	Shaw	720-554-8252	Pamela.Moss@shawgrp.com	Technical Lead

Consensus Decisions:

QAPP Worksheet #10 – Problem Definition

10.1 PROBLEM STATEMENT

Several decades ago, an underground fuel pipeline delivery system failed at the BFF Spill site at SWMUs ST-106 and ST-111, Kirtland AFB. The fuels Avgas, JP-4, and JP-8 have percolated to the groundwater table, resulting in a LNAPL plume and a dissolved-phase groundwater plume that is migrating off-base toward the City of Albuquerque municipal water supply wells. The leaks have been investigated since the 1990s, but the fuel plume was not discovered until 2007. The total plume has been estimated to be 2 to 4 million gallons with another five million gallons remaining in the vadose zone.

In 2010, NMED changed oversight of the BFF Spill from the Ground Water Quality Bureau to the Hazardous Waste Bureau, which issued NOD letters. The letters specified prescriptive requirements to investigate the vadose zone and groundwater media, and to implement an IM to contain the fuel plume from migrating further downgradient toward the municipal supply wells, thus protecting human health and the environment. The Air Force prepared and submitted draft work plans responding to the NOD letters. The work plans proposed a less robust investigation monitoring network than required by NMED and a phased IM approach. NMED reviewed the draft work plans and rejected the approach with a NOD letter on August 6, 2010. In that letter, NMED directed the Air Force to meet the original required monitoring network and added monitoring points. They also disapproved of the phased approach to implementing an interim measure to contain the fuel plume and directed the Air Force to install 16 SVE wells with internal-combustion engine (ICE) vacuum units to contain the fuel plume.

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

11.1 STATE THE PROBLEM

Step 1. Define the problem that necessitates the study. Identify the planning team members, including decision-makers, and determine resources such as budget, personnel, and schedule.

As stated in QAPP/SAP Worksheet #10, groundwater contamination in the form LNAPL and dissolved-phase plumes have been identified at the BFF Spill site (SWMUs ST-106 and SS-111) as a result of the failure of the underground fuel pipeline delivery system at the BFF site.

The planning team consists of the representatives of the USACE and Air Force, Shaw, and regulatory support and oversight from the NMED Hazardous Waste Bureau. The USACE is the lead federal agency for direction of site activities and is the prime decision-maker. The work will be conducted according to the USACE-awarded contract to Shaw, the approved budget, and sampling and reporting schedules described in QAPP/SAP Worksheet #16.

11.2 IDENTIFYING THE GOAL OF THE STUDY

Step 2. The principal BFF Spill objectives consist of the following:

- Determine the location of fine-grained lithologic units within the vadose zone at the BFF Spill, which control LNAPL migration;
- Determine the extent of the LNAPL plume on the water table;
- Determine gradients and flow paths within all three groundwater horizons at the site;
- Delineate contaminated vs. uncontaminated (from LNAPL plume) locations at BFF;
- Determine the extent of the dissolved-phase contaminant plume that exceeds the established EPA maximum contaminant levels (MCLs)/New Mexico Water Quality Control Commission (NMWQCC) standards for groundwater at the site; and
- Characterize nature and extent of contaminants within vadose zone and FFOR.

Groundwater monitoring associated with the BFF Spill will be conducted quarterly from 2011 through 2014 (four events per year). Monitoring will involve the following number of wells:

- 29 wells for January 2011 monitoring event,
- 72 wells for April 2011 monitoring event, and
- 111 wells on a quarterly basis for July 2011 - December 2014 monitoring events.

To maximize efficiency, quarterly vadose-zone monitoring will be conducted along with groundwater monitoring at the following number of wells:

- 15 soil gas monitoring points for January 2011 event,
- 123 soil gas monitoring points for April 2011 event, and
- 230 soil gas monitoring points for July 2011 - December 2014 events.

In addition, to quarterly groundwater and soil vapor monitoring, the following additional sampling and analysis activities will be performed in support of the BFF Spill remediation:

- Groundwater investigation – 72 soil samples/one event,
- Vadose zone investigation – 515 soil samples/one event,
- IM investigation at the FFOR – 400 soil samples/one event,
- LNAPL containment groundwater quality data gap – 6 groundwater samples/one event, and
- Monitored natural attenuation (MNA) assessment – 35 wells/four events.

Monitoring and sampling activities are summarized in QAPP/SAP Worksheets #17, 18, and 20.

11.3 IDENTIFYING INFORMATION INPUTS

Step 3. Identify data and information needed to answer study questions.

The data needed to answer principal study questions are monthly groundwater level and LNAPL measurements, laboratory analytical results from quarterly groundwater samples, quarterly soil gas samples, and soil samples from soil vapor monitoring (SVM) installation and FFOR sampling activities. Groundwater samples will be analyzed at an offsite laboratory for the following list of parameters:

- Volatile organic compounds (VOCs)
- Ethylene dibromide (EDB)
- Total petroleum hydrocarbons (TPH) - gasoline and diesel
- Volatile petroleum hydrocarbons (VPHs) and extractable petroleum hydrocarbons (EPHs) – four (4) quarters only
- Semivolatile organic compounds (SVOCs)
- Total lead, calcium, potassium, sodium, and magnesium

- Dissolved iron and manganese
- Anions – chloride, sulfate, nitrate nitrogen
- Alkalinity – carbonate and bicarbonate
- ammonia nitrogen
- total sulfide
- total organic carbon (TOC)
- total kjeldahl nitrogen (TKN)
- ortho-phosphorous
- dissolved gases – methane, ethane, ethene

Soil gas samples will be analyzed at an offsite laboratory for the following list of parameters:

- VOCs
- TPH gasoline
- Air-phased petroleum hydrocarbons (APHs) – four (4) quarters only
- Fixed gases

Soil samples will be analyzed at an off-site laboratory for the following list of parameters:

- VOCs
- VPH and EPH
- SVOCs
- Lead

Specific analytical methods and target analytes are summarized in QAPP/SAP Worksheet #15a (groundwater), Worksheet #15b (soil gas), and Worksheet #15c (soil).

11.3.1 Comparison Criteria

Analytical results from the quarterly groundwater monitoring events will be compared to EPA MCLs and NMWQCC standards contained in New Mexico Administrative Code Title 20 – Environmental Protection, Chapter 6 – Water Quality, Part 2 – Ground and Surface Water Protection. Soil samples results will be compared to EPA residential regional soil screening levels (RSLs) (EPA, 2010) and NM soil screening levels (SSLs) (NMED, 2006). Currently there

are no established regulatory standards for soil gas. Regulatory limits are summarized in QAPP/SAP Worksheet #15a (groundwater) and Worksheet # 15c (soil).

Analytical methods selected for the project will provide sufficient sensitivity to meet the data quality objectives and NMED requirements. As shown in QAPP/SAP Worksheet#15, laboratory reporting limits (RLs) or method detection limits (MDLs) for all but three SVOC compounds in soil, achieve respective EPA MCL, NMWQCC, or NMED SSL regulatory standards. In order to meet the regulatory limits, laboratories will report positive results down to the MDL and results between the MDL and the laboratory RL will be flagged with a J-qualifier and reported as estimated data. Target analytes with RLs greater than the regulatory limits are highlighted in QAPP/SAP Worksheet#15.

11.4 DEFINE THE BOUNDARIES OF THE STUDY

Step 4. Define target population of interest, specify the spatial and temporal boundaries, and determine the practical constraints on collecting data.

11.4.1 Target Population of Interest

The target population of interest is all future groundwater receptors, including workers who will perform Kirtland AFB BFF Spill groundwater monitoring activities and all future human and ecological receptors of the groundwater.

11.4.2 Spatial Boundaries

The approximate study boundaries are indicated on Figure 2.

11.4.3 Temporal Boundaries and Constraints

There are no physical constraints to data collection.

11.5 DEVELOP THE ANALYTIC APPROACH

Step 5. Define the parameter of interest and develop the logic for drawing conclusions from findings.

The following decisions may be made based on the results of the Kirtland AFB BFF Spill pre-remedy groundwater and soil gas monitoring:

- If proposed groundwater and soil gas monitoring wells being used for the purpose of monitoring contamination within the LNAPL plume do not address areas that have been delineated as possible preferential flow paths for LNAPL to the groundwater table, consider modifying proposed SVE well locations within the LNAPL plume.
- If proposed groundwater and soil gas monitoring wells being installed for the purpose of monitoring contamination within the LNAPL plume are not within the plume,

consider adjusting the location of these points or eliminate them from the drilling program.

- If groundwater and soil gas samples in monitoring wells proposed for the purpose of delineating the extent of the groundwater plume are impacted above MCLs, the dissolved-phase plume has not been delineated and additional wells must be installed to complete the delineation.

The following decisions may be made based on the results of the KAFB BFF soil monitoring:

- If soil samples collected during SVM installation are impacted above EPA RSLs /NMED SSLs, consider collecting additional samples or adjusting SVM locations.
- If soil samples collected during groundwater monitoring well installation are impacted above EPA RSLs /NMED SSLs, evaluate adjusting groundwater monitoring well locations.
- If soil samples collected at the FFOR for the purpose of delineating excavation contamination are impacted above EPA RSLs/NMED SSLs, consider collecting samples further from the excavation points.

11.6 SPECIFYING PERFORMANCE OR ACCEPTANCE CRITERIA

Step 6. Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use. Specify probability limits for false rejection and false acceptance decision errors.

To limit uncertainty in obtained environmental data, criteria for the precision, accuracy, representativeness, completeness, and comparability parameters, and RLs for the parameters have been developed and presented in this QAPP/SAP. Measurement errors will be controlled by using appropriate sampling and analytical methods, adhering to the DoD QSM (2009), following established standard operating procedures (SOPs), and having data review to verify laboratory processes. Field crews will be trained in the appropriate sample collection procedures and will review the QAPP/SAP before sample collection to limit sample collection errors. Subcontract analytical laboratories will have a copy of the QAPP/SAP and will adhere to DoD QSM guidance to limit measurement errors. The data that meet these criteria will be of definitive quality and of less uncertainty than data which was acquired with a less rigorous approach.

11.7 OPTIMIZING THE DESIGN FOR OBTAINING DATA

Step 7. Review DQO outputs; develop data collection design alternatives; formulate mathematical expressions for each design; select sample size that satisfies the DQOs; decide on the most resource-effective design or agreed alternative; and document details in the QAPP.

The sampling and analysis strategy is described in this QAPP/SAP worksheet #17.

QAPP Worksheet #12a – Measurement Performance Criteria Table - Groundwater

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both
Matrix Spikes	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA8015 TPH diesel – EPA 8015 VPH/EPH – MA DEP SVOCs – EPA 8270 Metals – 6010 Anions – EPA 300.0 Ammonia – SM 4500B, D TKN – EPA 351.4 Ortho-Phosphorous – SM 4500 PE Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases – RSK 175	One per 20 field samples collected	Precision and accuracy	Laboratory control sample (LCS) limits specified in the DoD QSM and in QAPP/SAP Worksheets #28a through #28e	A
Field Duplicate	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH diesel – EPA 8015 VPH/EPH – MA DEP SVOCs – EPA 8270 Metals – EPA 6010 Anions – EPA 300.0 Ammonia – SM 4500B, D TKN – EPA 351.4 Ortho-Phosphorus – SM	One per 10 field samples collected	Precision	Relative percent difference (RPD) less than or equal to 35%	S&A

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both
	4500 PE Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases– RSK 175 Stable carbon and hydrogen isotopes - Lab SOP				

QAPP Worksheet #12a – Measurement Performance Criteria Table – Groundwater (Continued)

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both
Equipment Rinse Blanks	VOCs – EPA 8260 TPH gasoline – EPA 8015 TPH diesel – EPA 88015 Metals – EPA 6010	None when dedicated sampling equipment is used to collect groundwater samples. If non-dedicated sampling equipment is used, one equipment rinse blank will be collected per day, regardless of the number of sampling teams working each day.	Representativeness	Analytes not detected (ND) above one-half RL; and acetone and methylene chloride ND above RL	S
Temperature Blanks	VOCs – EPA 8060 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH diesel – EPA 8015 VPH/EPH – MA DEP SVOCs – EPA 8270 Metals – EPA 6010 Anions – EPA 300.0 Ammonia – SM 4500 B, D TKN – EPA 351.4 Ortho-Phosphorous –SM 4500 PE Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175 Stable carbon and hydrogen isotopes (SOP)	Every cooler shipped to the laboratory	Representativeness	0-6 degrees Centigrade (°C)	S

QAPP Worksheet #12a – Measurement Performance Criteria Table – Groundwater (Continued)

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both
Trip Blanks	VOCs – EPA 8260	One per cooler containing liquid samples for VOC analysis	Representativeness	Analytes ND above one-half RL; and acetone and methylene chloride ND above RL	S&A
Ambient Blanks	VOCs – EPA 8260	One per cooler containing liquid samples for VOCs analyses	Representativeness	Analytes ND above one-half RL; and acetone and methylene chloride ND above RL	S&A

Note(s):

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

°C denotes degrees Celsius.
LCS denotes laboratory control sample.
RL denotes reporting limit.
RPD denotes relative percent difference.

QAPP Worksheet #12b – Measurement Performance Criteria Table - Soil Gas

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both
Field Duplicate	VOCs/TPH Gas – EPA TO15 APH – MA DEP Fixed Gases – ASTM D2504	One per 10 field samples collected	Precision	RPD less than or equal to 35%	S&A
Trip Blanks	VOCs – EPA TO-15	One per shipment	Representativeness	Analytes ND above one-half RL; and acetone and methylene chloride ND above RL	S&A

Note:

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

RL denotes reporting limit

RPD denotes relative percent difference.

QAPP Worksheet #12c – Measurement Performance Criteria Table - Soil

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both
Matrix Spikes	VOCs – EPA 8260 VPH/EPH – MA DEP SVOCs – EPA 8270 Lead – EPA 6010	One per 20 field samples collected	Precision and Accuracy	LCS limits specified in the DoD QSM and QAPP/SAP Worksheets #28a through #28e	A
Field Duplicate	VOCs – EPA 8260 VPH/EPH – MA DEP SVOCs – EPA 8270 Lead – EPA 6010	One per 10 field samples collected	Precision	RPD less than or equal to 50%	A and S
Temperature Blanks	VOCs – EPA 8260 VPH/EPH – MA DEP SVOCs – EPA 8270 Lead – EPA 6010	Every cooler shipped to the laboratory	Representativeness	0-6°C	S

Note(s):

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

°C denotes degrees Celsius.
LCS denotes laboratory control sample.
RPD denotes relative percent difference.

QAPP Worksheet #13 – Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/ collection dates)	How Data Will Be Used	Limitations on Data Use
VOCs, SVOCs, PAHs, pesticides, PCB, metals, TPH gas/diesel, and anions	Report title(s) and organization(s) unknown. Information is gathered through a review of Kirtland AFB historical data	Soil, May 1994 through November 2007 Organization(s) unknown	Data Evaluation	None
VOCs, SVOCs, PAHs, pesticides, PCB, metals, TPH gas/diesel, anions, ammonia, and total dissolved solids	Report title(s) and organization(s) unknown. Information is gathered through a review of Kirtland AFB historical data	Groundwater, January 2000 through October 2009 Organization(s) unknown	Data Evaluation	None
VOCs	Report title(s) and organization(s) unknown. Information is gathered through a review of Kirtland AFB historical data	Soil Gas, April 2006 through December 2009 Organization(s) unknown	Data Evaluation	None

QAPP Worksheet #14 – Summary of Project Tasks

14.1 SCOPE OF WORK

The scope of work for activities associated with pre-remedy quarterly monitoring at SWMUs ST-106 and SS-111 includes preparation, submission, and approval of this document. Additional project tasks are summarized below:

- Completion of downhole geophysics of 29 existing wells, installation of 39 deep and 5 shallow SVM wells for vadose zone investigations, installation of 82 groundwater monitoring wells for routine quarterly groundwater monitoring, and installation of 30 groundwater monitoring wells for MNA sampling and analysis.
- Monthly groundwater level and LNAPL measurements starting in January 2011 and continuing for the duration of the field efforts.
- Quarterly groundwater monitoring events starting in January 2011 through 2014.
- Laboratory analyses of quarterly groundwater samples for VOCs, EDB, TPH gas/ diesel, VPH/EPH, SVOCs, dissolved iron and manganese, total lead and cations, anions, alkalinity, ammonia as nitrogen, TKN, ortho-phosphorous, total sulfide, TOC, and dissolved gases. Alkalinity will also initially be measured in the field using a HACH test kit. Results will be compared to the laboratory to determine if this is warranted.
- EPA Level III automated data review (ADR) for each of the quarterly groundwater monitoring events.
- Quarterly soil gas monitoring events starting in January 2011 through 2014 (concurrent with the quarterly groundwater monitoring).
- Laboratory analyses of the soil gas samples for VOCs/TPH, APH, and fixed gases.
- EPA Level III ADR for each of the quarterly soil gas monitoring events.
- Quarterly vapor sampling of the existing SVE systems starting in January 2011 through 2014
- Field analysis of the vapor samples for TPH
- EPA Level III ADR for each of the quarterly vapor monitoring events.
- Soil sampling associated with groundwater monitoring well installation.
- Laboratory analyses of the soil samples associated with groundwater monitoring well installation for VOCs, VPH/EPH, SVOCs, and lead.
- EPA Level III ADR for soil samples associated with groundwater monitoring well installation.

- Soil sampling associated with SVM installation
- Laboratory analyses of the soil samples associated with SVM installation for VOCs, VPH/EPH, SVOCs, and lead.
- EPA Level III ADR for SVM soil sample results.
- IM investigation - FFOR soil sampling.
- Laboratory analyses of FFOR soil samples for VOCs, VPH/EPH, SVOCs, and lead.
- EPA Level III ADR for FFOR soil sample results.
- Waste characterization and disposal for soil wastes generated from SVM installation and FFOR soil sampling activities.
- Laboratory analysis of soil investigation-derived waste (IDW) for toxicity characteristic leaching procedures (TCLP) VOCs; TCLP SVOCs; TCLP metals; TCLP pesticides; TCLP herbicides; reactivity, corrosivity, and ignitability (RCI); total benzene, toluene, ethylbenzene, and xylenes (BTEX); and total TPH gas/diesel.
- Groundwater monitoring associated with the LNAPL containment IM investigations (one sampling event).
- Laboratory analysis of the groundwater samples associated with the LNAPL contaminant IM investigations for VOCs, SVOCs, total cations, and anions.
- EPA Level III ADR for IM groundwater sample results.
- MNA quarterly groundwater monitoring (concurrent with the routine quarterly groundwater monitoring).
- Laboratory analysis of MNA groundwater samples for total cations, anions, ammonia as nitrogen, total sulfide, ortho-phosphorous, and stable carbon and hydrogen isotopes.
- EPA Level III ADR for MNA groundwater sample results.
- Quarterly Environmental Resources Program Information Management System (ERPIMS) data submittal.
- Quarterly monitoring report submittal. The quarterly monitoring report will detail descriptions of installed groundwater and SVM wells, water level and LNAPL measurements, field and laboratory results for groundwater, soil gas, soil, vapor, and data review findings.

14.2 DATA RECORDING AND TRANSFER

This section details the requirements for data reporting and data package formats that will be provided by the laboratory.

14.2.1 Hard Copy Deliverables

All relevant raw data and documentation, including (but not limited to) logbooks, data sheets, electronic files, and final reports, will be maintained by the laboratory for at least 10 years. The laboratory will notify Shaw 30 days before disposal of any relevant laboratory records. In addition, Shaw will maintain laboratory data packages for ten years.

Shaw will maintain copies of all chain-of-custody (COC) forms until receipt of the laboratory report. Laboratory reports will be logged in upon receipt and filed in chronological order. The data deliverable requirements for this project will be 100 percent EPA Level III format for analytical data obtained from quarterly groundwater monitoring, quarterly soil gas monitoring, quarterly vapor monitoring, and soil sampling; and EPA Level II format for IDW soil sampling.

14.2.2 Electronic Deliverables

The electronic data deliverable for use in the validation effort will be in the Staged Electronic Data Deliverable (SEDD) stage 2a (version 5.0-Draft). The SEDDs will meet EPA specifications found at: http://www.epa.gov/superfund/programs/clp/seddspec5.htm. Prior to SEDD submittal, the analytical laboratory will check SEDDs for completeness and accuracy and correct all SEDD errors.

In addition, an ERPTOOLS X data deliverable will be provided by the laboratory for upload to the Air Force data repository.

Field information (e.g., sample collection date and time, sample identification, etc.) will be entered directly into a Shaw's database from the COC form and completed sample collection forms.

14.3 LABORATORY DATA MANAGEMENT

This section describes the data management procedures for data review, verification, reporting, and validation.

14.3.1 Data Reduction, Verification, and Reporting

All analytical data generated by the laboratory projects will be reviewed before reporting to assure the validity of reported data. This internal laboratory data review process will consist of data reduction, three levels of documented review, and reporting. Review processes will be documented using appropriate checklist forms, or logbooks, which will be signed and dated by the reviewer.

14.3.2 Data Reduction

Data reduction involves the mathematical or statistical calculations used by the laboratory to convert raw data to the reported data. The laboratory will perform reduction of analytical data as

specified in each of the appropriate analytical methods and laboratory SOPs. For each method, all raw data results will be recorded using method-specific forms or a standardized output from each of the various instruments.

All data calculations will be verified and initialed by personnel both generating and approving them. All raw and electronic data, notebook references, supporting documentation, and correspondence will be assembled, packaged, and stored for a minimum of 10 years for future use. All reports will be held client confidential. If the laboratory is unable to store project-related data for 10 years, then it is the responsibility of the laboratory to contact Shaw to make alternative arrangements.

14.3.3 Laboratory Data Verification and Review

The laboratory analyst who generates the analytical data will have the primary responsibility for the correctness and completeness of data. Each step of this verification and review process will involve the evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that data of known quality are generated consistently. All data generated and reduced will follow well-documented in-house protocols.

Level 1. Technical (Peer) Data Review

Analysts will review the quality of their work based on an established set of guidelines, including the QC criteria established in each method, in this QAPP/SAP, and as stated within the laboratory QA Manual. This review will, at a minimum, ensure that the following conditions have been met:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- Appropriate SOPs have been followed
- Calculations are verified
- There are no data transposition errors
- Analytical results are correct and complete
- QC samples are within established control limits
- Blanks and LCSs are within appropriate QC limits
- Special sample preparation and analytical requirements have been met

Documentation is complete, for example, any anomalies and holding times have been documented and forms have been completed.

Level 2. Technical Data Review

A supervisor or data review specialist whose function is to provide an independent review of data packages will perform this review. This review will also be conducted according to an

established set of guidelines and will be structured to verify the following finding of Level 1 data review:

- All appropriate laboratory SOPs have been followed
- Calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- Qualitative identification of contaminants is correct
- Manual integrations are justified and properly documented
- Quantitative results and calculations are correct
- Data are qualified correctly
- Documentation is complete, for example, any anomalies and holding times have been documented and appropriate forms have been completed
- Data are ready for incorporation into the final report
- The data package is complete and complies with contract requirements

The Level 2 review will be structured so that all calibration data and QC sample results are reviewed and all of the analytical results from at least 10 percent of the samples are checked back to the sample preparation and analytical bench sheets. If no problems are found with the data package, the review will be considered complete.

If any problems are found with the data package, an additional 10 percent of the sample results will be checked back to the sample preparatory and analytical bench sheets. This cycle will then be repeated either until no errors are found in the checked data set or until all data has been checked. All errors and corrections noted will be documented.

Level 3. Administrative Quality Assurance Data Review

The Laboratory QA Manager will review 10 percent of all data packages. This review should be similar to the review as provided in Level 2, except that it will provide a total overview of the data package to ensure its consistency and compliance with project requirements. All errors noted will be corrected and documented.

14.4 EPA LEVEL III DATA REVIEW

A Shaw Project Chemist will use an ADR software developed by Laboratory Data Consultants (LDC) Inc. to perform 100 percent EPA Level III data review. The review will be performed for analytical data obtained from each of the quarterly groundwater, soil gas, and vapor monitoring

events, IM groundwater monitoring, and quarterly MNA sampling. In addition, the Shaw Project Chemist will use the same ADR software to conduct 100 percent EPA Level III data review of the analytical data from the soil sampling associated with SVM installation, groundwater monitoring well installation, and FFOR sampling activities. The data review will be performed using the quality control criteria specified in the following:

- This QAPP/SAP
- *DoD Quality Systems Manual for Environmental Laboratories, Version 4.1* (April 2009)
- *USEPA Test Methods for Evaluating Solids Waste, Physical/Chemical Methods* (SW-846, 2006 and updates)
- *USEPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition,* Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) (January 1999)
- Massachusetts Department of Environmental Protection (MA DEP), *Method for the Determination of Volatile Petroleum Hydrocarbons (VPH)*(May 2004)
- MA DEP, *Method for the Determination of Extractable Petroleum Hydrocarbons (EPH)* (May 2004)
- MA DEP, *Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH)* (December 2008)
- American Water Works Association, *Standard Methods for the Examination of Water and Wastewater* (21st Edition)
- USACE 200-1-10, *Guidance for Evaluating Performance-Based Chemical Data* (2005)
- *USEPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review* (June 2008)
- *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review, Final* (January 2010)

The following QC elements will be included in the EPA Level III data review:

- Laboratory method blanks
- Sample extraction and analysis holding times
- Surrogate spike recoveries
- LCS/laboratory control sample duplicate (LCSD) recoveries
- Matrix spike (MS)/matrix spike duplicate (MSD) recoveries

- RPD
- Initial calibrations
- Continuing calibrations
- Field blanks
- Field duplicates

Data will be validated and flagged with the following data qualifiers as applicable:

- ***J+ qualifier*** denotes the analyte was positively identified, but the associated numerical value is estimated with a potential high bias.
- ***J- qualifier*** denotes the analyte was positively identified, but the associated numerical value is estimated with a potential low bias.
- ***U qualifier*** denotes the analyte was analyzed for, but was not detected.
- ***R qualifier*** denotes the data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria and data quality objectives.

Before data review, the Shaw Project Chemist will develop a project library in the ADR program for each of the groundwater, soil gas, and soil matrices and set up the required methods, target analytes, RLs, holding time, accuracy, precision and calibration requirements. Once the project libraries are built and verified to be accurate and complete, the Shaw Project Chemist will use the ADR program to review analytical results provided in the SEDDs. As a result of the ADR process, EPA qualifiers will be electronically generated and applied to the affected sample results that were outside the established QC criteria. Note that due to laboratory information system limitations, laboratories may not be able to provide initial and continuing calibration results in the SEDDs. Project-specific laboratory will not be required to provide stable isotope results in the SEDDS. In this case, the Shaw Project Chemist will manually review the calibration data and stable isotope data, and apply qualifiers to the affected sample results. Once the data is reviewed, the final qualified data will then be exported to a Shaw database. EPA level III data review findings will be summarized and documented with each quarterly monitoring report.

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	1,1,1,2-Tetrachloroethane	630-20-6	µg/L	NE	Note 1	1.0	1.0	0.25
	1,1,1-Trichloroethane	71-55-6	µg/L	60	NMWQCC	1.0	1.0	0.25
	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	NE	Note 1	1.0	1.0	0.25
	1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	µg/L	NE	Note 1	1.0	1.0	0.25
	1,1,2-Trichloroethane	79-00-5	µg/L	5	EPA MCL	1.0	1.0	0.25
	1,1-Dichloroethane	75-34-3	µg/L	25	NMWQCC	1.0	1.0	0.25
	1,1-Dichloroethene	75-35-4	µg/L	5	NMWQCC	1.0	1.0	0.25
	1,1-Dichloropropene	563-58-6	µg/L	NE	Note 1	1.0	1.0	0.25
	1,2,3-Trichlorobenzene	87-61-6	µg/L	NE	Note 1	2.0	2.0	0.5
	1,2,3-Trichloropropane	96-18-4	µg/L	NE	Note 1	2.0	2.0	0.5
	1,2,4-Trichlorobenzene	120-82-1	µg/L	70	EPA MCL	1.0	1.0	0.25
	1,2,4-Trimethylbenzene	95-63-6	µg/L	NE	Note 1	1.0	1.0	0.25
	1,3,5-Trimethylbenzene	108-67-8	µg/L	NE	Note 1	1.0	1.0	0.25
	1,2-Dibromo-3-Chloroprpane	96-12-8	µg/L	NE	Note 1	2.0	2.0	0.5
	1,2-Dibromoethane	106-93-4	µg/L	NE	Note 1	1.0	1.0	0.25
	1,2-Dichlorobenzene	95-50-1	µg/L	600	EPA MCL	1.0	1.0	0.25
	1,2-Dichloroethane	107-06-2	µg/L	5	EPA MCL	1.0	1.0	0.25
	1,2-Dichlorpropane	78-87-5	µg/L	5	EPA MCL	1.0	1.0	0.25
	1,3-Dichlorobenzene	541073-1	µg/L	NE	Note 1	1.0	1.0	0.25
	1,3-Dichloropropane	142-28-9	µg/L	NE	Note 1	1.0	1.0	0.25
	1,4-Dichlorobenzene	106-46-7	µg/L	75	EPA MCL	1.0	1.0	0.25
	1-Chlorohexane	544-10-5	µg/L	NE	Note 1	2.0	2.0	0.5
	2,2-Dichloropropane	594-20-7	µg/L	NE	Note 1	1.0	1.0	0.25

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	2-Butanone	78-93-3	µg/L	NE	Note 1	10	10	2.5
	2-Chloro Vinyl Ether		µg/L	NE	Note 1	5.0	5.0	1.25
	2-Chlorotoluene	95-49-8	µg/L	NE	Note 1	1.0	1.0	0.25
	2-Hexanone	591-78-6	µg/L	NE	Note 1	5.0	5.0	1.25
	4-Chlorotoluene	166-43-4	µg/L	NE	Note 1	1.0	1.0	0.25
	4-Methyl-2-Pentanone	108-10-1	µg/L	NE	Note 1	5.0	5.0	1.25
	Acetone	67-64-1	µg/L	NE	Note 1	10	10	2.5
	Acrolein	107-02-8	µg/L	NE	Note 1	5.0	5.0	1.25
	Acrylonitrile	107-13-1	µg/L	NE	Note 1	10	10	2.5
	Benzene	71-43-2	µg/L	5	EPA MCL	1.0	1.0	0.25
	Bromobenzene	108-86-1	µg/L	NE	Note 1	1.0	1.0	0.25
	Bromochloromethane	74-97-5	µg/L	NE	Note 1	1.0	1.0	0.25
	Bromodichloromethane	75-27-4	µg/L	NE	Note 1	1.0	1.0	0.25
	Bromoform	75-25-2	µg/L	NE	Note 1	2.0	2.0	0.5
	Bromomethane	74-83-9	µg/L	NE	Note 1	1.0	1.0	0.25
	Carbon Disulfide	75-15-0	µg/L	NE	Note 1	1.0	1.0	0.25
	Carbon Tetrachloride	56-23-5	µg/L	5	EPA MCL	1.0	1.0	0.25
	Chlorobenzene	108-90-7	µg/L	100	EPA MCL	1.0	1.0	0.25
	Chloroethane	75-00-3	µg/L	NE	Note 1	1.0	1.0	0.25
	Chloroform	67-66-3	µg/L	100	NMWQCC	1.0	1.0	0.25
	Chloromethane	74-87-3	µg/L	NE	Note 1	1.0	1.0	0.25
	cis-1,2-Dichloroethene	156-59-2	µg/L	70	EPA MCL	1.0	1.0	0.25

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	cis-1,3-Dichloropropene	10061-01-5	µg/L	NE	Note 1	1.0	1.0	0.25
	Cyclohexane	110-82-7	µg/L	NE	Note 1	1.0	1.0	0.25
	Dibromochloromethane	74-95-3	µg/L	NE	Note 1	1.0	1.0	0.25
	Dibromomethane	74-95-3	µg/L	NE	Note 1	1.0	1.0	0.25
	Dichlorodifluoromethane	75-71-8	µg/L	NE	Note 1	1.0	1.0	0.25
	Di-Isopropyl Ether	108-203	µg/L	NE	Note 1	1.0	1.0	0.25
	Ethyl tert-Butyl Ether	637-92-3-	µg/L	NE	Note 1	1.0	1.0	0.25
	Ethyl Methacrylate	97-63-2	µg/L	NE	Note 1	1.0	1.0	0.25
	Ethylbenzene	100-41-4	µg/L	700	EPA MCL	1.0	1.0	0.25
	Hexachlorobutadiene	87-68-3	µg/L	NE	Note 1	1.0	1.0	0.25
	Iodomethane	74-88-4	µg/L	NE	Note 1	1.0	1.0	0.25
	Isopropylbenzene	98-82-8	µg/L	NE	Note 1	1.0	1.0	0.25
	Methyl Acetate	79-209	µg/L	NE	Note 1	2.0	2.0	0.5
	Methyl Methacrylate	80-62-6	µg/L	NE	Note 1	1.0	1.0	0.25
	Methyl tert-Butyl Ether	1634-04-4	µg/L	NE	Note 1	1.0	1.0	0.25
	Methylcyclohexane	108-87-2	µg/L	NE	Note 1	1.0	1.0	0.25
	Methylene Chloride	75-09-2	µg/L	5	EPA MCL	1.0	1.0	0.25
	Naphthalene	91-20-3	µg/L	NE	Note 1	1.0	1.0	0.25
	n-Butylbenzene	104-51-8	µg/L	NE	Note 1	1.0	1.0	0.25
	n-Propylbenzene	103-65-1	µg/L	NE	Note 1	1.0	1.0	0.25
	p-Isopropyltoluene	99-87-6	µg/L	NE	Note 1	1.0	1.0	0.25
	sec-Butylbenzene	135-98-8	µg/L	NE	Note 1	1.0	1.0	0.25

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	Styrene	100-42-5	µg/L	NE	Note 1	1.0	1.0	0.25
	t-Butyl Alcohol	75-65-0	µg/L	NE	Note 1	5.0	5.0	1.25
	tert-Amyl Methyl Ether	994-05-8	µg/L	NE	Note 1	10	10	2.5
	tert-Butylbenzene	98-06-6	µg/L	NE	Note 1	1.0	1.0	0.25
	Tetrachloroethene	127-18-4	µg/L	5	EPA MCL	1.0	1.0	0.25
	Tetrahydrofuran	109-99-9	µg/L	NE	Note 1	5.0	5.0	1.25
	Toluene	108-88-3	µg/L	750	NMWQCC	1.0	1.0	0.25
	trans-1,2-Dichloroethene	156-60-5	µg/L	100	EPA MCL	1.0	1.0	0.25
	trans-1,3-Dichloropropene	10061-02-6	µg/L	NE	Note 1	1.0	1.0	0.25
	Trichloroethene	79-01-6	µg/L	5	EPA MCL	1.0	1.0	0.25
	Trichlorofluoromethane	75-69-4	µg/L	NE	Note 1	1.0	1.0	0.25
	Vinyl Acetate	108-05-4	µg/L	NE	Note 1	5.0	5.0	1.25
	Vinyl Chloride	75-01-4	µg/L	2	EPA MCL	1.0	1.0	0.25
	Xylenes	1330-20-7	µg/L	620	NMWQCC	3.0	3.0	0.75
EDB/EPA 8011	Ethylene dibromide	1832-54-8	µg/L	0.05	EPA MCL	0.030	0.030	0.010
TPH/EPA 8015	TPH as Gasoline (C6-C10)	2691-41-0	µg/L	NE	Note 1	50	50	150
	TPH Diesel (C10-C28)	121-82-4	µg/L	NE	Note 1	100	100	100
VPH/MA DEP	C5-C8 Alphatics	NA	µg/L	NE	Note 1	100	100	100
	C9-C12 Alphatics	NA	µg/L	NE	Note 1	100	100	100

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
EPH/MA DEP	C12-C40 Alphatics	NA	µg/L	NE	Note 1	100	100	100
SVOC/EPA 8270	1-Methylnaphthalene	90-12-0	µg/L	NE	Note 1	5.00	5.00	1.25
	1,1'-Biphenyl	92-52-4	µg/L	NE	Note 1	5.00	5.00	1.25
	1,2,4,5-Tetrachlorobenzene	95-94-3	µg/L	NE	Note 1	5.00	5.00	1.25
	1,2,4-Trichlorobenzene	120-82-1	µg/L	NE	Note 1	5.00	5.00	1.25
	1,2-Dichlorobenzene	95-50-1	µg/L	600	EPA MCL	5.00	5.00	1.25
	1,2-Diphenylhydrazine	122-66-7	µg/L	NE	Note 1	5.00	5.00	1.25
	1,3-Dichlorobenzene	541-73-1	µg/L	NE	Note 1	5.00	5.00	1.25
	1,4-Dichlorobenzene	106-46-7	µg/L	75	EPA MCL	5.00	5.00	1.25
	2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	NE	Note 1	5.00	5.00	1.25
	2,4,5-Trichlorophenol	95-95-4	µg/L	NE	Note 1	5.00	5.00	1.25
	2,4,6-Trichlorophenol (TCP)	88-06-2	µg/L	NE	Note 1	5.00	5.00	1.25
	2,4-Dichlorophenol (DCP)	120-83-2	µg/L	NE	Note 1	5.00	5.00	1.25
	2,4-Dimethylphenol	105-67-9	µg/L	NE	Note 1	20.0	20.0	5.00
	2,4-Dinitrophenol	51-28-5	µg/L	NE	Note 1	50.0	50.0	12.5
	2,4-Dinitrotoluene (DNT)	121-14-2	µg/L	NE	Note 1	5.00	5.00	1.25
	2,6-Dinitrotoluene	606-20-2	µg/L	NE	Note 1	5.00	5.00	1.25
	2-Chloronaphthalene	91-58-7	µg/L	NE	Note 1	5.00	5.00	1.25
	2-Chlorophenol	95-57-8	µg/L	NE	Note 1	5.00	5.00	1.25
	2-Methylnaphthalene	91-57-6	µg/L	NE	Note 1	5.00	5.00	1.25
	2-Methylphenol (o-Cresol)	95-48-7	µg/L	NE	Note 1	5.00	5.00	1.25
	2-Nitroaniline	88-74-4	µg/L	NE	Note 1	20.0	20.0	5.00

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
SVOC/EPA 8270	2-Nitrophenol (ONP)	88-75-5	µg/L	NE	Note 1	5.00	5.00	1.25
	3,3'-Dichlorobenzidine (DCB)	91-94-1	µg/L	NE	Note 1	5.00	5.00	1.25
	3-Methylphenol	108-39-4	µg/L	NE	Note 1	5.00	5.00	1.25
	3-Nitroaniline	99-09-2	µg/L	NE	Note 1	20.0	20.0	5.00
	4,6-Dinitro-2-methylphenol (DNOC)	534-52-1	µg/L	NE	Note 1	20.0	20.0	5.00
	4-Bromophenyl phenyl ether	101-55-3	µg/L	NE	Note 1	5.00	5.00	1.25
	4-Chloro-3-methylphenol	59-50-7	µg/L	NE	Note 1	5.00	5.00	1.25
	4-Chloroaniline	106-47-8	µg/L	NE	Note 1	5.00	5.00	1.25
	4-Chlorophenyl phenyl ether	7005-72-3	µg/L	NE	Note 1	5.00	5.00	1.25
	4-Methylphenol (p-Cresol)	106-44-5	µg/L	NE	Note 1	5.00	5.00	1.25
	4-Nitroaniline (PNA)	100-01-6	µg/L	NE	Note 1	20.0	20.0	5.00
	4-Nitrophenol (PNP)	100-02-7	µg/L	NE	Note 1	20.0	20.0	5.00
	Acenaphthene	83-32-9	µg/L	NE	Note 1	5.00	5.00	1.25
	Acenaphthylene	208-96-8	µg/L	NE	Note 1	5.00	5.00	1.25
	Acetaphenone	98-86-2	µg/L	NE	Note 1	5.00	5.00	1.25
	Aniline	62-53-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Anthracene	120-12-7	µg/L	NE	Note 1	5.00	5.00	1.25
	Benzidine	92-87-5	µg/L	NE	Note 1	50.0	50.0	12.5
	Benzo(a)anthracene	56-55-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Benzo(a)pyrene	50-32-8	µg/L	0.2	EPA MCL	5.00	5.00	1.25

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
SVOC/EPA 8270	Benzo(b)fluoranthene	205-99-2	µg/L	NE	Note 1	5.00	5.00	1.25
	Benzo(g,h,i)perylene	191-24-2	µg/L	NE	Note 1	5.00	5.00	1.25
	Benzo(k)fluoranthene	207-08-9	µg/L	NE	Note 1	5.00	5.00	1.25
	Benzoic Acid	65-85-0	µg/L	NE	Note 1	50.0	50.0	12.5
	Benzyl alcohol	100-51-6	µg/L	NE	Note 1	5.00	5.00	1.25
	bis(2-Chloroethoxy)methane	111-91-1	µg/L	NE	Note 1	5.00	5.00	1.25
	bis(2-Chloroethyl)ether (BCEE)	111-44-4	µg/L	NE	Note 1	5.00	5.00	1.25
	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)	108-60-1	µg/L	NE	Note 1	5.00	5.00	1.25
	bis(2-Ethylhexyl)phthalate (BEHP)	117-81-7	µg/L	NE	Note 1	5.00	5.00	1.25
	Butyl benzyl phthalate (BBP)	85-68-7	µg/L	NE	Note 1	5.00	5.00	1.25
	Carbazole	86-74-8	µg/L	NE	Note 1	5.00	5.00	1.25
	Chrysene	218-01-9	µg/L	NE	Note 1	5.00	5.00	1.25
	Dibenz(a,h)anthracene	53-70-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Dibenzofuran (DBF)	132-64-9	µg/L	NE	Note 1	5.00	5.00	1.25
	Diethyl phthalate (DEP)	84-66-2	µg/L	NE	Note 1	5.00	5.00	1.25
	Dimethyl phthalate (DMP)	131-11-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Di-n-butyl phthalate (DBP)	84-74-2	µg/L	NE	Note 1	5.00	5.00	1.25
	Di-n-octyl phthalate (DNOP)	117-84-0	µg/L	NE	Note 1	5.00	5.00	1.25
	Fluoranthene	206-44-0	µg/L	NE	Note 1	5.00	5.00	1.25
	Fluorene	86-73-7	µg/L	NE	Note 1	5.00	5.00	1.25
	Hexachlorobenzene (HCB)	118-74-1	µg/L	1.0	EPA MCL	5.00	5.00	1.25

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
SVOC/EPA 8270	Hexachlorobutadiene (HCBD)	87-68-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L	50	EPA MCL	5.00	5.00	1.25
	Hexachloroethane (HCE)	67-72-1	µg/L	NE	Note 1	5.00	5.00	1.25
	Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	NE	Note 1	5.00	5.00	1.25
	Isophorone	78-59-1	µg/L	NE	Note 1	5.00	5.00	1.25
	Hexachlorobutadiene (HCBD)	87-68-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Naphthalene	91-20-3	µg/L	NE	Note 1	5.00	5.00	1.25
	Nitrobenzene	98-95-3	µg/L	NE	Note 1	5.00	5.00	1.25
	N-Nitrosodimethylamine	62-75-9	µg/L	NE	Note 1	5.00	5.00	1.25
	N-Nitroso-di-n-propylamine (NDPA)	621-64-7	µg/L	NE	Note 1	5.00	5.00	1.25
	N-nitrosodiphenylamine (NDPHA)	86-30-6	µg/L	NE	Note 1	5.00	5.00	1.25
	Pentachlorophenol	87-86-5	µg/L	1.0	EPA MCL	20.0	20.0	5.0
	Phenanthrene	85-01-8	µg/L	NE	Note 1	5.00	5.00	1.25
	Phenol	108-95-2	µg/L	NE	Note 1	5.00	5.00	1.25
	Pyrene	129-00-0	µg/L	NE	Note 1	5.00	5.00	1.25
	Pyridine	110-86-1	µg/L	NE	Note 1	5.00	5.00	1.25
Metals/EPA 6010	Dissolved Iron (field filtered)	2691-41-0	µg/L	300	EPA MCL	100	100	30
	Dissolved Manganese (field filtered)	121-82-4	µg/L	50	EPA MCL	15	15	3.0
	Total Lead	99-35-4	µg/L	15	EPA MCL	3.0	3.0	1.5
Cations/EPA 6010	Sodium	99-65-0	µg/L	NE	Note1	5,000	5,000	1,000
	Potassium	479-45-8	µg/L	NE	Note1	5,000	5,000	1,000

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
Cation/EPA 6010	Calcium	98-95-3	µg/L	NE	Note1	5,000	5,000	1,000
	Magnesium	118-96-7	µg/L	NE	Note1	5,000	5,000	1,000
Anions//EPA 300.0	Nitrate	14797-55-8	mg/L	10	EPA MCL and NMWQCC	0.20	0.20	0.0330
	Sulfate	14808-79-8	mg/L	250	EPA MCL	2.0	2.0	0.330
	Nitrite	14797-65-0	mg/L	1	EPA MCL	0.20	0.20	0.0330
	Chloride	16887-006	mg/L	250	EPA MCL and NMWQCC	5.00	5.00	0.170
Alkalinity/ SM2320B	Alkalinity	NA	mg/L	NE	Note 1	5.00	5.00	1.0
Ammonia/SM 4500B, D	Ammonia	7664-41-7	mg/L	NE	Note 1	5.00	5.00	0.11
Sulfide/SM4 500 S-2CF	Total Sulfide	18496-25-8	mg/L	NE	Note 1	5.00	5.00	0.80
TKN/EPA 351.4	TKN	NA	mg/L	NE	Note 1	1.5	1.5	0.50
O-Phosphorous/ SM 4500 PE	O-Phosphorous	14265-44-2	mg/L	NE	Note 1	0.040	0.040	0.010
TOC/EPA 9060	TOC	NA	mg/L	NE	Note 1	5.00	5.00	0.25

QAPP Worksheet #15a – Reference Limits and Evaluation Table – Groundwater (Continued)

Analytical Group/ Method	Analyte	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
Dissolved Gases RSK 175	Methane	9004-70-0	µg/L	NE	Note 1	20.0	20.0	1.0
	Ethane	14797-14-0	µg/L	NE	Note 1	5.00	5.00	1.0
	Ethene	74-85-1	µg/L	NE	Note 1	5.00	5.00	1.0
Stable Isotopes/ Laboratory SOP	Stable carbon and hydrogen isotopes	NA	$^{0}/_{00}$	NE	Note 1	NA	NA	NA

Note(s) for project comparison limit reference:

MCL: Maximum Contaminant Level, EPA National Primary Drinking Water Regulations.

NMWQCC: New Mexico Water Quality Control Commission Standards, New Mexico Administrative Code, Attachment 4, Title 20 Environmental Protection, Chapter 6- Water Quality, Part 2- Ground and Surface Water Protection.

Note 1: Project comparison limits not established.

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

CAS denotes Chemical Abstract Service.

MDL denote method detection limit.

NE denotes not established.

Stable isotopes will be expressed as $^{13}C/^{12}C$ as CO_2 and $^{2}H/^{1}H$ as H_2

QAPP Worksheet #15b – Reference Limits and Evaluation Table – Soil Gas

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/TPH/EPA TO15	1,1,1-Trichloroethane	71-55-6	ppbv	NE	Note 1	1	1	0.33
	1,1,2,2-Tetrachloroethane	79-34-5	ppbv	NE	Note 1	1	1	0.42
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	ppbv	NE	Note 1	1	1	0.31
	1,1,2-Trichloroethane	79-00-5	ppbv	NE	Note 1	0.5	0.5	0.23
	1,1-Dichloroethane	75-34-3	ppbv	NE	Note 1	1	1	0.38
	1,1-Dichloroethene	75-35-4	ppbv	NE	Note 1	2	2	0.65
	1,2,4-Trichlorobenzene	120-82-1	ppbv	NE	Note 1	2	2	0.52
	1,2,4-Trimethylbenzene	95-63-6	ppbv	NE	Note 1	1	1	0.42
	1,2-Dibromoethane	106-93-4	ppbv	NE	Note 1	0.5	0.5	0.19
	1,2-Dichlorobenzene	95-50-1	ppbv	NE	Note 1	1	1	0.37
	1,2-Dichloroethane	594-20-7	ppbv	NE	Note 1	1	1	0.33
	1,2-Dichloropropane	78-87-5	ppbv	NE	Note 1	0.5	0.5	0.23
	1,3,5-Trimethylbenzene	108-67-8	ppbv	NE	Note 1	1	1	0.38
	1,3-Butadiene	106-99-0	ppbv	NE	Note 1	3	3	1.34
	1,3-Dichlorobenzene	541-73-1	ppbv	NE	Note 1	1	1	0.36
	1,4-Dichlorobenzene	106-46-7	ppbv	NE	Note 1	1	1	0.45
	1,4-Dioxane	123-91-1	ppbv	NE	Note 1	5	5	1.8
	2-Butanone	78-93-3	ppbv	NE	Note 1	2	2	0.54
	2-Hexanone	591-78-6	ppbv	NE	Note 1	5	5	2.16
	2-Propanol	67-63-0	ppbv	NE	Note 1	1	1	0.44
	4-Methyl-2-pentanone	108-10-1	ppbv	NE	Note 1	5	5	1.07

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
	Acetone	67-64-1	ppbv	NE	Note 1	2	2	0.44

Worksheet #15b – Reference Limits and Evaluation Table – Soil Gas (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/TPH/EPA TO-15	Benzene	71-43-2	ppbv	NE	Note 1	1	1	0.39
	Benzyl chloride	100-44-7	ppbv	NE	Note 1	1	1	0.54
	Bromodichloromethane	75-27-4	ppbv	NE	Note 1	0.5	0.5	0.21
	Bromoform	75-25-2	ppbv	NE	Note 1	1	1	0.41
	Bromomethane	74-83-9	ppbv	NE	Note 1	2	2	0.71
	Carbon disulfide	75-15-0	ppbv	NE	Note 1	2	2	0.41
	Carbon tetrachloride	56-23-5	ppbv	NE	Note 1	1	1	0.35
	Chlorobenzene	108-90-7	ppbv	NE	Note 1	1	1	0.39
	Chlorodibromomethane	124-48-1	ppbv	NE	Note 1	1	1	0.34
	Chloroethane	75-00-3	ppbv	NE	Note 1	1	1	0.49
	Chloroform	67-66-3	ppbv	NE	Note 1	1	1	0.3
	Chloromethane	74-87-3	ppbv	NE	Note 1	2	2	0.68
	cis-1,2-Dichloroethene	156-59-2	ppbv	NE	Note 1	1	1	1
	cis-1,3-dichloropropene	10061-01-5	ppbv	NE	Note 1	0.5	0.5	0.24
	Cyclohexane	110-82-7	ppbv	NE	Note 1	1	1	0.37
	Dichlorodifluoromethane	75-71-8	ppbv	NE	Note 1	1	1	0.4
	Ethanol	64-17-5	ppbv	NE	Note 1	1	1	0.53
	Ethyl acetate	141-78-6	ppbv	NE	Note 1	1	1	0.55
	Ethylbenzene	100-41-4	ppbv	NE	Note 1	1	1	0.35
	Heptane	142-82-5	ppbv	NE	Note 1	1	1	0.37
	Hexachlorobutadiene	87-68-3	ppbv	NE	Note 1	2	2	0.54

Worksheet #15b – Reference Limits and Evaluation Table – Soil Gas (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/TPH/EPA TO-15	m,p-Xylene	179601-23-1	ppbv	NE	Note 1	2	2	0.75
	Methylene chloride	75-09-2	ppbv	NE	Note 1	2	2	0.31
	n-Hexane	110-54-3	ppbv	NE	Note 1	1	1	0.31
	o-Xylene	95-47.6	ppbv	NE	Note 1	1	1	0.39
	Propylene	115-07-1	ppbv	NE	Note 1	1	1	0.37
	Styrene	100-42-5	ppbv	NE	Note 1	1	1	0.43
	tert-Butyl Methyl Ether	1634-04-4	ppbv	NE	Note 1	2	2	0.61
	Tetrachloroethene	127-18-4	ppbv	NE	Note 1	0.5	0.5	0.21
	Tetrahydrofuran	109-99-9	ppbv	NE	Note 1	2	2	0.58
	Toluene	108-88-3	ppbv	NE	Note 1	0.5	0.5	0.24
	trans-1,2-Dichloroethene	156-60-5	ppbv	NE	Note 1	1	1	0.38
	trans-1,3-dichloropropene	10061-02-6	ppbv	NE	Note 1	1	1	0.31
	Trichloroethene	79-01-6	ppbv	NE	Note 1	1	1	0.35
	Trichlorofluoromethane	75-69-4	ppbv	NE	Note 1	1	1	0.31
	Vinyl acetate	108-05-4	ppbv	NE	Note 1	1	1	0.31
	Vinyl chloride	75-01-4	ppbv	NE	Note 1	1	1	0.41
	Xylenes, Total	1330-20-7	ppbv	NE	Note 1	3	3	1.14
VOC/TPH/EPA TO15	C5-C12, range	NA	ppbv	NE	Note 1	50	50	50

Worksheet #15b – Reference Limits and Evaluation Table – Soil Gas (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
APH/Method MA DEP	C5-C8 Aliphatic	NA	Ppbv	NE	Note 1	50	50	50
	C9-C12 Aliphatic	NA	ppbv	NE	Note 1	50	50	50
	Benzene	71-43-2	ppbv	NE	Note 1	1	1	.39
	Toluene	108-88-3	ppbv	NE	Note 1	0.5	0.5	.24
	Ethylbenzene	100-41-4	ppbv	NE	Note 1	1	1	.35
	Xylenes	1330-20-7	ppbv	NE	Note 1	3	3	1.14
	Naphthalene	91-20-3	ppbv	NE	Note 1	5	5	5
Fixed Gases/ASTM D2504	Oxygen	7782-44-7	%	NE	Note 1	0.1	0.1	0.1
	Nitrogen	7727-37-9	%	NE	Note 1	0.1	0.1	0.1
	Carbon Monoxide	630-08-0	%	NE	Note 1	0.1	0.1	0.1
	Carbon Dioxide	124-38-9	%	NE	Note 1	0.1	0.1	0.1
	Methane	74-82-8	%	NE	Note 1	0.5	0.5	0.5

Note 1: Project comparison limits not established.

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

CAS denotes Chemical Abstract Service.

MDL denote method detection limit.

NE denotes not established.

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	Acetone	67-64-1	µg/kg	2.81E07	NM SSL	5.0	5.0	1.06
	Acrolein	107-02-8	µg/kg	150	EPA SSL	25	25	2.00
	Acrylonitrile	75-05-8	µg/kg	4.27E03	NM SSL	25	25	1.07
	Benzene	71-43-2	µg/kg	1100	EPA SSL	2.0	2.0	0.137
	Bromobenzene	108-86-1	µg/kg	3.7E04	NM SSL	2.0	2.0	0.301
	Bromochloromethane	74-97-5	µg/kg	NE	Note 1	2.0	2.0	0.386
	Bromodichloromethane	75-27-4	µg/kg	270	EPA SSL	2.0	2.0	0.150
	Bromoform	75-25-2	µg/kg	6.1E04	EPA SSL	2.0	2.0	0.231
	Bromomethane	74-83-9	µg/kg	7.3E03	EPA SSL	2.0	2.0	1.46
	2-Butanone (MEK)	78-93-3	µg/kg	2.8E07	EPA SSL	5.0	5.0	0.603
	n-Butylbenzene	104-51-8	µg/kg	6.21E04	NM SSL	2.0	2.0	0.349
	sec-Butylbenzene	135-98-8	µg/kg	6.06E04	NM SSL	2.0	2.0	0.251
	tert-Butylbenzene	98-06-6	µg/kg	1.6E05	NM SSL	2.0	2.0	0.237
	Carbon disulfide	75-15-0	µg/kg	4.6E05	NM SSL	2.0	2.0	0.465
	Carbon tetrachloride	56-23-5	µg/kg	610	EPA SSL	2.0	2.0	0.236
	Chlorobenzene	108-90-7	µg/kg	1.94E05	NM SSL	2.0	2.0	0.188
	Chlorodibromomethane	124-48-1	µg/kg	680	EPA SSL	2.0	2.0	0.140
	Chloroethane	75-00-3	µg/kg	6.33E04	NM SSL	2.0	2.0	0.659
	Chloroform	67-66-3	µg/kg	290	EPA SSL	2.0	2.0	0.246
	Chloromethane	74-87-3	µg/kg	2.81E04	NM SSL	2.0	2.0	0.757
	2-Chlorotoluene	95-49-8	µg/kg	2.02E05	NM SSL	2.0	2.0	0.264
	4-Chlorotoluene	106-43-4	µg/kg	5.5E06	EPA SSL	2.0	2.0	0.306

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	1,2-Dibromo-3-chloropropane	96-12-8	µg/kg	5.4	EPA SSL	2.0	2.0	0.801
	1,2-Dibromoethane	106-93-4	µg/kg	34	EPA SSL	2.0	2.0	0.239
	Dibromomethane	74-95-3	µg/kg	2.5E04	EPA SSL	2.0	2.0	0.314
	1,2-Dichlorobenzene	95-50-1	µg/kg	3.74E04	NM SSL	2.0	2.0	0.325
	1,3-Dichlorobenzene	541-73-1	µg/kg	3.26E04	NM SSL	2.0	2.0	0.319
	1,4-Dichlorobenzene	106-46-7	µg/kg	2.4E03	EPA SSL	2.0	2.0	0.411
	Dichlorodifluoromethane	75-71-8	µg/kg	1.61E05	NM SSL	2.0	2.0	0.111
	1,1-Dichloroethane	75-34-3	µg/kg	3.3E03	EPA SSL	2.0	2.0	0.332
	1,2-Dichloroethane	107-06-2	µg/kg	430	EPA SSL	2.0	2.0	0.131
	1,1-Dichloroethene	75-35-4	µg/kg	2.06E05	NM SSL	2.0	2.0	0.667
	cis-1,2-Dichloroethene	156-59-2	µg/kg	7.65E04	NM SSL	2.0	2.0	0.172
	trans-1,2-Dichloroethene	156-60-5	µg/kg	1.12E05	NM SSL	2.0	2.0	0.202
	1,2-Dichloropropane	78-87-5	µg/kg	890	EPA SSL	2.0	2.0	0.108
	1,3-Dichloropropane	142-28-9	µg/kg	1.2E04	NM SSL	2.0	2.0	0.179
	2,2-Dichloropropane	594-20-7	µg/kg	NE	Note 1	2.0	2.0	1.16
	1,1-Dichloropropene	563-58-6	µg/kg	NE	Note 1	2.0	2.0	0.208
	cis-1,3-Dichloropropene	10061-01-5	µg/kg	NE	Note 1	2.0	2.0	0.145
	trans-1,3-Dichloropropene	10061-02-6	µg/kg	NE	Note 1	2.0	2.0	0.220
	Ethylbenzene	100-41-4	µg/kg	5.4E03	EPA SSL	2.0	2.0	0.206
	Hexachlorobutadiene	87-68-3	µg/kg	6.2E03	EPA SSL	2.0	2.0	0.233
	2-Hexanone	591-78-6	µg/kg	2.1E05	EPA SSL	5.0	5.0	0.339
	Isopropylbenzene	98-82-8	µg/kg	2.71E05	NM SSL	2.0	2.0	0.195

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	p-Isopropyltoluene	99-87-6	µg/kg	NE	Note 1	2.0	2.0	0.266
	Methylene chloride	75-09-2	µg/kg	1.1E04	EPA SSL	5.0	5.0	0.348
	Methyl-tert-butyl ether	1634-04-4	µg/kg	4.3E04	EPA SSL	2.0	2.0	0.167
	4-Methyl-2-pentanone	108-10-1	µg/kg	5.3E06	EPA SSL	5.0	5.0	0.341
	Naphthalene	91-20-3	µg/kg	3.6	EPA SSL	2.0	2.0	0.825
	n-Propylbenzene	103-65-1	µg/kg	6.21E04	NM SSL	2.0	2.0	0.271
	Styrene	100-42-5	µg/kg	1.0E05	NM SSL	2.0	2.0	0.264
	1,1,1,2-Tetrachloroethane	630-20-6	µg/kg	1.9E03	EPA SSL	2.0	2.0	0.105
	1,1,2,2-Tetrachloroethane	79-34-5	µg/kg	560	EPA SSL	2.0	2.0	0.276
	Tetrachloroethene	127-18-4	µg/kg	550	EPA SSL	2.0	2.0	0.207
	Toluene	108-88-3	µg/kg	2.52E05	NM SSL	2.0	2.0	0.200
	1,2,3-Trichlorobenzene	87-61-6	µg/kg	4.9E04	EPA SSL	2.0	2.0	0.270
	1,2,4-Trichlorobenzene	120-82-1	µg/kg	2.2E04	EPA SSL	2.0	2.0	0.305
	1,1,1-Trichloroethane	71-55-6	µg/kg	5.63E05	NM SSL	2.0	2.0	0.231
	1,1,2-Trichloroethane	79-00-5	µg/kg	1.1E03	EPA SSL	2.0	2.0	0.235
	Trichloroethene	79-01-6	µg/kg	638	NM SSL	2.0	2.0	0.234
	Trichlorofluoromethane	75-69-4	µg/kg	5.88E05	NM SSL	2.0	2.0	0.134
	1,2,3-Trichloropropane	96-18-4	µg/kg	5	EPA SSL	2.0	2.0	0.347
	1,2,4-Trimethylbenzene	95-63-6	µg/kg	5.8E04	NM SSL	2.0	2.0	0.298
	1,3,5-Trimethylbenzene	108-67-8	µg/kg	2.48E04	NM SSL	2.0	2.0	0.241
	Vinyl acetate	108-05-4	µg/kg	9.7E05	EPA SSL	2.0	2.0	0.222
	Vinyl chloride	75-01-4	µg/kg	60	EPA SSL	2.0	2.0	0.135

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
VOCs/EPA 8260	o-Xylene	95-47-6	µg/kg	9.95E04	NM SSL	2.0	2.0	0.189
	M,p-Xylene	136777-61-2	µg/kg	8.2E04	NM SSL	4.0	4.0	0.503
	Xylenes, total	1330-20-7	µg/kg	8.2E04	NM SSL	6.0	6.0	0.686
	1-Chlorohexane	544-10-5	µg/kg	NE	Note 1	2.0	2.0	0.141
VPH/MA DEP	C5-C8 Alphatics	NA	µg/kg	NE	Note 1	1,500	1,500	220
	C9-C12 Alphatics	NA	µg/kg	NE	Note 1	1,000	1,000	264
EPH/MA DEP	C9-C18 Alphatics	NA	µg/kg	NE	Note 1	20,000	20,000	1,926
	C19 –C36 Alphatics	NA	µg/kg	NE	Note 1	20,000	20,000	1,112
SVOC/EPA8270	Acenaphthene	83-32-9	µg/kg	3.4E06	EPA SSL	330	330	18.7
	Acenaphthylene	208-96-8	µg/kg	NE	Note 1	330	330	11.1
	Aniline	62-53-3	µg/kg	8.5E04	EPA SSL	330	330	17.7
	Anthracene	120-12-7	µg/kg	1.7E07	EPA SSL	330	330	11.6
	Benzo(a)anthracene	56-55-3	µg/kg	150	EPA SSL	330	330	14.1
	Benzo(b)fluoranthene	205-99-2	µg/kg	150	EPA SSL	330	330	10.3
	Benzo(k)fluoranthene	207-08-9	µg/kg	1.5E03	EPA SSL	330	330	15.1
	Benzo(g,h,i)perylene	191-24-2	µg/kg	NE	Note 1	330	330	9.12
	Benzo(a)pyrene	50-32-8	µg/kg	15	EPA SSL	330	330	19.0
	4-Bromophenyl-phenylether	101-55-3	µg/kg	NE	Note 1	330	330	29.1
	Butyl benzyl phthalate	85-68-7	µg/kg	2.6E05	EPA SSL	330	330	6.96
	Carbazole	86-74-8	µg/kg	NE	Note1	330	330	23.7
	4-Chloroaniline	106-47-8	µg/kg	2.4E03	EPA SSL	330	330	32.9
	4-Chloro-3-methylphenol	59-50-7	µg/kg	6.1E06	EPA SSL	330	330	26.0

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
	Bis(2-chloroethoxy)methane	111-91-1	µg/kg	1.8E05	EPA SSL	330	330	18.2
	bis(2-Chloroethyl)ether	111-44-4	µg/kg	210	EPA SSL	330	330	24.9

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
SVOC/EPA8270	Bis(2-chloroisopropyl) ether	108-60-1	µg/kg	4.6E03	EPA	330	330	17.0
	2-Chloronaphthalene	91-58-7	µg/kg	3.99E06	NM SSL	330	330	17.9
	2-Chlorophenol	95-47-8	µg/kg	1.66E05	NM SSL	330	330	25.4
	4-Chlorophenyl-phenylether	7005-72-3	µg/kg	NE	Note 1	330	330	36.7
	Chrysene	218-01-9	µg/kg	1.5E04	EPA SSL	330	330	11.1
	Dibenzo(a,h)anthracene	53-70-3	µg/kg	15	EPA SSL	330	330	9.06
	Dibenzofuran	132-64-9	µg/kg	7.8E04	EPA SSL	330	330	11.4
	Di-n-butylphthalate	84-74-2	µg/kg	6.1E06	EPA SSL	330	330	7.97
	1,2-Dichlorobenzene	95-50-1	µg/kg	3.74E04	NM SSL	330	330	17.7
	1,3-Dichlorobenzene	541-73-1	µg/kg	3.26E04	NM SSL	330	330	18.5
	1,4-Dichlorobenzene	106-46-7	µg/kg	2.4E03	EPA SSL	330	330	10.4
	3,3'-Dichlorobenzidine	91-94-1	µg/kg	1.1E03	EPA SSL	660	660	211
	2,4-Dichlorophenol	120-83-2	µg/kg	1.8E05	EPA SSL	330	330	53.1
	2,6-Dichlorophenol	87-65-0	µg/kg	NE	Note 1	330	330	13.3
	Diethylphthalate	84-66-2	µg/kg	4.89E04	NM SSL	330	330	30.5
	2,4-Dimethylphenol	105-67-9	µg/kg	1.22E03	EPA SSL	330	330	42.0
	Dimethylphthalate	131-11-3	µg/kg	NE	Note 1	330	330	7.31
	2,4-Dinitrophenol	51-28-5	µg/kg	1.2E05	EPA SSL	1650	1650	177
	2,4-Dinitrotoluene	121-14-2	µg/kg	1.6E03	EPA SSL	330	330	46.5
	2,6-Dinitrotoluene	606-20-2	µg/kg	1.6E04	EPA SSL	330	330	19.5
	Di-n-octylphthalate	117-84-0	µg/kg	NE	Note 1	330	330	10.8
	Bis(2-ethylhexyl)phthalate	117-81-7	µg/kg	3.5E04	EPA SSL	330	330	12.7

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
SVOC/EPA 8270	Fluoranthene	206-44-0	µg/kg	2.29E06	NM SSL	330	330	7.30
	Fluorene	86-73-7	µg/kg	2.3E06	NM SSL	330	330	10.1
	Hexachlorobenzene	118-74-1	µg/kg	300	EPA SSL	330	330	39.5
	Hexachlorobutadiene	87-68-3	µg/kg	6.2E03	EPA SSL	330	330	21.7
	Hexachlorocyclopentadiene	77-47-4	µg/kg	3.66E05	NM SSL	330	330	49.3
	Hexachloroethane	67-72-1	µg/kg	3.5E04	EPA SSL	330	330	49.0
	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	150	EPA SSL	330	330	13.2
	Isophorone	78-59-1	µg/kg	5.1E05	EPA SSL	330	330	10.8
	2-Methyl-4,6-Dinitrophenol	534-52-1	µg/kg	4.9E03	EPA SSL	1650	1650	32.4
	2-Methylnaphthalene	91-57-6	µg/kg	3.1E05	EPA SSL	330	330	17.7
	2-Methylphenol	95-48-7	µg/kg	3.1E06	EPA SSL	330	330	10.1
	4-Methylphenol (and/or 3-Methylphenol)	1319-77-3	µg/kg	7.5E06	EPA SSL	330	330	58.1
	Naphthalene	91-20-3	µg/kg	3.6E06	EPA SSL	330	330	11.0
	2-Nitroaniline	88-74-4	µg/kg	6.1E05	EPA SSL	1650	1650	37.1
	3-Nitroaniline	99-09-2	µg/kg	NE	Note 1	1650	1650	40.3
	4-Nitroaniline	100-01-6	µg/kg	2.4E04	EPA SSL	1650	1650	61.6
	Nitrobenzene	98-95-3	µg/kg	4.8E03	EPA SSL	330	330	15.3
	2-Nitrophenol	88-75-5	µg/kg	NE	Note 1	330	330	15.1
	4-Nitrophenol	100-02-7	µg/kg	NE	Note 1	1650	1650	114
	N-Nitrosodiethylamine	55-18-5	µg/kg	0.77	EPA SSL	330	330	17.4
	N-Nitrosodimethylamine	62-75-9	µg/kg	2.3	EPA SSL	330	330	17.0

QAPP Worksheet #15c – Reference Limits and Evaluation Table – Soil (Continued)

Analytical Group/ Method	Analyte and Location	CAS Number	Units	Project Comparison Limit	Project Comparison Limit Reference	Project RL	Laboratory-Specific	
							RL	MDL
SVOC/EPA 8270	N-Nitrosodiphenylamine	86-30-6	µg/kg	9.9E04	EPA SSL	330	330	10.5
	N-Nitroso-di-n-propylamine	621-64-7	µg/kg	69	EPA SSL	330	330	16.7
	Pentachlorobenzene	608-93-5	µg/kg	4.89E04	NM SSL	330	330	26.4
	Pentachlorophenol	87-86-5	µg/kg	3.0E06	EPA SSL	1650	1650	27.0
	Phenanthrene	85-01-8	µg/kg	1.83E06	NM SSL	330	330	13.4
	Phenol	108-95-2	µg/kg	1.8E07	NM SSL	330	330	16.0
	Pyrene	129-00-0	µg/kg	1.7E06	EPA SSL	330	330	46.3
	Pyridine	110-86-1	µg/kg	7.8E04	EPA SSL	330	330	18.6
	1,2,4,5-Tetrachlorobenzene	95-94-3	µg/kg	1.8E04	EPA SSL	330	330	7.95
	2,3,4,6-Tetrachlorophenol	58-90-2	µg/kg	1.8E06	EPA SSL	330	330	13.5
	1,2,4-Trichlorobenzene	120-82-1	µg/kg	2.2E04	EPA SSL	330	330	22.0
	2,4,5-Trichlorophenol	95-95-4	µg/kg	6.1E06	EPA SSL	330	330	39.4
	2,4,6-Trichlorophenol	88-06-2	µg/kg	6.11E06	EPA SSL	330	330	51.8
	1,2-Diphenylhydrazine	122-66-7	µg/kg	610	EPA SSL	330	330	7.51
Lead/EPA 6010	Lead	7439-92-1	mg/kg	400	EPA and NM SSL	0.6	0.6	0.0662

Note:
NM SSL denotes New Mexico Soil Screening Level (New Mexico Environmental Department, Technical Background Document for Development of Soil Screening Levels, Revision 4.0, June 2006)
EPA SSL denotes EPA regional soil screening Level (May 2010)
Note 1: project comparison levels not established.

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

CAS denotes Chemical Abstract Service.

MDL denote method detection limit.

NE denotes not established.

QAPP Worksheet #16 – Project Schedule/Timeline Table

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
QAPP/SAP Preparation	Shaw	October	October 29, 2010	QAPP/SAP	October 29, 2010
QAPP/SAP Reviews	USACE	November	November	QAPP/SAP	November
First Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	January 2011	March 2011	First Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter groundwater, soil gas, and vapor data	Shaw	January 2011	March 2011	First Quarter Data Validation Report	within 60 days after collection of the last field sample
First quarter groundwater, soil gas, and vapor data submittal	Shaw	January 2011	March 2011	First Quarter ERMPIS Submittal	within 60 days after collection of the last field sample
Second Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	April 2011	June 2011	Second Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the second quarter groundwater, soil gas, and vapor data	Shaw	April 2011	June 2011	Second Quarter Data Validation Report	within 60 days after collection of the last field sample
Second quarter groundwater, soil gas, and vapor data submittal	Shaw	April 2011	June 2011	Second Quarter ERMPIS Submittal	within 60 days after collection of the last field sample
Third Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	July 2011	September 2011	Third Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the third quarter groundwater, soil gas and vapor data	Shaw	July 2011	September 2011	Third Quarter Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Third quarter groundwater, soil gas, and vapor data submittal	Shaw	July 2011	September 2011	Third Quarter ERMPIS Submittal	within 60 days after collection of the last field sample
Fourth Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	October 2011	December 2011	Fourth Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the fourth quarter groundwater, soil gas, and vapor data	Shaw	October 2011	December 2011	Fourth Quarter Data Validation Report	within 60 days after collection of the last field sample
Fourth quarter groundwater, soil gas, and vapor data submittal	Shaw	October 2011	December 2011	Fourth Quarter ERMPIS Submittal	within 60 days after collection of the last field sample
First Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	January 2012	March 2012	First Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter groundwater, soil gas, and vapor data	Shaw	January 2012	March 2012	First Quarter Data Validation Report	within 60 days after collection of the last field sample
First quarter groundwater, soil gas, and vapor data submittal	Shaw	January 2012	March 2012	First Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Second Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	April 2012	June 2012	Second Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the second quarter groundwater, soil gas, and vapor data	Shaw	April 2012	June 2012	Second Quarter Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Second quarter groundwater, soil gas, and vapor data submittal	Shaw	April 2012	June 2012	Second Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Third Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	July 2012	September 2012	Third Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the third quarter groundwater, soil gas and vapor data	Shaw	July 2012	September 2012	Third Quarter Data Validation Report	within 60 days after collection of the last field sample
Third quarter groundwater, soil gas, and vapor data submittal	Shaw	July 2012	September 2012	Third Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Fourth Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	October 2012	December 2012	Fourth Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the fourth quarter groundwater, soil gas, vapor data	Shaw	October 2012	December 2012	Fourth Quarter Data Validation Report	within 60 days after collection of the last field sample
Fourth quarter groundwater, soil gas, and vapor data submittal	Shaw	October 2012	December 2012	Fourth Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
First Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	January 2013	March 2013	First Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter groundwater, soil gas, and vapor data	Shaw	January 2013	March 2013	First Quarter Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
First quarter groundwater, soil gas, and vapor data submittal	Shaw	January 2013	March 2013	First Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Second Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	April 2013	June 2013	Second Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the second quarter groundwater, soil gas, and vapor data	Shaw	April 2013	June 2013	Second Quarter Data Validation Report	within 60 days after collection of the last field sample
Second quarter groundwater, soil gas, and vapor data submittal	Shaw	April 2013	June 2013	Second Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Third Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	July 2013	September 2013	Third Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the third quarter groundwater, soil gas, and vapor data	Shaw	July 2013	September 2013	Third Quarter Data Validation Report	within 60 days after collection of the last field sample
Third quarter groundwater, soil gas data, and vapor submittal	Shaw	July 2013	September 2013	Third Quarter ERMPIS Submittal	within 60 days after collection of the last field sample
Fourth Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	October 2013	December 2013	Fourth Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the fourth quarter groundwater, soil gas, and vapor data	Shaw	October 2013	December 2013	Fourth Quarter Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
Fourth quarter groundwater, soil gas, and vapor data submittal	Shaw	October 2013	December 2013	Fourth Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
First Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	January 2014	March 2014	First Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter groundwater, soil gas, and vapor data	Shaw	January 2014	March 2014	First Quarter Data Validation Report	within 60 days after collection of the last field sample
First quarter groundwater, soil gas, and vapor data submittal	Shaw	January 2014	March 2014	First Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Second Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	April 2014	June 2014	Second Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the second quarter groundwater, soil gas, and vapor data	Shaw	April 2014	June 2014	Second Quarter Data Validation Report	within 60 days after collection of the last field sample
Second quarter groundwater, soil gas, and vapor data submittal	Shaw	April 2014	June 2014	Second Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Third Quarterly Groundwater, Soil Gas, and Vapor Monitoring	Shaw	July 2014	September 2014	Third Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the third quarter groundwater, soil gas, and vapor data	Shaw	July 2014	September 2014	Third Quarter Data Validation Report	within 60 days after collection of the last field sample
Third quarter groundwater, soil gas, vapor data submittal	Shaw	July 2014	September 2014	Third Quarter ERPIMS Submittal	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Fourth Quarterly Groundwater, Soil Gas, Vapor Monitoring	Shaw	October 2014	December 2014	Fourth Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the fourth quarter groundwater, soil gas, and vapor data	Shaw	October 2014	December 2014	Fourth Quarter Data Validation Report	within 60 days after collection of the last field sample
Fourth quarter groundwater, soil gas, and vapor data submittal	Shaw	October 2014	December 2014	Fourth Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Soil Sampling Associated with SVM Installation	Shaw	January 11, 2011	February 11, 2011	Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the soil SVM data	Shaw	Two weeks after laboratory analysis is completed	Two weeks after laboratory analysis is completed	Data Validation Report	within 60 days after collection of the last field sample
Soil SVM data submittal	Shaw	Within 60 days after collection of the last field samples	Within 60 days after collection of the last field samples	ERPIMS Submittal	within 60 days after collection of the last field sample
FFOR Soil Sampling	Shaw	March 4, 2011	April 7, 2011	Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the FFOR soil data	Shaw	Two weeks after laboratory analysis is completed	Two weeks after laboratory analysis is completed	Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Soil FFOR data submittal	Shaw	Within 60 days after collection of the last field samples	Within 60 days after collection of the last field samples	ERPIMS Submittal	within 60 days after collection of the last field sample
Soil Sampling associated with monitoring well installation	Shaw	February 14, 2011	April 28, 2011	Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the soil data associated with groundwater monitoring well installation	Shaw	Two weeks after laboratory analysis is completed	Two weeks after laboratory analysis is completed	Data Validation Report	within 60 days after collection of the last field sample
Soil data submittal (monitoring well installation)	Shaw	Within 60 days after collection of the last field samples	Within 60 days after collection of the last field samples	ERPIMS Submittal	within 60 days after collection of the last field sample
Groundwater monitoring to support the LNAPL contaminant IM Investigations (one event)	Shaw	January 2010	April 2010	Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the groundwater data associated with the LNAPL contaminant IM Investigations	Shaw	January 2010	April 2010	Data Validation Report	within 60 days after collection of the last field sample
Groundwater data submittal (LNAPL contaminant IM Investigations)	Shaw	January 2010	April 2010	ERPIMS Submittal	within 60 days after collection of the last field sample
First quarter MNA Groundwater Monitoring	Shaw	January 2011	March 2011	First Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter MNA data	Shaw	January 2011	March 2011	First Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
First quarter MNA data submittal	Shaw	January 2011	March 2011	First Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Second quarter MNA Groundwater Monitoring	Shaw	April 2011	June 2011	Second Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter MNA data	Shaw	April 2011	June 2011	Second Quarter Data Validation Report	within 60 days after collection of the last field sample
Second quarter MNA data submittal	Shaw	April 2011	June 2011	Second Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Third quarter MNA Groundwater Monitoring	Shaw	July 2011	September 2011	Third Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter MNA data	Shaw	July 2011	September 2011	Third Quarter Data Validation Report	within 60 days after collection of the last field sample
Third quarter MNA data submittal	Shaw	July 2011	September 2011	Third Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Fourth quarter MNA Groundwater Monitoring	Shaw	October 2011	December 2011	Fourth Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the first quarter MNA data	Shaw	October 2011When	December 2011	Fourth Quarter Data Validation Report	within 60 days after collection of the last field sample

QAPP Worksheet #16 – Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Fourth quarter MNA data submittal	Shaw	October 2011When	December 2011	Fourth Quarter ERPIMS Submittal	within 60 days after collection of the last field sample
Soil IDW sampling associated with FFOR and SVM Installation	Shaw	January 11, 2011	April 7, 2011	Quarter Monitoring Report	within 60 days after collection of the last field sample
Automated data review of the soil IDW data	Shaw	Two weeks after laboratory analysis is completed	Two weeks after laboratory analysis is completed	Data Validation Report	within 60 days after collection of the last field sample
Soil IDW data submittal	Shaw	Within 60 days after collection of the last field sample	Within 60 days after collection of the last field sample	ERPIMS Submittal	within 60 days after collection of the last field sample

Note:

ERPIMS denotes Environmental Resources Program Information Management System

QAPP Worksheet #17 – Sampling Design and Rationale

This section discusses the sampling and analysis strategy for groundwater, soil gas, and soil samples required to meet the project DQOs. Locations of the groundwater monitoring wells, soil gas vapor wells, and soil sampling are depicted on the site maps for SWMUs ST-106 and SS-111 (Figure 2).

17.1 WATER LEVEL AND LNAPL MEASUREMENTS

Monthly water level and LNAPL measurements will be conducted at 29 monitoring wells starting in January 2011 and continuing for the duration of the year adding the 78 wells as they become completed. Following Kirtland SOP B5-6 and Shaw's SOP EI-FS108, water levels and LNAPL will be measured, respectively. Results of the monthly water levels and LNAPL measurements will be recorded in log books and Shaw's database.

17.2 PRE-REMEDY QUARTERLY MONITORING PROGRAM – GROUNDWATER

Currently, there are a total of 29 existing groundwater monitoring wells and municipal wells at the BFF site. In compliance with NMED requirements, quarterly groundwater monitoring will be performed at these 29 existing wells during January 2011. In addition, a remedial facility investigation (RFI) of the groundwater associated with the BFF Spill SWMUs ST-106 and ST-111 will be conducted. The RFI will consist of installing monitoring wells, performing down hole geophysics of existing and new monitoring wells, and sampling of existing and new monitoring wells. As part of the groundwater investigation and to further characterize the LNAPL and dissolved-phase plumes, an additional 82 groundwater monitoring wells (including 2 extraction and 2 injection wells) will be installed within five months of work plan approval. These groundwater monitoring wells will be installed in the locations required by NMED to determine the lateral and vertical extent of the LNAPL and dissolved-phase plumes. Following well installation and development, 43 new wells in addition to the 29 existing will be sampled in April 2009. During July 2011 through December 2014, a total of 111 monitoring wells will be sampled on a quarterly basis, includes the 29 existing and the 82 new wells to be installed by July 2011.

All groundwater samples will be collected using the low-flow groundwater sampling procedure described in Kirtland SOP B4.1 "Monitoring Well Sampling". Groundwater samples will be analyzed for the following parameters:

- VOCs - EPA Method 8260
- EDB - EPA Method 8011
- TPH gasoline - EPA Method 8015
- TPH diesel - EPA Method 8015 with silica gel cleanup

- VPH (C5-C8) and (C9-12) - Massachusetts Department of Environmental Protection (MA DEP)
- EPH (C12-C40) - MA DEP with silica gel cleanup
- SVOCs - EPA Method 8270
- Dissolved iron and manganese - EPA Method 6010 (field filtered)
- Total cations (calcium, potassium, manganese, and sodium) and total lead - EPA Method 6010
- Anions (nitrate, chloride, sulfate) - EPA Method 300.0
- Carbonate and bicarbonate alkalinity - Standard Method (SM) 2320B and field measurement by HACH 8203 Method
- Ammonia nitrogen - SM 4500 B, D
- Total kjeldahl nitrogen - EPA Method 351.4
- Ortho-Phosphorous - SM 4500 PE
- Total sulfide - SM 4500 S-2CF
- Total organic carbon - EPA Method 9060
- Dissolved gases (methane, ethane, ethane) - RSK175

For risk evaluation purposes, the VPH/EPH analysis will be conducted for only four quarterly groundwater monitoring events. After sample collection, all samples will be labeled, packaged and shipped to an off-site DoD Environmental Laboratory Accreditation Program (DOD ELAP) approved laboratory for analysis as applicable.

In accordance with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009). QAPP/SAP Worksheets #18a presents a summary of sampling locations and analytical methods for each of the quarterly groundwater monitoring events. Specific target analytes for the quarterly groundwater monitoring program can be found in QAPP/SAP Worksheets #15a.

17.2.1 LNAPL CONTAINMENT IM INVESTIGATIONS – GROUNDWATER MONITORING

To support the LNAPL containment IM investigation and to complete data gaps, one groundwater sampling event will be conducted in January 2011 at six existing monitoring wells. The samples will be collected using the low flow sampling procedure described in Kirtland SOP B4.1 “Monitoring Well Sampling” and analyzed for the following parameters:

- VOCs - EPA Method 8260
- SVOCs - EPA Method 8270
- TPH – EPA Method 8015
- Total metals and major cations - EPA Method 6010
- Anions - EPA Method 300.0

In addition, NAPL samples will be collected from the same six wells and analyzed by a hydrocarbon specialty laboratory for the following list of hydrocarbon parameters:

- NAPL cleaning – Lab proprietary method
- Density – ASTM D1481
- Viscosity – ASTM D445
- Interfacial tension – ASTM D970
- Flashpoint – ASTM D93
- API gravity – ASTM D287
- PIANO, EDC, EDB – Lab proprietary method

Following sample collections, samples will be labeled, packaged and shipped to an off-site DoD ELAP approved laboratory for analysis. In accordance with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009). QAPP/SAP Worksheets #18g presents a summary of sampling locations and analytical methods for the groundwater monitoring event. Specific target analytes for the groundwater monitoring program can be found in QAPP/SAP Worksheets #15a.

17.2.2 MNA GROUNDWATER MONITORING

It is planned that 30 groundwater monitoring wells will be installed for the MNA investigation effort. Following well installation and well development, quarterly MNA groundwater sampling will be performed concurrently with the routine quarterly groundwater monitoring. Groundwater samples will be collected from these 30 groundwater wells for a total of four sampling events. Following the low flow sampling procedure, samples will be collected and analyzed for the parameters listed below:

- Filtered cations (calcium, potassium, magnesium, and sodium) - EPA Method 6010
- Filtered manganese – EPA Method 6010
- Anions (chloride, sulfate and nitrate) - EPA Method 300.0
- Ammonia nitrogen - SM 4500 B, D
- Ortho-phosphate - SM 4500 PE
- Total sulfide - SM 4500 S-2CF
- Carbon specific isotope analysis (carbon and hydrogen isotopes) - Laboratory SOP

Additionally, samples will be collected and analyzed in the field for ferrous iron, carbon dioxide, and alkalinity using HACH test kit methods. Laboratory samples will be labeled, packaged and shipped to an off-site DoD ELAP approved laboratory for analysis as applicable. In accordance

with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009) or other appropriate laboratory proprietary methods. QAPP/SAP Worksheets #18h presents a summary of sampling locations and analytical methods for each of the quarterly groundwater monitoring events. Specific target analytes for the quarterly groundwater monitoring program can be found in QAPP/SAP Worksheets #15a.

17.3 PRE-REMEDY QUARTERLY MONITORING PROGRAM – SOIL VAPOR

There are 15 existing soil vapor monitoring wells at the BFF site. In accordance with NMED requirements, quarterly soil gas sampling will be collected at these existing vapor well locations during January 2011. In addition, a RFI of the vadose zone within BFF Spill SWMU ST-106 will be conducted. The RFI will consist of installing SVMs, conducting soil vapor monitoring, and performing down well and borehole geophysics. Within five months of work plan approval, an additional 35 deep SVMs and five shallow SVMs wells will be installed at locations and screen intervals specified in the NMED letters. After the new SVM wells are installed, a total of 123 soil vapor samples will be collected from the new vapor well locations and existing vapor well locations in April 2011. These new vapor well locations will be sampled and then incorporated in the Pre-Remedy Quarterly Monitoring Program. During July 2011 through December 2014, a total of 230 soil gas will be sampled on a quarterly basis. To maximize efficiency, quarterly soil gas monitoring will be conducted concurrently with quarterly groundwater monitoring.

Prior to soil gas sampling, the laboratory will clean and leak check all associated Bottle vac canister sampling equipment including flow controllers and critical orifice assemblies. One vapor sampling canister from each batch of will also be analyzed for VOCs as a laboratory blank.

Soil gas samples will be collected from soil vapor wells following Kirtland SOP B1-7. Bottle vac canister samples will be collected with a flow controller to obtain a time integrated soil gas sample. Following soil gas sample collection, all soil gas samples will be analyzed for the following parameters:

- VOCs and TPH – EPA Method TO15
- APH (C5-C8 and C9-C12) - MA DEP
- Fixed Gases (oxygen, nitrogen, carbon monoxide, carbon dioxide, methane) – ASTM D2504

Note that the APH analysis is required for only four quarterly soil gas monitoring events for risk evaluation purposes. Soil gas samples will be labeled, recorded on COC and shipped to an off - site DoD ELAP approved laboratory for analysis.

Specific analytical parameters for the above methods are summarized in QAPP/SAP worksheet #15b. Sampling locations and methods for each of the quarterly soil gas monitoring events are presented in QAPP/SAP Worksheet #18b.

17.4 OPERATION AND MAINTENANCE OF THE EXISTING SOIL VAPOR EXTRACTION SYSTEMS

Presently there are four ICM soil vapor extraction (SVE) systems operated at the BFF site. Quarterly monitoring and operation of the existing SVE systems will be conducted. SUMMA canister vapor samples will be collected from all SVEs, SVM wells, and the SVE inlet and outlet. It is anticipated that a total of 41 vapor samples will be collected on a quarterly basis from January 2011 through December 2014. Vapor samples from the SVE systems will be collected into passivated Bottle Vac® canisters using the general sampling technique described below:

- Collect vapor samples under standard pressure or minimal vacuum conditions to achieve the lowest reporting limit.
- Obtain canisters and vacuum gauge from the off-site laboratory. Verify the canisters have a vacuum pressure of no less than 27 inches of mercury, prior to sample collection. Record the initial vacuum on the COC or sample collection log.
- Attach the canister to the sampling port using an airtight fitting, then open the value on the sample tap, and then open the canister valve. A slight hissing sound immediately after opening the valve of the canister indicates that vapor is filling the canister. Leave the canister value open for approximately 1 to 2 minutes for sample collection.
- Close the canister valve, and disconnect it from the sampling port.
- Measure and record the final pressure of the canister.
- Label the sample using the tag attached to the canister. Record the serial number on the COC Form next to the sample identification (ID). Store the canister properly to avoid exposure to high temperatures.
- Package and prepare the samples for shipment to the laboratory. SUMMA canisters do not require cold storage and can be returned to the laboratory in the same packaging in which they were delivered.

The vapor samples will be analyzed in the field for the following parameters:

- TPH – EPA TO 3
- Oxygen
- Carbon Monoxide
- Carbon Dioxide

Results of the vapor samples will be used to evaluate VOC destruction efficiency, and to determine optimization and effectiveness of the SVE systems. Sampling locations and methods for each of the quarterly vapor monitoring events are summarized in QAPP/SAP Worksheet #18c. Specific analytical parameters for the methods are summarized in QAPP/SAP worksheet #15b.

17.5 SOIL SAMPLING ASSOCIATED WITH SVM INSTALLATION (VADOSE ZONE INVESTIGATION)

During installation of the 35 deep SVMs and 5 shallow SVMs, soil samples will be collected and analyzed to estimate the amount of residual fuel adsorbed to soil, as soil gas and as residual liquid in the soils. Soil samples will be collected from the nested SVMs borings using a split-spoon sampler at 10 - feet intervals from ground surface to 50 feet below ground surface (bgs) followed by 50 - feet interval samples and at changes in lithology to the total depth (water table). Soil samples from the shallow SVMs will be collected in 4 - feet intervals.

Soil samples will be collected following Kirtland SOP B2-3 –Subsurface Soil Sampling, Split Spoon Sampling Procedure. It is anticipated that a total of 515 soil samples will be collected and analyzed for the following parameters:

- VOCs - EPA Method 8260
- VPH (C5-C8) and (C9-12) – MA DEP
- EPH (C9-C18) and C(19-C36) - MA DEP with silica gel cleanup
- SVOCs - EPA Method 8270
- Lead - EPA Method 6010

Samples will be labeled, packaged, and shipped to off - site DoD ELAP laboratory for analysis. In accordance with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009). Sampling locations and methods for the soil sampling associated with SVM installation are summarized in QAPP/SAP Worksheet #18d. Specific analytical parameters for the above methods are summarized in QAPP/SAP worksheet #15c.

17.6 FFOR SOIL SAMPLING (IM INVESTIGATION)

Soil samples will be collected to identify the area of shallow soil containing LNAPL or hazardous constituents above the NMED Soil Screening Levels down to 20 ft bgs. Soil samples will be collected along the 350 feet length and 650 feet length of pipeline using a Geoprobe along each side of the excavation. Spacing between samples will not exceed 25 feet. Soil samples will be collected at five foot interval for a total of five samples per borehole.

Soil samples will be collected following Kirtland SOP B2-3 –Subsurface Soil Sampling, Direct Push Sampling Procedure. It is anticipated that a total of 400 soil samples will be collected for the FFOR soil sampling (IM Investigation) and analyzed for the parameters listed below.

- VOCs - EPA Method 8260
- VPH (C5-C8) and (C9-12) – MA DEP
- EPH (C9-C18) and C(19-C36) - MA DEP with silica gel cleanup
- SVOCs - EPA Method 8270
- Lead - EPA Method 6010

Samples will be labeled, packaged, and shipped to off - site DoD ELAP laboratory for analysis. In accordance with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009). Specific analytical parameters for the above methods are summarized in QAPP/SAP worksheet #15c. Sampling locations and methods are presented in QAPP/SAP worksheet #18e.

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17.7 SOIL SAMPLING ASSOCIATED WITH GROUNDWTAER MONITORING WELL INSTALLATION

During groundwater monitoring well installation, soil samples will be collected to characterize nature and extent of contaminants in new groundwater monitoring well locations. It is anticipated that a total of 72 soil samples will be collected at 4 well locations and 18 depth intervals following Kirtland SOP B2- Subsurface Soil Sampling. All soil samples will be analyzed for the following parameters:

- VOCs - EPA Method 8260
- VPH (C5-C8) and (C9-12) – MA DEP
- EPH (C9-C18) and (19-C36) - MA DEP with silica gel cleanup
- SVOCs - EPA Method 8270
- Lead - EPA Method 6010

Samples will be labeled, packaged, and shipped to off - site DoD ELAP laboratory for analysis. In accordance with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009). Specific analytical parameters for the above methods are summarized in QAPP/SAP worksheet #15c. Sampling locations and methods for this soil sampling event are presented in QAPP/SAP worksheet #18f.

17.8 DECONTAMINATION PROCEDURE

It is anticipated that dedicated sampling equipment will be used to collect the majority of groundwater and soil samples. Since no cross contamination between samples will occur, no equipment decontamination will be performed. When non-dedicated equipment is used to collect

samples, decontamination of non-dedicated sampling equipment that comes in contact with samples will be performed to prevent the introduction of extraneous material into samples, and to prevent cross contamination between samples. All non-dedicated sampling equipment will be decontaminated by washing with a non-phosphate detergent such as Liquinox™ or equivalent and double rinsed with distilled water. Decontamination water will be collected in 55-gallon, Department of Transportation (DOT) -approved drums. Equipment decontamination procedures will be performed in accordance with Kirtland SOP B1.11 - Equipment Decontamination.

17.8 INVESTIGATION-DERIVED WASTE MANAGEMENT

The sampling methods proposed for the quarterly groundwater monitoring typically generate small amounts of investigation-derived waste (IDW). All purge water and equipment decontamination liquid (if any) from the quarterly groundwater monitoring activities will be containerized in approved drums or collected in temporary storage tanks and then transferred to a Baker storage tank pending characterization for discharge or disposal. Environmental samples collected from the monitoring wells will be used to characterize liquid IDW and determine disposition. Purge water will be discharged to ground surface pending approval from Kirtland AFB.

Prior to waste disposal, soil IDW generated from the SVM installation and FFOR soil sampling activities will be collected in lined roll-offs and DOT approved drums. It is estimated that a total of 160 IDW soil samples will be collected from the SVM installation, and 30 soil IDW samples will be collected from the FFOR soil sampling. The IDW soil samples will be collected using the general sampling technique describe below.

- Obtain 8-ounce jars.
- Put on a new (unused) pair of sampling gloves and other appropriate PPE.
- Fill the glass jar with soil for the required analyses.
- Label, package, and prepared the samples for shipment to an-off site laboratory for analysis.

The IDW soil samples will be analyzed for the following parameters per the Kirtland AFB on-site nonhazardous waste landfill disposal requirements:

- TCLP VOCs - EPA Methods 1311/8260
- TCLP SVOCs - EPA Methods 1311/8270
- TCLP pesticides - EPA Methods 1311/8081
- TCLP herbicides - EPA Method 1311/8151
- TCLP Metals - EPA Methods 1311/6010B/7471
- Reactivity, Corrosivity, and Ignitability - SW856, Chapter 7, 7.3.3.2
- BTEX - EPA Method 8260

- TPH gasoline – EPA Method 8015
- TPH diesel - EPA Method 8015 with silica gel cleanup.

The IDW soil samples will be labeled, packaged, and shipped to off - site DoD ELAP laboratory for analysis. In accordance with the DoD QSM requirements, the most current version of the EPA Methods will be selected for analysis (DoD, 2009). Analytical methods and IDW sample quantities are presented in QAPP/SAP Worksheet #18i.

All IDW drums and or rolloffs will be labeled and stored at the site until appropriate disposal is determined. Non-hazardous waste will be disposed of at the Kirtland AFB landfill or appropriate off-site facility. Shaw will coordinate with Kirtland AFB on disposal of all IDW.

17.9 FIELD QUALITY CONTORL SAMPLES

Field QC samples will be collected and analyzed during the project to assess the consistency and performance of the sampling program. Field QC samples for this project will include MS/ MSD, field duplicates, equipment rinsate samples, trip and ambient blanks for aqueous VOC samples, and temperature blanks, discussed below and shown in QAPP Worksheets # 12 and 20.

17.9.1 Matrix Spike and Matrix Spike Duplicate

Matrix spike/matrix spike duplicate samples will be collected at one per 20 groundwater or soil project samples. Matrix spike/matrix spike duplicate analyses will not be performed on IDW soil samples, soil gas samples or vapor samples. Additionally, MS/MSD samples will not be collected for stable carbon and hydrogen isotopes analysis, as MS/MSD analysis for this method and matrix are not applicable. Accuracy of vapor/soil gas, and stable isotope analysis will be assessed through a review of field duplicates, laboratory duplicates and surrogate recoveries (when applicable). Field personnel will collect extra volumes for water and soil for MS/MSD analysis and designate the MS/MSD sample on the COC Form (Figure 3).

17.9.2 Field Duplicates

Field duplicate pairs consist of two samples of the same matrix (a primary and a duplicate) collected at the same time and location to the extent possible, using the same sampling techniques. The purpose of field duplicate samples is to evaluate sampling precision. Field duplicate samples will be collected from the quarterly groundwater monitoring, quarterly soil gas monitoring, quarterly MNA sampling, IM groundwater sampling, soil sampling associated with SVM and groundwater monitoring well installation, and FFOR soil sampling events. Field duplicate samples will be collected at a frequency of 10 percent and will be analyzed for the same analytical parameters as their corresponding primary samples.

17.9.3 Equipment Rinse Blanks

Equipment rinsate blanks are used to evaluate the effectiveness of the decontamination procedure and to identify potential cross-contamination during sampling events. When dedicated or disposal sampling equipment is used to collect samples, equipment rinsate blanks will not be collected. However, if non-disposable sampling equipment is used, equipment rinsate blanks will be collected at one per day regardless of number of sampling teams working on that day. Equipment rinsate blanks consist of distilled water collected from the final rinse of the decontamination process and placed in appropriate pre-cleaned containers supplied by the analytical laboratory. The equipment rinse blanks will be analyzed for VOCs, TPH gasoline and diesel and metals. Results from these analyses will provide sufficient information to evaluate the effectiveness of equipment decontamination procedures.

17.9.4 Trip Blanks

Each cooler containing groundwater samples for VOC analysis will contain a trip blank. Trip blanks are 40-milliliter volatile organic analysis vials that contain analyte-free water, which are kept with the field samples during sampling and shipping to an off-site laboratory. The purpose of trip blanks is to determine whether samples have been contaminated with errant VOCs during transportation or sample collection. One trip blank will be collected for each day of groundwater sampling for VOC samples. One trip blank will also be included with each shipment of soil gas samples for VOC analysis. No trip blanks will be collected for soil samples for VOC analysis.

17.9.5 Ambient Blanks

Ambient blanks serve as a check on environmental contamination from contaminates in air at a sampling location. The ambient blank is prepared by pouring distilled water into a clean sample container either at the laboratory or in the field, and exposing this blank in the field at the time of sample collection and at a particular well location. This blank will be submitted for groundwater samples for VOC analysis. One ambient blank will be collected per day of groundwater sampling.

17.9.6 Temperature Blanks

Each cooler containing soil and groundwater samples will be shipped with a temperature blank. A temperature blank is a sample container filled with tap water and stored in the cooler during sample collection and transportation. The laboratory will record the temperature of the temperature blank immediately upon receipt of the samples. No temperature blank is required for soil gas or vapor samples.

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2011					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500 B, D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	29	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Second Quarter 2011					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500 B, D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	72	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarter 2011					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500 B, D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2011					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500 B, D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2012					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 VPH – MA DEP EPH – MA DEP with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Second Quarter 2012					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 VPH – MA DEP EPH – MA DEP with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarter 2012					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 VPH – MA DEP EPH – MA DEP with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2012					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 VPH – MA DEP EPH – MA DEP with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2013					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Second Quarter 2013					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarter 2013					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2013					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2014					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Second Quarter 2014					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarter 2014					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18a – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Groundwater Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2014					
Groundwater Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH Diesel – EPA 8015 with silica gel cleanup SVOCs – EPA 8270 Dissolved Iron and Manganese –EPA 6010 Total Cations and Lead – EPA 6010 Anions – EPA 300.0 Ammonia as nitrogen – SM 4500B,D TKN by EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases RSK 175	111	QAPP Worksheet #17

QAPP Worksheet #18b – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Soil Gas Monitoring Program

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2011					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	15	QAPP Worksheet #17
Second Quarter 2011					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	123	QAPP Worksheet #17
Third Quarter 2011					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17

QAPP Worksheet #18b – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Soil Gas Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2011					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
First Quarter 2012					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs – EPA TO15 APH – MA DEP Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
Second Quarter 2012					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs – EPA TO15 APH – MA DEP Fixed Gases – ASTM D2504	230	QAPP Worksheet #17

QAPP Worksheet #18b – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Soil Gas Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarter 2012					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs – EPA TO15 APH – MA DEP Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
Fourth Quarter 2012					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs – EPA TO15 APH – MA DEP Fixed Gases –ASTM D2504	230	QAPP Worksheet #17
First Quarter 2013					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17

QAPP Worksheet #18b – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Soil Gas Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Second Quarter 2013					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
Third Quarter 2013					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
Fourth Quarter 2013					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases –ASTM D2504	230	QAPP Worksheet #17

QAPP Worksheet #18b – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Soil Gas Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2014					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
Second Quarter 2014					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17
Third Quarter 2014					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17

QAPP Worksheet #18b – Sampling Locations and Methods/SOP Requirements Table – Pre-Remedy Soil Gas Monitoring Program (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2014					
Soil Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil Gas	VOCs/TPH gas – EPA TO15 Fixed Gases – ASTM D2504	230	QAPP Worksheet #17

QAPP Worksheet #18c – Sampling Locations and Methods/SOP Requirements Table – Operation and Maintenance of Existing SVE Systems

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2011					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Second Quarter 2011					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Third Quarter 2011					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17

QAPP Worksheet #18c – Sampling Locations and Methods/SOP Requirements Table – Operation and Maintenance of Existing SVE Systems (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2011					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
First Quarter 2012					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Second Quarter 2012					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17

QAPP Worksheet #18c – Sampling Locations and Methods/SOP Requirements Table – Operation and Maintenance of Existing SVE Systems (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarter 2012					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Fourth Quarter 2012					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
First Quarter 2013					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17

QAPP Worksheet #18c – Sampling Locations and Methods/SOP Requirements Table – Operation and Maintenance of Existing SVE Systems (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Second Quarter 2013					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Third Quarter 2013					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Fourth Quarter 2013					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17

QAPP Worksheet #18c – Sampling Locations and Methods/SOP Requirements Table – Operation and Maintenance of Existing SVE Systems (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarter 2014					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Second Quarter 2014					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17
Third Quarter 2014					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17

QAPP Worksheet #18c – Sampling Locations and Methods/SOP Requirements Table – Operation and Maintenance of Existing SVE Systems (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Fourth Quarter 2014					
Vapor Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Vapor	TPH – EPA TO3	41	QAPP Worksheet #17

QAPP Worksheet #18d – Sampling Locations and Methods/SOP Requirements Table – Soil Sampling Associated with SVM Installation (Vadose Zone Investigation)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
SVM Well ID	Each sample will have unique sample number which consists of site ID, well ID, and index number. Sample ID will be assigned prior to sampling	Soil	VOC – EPA 8260 VPH – MA DEP EPH – MA DEP SVOCs – EPA 8270 Lead – EPA 6010	515	QAPP Worksheet #17

QAPP Worksheet #18e – Sampling Locations and Methods/SOP Requirements Table – FFOR Soil Sampling (IM Investigation)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Soil Boring ID	Each sample will have unique sample number which consists of site ID, soil boring ID, and index number. Sample ID will be assigned prior to sampling	Soil	VOC – EPA 8260 VPH- MA DEP EPH – MA DEP SVOCs – EPA 8270 Lead – EPA 6010	400	QAPP Worksheet #17

Worksheet #18f – Sampling Locations and Methods/SOP Requirements Table – Soil Sampling Associated with Groundwater Monitoring Well Installation

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Soil Boring ID	Each sample will have unique sample number which consists of site ID, soil boring ID, and index number. Sample ID will be assigned prior to sampling	Soil	VOC – EPA 8260 VPH -_MA DEP EPH – MA DEP SVOCs - EPA 8270 Lead – EPA 6010	72	QAPP Worksheet #17

Worksheet #18g – Sampling Locations and Methods/SOP Requirements Table – Groundwater Sampling in Support of the LNAPL Containment IM Investigation

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Groundwater Monitoring Well ID	Each sample will have unique sample number which consists of site ID, groundwater well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	VOC – EPA 8260 TPH gas/diesel – EPA 8015M SVOCs - EPA 8270 Metals/Cations – EPA 6010 Anions – EPA 300.0	6	QAPP Worksheet #17

Worksheet #18h – Sampling Locations and Methods/SOP Requirements Table – MNA Groundwater Monitoring

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
First Quarterly Monitoring Event					
Groundwater Monitoring Well ID	Each sample will have unique sample number which consists of site ID, groundwater well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	Cations – EPA 6010 (field filtered) Dissolved manganese – EPA 6010 (field filtered) Anions – EPA 300.0 Ammonia nitrogen – SM 4500B,D o-Phosphate – SM 4500 PE Total Sulfide – SM 4500 S-2CF Stable carbon and hydrogen isotopes – Laboratory SOP	30	QAPP Worksheet #17
Second Quarterly Monitoring Event					
Groundwater Monitoring Well ID	Each sample will have unique sample number which consists of site ID, groundwater well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	Cations – EPA 6010 (field filtered) Dissolved manganese – EPA 6010 (field filtered) Anions – EPA 300.0 Ammonia nitrogen – SM 4500B,D o-Phosphate – SM 4500 PE Total Sulfide – SM 4500 S-2CF Stable carbon and hydrogen isotopes – Laboratory SOP	30	QAPP Worksheet #17

Worksheet #18h – Sampling Locations and Methods/SOP Requirements Table – MNA Groundwater Monitoring (Continued)

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Third Quarterly Monitoring Event					
Groundwater Monitoring Well ID	Each sample will have unique sample number which consists of site ID, groundwater well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	Cations – EPA 6010 (field filtered) Dissolved manganese – EPA 6010 (field filtered) Anions – EPA 300.0 Ammonia nitrogen – SM 4500B,D o-Phosphate – SM 4500 PE Total Sulfide – SM 4500 S-2CF Stable carbon and hydrogen isotopes – Laboratory SOP	30	QAPP Worksheet #17
Fourth Quarterly Monitoring Event					
Groundwater Monitoring Well ID	Each sample will have unique sample number which consists of site ID, groundwater well ID, and index number. Sample ID will be assigned prior to sampling	Groundwater	Cations – EPA 6010 (field filtered) Dissolved manganese – EPA 6010 (field filtered) Anions – EPA 300.0 Ammonia nitrogen – SM 4500B,D o-Phosphate – SM 4500 PE Total Sulfide – SM 4500 S-2CF Stable carbon and hydrogen isotopes – Laboratory SOP	30	QAPP Worksheet #17

QAPP Worksheet #18i – Sampling Locations and Methods/SOP Requirements Table – IDW Soil Sampling

Sampling Location	Sample ID Number	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
IDW Soil Sampling Associated with SVM Installation					
NA	Each IDW soil sample will have unique ID and will be assigned prior to sampling	Soil	VOC – EPA 1311/8260 SVOCs - EPA 1311/8270 Pesticides – EPA 1311/8081 Herbicides – EPA 1311/8151 Metals – EPA 1311/6010/7471 RCI – SW846 Chapter 7, 7.3.2 BTEX – EPA 8260 TPH Gasoline – EPA 8015 TPH Diesel – EPA 8015	160	QAPP Worksheet $17
IDW Soil Sampling Associated with FFOR					
NA	Each IDW soil sample will have unique ID and will be assigned prior to sampling	Soil	VOC – EPA 1311/8260 SVOCs - EPA 1311/8270 Pesticides – EPA 1311/8081 Herbicides – EPA 1311/8151 Metals – EPA 1311/6010/7471 RCI – SW846 Chapter 7, 7.3.2 BTEX – EPA 8260 TPH Gasoline – EPA 8015 TPH Diesel – EPA 8015	30	QAPP Worksheet $17

QAPP Worksheet #19a – Analytical SOP Requirements Table – Groundwater

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Sample Volume	Container (number, Size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Water	VOCs – EPA 8260	Preparation: EPA 5030 Analysis: EPA 8260	40 mL	3 X 40 mL VOA with Teflon® septa	HCL to pH <2 Cool at 0-6°C	14 days for analysis
Water	EDB – EPA 8011	Preparation: EPA 8011 Analysis: EPA 8011	40 mL	3 X 40 mL VOA with Teflon® septa	Sodium Thiosulfate Cool at 0-6°C	14 days for analysis
Water	TPH gasoline – EPA 8015	Preparation: EPA 5030 Analysis: EPA 8015	40 mL	3 X 40 mL VOA with Teflon® septa	HCL Cool at 0-6°C	14 days for analysis
Water	TPH diesel – EPA 8015	Preparation: EPA 3510 and silica gel cleanup Analysis: EPA 8015	1 L	1 X I L Amber	Cool at 0-6°C	7 days for extraction 40 days for analysis
Water	VPH – MA DEP	Preparation: Method MA DEP Analysis: Method MA DEP	40 mL	3 X 40 mL VOA with Teflon® septa	HCL to pH <2 Cool at 0-6°C	14 days for analysis
Water	EPH – MA DEP	Preparation: Method MA DEP and silica gel cleanup Analysis: Method MA DEP	1 L	1 X I L Amber	Cool at 0-6°C	7 days for extraction 40 days for analysis
Water	SVOC – EPA 8270	Preparation: EPA 3510 Analysis: EPA 8270	1 L	1 X I L Amber	Cool at 0-6°C	7 days for extraction 40 days for analysis
Water	Dissolved Iron and Manganese – EPA 6010	Preparation: EPA 3005/3010 Analysis: EPA 6010	100 mL	1 X 250 mL polyethylene(field filtered with 0.45 micrometers filter)	HNO_3 to pH <2 Cool at 0-6°C	180 days for analysis
Water	Total Cations and Lead– EPA 6010	Preparation: EPA 3005/3010 Analysis: EPA 6010	100 mL	1 X 250 mL polyethylene	HNO_3 to pH <2 Cool at 0-6°C	180 days for analysis
Water	Anions – EPA 300.0	Preparation: EPA 300.0 Analysis: EPA 300.0	100 mL	1 X 250 mL polyethylene	Cool at 0-6°C	48 hours for nitrate and 28 days for all other anions

QAPP Worksheet #19a – Analytical SOP Requirements Table – Groundwater (Continued)

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Sample Volume	Container (number, Size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Water	Alkalinity – SM 2320B	Preparation: SM 2320B Analysis: SM 2320B	100 mL	1 X 250 mL polyethylene	Cool at 0-6°C	14 days for analysis
Water	Ammonia – SM 4500B, D	Preparation: EPA 4500B, D Analysis: EPA 4500 B, D	100 mL	1 X 250 mL polyethylene	H_2SO_4 to pH<2 Cool at 0-6°C	28 days for analysis
Water	TKN – EPA 351.4	Preparation: EPA 354.1 Analysis: EPA 354.1	100 mL	1 X 250 mL polyethylene	H_2SO_4 to pH<2 Cool at 0-6°C	28 days for analysis
Water	o-Phosphorous – SM 4500 PE	Preparation: SM 4500 PE Analysis: SM 4500 PE	100 mL	1 X 250 mL polyethylene	H_2SO_4 to pH<2 Cool at 0-6°C	28 days for analysis
Water	Sulfide – SM 4500 S-2CF	Preparation: EPA 4500 S-2CF Analysis: EPA 4500 S-2CF	100 mL	1 X 250 mL polyethylene	Zinc Acetate and Sodium Hydroxide to pH>9 Cool at 0-6°C	7 days for analysis
Water	TOC – EPA 9060	Preparation: EPA 9060 Analysis: EPA 9060	100 mL	1 X 250 mL Amber	H_2SO_4 to pH<2 Cool at 0-6°C	28 days for analysis
Water	Dissolved Gases – RSK 175	Preparation: RSK175 Analysis: RSK 175	40 mL	3 X 40 mL VOA with Teflon® septa	Cool at 0-6°C	7 days for analysis
Water	Stable Carbon and Hydrogen Isotope – Laboratory SOP	Preparation: Lab SOP Analysis: Lab SOP	100 ml	1 x 1 L polyethylene	Cool at 0-6°C	3 months for analysis

Note(s):

In accordance with the DoD QSM requirements, the most current version of the EPA extraction and analytical methods will be implemented for each sampling event.

HNO_3 denotes nitric acid.

H_2SO_4 denotes sulfuric acid.

L denotes liter.

QAPP Worksheet #19b – Analytical SOP Requirements Table – Soil Gas

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Sample Volume	Container (number, Size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil Gas	VOCs/TPH – EPA TO15	Preparation: EPA TO15 Analysis: EPA TO15	1 L	1 L Bottle Vac Canister 1L for Vapor	NA	14 days for analysis
Soil Gas	APH – Method MA DEP	Preparation: Method MA DEP Analysis: Method MA DEPP	1 L	1 L Bottle Vac Canister	NA	14 days for analysis
Soil Gas	Fixed Gases– ASTM D2504	Preparation: ASTM D2504 Analysis: ASTM D2504	1 L	Tedlar Bag	NA	14 days for analysis

Note:

In accordance with the DoD QSM requirements, the most current version of the EPA methods will be implemented for each sampling event.

QAPP Worksheet #19c – Analytical SOP Requirements Table – Soil

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Sample Volume	Container (number, Size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil/Soil IDW	VOCs – EPA 8260	Preparation: EPA 5035 Analysis: EPA 8260	5 gram	3 X 5 gram Encore	Cool at 0-6°C	48 hours for analysis 14 days for analysis if kept frozen
Soil	VPH - MA DEP	Preparation: Method MA DEP Analysis: Method MA DEP	5 gram	3 X 5 gram Encore	Cool at 0-6°C	48 hours for analysis 14 days for analysis if kept frozen
Soil	EPH – MA DEP	Preparation: Method MA DEP Analysis: Method MA DEP	30 gram	1 X 8 oz Jar	Cool at 0-6°C	14 days for extraction 40 days for analysis
Soil IDW	TPH gasoline – EPA 8015	Preparation: EPA 5035 Analysis: EPA 8015	5 gram	3 X 5 gram Encore	Cool at 0-6°C	48 hours for analysis 14 days for analysis if kept frozen
Soil IDW	TPH diesel – EPA 8015	Preparation: EPA3545/3540/3550, and silica gel cleanup Analysis: EPA 8015	30 grams	1 X 8 oz Jar	Cool at 0-6°C	14 days for extraction 40 days for analysis
Soil	SVOCs – EPA 8270	Preparation: EPA3545/3540/3550 Analysis: EPA 8270	30 grams	1 X 8 oz Jar	Cool at 0-6°C	14 days for extraction 40 days for analysis
Soil	Lead – EPA 6010	Preparation: Method 3050 Analysis: 6010	2 grams	1 X 8 oz Jar	Cool at 0-6°C	180 days for analysis
Soil IDW	VOCs – EPA 1311/8260	Preparation: EPA 1311/5035 Analysis: EPA 8260	25 grams	1 X 8 oz. Jar	Cool at 0-6°C	48 hours for analysis 14 days for analysis
Soil IDW	SVOCs – EPA 1311/8270	Preparation: EPA 1311/3545/3540/3550 Analysis: EPA 8270	30 grams	1 X 8 oz Jar	Cool at 0-6°C	14 days for extraction 40 days for analysis

Soil IDW	Pesticides – EPA 1311/8081	Preparation: EPA 1311/3545/3540/3550 Analysis: EPA 8081	30 grams	1 X 8 oz Jar	Cool at 0-6°C	14 days for extraction 40 days for analysis
Soil IDW	Herbicides – EPA 1311/8151	Preparation: EPA 1311/3545/3540/3550 Analysis: EPA 8151	30 grams	1 X 8 oz Jar	Cool at 0-6°C	14 days for extraction 40 days for analysis

Worksheet #19c – Analytical SOP Requirements Table – Soil (Continued)

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Sample Volume	Container (number, Size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil IDW	Metals – EPA 1311/6010/7471	Preparation: EPA 1311/3050 Analysis: EPA 6010/7471	2 grams	1 X 8 oz Jar	Cool at 0-6°C	28 days for mercury and 180 days for all other metals
Soil IDW	RCI – SW846 Chapter 7, 7.3.2	Preparation: SW846 Chapter 7, 7.3.2 Analysis: SW846 Chapter 7, 7.3.2	2 grams	1 X 8 oz Jar	Cool at 0-6°C	14 days for reactivity and ignitability, and 24 hours for corrosivity

Note:

In accordance with the DoD QSM requirements, the most current version of the EPA extraction and analytical methods will be implemented for each sampling event.

QAPP Worksheet #20a – Field Quality Control Sample Summary Table – 2011 Pre-Remedy Groundwater Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2011 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	29	3	2	1 per day	1 per day if needed	1 per cooler	34 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	29	3	2	0	1 per day if needed	0	34 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	29	3	2	0	1 per day if needed	0	34 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	29	3	2	0	1 per day if needed	0	34 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	29	3	2	0	1 per day if needed	0	34 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	TNK – EPA 351.4	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	TOC – EPA 9060	QAPP Worksheet #19	29	3	2	0	0	0	34
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	29	3	2	0	0	0	34

QAPP Worksheet #20a – Field Quality Control Sample Summary Table – 2011 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Second Quarter 2011 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	72	8	4	1 per day	1 per day if needed	1 per cooler	84 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	72	8	4	0	1 per day if needed	0	84 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	72	8	4	0	1 per day if needed	0	84 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	72	8	4	0	1 per day if needed	0	84 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	72	8	4	0	1 per day if needed	0	84 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	TNK – EPA 351.4	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	TOC – EPA 9060	QAPP Worksheet #19	72	8	4	0	0	0	84
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	72	8	4	0	0	0	84

QAPP Worksheet #20a – Field Quality Control Sample Summary Table – 2011 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Third Quarter 2011 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20a – Field Quality Control Sample Summary Table – 2011 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Fourth Quarter 2011 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20b – Field Quality Control Sample Summary Table – 2012 Pre-Remedy Groundwater Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2012 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	VPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	EPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20b – Field Quality Control Sample Summary Table – 2012 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Second Quarter 2012 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	VPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	EPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20b – Field Quality Control Sample Summary Table – 2012 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Third Quarter 2012 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	VPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	EPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20b – Field Quality Control Sample Summary Table – 2012 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Fourth Quarter 2012 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	VPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	EPH – MA DEP	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20c – Field Quality Control Sample Summary Table – 2013 Pre-Remedy Groundwater Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2013 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20c – Field Quality Control Sample Summary Table – 2013 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Second Quarter 2013 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20c – Field Quality Control Sample Summary Table – 2013 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Third Quarter 2013 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB/DBCP – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	0	0	0	0	122
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20c – Field Quality Control Sample Summary Table – 2013 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Fourth Quarter 2013 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20d – Field Quality Control Sample Summary Table – 2014 Pre-Remedy Groundwater Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2014 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20d – Field Quality Control Sample Summary Table – 2014 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Second Quarter 2014 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20d – Field Quality Control Sample Summary Table – 2014 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Third Quarter 2014 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20d – Field Quality Control Sample Summary Table – 2014 Pre-Remedy Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Fourth Quarter 2014 Groundwater Monitoring Event									
Water	VOCs – EPA 8260	QAPP Worksheet #19	111	11	6	1 per day	1 per day if needed	1 per cooler	128 and blanks
Water	EDB – EPA 8011	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TPH gasoline – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	TPH diesel – EPA 8015	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	SVOCs – 8270	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Iron and Manganese – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Total Cations and Lead – EPA 6010	QAPP Worksheet #19	111	11	6	0	1 per day if needed	0	128 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Ammonia – SM 4500B, D	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TNK – EPA 351.4	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	o-Phosphorous – SM 4500 PE	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	TOC – EPA 9060	QAPP Worksheet #19	111	11	6	0	0	0	128
Water	Dissolved Gases - RSK 175	QAPP Worksheet #19	111	11	6	0	0	0	128

QAPP Worksheet #20e – Field Quality Control Sample Summary Table – 2011 Pre-Remedy Soil Gas Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2011 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	15	2	0	0	0	1 per trip	17 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	15	2	0	0	0	0	17
Second Quarter 2011 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	123	13	0	0	0	1 per trip	136 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	123	13	0	0	0	0	136
Third Quarter 2011 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Fourth Quarter 2011 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253

.

Worksheet #20f – Field Quality Control Sample Summary Table – 2012 Pre-Remedy Soil Gas Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2012 Soil Gas Monitoring Event									
Soil Gas	VOCs – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	APH – Method MA DEP	QAPP Worksheet #19	230	23	0	0	0	0	253
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Second Quarter 2012 Soil Gas Monitoring Event									
Soil Gas	VOCs – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	APH – Method MA DEP	QAPP Worksheet #19	230	23	0	0	0	0	253
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Third Quarter 2012 Soil Gas Monitoring Event									
Soil Gas	VOCs – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	APH – Method MA DEP	QAPP Worksheet #19	230	23	0	0	0	0	253
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Fourth Quarter 2012 Soil Gas Monitoring Event									
Soil Gas	VOCs – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	APH – Method MA DEP	QAPP Worksheet #19	230	23	0	0	0	0	253

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253

QAPP Worksheet #20g – Field Quality Control Sample Summary Table – 2013 Pre-Remedy Soil Gas Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2013 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Second Quarter 2013 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Third Quarter 2013 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Fourth Quarter 2013 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas– EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253

QAPP Worksheet #20h – Field Quality Control Sample Summary Table – 2014 Pre-Remedy Soil Gas Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2014 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Second Quarter 2014 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Third Quarter 2014 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253
Fourth Quarter 2014 Soil Gas Monitoring Event									
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #19	230	23	0	0	0	1 per trip	253 and blanks
Soil Gas	Fixed Gases – ASTM D2504	QAPP Worksheet #19	230	23	0	0	0	0	253

QAPP Worksheet #20i – Field Quality Control Sample Summary Table – 2011 Operation and Maintenance of Existing SVE Systems

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2011 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Second Quarter 2011 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Third Quarter 2011 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Fourth Quarter 2011 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41

Note: TPH vapor samples from the SVE systems will be measured in the field using a field monitor.

QAPP Worksheet #20j – Field Quality Control Sample Summary Table – 2012 Operation and Maintenance of Existing SVE Systems

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2012 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Second Quarter 2012 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Third Quarter 2012 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Fourth Quarter 2012 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41

Note: TPH vapor samples from the SVE systems will be measured in the field using a field monitor.

QAPP Worksheet #20k – Field Quality Control Sample Summary Table – 2013 Operation and Maintenance of Existing SVE Systems

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2013 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Second Quarter 2013 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Third Quarter 2013 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Fourth Quarter 2013 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41

Note: TPH vapor samples from the SVE systems will be measured in the field using a field monitor

QAPP Worksheet #20l – Field Quality Control Sample Summary Table – 2014 Operation and Maintenance of Existing SVE Systems

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter 2014 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Second Quarter 2014 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Third Quarter 2014 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41
Fourth Quarter 2014 Vapor Monitoring Event									
Vapor	TPH – EPA TO3	QAPP Worksheet #19	41	0	0	0	0	0	41

Note: TPH vapor samples from the SVE systems will be measured in the field using a field monitor

QAPP Worksheet #20m – Field Quality Control Sample Summary Table – Soil Sampling

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Soil Sampling associated with SVM Installation (Vadose Zone Investigation)									
Soil	VOCs – EPA 8260	QAPP Worksheet #19	515	52	26	0	26	0	619
Soil	VPH – MA DEP	QAPP Worksheet #19	515	52	26	0	26	0	619
Soil	EPH – MA DEP	QAPP Worksheet #19	515	52	26	0	26	0	619
Soil	SVOCs – EPA 8270	QAPP Worksheet #19	515	52	26	0	26	0	619
Soil	Lead – EPA 6010	QAPP Worksheet #19	515	52	26	0	26	0	619
FFOR Soil Sampling (IM Investigation)									
Soil	VOCs – EPA 8260	QAPP Worksheet #19	400	40	20	0	20	0	480
Soil	VPH – MA DEP	QAPP Worksheet #19	400	40	20	0	20	0	480
Soil	EPH – MA DEP	QAPP Worksheet #19	400	40	20	0	20	0	480
Soil	SVOC – EPA 8270	QAPP Worksheet #19	400	40	20	0	20	0	480
Soil	Lead – EPA 6010	QAPP Worksheet #19	400	40	20	0	20	0	480
Soil Sampling Associated with Groundwater Monitoring Well Installation									
Soil	VOCs – EPA 8260	QAPP Worksheet #19	72	8	4	0	2	0	86
Soil	VPH – MA DEP	QAPP Worksheet #19	72	8	4	0	2	0	86
Soil	EPH – MA DEP	QAPP Worksheet #19	72	8	4	0	2	0	86
Soil	SVOC – EPA 8270	QAPP Worksheet #19	72	8	4	0	2	0	86
Soil	Lead – EPA 6010	QAPP Worksheet #19	72	8	4	0	2	0	86

QAPP Worksheet #20j – Field Quality Control Sample Summary Table – Soil Sampling (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Soil IDW Sampling Associated with SVM Installation (Vadose Zone Investigation)									
Soil IDW	VOCs – EPA 1311/8260	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	SVOCs – EPA 1311/8270	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	Pesticides – EPA 1311/8081	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	Herbicides – EPA 1311/8151	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	RCI – SW846, Chapter 7, 7.3.2	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	Metals – EPA 1311/6010/7471	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	BTEX – EPA 8260	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	TPH gasoline – EPA 8015	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW	TPH diesel – EPA 8015	QAPP Worksheet #19	160	0	0	0	0	0	160
Soil IDW Sampling Associated with FFOR Sampling (IM Investigation)									
Soil IDW	VOCs – EPA 1311/8260	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	SVOCs – EPA 1311/8270	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	Pesticides – EPA 1311/8081	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	Herbicides – EPA 1311/8151	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	RCI – SW846, Chapter 7, 7.3.2	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	Metals – EPA 1311/6010/7471	QAPP Worksheet #19	30	0	0	0	0	0	30

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Soil IDW	BTEX – EPA 8260	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	TPH gasoline – EPA 8015	QAPP Worksheet #19	30	0	0	0	0	0	30
Soil IDW	TPH diesel – EPA 8015	QAPP Worksheet #19	30	0	0	0	0	0	30

QAPP Worksheet #20m – Field Quality Control Sample Summary Table – Groundwater Monitoring in Support of the LNAPL Containment IM Investigation

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Water	VOCs – EPA 8260	QAPP Worksheet #19	6	1	1	1 per day	1 per day if needed	1 per cooler	8 and blanks
Water	SVOCs – EPA 8270	QAPP Worksheet #19	6	1	1	0	1 per day if needed	0	8 and blanks
Water	TPH – EPA 8015M	QAPP Worksheet #19	6	1	1	0	1 per day if needed	0	8 and blanks
Water	Metals/Cations – EPA 6010	QAPP Worksheet #19	6	1	1	0	1 per day if needed	0	8 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	6	1	1	0	0	0	8

QAPP Worksheet #20n – Field Quality Control Sample Summary Table – MNA Groundwater Monitoring

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
First Quarter Monitoring									
Water	Dissolved Total Cations – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Dissolved Manganese – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Ammonia nitrogen– SM 4500B, D	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	o-Phosphate – SM 4500 PE	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Stable carbon and hydrogen isotope – Laboratory SOP	QAPP Worksheet #19	30	3	0	0	0	0	33
Second Quarter Monitoring									
Water	Dissolved Total Cations – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Dissolved Manganese – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Ammonia nitrogen– SM 4500B, D	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	o-Phosphate – SM 4500 PE	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Stable carbon and hydrogen isotope – Laboratory SOP	QAPP Worksheet #19	30	3	0	0	0	0	33

QAPP Worksheet #20n – Field Quality Control Sample Summary Table – MNA Groundwater Monitoring (Continued)

Matrix	Analytical Group	Analytical and Preparation QAPP Reference	# of Primary Sampling Locations	# of Field Duplicates[a]	# of MS/MSDs	# of Field Blanks[b]	# of Equipment Rinsates[c]	# of Trip Blanks[d]	Total # of Samples to Laboratory
Third Quarter Monitoring									
Water	Dissolved Total Cations – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Dissolved Manganese – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Ammonia nitrogen– SM 4500B, D	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	o-Phosphate – SM 4500 PE	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Stable carbon and hydrogen isotope – Laboratory SOP	QAPP Worksheet #19	30	3	0	0	0	0	33
Fourth Quarter Monitoring									
Water	Dissolved Total Cations – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Dissolved Manganese – EPA 6010	QAPP Worksheet #19	30	3	2	0	1 per day if needed	0	35 and blanks
Water	Anions – EPA 300.0	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Ammonia nitrogen– SM 4500B, D	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Total Sulfide – SM 4500 S-2CF	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	o-Phosphate – SM 4500 PE	QAPP Worksheet #19	30	3	2	0	0	0	35
Water	Stable carbon and hydrogen isotope – Laboratory SOP	QAPP Worksheet #19	30	3	0	0	0	0	33

QAPP Worksheet #21 – Project Sampling SOP References

Reference Number	Title	Date, Revision and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
Kirtland SOP B1-1	Borehole and Sampling Logging	April 2004	Kirtland AFB	Borehole logging procedures	N	
Kirtland SOP B1-3	Monitoring Well Installation	April 2004	Kirtland AFB	Well installation procedures	N	
Kirtland SOP B1-4	Monitoring Well Development	April 2004	Kirtland AFB	Well development procedure	N	
Kirtland SOP B1-7	Soil Gas Investigation	April 2004	Kirtland AFB	Soil Gas sampling procedures	N	SOP will be reviewed and may be updated
Kirtland SOP B1-17	Equipment Decontamination	April 2004	Kirtland AFB	Equipment Decontamination Procedures	N	
Kirtland SOP B2-3	Subsurface Soil Sampling	April 2004	Kirtland AFB	Subsurface Soil Sampling procedures	N	SOP will be reviewed and may be updated
Kirtland SOP B3-1	PID and Organic Vapor Analyzer	April 2004	Kirtland AFB	PID and Organic Vapor Analyzer	N	
Kirtland SOP B4-1	Monitoring Well Sampling	April 2004	Kirtland AFB	pump and water level meter	N	SOP will be reviewed and may be updated
Kirtland SOP B4-4	Field Filtration	April 2004	Kirtland AFB	filter	N	
Kirtland SOP B5-6	Water Levels	April 2004	Kirtland AFB	Measuring tap	N	
Shaw SOP EI-FS108	Measurement of Water and LNAPL in Monitoring Wells	September 2006	Kirtland AFB	Oil/water interface probe	N	

Note(s):

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

Field Equipment	Calibration Verification Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Photoionization Detector	Check calibration to 100 parts per million isobutylene	Once per day before first use	± 5% of standard value	Recalibrate	Shaw Sampler	Manufactures Operation Manual
YSI (or equivalent) water quality meter with flow cell	Check calibration against two of the following three traceable standards with nominal pH of 4.0, 7.00 and 10.00	Once per day before first use	± 0.05 pH units	Recalibrate	Shaw Sampler	Manufactures Operation Manual
	Check calibration against specific conductance standard	Once per day before first use	± 5% of standard value	Recalibrate	Shaw Sampler	Manufactures Operation Manual
	Check calibration against turbidity standards	Once per day before first use	± 5% of standard value	Recalibrate	Shaw Sampler	Manufactures Operation Manual
	Check calibration against dissolved oxygen (ambient air)	One per day before first use	± 10% of 100% saturation	Recalibrate	Shaw Sampler	Manufactures Operation Manual
	Check calibration against oxygen reduction potential standards	One per day before first use	± 10% standard value	Recalibrate	Shaw Sampler	Manufactures Operation Manual

QAPP Worksheet #23a – Analytical SOP References Table - Groundwater

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP-202	GC/MS Volatiles by EPA Method 624 and SW846 Method 8260B 9/09/2010 Rev 23	Definitive	Water – VOCs/EPA 8260	GC/MS	Empirical Laboratories	N
Empirical SOP-218	GC/ECD 1,2-Dibromoethane and 1,2-Dibromo-3-Chloropropane by EPA Methods 504.1 and SW-846 8011 9/07/2010 Rev7	Definitive	Water – EDB/EPA 8011	GC	Empirical Laboratories	N
Empirical SOP-219	GC/FID Nonhalogenated Volatile Organics And TPH by Method 8015B/8015C/ TN EPH/GRO 9/20/2010 Rev 13	Definitive	Water – TPH gasoline/EPA 8015	GC	Empirical Laboratories	N
Empirical SOP-322 and Empirical SOP 219	TPH (Total Petroleum Hydrocarbons) Aqueous Matrix by USEPA SW846 Method 8015B 9/09/2010 Rev 10 GC/FID Nonhalogenated Volatile Organics And TPH by Method 8015B/8015C/ TN EPH/GRO 9/20/2010 Rev 13	Definitive	Water –TPH diesel/EPA 8015	GC	Empirical Laboratories	N
Empirical SOP 226 and Empirical SOP 335	Method for the Determination of Extractable Hydrocarbons (EPH) MA DEP– EPH-04-1.1 4/7/2009 Rev3 Massachusetts EPH (Extractable Petroleum Hydrocarbons) MA DEP-EPH-04-1.1 Aqueous Matrix 6/18/2009 Rev 3	Definitive	Water – EPH/MA DEP	GC	Empirical Laboratories	N

QAPP Worksheet #23a – Analytical SOP References Table - Groundwater (Continued)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP-227	Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) MA DEP– VPH-04-1.1 12/30/2009 Rev 5	Definitive	Water – VPH/MA DEP	GC	Empirical Laboratories	N
Empirical SOP-300 and Empirical SOP-201	GC/MS-Semi-Volatile BNA-Aqueous Matrix Extraction Using SW-846 Method 3510C for 8270C/625 Analysis, 4/26/2010 Rev 18 GC/MS SEMIVOLATILES and LOW-CONCENTRATION PAHs BY EPA METHOD 625 AND SW846 METHOD 8270C AND 8270D INCLUDING ADDITIONAL APPENDIX IX COMPOUNDS,4/26/2010 Rev 20	Definitive	Water – SVOCs/EPA 8270	GC/MS	Empirical Laboratories	N
Empirical SOP-100 and Empirical SOP-105	Metals Digestion/Preparation Methods 3005A, 3010A,3020A,3030,3040A,3050B USEPA CLPILMO 04.1 Aqueous and Soil/Sediment USEPA CLPILMO 05.2 Aqueous and Soil/Sediment, USEPA Method 200.7 (Standard Methods) 3030C 9/1/2010 Rev 21 Metals Analysis by ICP Technique Methods 200.7, (SW846) 6010B, (SW-846) 6010C, (SM 19th Edition 2340B) USEPA CLP ILMO 4. 4/11/2010 Rev 16	Definitive	Water – Metals/EPA 6010	ICP	Empirical Laboratories	N
Empirical SOP-145	Determination of Inorganic Anions in water by ION Chromatography using Dionex DX-500 Ion Chromatograph with Hydroxide Eluent And Dionex Column AS18, Method 300.0 Guidance, 3/25/2010 Rev 7	Definitive	Water – Anions/EPA 300.0	Ion Chromatography	Empirical Laboratories	N

QAPP Worksheet #23a – Analytical SOP References Table - Groundwater (Continued)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP-154	Alkalinity by EPA Method 310.1, SM2320B, 9/21/2010 Rev 7	Definitive	Water – Alkalinity/SM 2320B	Titration	Empirical Laboratories	N
Empirical SOP-176	Ammonia (Phenolate) Potable and Surface Waters Method 10-107-06-1-A 0.1 to 20 mg N/L as NH3, SM4500NH3 G, 20th Ed. and USEPA Method 350.1 10/05/2010 Rev10	Definitive	Water – Ammonia/SM 4500B, D	Lachet Autoanalyzer	Empirical Laboratories	N
Empirical SOP-153	Sulfide Method 376.1 and Standard Methods SM4500S-2 F(19th ED) (Titrimetric, Iodine) with Sample Pretreatment to Remove Interfering Substances or to Concentrate the Sulfide,9/7/2010 Rev 4	Definitive	Water – Sulfide/SM 4500S-2CF	Titration	Empirical Laboratories	N
Empirical SOP-221	Total Organic Carbon SM5310C, USEPA Method 415.1 and SW846 Method 9060/9060A and Lloyd Kahn Method,7/12/2010 Rev 9	Definitive	Water – TOC/EPA 9060	TOC Analyzer	Empirical Laboratories	N
Empirical SOP-236	Methane, Ethane, Ethene in Aqueous Samples by Modified RSK-175 (Automated Headspace) 9/7/2010 Rev 2	Definitive	Water – Dissolved Gases /RSK 175	GC	Empirical Laboratories	N
Empirical SOP 182	Total Kjeldahl Nitrogen in Waters Method 10-107-06-2-D 0.02 to 20.0 mg N/L by USEPA Method 351.2 9/7/2010 Rev 7	Definitive	Water – TKN/EPA 351.4	Lachet Autoanalyzer	Empirical Laboratories	N
Empirical SOP 165	Phosphorous, Total and Ortho Standard Methods(20th edition) Method SM4500P B5E and Method SM4500PE/ (USEPA) Method 365.2 (Colorimetric, Ascorbic Acid, Single Reagent) 9/7/2010 Rev 8	Definitive	Water – O Phosphorous /SM 4500 PE	Spectrophotometer	Empirical Laboratories	N

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TBD	TBD	Definitive	Water – Stable carbon and hydrogen isotopes	TBD	Microseeps Inc.	N

QAPP Worksheet #23b – Analytical SOP References Table - Soil Vapor

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TO15_083109_R0_1_v1	ANALYSIS OF VOLATILE ORGANIC COMPOUNDS IN AIR SAMPLES; Revision 0, v1, 08/31/09	Definitive	Soil Gas – VOCs and TPH/EPA TO15	GC/MS	RTI Laboratories	N
TO15_083109_R0_1_v1	ANALYSIS OF VOLATILE ORGANIC COMPOUNDS IN AIR SAMPLES; Revision 0, v1, 08/31/09	Definitive	Soil Gas – APH/MA DEP	GC/MS	RTI Laboratories	N
RSKSOP_092310_R0_v1.pdf	ANALYSIS OF DISSOLVED GASES; Revision o, v1, 092310	Definitive	Soil Gas – Fixed Gases/ASTM D2504	GC	RTI Laboratories	N

QAPP Worksheet #23c – Analytical SOP References Table - Soil

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
GCMSV-003	SOP for the Analysis of Volatile Mass Spec Samples Method 8260, Rev 20, 7/9/10	Definitive	Soil – VOCs/EPA 8260	GC/MS	Golf Coast Analytical Laboratories	N
GC-032	SOP for Determination of Volatile Petroleum Hydrocarbons Rev 2, 7/10/2009	Definitive	Soil – VPH /MA DEP	GC	Golf Coast Analytical Laboratories	N
GC-025	SOP for Characterization of Extractable Petroleum Hydrocarbons Rev 5, 9/101/2009	Definitive	Soil – EPH/MA DEP	GC	Golf Coast Analytical Laboratories	N
GCMSSV-001	SOP for the Analysis of Semi-Volatile Mass Spec Samples for 8270C, Rev 16, 5/21/10	Definitive	Soil – SVOCs/EPA 8270	GC/MS	Golf Coast Analytical Laboratories	N
MET-010	SOP for Analysis of Samples by ICP, Rev 18, 5/19/10	Definitive	Soil – Lead EPA 6010	ICP	Golf Coast Analytical Laboratories	N

QAPP Worksheet #24a – Analytical Instrument Calibration Table (Gas Chromatography/Mass Spectrometry)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, TO15

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
GC/MS	EPA 8260, MA DEP and TO15: Check of mass spectral ion intensities (tuning procedure) using bromofluorobenzene EPA 8270: Check of mass spectral ion intensities (tuning procedure) using decafluorotriphenylophosphine in accordance with DoD QSM requirements	EPA 8260 and EPA 8270: Prior to initial calibration and every 12 - hour during sample analysis TO15 and MA DEP: prior to initial calibration and meet frequency requirements specified in the method.	Must meet the method requirements before samples are analyzed	Retune instrument and verify the tune acceptability, rerun the affected samples	Lab Manager/Analyst	QAPP Worksheet #23
	Five-point initial calibration for target analytes, lowest calibration standard at or near the RL in accordance with DoD QSM requirements	Initial calibration prior to sample analysis	EPA 8260: The minimum average system performance check compound response factor is 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane. EPA 8270: The minimum average system performance check compound response factor is 0.05. EPA 8260 and EPA 8270: Relative standard deviation (RSD) is less than 30% in accordance	Correct problem, then rerun initial calibration in accordance with DoD QSM/method requirements	Lab Manager/Analyst	QAPP Worksheet #23

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, TO15

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
			with DoD QSM requirements TO15 and MA DEP: RSD is less than 30%per method requirements			

QAPP Worksheet #24a – Analytical Instrument Calibration Table (Gas Chromatography/Mass Spectrometry) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, TO15

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
GC/MS	Second-source calibration verification in accordance with DoD QSM requirements	Once per five-point initial calibration	EPA 8260 and EPA 8270: Less than 20% difference for all target analytes in accordance with DoD QSM requirements MA DEP: 70-130% recovery through LCS analysis per method requirements	Correct problem, then rerun second source calibration verification in accordance with DoD QSM/method requirements	Lab Manager/Analyst	QAPP Worksheet #23
	Daily calibration verification in accordance with DoD QSM requirements	Before sample analysis and every 12 hours of analysis	EPA 8260: The minimum average system performance check compound response factor is 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane. EPA 8270: The minimum average system performance check compound response factor is 0.05. EPA 8260 and EPA 8270: Less than 20% difference for all target analytes in accordance with DoD QSM requirements TO15 and MA DEP: Less than 30% difference for all target analytes per method requirements.	Correct problem, then rerun calibration verification in accordance with DoD QSM/method requirements	Lab Manager/Analyst	QAPP Worksheet #23

QAPP Worksheet #24a – Analytical Instrument Calibration Table (Gas Chromatography/Mass Spectrometry) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, and MA DEP

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
GC/MS	Breakdown check	Before sample analysis and every 12 hours of analysis	EPA 8270: Degradation less than 20% for DDT. Benzidine and pentachlorophenol are present at normal response and not greater than a tailing factor of 2.	Correct problem, then rerun breakdown check	Lab Manager/Analyst	QAPP Worksheet #23

QAPP Worksheet #24b – Analytical Instrument Calibration Table (Gas Chromatography)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	EDB/DBCP, TPH, VPH/EPH, Dissolved Gases
Analytical Method	EPA Methods 8011 and 8015, MA DEP, RSK 175

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
GC	Minimum five-point initial calibration for target analytes, lowest calibration standard at or near the reporting limit in accordance with DoD QSM requirements.	Initial calibration prior to sample analysis	EPA 8011, EPA 8015, RSK 175: RSD less than or equal to 20% for all target analytes in accordance with DoD QSM requirements MA DEP: RSD less than 25% for all target analytes per method requirements.	Correct problem, then rerun initial calibration in accordance with DoD QSM requirements	Lab Manager / Analyst	QAPP Worksheet #23
	Second-source calibration verification	Once per five-point initial calibration	EPA 8011, EPA 8015, RSK 175: Less than 20% of expected values from the initial calibration for all target analytes in accordance with DoD QSM requirements MA DEP: Less than 25% of expected values from the initial calibration for all target analytes per method requirements.	Correct problem, then rerun second source calibration verification in accordance with DoD QSM requirements	Lab Manager / Analyst	QAPP Worksheet #23
	Daily calibration verification	EPA 8011 and EPA 8015: Before sample analysis	EPA 8011, EPA 8015, , RSK 175: Less than 20% of expected values from the initial	Correct problem, then rerun calibration verification in	Lab Manager / Analyst	QAPP Worksheet #23

		and every 10 samples TO3 and MA DEP: Before sample analysis and at frequency specified in the method.	calibration for all target analytes in accordance with DoD QSM requirements MA DEP: Less than 25% of expected values from the initial calibration for all target analytes per method requirements	accordance with DoD QSM requirements		

QAPP Worksheet #24c – Analytical Instrument Calibration Table (Inductively Coupled Plasma Atomic Emission Spectrometry)

Matrix	Groundwater and Soil
Analytical Group	Metals
Analytical Method	EPA Method 6010

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
ICP	EPA 6010: initial calibration with a minimum of one high standard and one calibration blank in accordance with DoD QSM requirements	EPA 6010: Initial calibration prior to sample analysis	EPA 6010: Correlation coefficient greater than 0.995 in accordance with DoD QSM requirements	EPA 6010: Correct problem, then repeat initial calibration in accordance with DoD QSM requirements	Lab Manager/Analyst	QAPP Worksheet # 23
	EPA 6010: Low standard at or near the RL in accordance with DoD QSM requirements (ICP/MS only)	EPA 6010: Daily after one-point initial calibration	EPA 6010: within 20% difference from initial calibration for all target analytes in accordance with DoD QSM requirements	EPA 6010: Correct problem, then rerun low standard in accordance with DoD QSM requirements	Lab Manager/Analyst	QAPP Worksheet # 23
	EPA 6010: Second source calibration standard, prepared at the calibration midpoint in accordance with DoD QSM requirements	EPA 6010: Once per initial calibration, prior to sample analysis	EPA 6010: within 10% difference from the expected value for all target analytes in accordance with DoD QSM requirements	EPA 6010: Correct problem, then rerun second source calibration in accordance with DoD QSM requirements	Lab Manager/Analyst	QAPP Worksheet # 23

QAPP Worksheet #24c – Analytical Instrument Calibration Table (Inductively Coupled Plasma Atomic Emission Spectrometry (Continued)

Matrix	Groundwater and Soil
Analytical Group	Metals
Analytical Method	EPA Method 6010

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
ICP	EPA 6010: CCV in accordance with DoD QSM requirements	EPA 6010: Following initial calibration, after every 10 samples and the end of the sequence	EPA 6010: within 10% difference from initial calibration for all target analytes	EPA 6010: Correct problem, then repeat CCV in accordance with DoD QSM requirements	Lab Manager/Analyst	QAPP Worksheet # 23

Note(s):

CCV denotes continuing calibration verification.

QAPP Worksheet #24d – Analytical Instrument Calibration Table (Ion Chromatography/Colorimetric/TOC Analyzer)

Matrix	Groundwater
Analytical Group	Anions, TOC, and Ammonia, TKN
Analytical Method	EPA Methods 300.0, 351.4, and 9060, SM4500B, D

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Person(s) Responsible for Corrective Actions	SOP Reference
IC/Colorimetric/TOC Analyzer	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Initial calibration with a minimum of three calibration standards and one calibration blank	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Initial calibration prior to sample analysis	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Correlation coefficient greater than 0.995	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Correct problem, then repeat initial calibration	Lab Manager/Analyst	QAPP Worksheet # 23
	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Initial calibration verification, prepared at the calibration midpoint.	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Once after initial calibration, before sample analysis	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Less than 10% difference from initial calibration for all target analytes	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Correct problem, then rerun initial calibration verification	Lab Manager/Analyst	QAPP Worksheet # 23
	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: CCV	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Following initial calibration, after every 10 samples and the end of the sequence	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Less than 10% difference from initial calibration for all target analytes	EPA 300.0 and 351.4, SM4500B, D, and EPA 9060: Correct problem, then repeat CCV	Lab Manager/Analyst	QAPP Worksheet # 23

Note(s):

IC denotes ion chromatography.

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table – Groundwater

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
GC/MS - VOC	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.	VOC's	Ion source, injector liner, column, column flow, purge lines, purge flow, trap.	Prior to initial calibration and/or as necessary.	Acceptable tune and Calibration or CCV.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Empirical Analyst and Laboratory Manager	Empirical SOP 202
GC/MS - SVOC	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.	SVOC's	Ion source, injector liner, column, column flow.	Prior to initial calibration and/or as necessary.	Acceptable tune and Calibration or CCV.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Empirical Analyst and Laboratory Manager	Empirical SOP 201/300

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table – Groundwater (Continued)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
GC	Check pressure and gas supply daily. Change septa and/or liner as needed, replace or cut column as needed.	RSK175 dissolved Gases, GRO 8015B, EPH/VPH MA, 8011,DRO 8015B	Liner, seal, septum, column	Prior to initial calibration or as necessary	Acceptable Calibration or CCV.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Empirical Analyst and Laboratory Manager	Empirical SOP's 218, 219, 322, 227,236
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.	Metals	Torch, nebulizer chamber, pump, pump tubing.	Prior to initial calibration and as necessary.	Acceptable Calibration or CCV.	Correct the problem and repeat Calibration or CCV.	Empirical Analyst and Laboratory Manager	Empirical SOP 100/105

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table – Groundwater (Continued)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
Lachet	Check and clean segments weekly, clean reagent tubes monthly. Change lamp, change dilutent and wash tubes, change mixing paddles and syringes, and change dispensing needle, all as needed.	Ammonia/ TKN	Tubing and rollers.	Prior to ICAL or as necessary.	Acceptable ICAL and CCV.	Recalibrate and/or perform necessary equipment maintenance. Reanalyze samples not bracketed by passing CCV.	Empirical Analyst and Laboratory Manager	Empirical SOP 176 and 182
IC	Replace column	Anions	Check gas supply, check for leaks, check pistons	Daily or as needed	Must meet ICAL and continuing calibration criteria.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data	Empirical Analyst and Laboratory Manager	Empirical SOP 145
Buret	Check Buret for any cracks or chips. Rinse buret prior to each use and at the end of each day.	Sulfide	Visual inspection for cracks or chips.	Each Use	NA	Remove from service.	Empirical Analyst and Laboratory Manager	Empirical SOP 153

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table – Groundwater (Continued)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
TOC Analyzer	Replace sample tubing, clean sample boat, replace syringe	TOC	Tubing, sample boat, syringe	As needed	Must meet ICAL and continuing calibration criteria.	Repeat maintenance activity or remove from service.	Empirical Analyst and Laboratory Manager	Empirical SOP 221
pH Meter	Keep probe wet at all times and inspect prior to use. Rinse thoroughly between uses.	Alkalinity	Visual inspection of probe.	Each use	Must meet factory specified start up limits.	Remove from service.	Empirical Analyst and Laboratory Manager	Empirical SOP 154
Spectrophotometer	Clean reagent tubes. Change lamp.	Ortho Phosphate	Check wavelength	At the beginning of every run.	Must meet ICAL and continuing calibration criteria.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Empirical Analyst and Laboratory Manager	Empirical SOP 165
TBD	TBD	TBD	TBD	TBD	TBD	TBD	Microseeps Analyst and Laboratory Manager	TBD

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table – Soil Gas

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/MS	Daily/Regular as specified	Air samples	Inst operating parameters	Daily	Per SOP	Recalibrate/ stop for service on failure.	RTI Laboratory Analyst and Laboratory Manager	RTI SOP TO15_083109_R0_1_v1
GC	Daily during use	Air/gas samples	Inst operating parameters	Daily	Per SOP	Recalibrate/ stop for service on failure.	RTI Laboratory Analyst and Laboratory Manager	RTI SOP TO15_083109_R0_1_v1
Decon/Cleaning oven	Vacuum/Helium adjust	None	Temp/Flow	Daily	1 clean check per batch		RTI Laboratory Analyst and Laboratory Manager	RTI SOP TO15_083109_R0_1_v1

QAPP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table - Soil

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
Gas Chromatograph / Mass Spectrometer (GC/MS)	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	Volatiles	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	Gulf Coast Analytical Analyst and Supervisor	Gulf Coast Analytical SOP GCMSV-003
Gas Chromatograph / Mass Spectrometer (GC/MS)	Clean Injection port and replace liner Clip Column Leak check Maintain pumps by checking replacing pump oil	Semi-volatiles	Monitor instrument performance via Continuing Calibration Verification DFTPP tune, breakdown and tailing	Daily	No maintenance is required as long as instrument QC meets DOD criteria	Change column Clean source	Gulf Coast Analytical Analyst and Supervisor	Gulf Coast Analytical SOP GCMSSV-001
Gas Chromatograph	Check for leaks, replace gas line filters, replace column, clean injection port/liner	EPH	Monitor instrument performance via Continuing Calibratioin Verification	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Replace connections, replace gas line filters, replace GC column, clip column, replace injection port liner, clean injection port	Gulf Coast Analytical Analyst and Supervisor	Gulf Coast Analytical SOP GC-032

QAPP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table – Soil (Continued)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person2	SOP Reference1
Gas Chromatograph	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	VPH	Monitor instrument performance via Continuing Calibration Verification	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Replace connections, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port	Gulf Coast Analytical Analyst and Supervisor	Gulf Coast Analytical SOP GC-025
ICP - Metals	Perform leak test, change pump tubing, change torch and window, clean filters	Metals	Monitor instrument performance via Continuing Calibration Verification and CCBlank	As needed	No maintenance is required as long as instrument QC meets DOD criteria	Change pump tubing, change torch and window, clean filters; recalibrate and reanalyze affected data	Gulf Coast Analytical Analyst and Supervisor	Gulf Coast Analytical SOP MET-010

QAPP Worksheet #26 – Sample Handling System

Sample Handling System
GROUNDWATER, SOIL GAS, AND SOIL SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Shaw Field Technician
Sample Packaging (Personnel/Organization): Shaw Field Technician or QC Manager
Coordination of Shipment (Personnel/Organization): Shaw Field Technician or QC Manager
Type of Shipment/Carrier: FedEx or UPS
GROUNDWATER, SOIL GAS, AND SOIL SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Empirical for groundwater sample analyses, RTI for soil gas sample analyses, Golf Coast Analytical for soil sample analyses, and Microseeps for stable isotope analysis
Sample Custody and Storage (Personnel/Organization): Empirical for groundwater sample analyses, RTI for soil gas sample analyses, Golf Coast Analytical for soil sample analyses, and Microseeps for stable isotope analysis
Sample Preparation (Personnel/Organization): Empirical for groundwater sample analyses, RTI for soil gas sample analyses, Golf Coast Analytical for soil sample analyses, and Microseeps for stable isotope analysis
Sample Determinative Analysis (Personnel/Organization): Empirical for groundwater sample analyses, RTI for soil gas sample analyses, Golf Coast Analytical for soil sample analyses, and Microseeps for stable isotope analysis
GROUNDWATER, SOIL GAS, AND SOIL SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): On the day of sampling, samples will be shipped to Empirical Laboratories for groundwater sample analysis, RTI for soil gas sample analysis, Golf Coast Analytical for soil sample analyses, and Microseeps for stable isotope analysis on the day of sampling. In cases when samples can't be shipped to the laboratories on the same day due to field conditions, samples will be kept in a refrigerator at the site for a maximum of one day. Samples with short holding time requirements will be shipped to the laboratories on the day of sampling.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): See QAPP/SAP Worksheet #19 for various analyses
Biological Sample Storage (No. of days from sample collection): NA
GROUNDWATER, SOIL, AND SOIL GAS SAMPLE DISPOSAL
Personnel/Organization: Empirical, RTI, Golf Coast Analytical, and Microseeps
Number of Days from Analysis: Hold samples for 120 days

QAPP Worksheet #27 – Sample Custody Requirements Table

27.1 SAMPLE CUSTODY AND DOCUMENTATION

Sampling information will be recorded on a COC form and sample collection forms. All entries will be legible and recorded in indelible ink. Sampling information will be recorded on a COC form and sample collection forms. All entries will be legible and recorded in indelible ink. Because samples will be analyzed by multiple laboratories, the terms laboratory and Sample Custodian are generic. The custody procedures described herein apply to all laboratories which are involved in the analysis of groundwater, soil gas, and soil samples.

27.2 CHAIN OF CUSTODY

An example COC form is shown on Figure 3, "Typical Chain-of-Custody." In addition to providing a custody exchange record for the samples, the COC serves as a formal request for sample analyses. The COC form will be completed, signed, and distributed as follows:

- One copy retained by the sample coordinator for inclusion in the project files
- The original sent to the analytical laboratory with the sample shipment

After the laboratory receives the samples, the Sample Custodian will inventory each shipment before signing for it, and note on the original COC form any discrepancy in the number of samples, temperature of the cooler or broken samples. The Project Chemist will be notified immediately of any problems identified with shipped samples. The Project Chemist will in turn notify the Project QC Manager, and together they will determine the appropriate course of action. The Project Chemist will also notify the Project Manager if the project budget and schedule may be impacted.

The laboratory will initiate an internal COC that will track the sample within the various areas of the laboratory. The relinquishing signature of the Sample Custodian and the custody acceptance signature of the laboratory personnel transfer custody of the sample. This procedure is followed each time a sample changes hands. The laboratory will archive the samples and maintain their custody as required by the contract or until further notification from the Project Chemist, at which time the samples will either be returned to the project for disposal, or disposed by the laboratory.

27.3 FIELD SAMPLE CUSTODY

The COC Form will be the controlling document to assure that sample custody is maintained. Upon collecting a sample, sampling personnel will initiate the COC in the field. Each individual who has the sample(s) in their possession will sign the COC. Each time the sample custody is transferred, the former custodian will sign the COC on the "Relinquished by" line, and the new

custodian will sign the COC on the "Received by" line. The date, time, and name of their project or company affiliation will accompany each signature.

The waybill number or courier name will be recorded on the COC form when a commercial carrier is used. The shipping container will be secured with two custody seals, thereby allowing shipping personnel to maintain custody until receipt by the laboratory.

If the laboratory sample custodian judges sample custody to be invalid (*e.g.*, custody seals have been broken), the laboratory will initiate a Nonconformance Report. The Project Chemist will be immediately notified. The Project Chemist will notify in turn, the Project Manager and the Project QC Manager. The Project Manager will make a decision, in consultation with the client, as to the fate of the sample(s) in question on a case-by-case basis. The sample(s) will either be processed "as-is" with custody failure noted along with the analytical data, or rejected with resampling scheduled, if necessary. The nonconformance associated with the samples will be noted on the appropriate certificate of analysis or case history.

27.4 SAMPLE COLLECTION FORMS

Sample Collection Forms will be used to document every sample collected. All entries will be recorded in indelible ink. Corrections will be made following the procedure described below.

At a minimum, the sample collection form will contain the following information:

- Project name and location
- Sampler name
- Date and time of collection for each sample
- Sampling method (bailer or low flow)
- Sample number
- Sample location (i.e., soil boring or sampling point)
- Sample matrix (i.e., soil and water)
- Sample type (i.e., normal sample, field duplicate, blank)
- Composite or grab
- Composite type (the number of grab samples)
- Depth of sample
- Weather information (e.g., rain, sunny, approximate temperature, etc.)
- Containers used (e.g., brass liners, glass bottles, etc.)

- Requested analyses
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments (i.e., photoionization detector reading)
- Descriptions of deviations from this QAPP/SAP
- Problems encountered and corrective action taken
- Verbal or written instructions from the USACE and Shaw Project QC Manager
- Any other events that may affect the samples

The sampler will cross out the unused portion and sign each page.

27.5 LOW-FLOW GROUNDWATER PURGE AND SAMPLE LOG

Low-Flow Groundwater Purge and Sample Logs (purge and sample log) will be used to document every sample collected. All entries will be recorded in indelible ink. Corrections will be made following the procedure described in Section 27.6.

At a minimum, the sample purge logs will contain the following information:

- Project name and site
- Well identification number
- Sampler name
- Sample date and time
- Water level
- Screen interval
- PID reading
- Purge information (time, purge rate, volume purged, depth to water, temperature, pH, DO, ORP, conductivity, turbidity)
- VOC sample rate, sample number and requested analysis
- Sample type (i.e., normal sample, field duplicate, blank)

27.6 DOCUMENT CORRECTIONS

Changes or corrections on any project documentation will be made by crossing out the item with a single line, initialing by the person performing the correction, and dating the correction. The original item, although erroneous, will remain legible beneath the cross out. The new information will be written above the crossed-out item. Corrections will be written clearly and legibly with indelible ink.

QAPP Worksheet #28a – Laboratory QC Samples Table (Gas Chromatography/Mass Spectrometry)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, and TO15

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
Internal standards	Every field sample and QC samples	RT within ±30 seconds from RT of initial calibration midpoint standard; area counts within -50% to +100% of initial calibration midpoint standard	Correct problem, then re-reanalyze affected samples.	Lab Manager/Analyst	Accuracy	RT within ±30 seconds and area count within -50% to +100%
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.

QAPP Worksheet #28a – Laboratory QC Samples Table (Gas Chromatography/Mass Spectrometry) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, and TO15

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8260 and EPA 8270: LCS control limits specified in the DoD QSM (also presented in Appendix A) RPD less than 30% between MS and MSD	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/Analyst	Precisions and Accuracy	EPA 8260 and EPA 8270: LCS control limits specified in the DoD QSM RPD less than 30% between MS and MSD
LCS or LCS/LCSD pair	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8260 and EPA 8270: LCS control limits specified in the DoD QSM (also presented in Appendix A) TO15 and MA DEP: Laboratory in-house LCS control limits (also presented in Appendix A) RPD less than 30% between LCS and	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/Analyst	Precisions and Accuracy	EPA 8260 and EPA 8270: LCS control limits specified in the DoD QSM TO15 and MA DEP: Laboratory in-house LCS control limits. RPD less than 30% between LCS and LCSD

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, and TO15

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
		LCSD				

QAPP Worksheet #28a – Laboratory QC Samples Table (Gas Chromatography/Mass Spectrometry) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260, 8270, MA DEP, and TO15

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
Surrogate standards	Every field sample and QC sample	EPA 8260 and EPA 8270: Surrogate recovery acceptance criteria specified in the DoD QSM (also presented in Appendix A). TO15: Laboratory in-house surrogate control limits (also presented in Appendix A)	Correct problem, then re-reanalyze all affected samples	Lab Manager/Analyst	Accuracy	EPA 8260 and EPA 8270: Surrogate recovery acceptance criteria specified in the DoD QSM TO15: Laboratory in-house surrogate control limits
Sample duplicate	Every 20 samples	TO15: RPD less than 25% per method requirements. MA DEP: RPD less than 30% per method requirements	NA	Lab Manager/Analyst	Accuracy	TO15: RPD less than 25% per method requirements. MA DEP: RPD less than 30% per method requirements
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/Analyst	Sensitivity	

QAPP Worksheet #28a – Laboratory QC Samples Table (Gas Chromatography/Mass Spectrometry) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	VOCs, SVOCs, and APH
Analytical Method	EPA Methods 8260 and 8270, and8270, MA DEP, and TO15

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements.	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/Analyst	Sensitivity	
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ		Lab Manager/Analyst	Sensitivity	

Note(s):

LOD denotes limit of detection.

LOQ denotes limit of quantitation.

RPD denotes relative percent difference.

QAPP Worksheet #28b – Laboratory QC Samples Table (Gas Chromatography)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	EDB/DBCP, TPH, VPH/EPH, Dissolved Gases
Analytical Method	EPA Methods 8011 and 8015, MA DEP, and RSK 175

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and >1/10 amount detected in project samples or 1/10 the regulatory limit (whichever is greater).	Correct problem, then re-extract and reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/Analyst	Representativeness	No target analytes detected greater than one-half RL and >1/10 amount detected in project samples or 1/10 the regulatory limit (whichever is greater).
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8011 and EPA 8015, MA DEP ,RSK 175: Laboratory in-house LCS control limits (also presented in Appendix A) RPD less than 30% between MS and MSD	Identify problem; if not related to matrix interference, re-extract and reanalyze MS/MSD and all associated batch samples	Lab Manager/Analyst	Precisions and Accuracy	EPA 8011 and EPA 8015, MA DEP ,RSK 175: Laboratory in-house LCS control limits RPD less than 30% between MS and MSD

QAPP Worksheet #28b – Laboratory QC Samples Table (Gas Chromatography (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	EDB/DBCP, TPH, VPH/EPH, Dissolved Gases
Analytical Method	EPA Methods 8011 and 8015, MA DEP, SRK 175

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
LCS or LCS/LCSD pair	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8011 and EPA 8015, MA-DEP, , and RSK 175: Laboratory in-house LCS control limits (also presented in Appendix A) RPD less than 30% between LCS and LCSD	Correct problem, then re-extract and reanalyze the LCS and all associated batch samples	Lab Manager/Analyst	Precisions and Accuracy	EPA 8011 and EPA 8015, MA-DEP, RSK 175: Laboratory in-house LCS control RPD less than 30% between LCS and LCSD
Surrogate standards	Every field sample and QC sample	EPA 8015, and MA-DEP: Laboratory in-house surrogate acceptance criteria (Also presented in Appendix A)	Correct problem, then re-extract and reanalyze all affected samples	Lab Manager/Analyst	Accuracy	EPA 8015, and MA-DEP : Laboratory in-house surrogate acceptance criteria

QAPP Worksheet #28b – Laboratory QC Samples Table (Gas Chromatography) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	EDB/DBCP, TPH, VPH/EPH, Dissolved Gases
Analytical Method	EPA Methods 8011 and 8015, MA DEP, RSK 175

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
Confirmation of positive results using second column or second detector	All positive results must be confirmed	EPA 8011: Same calibration and QC requirements as for initial or primary column analysis. RPD between primary and second column results less than 40%	NA	Lab Manager/Analyst	Precision	EPA 8011: RPD between primary and second column results less than 40%
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study in accordance with DoD QSM requirements	Lab Manager/Analyst	Sensitivity	
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements.	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration per DoD QSM	Lab Manager/Analyst	Sensitivity	

QAPP Worksheet #28b – Laboratory QC Samples Table (Gas Chromatography) (Continued)

Matrix	Groundwater, Soil, and Soil Gas
Analytical Group	EDB/DBCP, TPH, VPH/EPH, Dissolved Gases
Analytical Method	EPA Methods 8011 and 8015, MA DEP, RSK 175

QC Sample	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ		Lab Manager/Analyst	Sensitivity	

QAPP Worksheet #28c – Laboratory QC Samples Table (Inductively Coupled Plasma Atomic Emission Spectrometry)

Matrix	Groundwater and Soil
Analytical Group	Metals
Analytical Method	EPA Method 6010

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
EPA 6010: Calibration blank	EPA 6010: After initial calibration, before CCV calibration, after every 10 samples, and at the end of the sequence	EPA 6010: No target analytes detected greater than LOD in accordance with DoD QSM requirements	EPA 6010: Re-prepare and reanalyze the blank and the affected samples in accordance with DoD QSM requirements	Lab Manager/Analyst	Representativeness	EPA 6010: No target analytes detected greater than LOD
EPA 6010: Method blank	EPA 6010: One per preparation batch	EPA 6010: No target analytes detected greater than one-half RL and greater than 1/10 amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	EPA 6010: Correct problem, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with DoD QSM requirements	Lab Manager/Analyst	Representativeness	EPA 6010: No target analytes detected greater than one-half RL and greater than 1/10 amount measured in any sample or 1/10 the regulatory limit (whichever is greater).
EPA 6010: Interference check solution	EPA 6010: At the beginning of an analytical run and every 12 hours	EPA 6010: Within ±20% of expected value in accordance with DoD QSM requirements	EPA 6010: Identify and correct problem, then reanalyze the interference check solution and all affected samples in accordance with DoD QSM requirements	Lab Manager/Analyst	Accuracy	EPA 6010: within ±20% of expected value

QAPP Worksheet #28c – Laboratory QC Samples Table (Inductively Coupled Plasma Atomic Emission Spectrometry) (Continued)

Matrix	Groundwater and Soil
Analytical Group	Metals
Analytical Method	EPA Method 6010

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
EPA 6010: MS/MSD for all analytes	EPA 6010: One MS/MSD pair per preparation batch per matrix	EPA 6010: LCS control limits specified in the DoD QSM (also presented in Appendix A) RPD less than 20% between MS and MSD	EPA 6010: Identify problem, if not related to matrix interference, then re-prepare and reanalyze the MS/MSD pair and all samples in the associated batch in accordance with DoD QSM requirements	Lab Manager/Analyst	Precision and Accuracy	EPA 6010: LCS control limits specified in the DoD QSM
EPA 6010: LCS for all analytes	EPA 6010: One LCS per each preparation batch	EPA 6010: LCS control limits specified in the DoD QSM (also presented in Appendix A) RPD less than 20% between LCS and LCSD	EPA 6010: Identify and correct the problem, then reanalyze the LCS and all affected samples in accordance with DoD QSM requirements	Lab Manager/Analyst	Precision and Accuracy	EPA 6010: LCS control limits specified in the DoD QSM

QAPP Worksheet #28c – Laboratory QC Samples Table (Inductively Coupled Plasma Atomic Emission Spectrometry (Continued)

Matrix	Groundwater and Soil
Analytical Group	Metals
Analytical Method	EPA Methods 6010

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
EPA 6010: Dilution test	EPA 6010: Each preparation batch	EPA 6010: Five-fold dilution results within ±10% of the original results in accordance with DoD QSM requirements	EPA 6010: Perform post-digestion spike	Lab Manager/Analyst	Accuracy	EPA 6010: within ±10% difference
EPA 6010: Post digestion spike addition	EPA 6010: When dilution test fails	EPA 6010: Recovery within 75% -125% of expected results in accordance with DoD QSM requirements	EPA 6010: Correct problem, then rerun samples by method of standard addition in accordance with DoD QSM requirements	Lab Manager/Analyst	Accuracy	EPA 6010: Recovery within 75% -125% of expected values
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study in accordance with DoD QSM requirements	Lab Manager/Analyst	Sensitivity	

QAPP Worksheet #28c – Laboratory QC Samples Table (Inductively Coupled Plasma Atomic Emission Spectrometry) (Continued)

Matrix	Groundwater and Soil
Analytical Group	Metals
Analytical Method	EPA Method 6010

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements.	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration per DoD QSM	Lab Manager/Analyst	Sensitivity	
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ		Lab Manager/Analyst	Sensitivity	

Note(s):

ICS denotes interference check solution.

ICV denotes initial calibration verification.

QAPP Worksheet #28d – Laboratory QC Samples Table (Wet Chemistry)

Matrix	Groundwater
Analytical Group	Anions, TKN , Ammonia, Sulfide, TOC, , and o-Phosphorous
Analytical Method	EPA Methods 300.0, 351.4, 4500B, D, 4500S-2CF, 4500PE, and EPA 9060

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
EPA 300.0, 351.4, 4500B, 4500PE, 4500S-2CF and EPA 9060: Method blank	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: One per preparation batch	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: No target analytes detected greater than one-half RL and 1/10 the amount measured in any samples or 1/10 the regulatory limit (whichever is greater)	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Correct problem, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank.	Lab Manager/ Analyst	Representativeness	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: No target analytes detected greater than one-half RL and 1/10 the amount measured in any samples or 1/10 the regulatory limit (whichever is greater)
EPA 300.0, 351.4, 4500B, 4500PE, 4500S-2CF and EPA 9060: MS/MSD	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: One MS/MSD pair per preparation batch	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Laboratory in-house LCS control limits (also presented in Appendix A) RPD less than 15% between MS and MSD	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Identify problem, if not related to matrix interference, then re-prepare and reanalyze the MS/MSD pair and all samples in the associated batch	Lab Manager/ Analyst	Precision and Accuracy	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Laboratory in-house LCS control limits RPD less than 15% between MS and MSD
EPA 300.0, 351.4, SM 4500B,	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA	Lab Manager/ Analyst	Precision and Accuracy	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-

Matrix	Groundwater
Analytical Group	Anions, TKN , Ammonia, Sulfide, TOC, , and o-Phosphorous
Analytical Method	EPA Methods 300.0, 351.4, 4500B, D, 4500S-2CF, 4500PE, and EPA 9060

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
4500PE, 4500S-2CF and EPA 9060: LCS	2CF and EPA 9060: One LCS per each preparation batch	2CF and EPA 9060: Laboratory in-house LCS control limits (also presented in Appendix A) RPD less than 15% RPD less than 15% between LCS and LCSD	9060: Identify and correct the problem, then reanalyze the LCS and all affected samples			2CF and EPA 9060: Laboratory in-house LCS control limits not to exceed ±20% RPD less than 15% between LCS and LCSD

QAPP Worksheet #28d – Laboratory QC Samples Table (Wet Chemistry) (Continued)

Matrix	Groundwater
Analytical Group	Anions, TKN , Ammonia, Sulfide, TOC, , and o-Phosphorous
Analytical Method	EPA Methods 300.0, 351.4, SM 4500B, D, 4500S-2CF, 4500PE, and EPA 9060

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Sample duplicate	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: One per every 10 samples	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Within 10% difference between sample and duplicate	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Correct problem, reanalyze sample and duplicate	Lab Manager/ Analyst	Accuracy	EPA 300.0, 351.4, SM 4500B, 4500PE, 4500S-2CF and EPA 9060: Within 10% difference
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements.	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration per DoD QSM	Lab Manager/ Analyst	Sensitivity	
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range.		Lab Manager/ Analyst	Sensitivity	

Matrix	Groundwater
Analytical Group	Anions, TKN , Ammonia, Sulfide, TOC, , and o-Phosphorous
Analytical Method	EPA Methods 300.0, 351.4, SM 4500B, D, 4500S-2CF, 4500PE, and EPA 9060

QC Check	Frequency	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Actions	Data Quality Indicators	Measurement Performance Criteria
		Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ				

QAPP Worksheet #29 – Project Documents and Records Table

Document	Where Maintained
Daily QC reports	Project file and Quarterly Monitoring Report
Descriptions of installed groundwater and soil gas monitoring wells and surveyed locations	Project file and Quarterly Monitoring Report
Geologic and geophysical logs of wells ad boreholes	Project file and Quarterly Monitoring Report
Water levels and water level maps	Project file and Quarterly Monitoring Report
LNAPL measurements	Project file and Quarterly Monitoring Report
Plume contaminant maps and cross-sections	Project file and Quarterly Monitoring Report
SVE maintenance and monitoring	Project file and Quarterly Monitoring Report
Field notes/sample collection forms	Project file and Quarterly Monitoring Report
COC forms	Project file and Quarterly Monitoring Report
Field Equipment Calibration Logs	Project file
EPA Level III ADR worksheets	Project file and Quarterly Monitoring Report
Laboratory Level III data packages	Project file
Audit/assessment checklists/reports	Project file and laboratory
Corrective action forms/reports	Project file and laboratory
Laboratory equipment calibration logs	Laboratory
Sample preparation logs	Laboratory
Run logs	Laboratory
Sample disposal records	Laboratory

QAPP Worksheet #30 – Analytical Services Table - Groundwater

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
Groundwater	VOCs – EPA 8260	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for VOCs analysis
	EDB – EPA 8011	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for EDB analysis
	TPH gasoline – EPA 8015	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for TPH gasoline analysis
	TPH diesel – EPA 8015	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for TPH diesel analysis
	VPH – MA DEP	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for VPH analysis
	EPH – MA DEP	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for EPH analysis

QAPP Worksheet #30 – Analytical Services Table – Groundwater (Continued)

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
Groundwater	SVOCs – EPA 8270	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for SVOCs analysis
	Metals – EPA 6010	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for metals analysis
	Anions – EPA 300.0	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for anions analysis
	Alkalinity – SM 2320B	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for alkalinity analysis Alkalinity may be measured in the field
	Ammonia – SM 4500B, D	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for ammonia analysis
	TKN – EPA 351.4	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228	Only one laboratory will be used for TKN analysis

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
					(877) 345-1113	

QAPP Worksheet #30 – Analytical Services Table – Groundwater (Continued)

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
Groundwater	o-Phosphorous - SM 4500 PE	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for o-Phosphorous analysis
	Total Sulfide – SM 4500S-2CF	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for total sulfide analysis
	TOC – EPA 9060	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for TOC analysis
	Dissolved Gases – RSK 175	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (877) 345-1113	Only one laboratory will be used for dissolved gases analysis
	Stable carbon and hydrogen isotope – Laboratory SOP	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Days	Microseeps Inc. 220 William Pitt Way Pittsburgh, PA 15238 412 826 5245	Only one laboratory will be used for stable isotope analysis

QAPP Worksheet #30 – Analytical Services Table – Soil Gas

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
Soil Gas	VOCs/TPH gas – EPA TO15	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	RTI Laboratories 31628 Glendale Ave. Livonia, MI 48150 (734) 422-8000	Only one laboratory will be used for VOCs/TPH gas analysis
	APH – MA DEP	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	RTI Laboratories 31628 Glendale Ave. Livonia, MI 48150 (734) 422-8000	Only one laboratory will be used for APH analysis
	Fixed Gases – ASTM D2504	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	RTI Laboratories 31628 Glendale Ave. Livonia, MI 48150 (734) 422-8000	Only one laboratory will be used for fixed gases analysis

QAPP Worksheet #30 – Analytical Services Table – Soil

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
Soil and IDW soil	VOCs – EPA 8260	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for VOCs analysis
	SVOCs – EPA 8270	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for SVOC analysis
	VPH – MA DEP	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for VPH analysis
	EPH –MA DEP	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for EPH analysis
	TPH gasoline – EPA 8015	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for TPH gasoline analysis
	TPH diesel – EPA 8015	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for TPH diesel analysis
	Lead – EPA 6010	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for lead analysis

QAPP Worksheet #30 – Analytical Services Table – Soil

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOP(s)	Data Package Turnaround Time	Laboratory/Organization (Name, Address, Contact, & Telephone #)	Backup Laboratory (Name, Address, Contact, & Telephone #)
Soil and IDW Soil	VOCs – EPA 1311/8260	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for VOCs analysis
	SVOCs – EPA 1311/8270	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for SVOCs analysis
	Pesticides – EPA 1311/8081	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for pesticides analysis
	Herbicides – EPA 1311/8151	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for herbicides analysis
	Metals – EPA 1311/6010/7471	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for metals analysis
	RCI –SW846 Chapter 7, 7.3.2	QAPP Worksheet #18	QAPP Worksheet #23	21 Business Day	Golf Coast Analytical Laboratories 7979 GSRI Avenue Baton Rouge, LA 70820 931-636-1019	Only one laboratory will be used for RCI analysis

QAPP Worksheet #31 – Planned Project Assessments Table

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
NELAP lab assessment	Every 18 months The laboratory must hold a current Utah NELAP certification throughout the project duration	External	NELAP	NELAP	Laboratory QAO	Laboratory QAO	Laboratory QAO
DoD ELAP assessment	After October 1, 2009, the laboratory must receive DoD ELAP approval. The laboratory must hold a current DoD ELAP certification throughout the project duration	External	Independent accrediting bodies on behalf of DoD	Independent accrediting bodies on behalf of DoD	Laboratory QAO	Laboratory QAO	Laboratory QAO
Laboratory Technical Systems Audit (TSA)	If deemed necessary prior to start of sampling activities	External	Shaw	Shaw Project or Program Chemist	Laboratory QAO	Laboratory QAO	Laboratory QAO and Shaw Project Chemist
Performance Evaluation (audit	If deemed necessary prior to the start of or during sampling activities	External	Shaw - submission of blind performance evaluation samples to laboratory	Shaw Project or Program Chemist	Laboratory QAO	Laboratory QAO	Laboratory QAO and Shaw Project Chemist

QAPP Worksheet #31 – Planned Project Assessments Table (Continued)

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 audits	every sampling event	Internal	Shaw and/or USACE QAO	Shaw and/or USACE QAO	Shaw Technical Manager; Field Sampling Technician or Project Chemist	Shaw Technical Manager; Field Sampling Technician or Project Chemist	Laboratory QAO and Shaw Project Chemist
Field documentation review	every sampling event	Internal	Shaw	Shaw Program Chemist or Field QC Manager	Shaw Technical Manager; Field Sampling Technician or Project Chemist	Shaw Technical Manager; Field Sampling Technician or Project Chemist	Shaw Program Chemist or Field QC Manager

Note(s):

ELAP denotes Environmental Laboratory Accreditation Program

NELAP denotes National Environmental Laboratory Accreditation Program.

QAPP Worksheet #32 – Assessment Findings and Corrective Action Responses

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	Timeframe for Response
Field Sampling TSA	Written Audit Report	Shaw QC Manager	48 hours after audit	Email or letter	Shaw field technician, Shaw Project Chemist (Susan Huang) Shaw Program Chemist (Pam Moss)	24 hours after notification
Off-Site Laboratory Audit (if performed for project)	Written Audit Report	Empirical, Golf Coast Analytical, RTI, and Microseeps QA Managers and Project Managers	5 days after Audit	Corrective Action Plan	Shaw Project Chemist (Susan Huang) or Shaw Program Chemist (Pam Moss)	10 business days after receiving report
Laboratory Data Review Findings	Memo	Empirical, Golf Coast Analytical , RTI, and Microseeps QA Managers and Project Managers	48 hours after audit	Email or letter	Shaw Project Chemist (Susan Huang) or Shaw Program Chemist (Pam Moss)	3 days after notification

QAPP Worksheet #33 – QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person's Responsible for Report Preparation	Report Recipient(s)
Field Sampling TSA Report	As needed	Within 24 hours of Field Sampling Audit	Shaw QC Manager or Shaw Project Chemist (Susan Huang)	Shaw Technical Manager or Shaw Project Manager (Tom Cooper)
Off-Site Laboratory TSA Report (if performed)	Prior to sample receipt at laboratory	Within 48 hours of on-site audit	Shaw Project Chemist (Susan Huang) or Shaw Program Chemist (Pam Moss)	Empirical, Golf Coast Analytical RTI, and Microseeps QA Managers and Project Managers
Data Validation Report	After all groundwater, soil gas, and soil data package(s) received from laboratory	Within 2 weeks of data package receipt	Shaw Project Chemist (Susan Huang)	Project file
Quarterly Monitoring Report	Quarterly, QAPP/SAP Worksheet #16	QAPP/SAP Worksheet #16	Shaw Technical Manager and Shaw Project Geologist	USACE Project Manager and NMED Hazardous Branch Project Lead

QAPP Worksheet #34 – Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
COC forms	COC forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the COC should be initialed by the reviewer, a copy of the COC retained in the project file, and the original and remaining copies taped inside the cooler for shipment.	Internal	Field team leader (Shaw)
Audit reports	Upon report completion, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the project file. At the beginning of each week, and at the completion of the site work, project file audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the project manager will be notified to ensure action is taken.	Internal	Technical Manager
Field notes/sample collection forms	Field notes and sample collection forms will be reviewed internally and placed in the project file. A copy of the field notes and sample collection forms will be kept in the project file.	Internal	Field team leader (Shaw)
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be validated Shaw Project Chemist (Susan Huang) according to the data validation procedures specified in this QAPP/SAP.	Internal	Laboratory, Shaw Project Chemist (Susan Huang)

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

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	All definitive data collected for the project	Review data package for compliance with approved QAPP/SAP, DoD QSM requirements, EPA Methods, USACE documents, and EPA Functional guidelines	Shaw Project Chemist (Susan Huang)
IIa	Verify that all sampling procedures (per the QAPP/SAP) were followed	Review field sample collection forms for compliance with the approved QAPP/SAP	Shaw Project Chemist (Susan Huang) or Shaw Project QC Manager
IIa	Documentation of all EPA Method QC sample Results	Determine if all EPA Method required QC samples were analyzed and met required control limits per QAPP/SAP and DoD QSM requirements when applicable.	Shaw Project Chemist (Susan Huang)
IIb	Documentation of all QAPP/SAP QC sample Results	Determine if all QAPP/SAP required QC samples were collected and met required control limits per QAPP/SAP and DoD QSM requirements when applicable.	Shaw Project Chemist (Susan Huang)
IIb	Project RLs met	Review all laboratory data to ensure that project specific RLs specified in the QAPP/SAP are met	Shaw Project Chemist (Susan Huang)

Note(s):

IIa denotes compliance with methods, procedures, and contracts.

IIb denotes comparison with measurement performance criteria in the QAPP/SAP.

QAPP Worksheet #36a – Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa and IIb	Groundwater	VOCs – EPA 8260 EDB – EPA 8011 TPH gasoline – EPA 8015 TPH diesel – EPA 8015 VPH – MA DEP EPH – MA DEP SVOCs – EPA 8270 Metals – EPA 6010 Anions – EPA 300.0 Alkalinity – SM 2320B Ammonia – SM 4500B, D TKN – EPA 351.4 o-Phosphorous – SM 4500 PE Total Sulfide – SM 4500 S-2CF TOC – EPA 9060 Dissolved Gases – RSK 175 Stable carbon and hydrogen isotope – Laboratory SOP	QC criteria specified in the following: QAPP/SAP DoD QSM EPA Methods USACE 200-1-10, Guidance for Evaluating`` Performance Based Data (June 30, 2005) USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (Final, June 2008) USEPA Contract Laboratory Program National Functional guidelines for Superfund Inorganic Data Review (Final January 2010)	Shaw Project Chemist (Susan Huang)
IIa and IIb	Soil Gas	VOCs/TPH gas – EPA TO15 APH – MA DEP Fixed Gases – ASTM D2504	QC criteria specified in the following: QAPP/SAP DoD QSM EPA Methods USACE 200-1-10, Guidance for Evaluating Performance-Based Chemical Data (June 30, 2005) USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (Final, June 2008)	Shaw Project Chemist (Susan Huang)

QAPP Worksheet #36b – Analytical Data Validation (Steps IIa and IIb) Summary Table (Continued)

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa and IIb	Soil	VOCs – EPA 8260 VPH – MA DEP EPH – MA DEP SVOCs – EPA 8270 Lead – EPA 6010	QC criteria specified in the following: QAPP/SAP DoD QSM EPA Methods USACE 200-1-10, Guidance for Evaluating Performance-Based Chemical Data (June 30, 2005) USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (Final, June 2008) USEPA Contract Laboratory Program National Functional guidelines for Superfund Inorganic Data Review (Final January 2010)	Shaw Project Chemist (Susan Huang)

QAPP Worksheet #37 – Usability Assessment

37.1 DATA QUALITY ASSESSMENT REPORT

Based on data validation and data review findings, the Project Chemist will determine if the project DQOs have been met, and will calculate data completeness. To reconcile the collected data with project DQOs and to establish and document data usability, the data will be reviewed against Data Quality Indicators (Section 37.2).

The Project Chemist will prepare a Data Quality Assessment (DQA) for each of the Quarterly Monitoring Events. The DQA will cover the following topics:

- Implementation of sampling design and analysis according to the approved QAPP/SAP (or sample completeness and representativeness)
- Proper frequency of field QC samples and the adequacy of field decontamination procedures
- Accuracy and precision of the data collected
- Data comparability, if appropriate
- Data usability for project decisions

A DQA assessment will be included in each Quarterly Monitoring Report.

37.2 DATA QUALITY INDICATORS

This section defines the Data Quality Indicators and their use for assessment of data quality.

37.2.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. The following equation illustrates the method for calculating RPD to assess a method's precision:

$$\text{Precision as RPD} = \frac{\text{Absolute (Result} - \text{Duplicate Result)}}{\text{Average (Result} + \text{Duplicate Result)}} \times 100\%$$

The laboratory uses MS/MSD pairs to assess the precision of analytical procedures, with one MS/MSD pair analyzed for every batch of up to 20 samples. According to the USACE requirements, analytical laboratories perform MS/MSD on the project samples. This allows determining whether matrix interferences may be present.

The laboratory uses LCS/LCSD pairs when MSs are not practical due to the nature of sample or analytical method used, and they are prepared and analyzed with each batch of samples instead of MS/MSD. Sufficient sample volume will be obtained in the field to perform the MS/MSD

analysis. For inorganic analyses, analytical precision is usually calculated based on the sample and sample duplicate results.

Laboratories will use precision limits specified in the DoD QSM for both LCS and MS analyses (DoD, 2009). When precision limits are not available in the DoD QSM, laboratories may use statistically-based acceptability limits for RPDs established for each method of analysis and sample matrix. The laboratory will review the QC samples to ensure that internal QC data lie within the limits of acceptability. Any suspect trends will be investigated and corrective actions taken.

37.2.2 Accuracy

Accuracy measures the bias of an analytical system by comparing the difference of a measurement with a reference value. The percent recovery of an analyte, which has been added to the environmental samples at a known concentration before extraction and analysis, provides a quantitation tool for analytical accuracy. The spiking solutions used for accuracy determinations are not used for instrument calibrations. The following equation illustrates how accuracy is evaluated:

$$\text{Accuracy as Percent Recovery} = \frac{\text{Spiked Sample Result} - \text{Sample Result}}{\text{Spiked Sample True Value}} \times 100\%$$

Percent recoveries for MS, MSD, and LCS that are analyzed for every batch of up to 20 samples serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MS, MSD, and LCS analyzed for organic contaminants to evaluate accuracy of the method and help to determine matrix interferences.

Laboratories will use LCS limits specified in the DoD QSM for both LCS and MS analyses (2009). When LCS limits are not available in the DoD QSM, the laboratory may use in-house statistically-based control limits or control limits specified in EPA Methods.

Control limits are defined as the mean recovery, plus or minus three standard deviations, of the 20 data points, with the warning limits set as the mean, plus or minus two standard deviations. The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that internal QC data lay within the limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions.

37.2.3 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or

an environmental condition. A qualitative parameter depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the approved QAPP/SAP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

Data generated by the laboratory must be representative of the laboratory database of accuracy and precision measurements for analytes in different matrices. Laboratory procedures for sample preparation will ensure that aliquots used for analysis are representative of the whole sample. Aliquots to be analyzed for volatile (if any) parameters will be removed before the laboratory composites/homogenizes the samples, to avoid losing volatile compounds during mixing.

37.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence where one data set can be compared with another, whether it was generated by a single laboratory or during inter-laboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units and standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

37.2.5 Completeness

Completeness goals for each sampling round are defined in the following section.

Contractual Completeness

The contractual completeness goal is set at 95 percent for all methods and is calculated as defined below. Holding time completeness is set at 100 percent for all methods. The following QC elements are typically within the laboratory's control and will be considered contractual deficiencies for the purposes of contractual completeness calculation.

- Holding time
- Laboratory blank contamination
- Initial calibration verification
- CCV
- LCSs

$$\text{\% Contract Completeness} = \frac{\text{Number of Unqualified Results*}}{\text{Number of Results Reported}} \times 100\%$$

* *Determined by subtracting the results qualified based on contractual deficiencies from the total number of results*

Analytical Completeness

The analytical completeness goal is set at 90 percent for all methods and is calculated as defined below. The following QC elements will be considered analytical deficiencies for the purposes of the analytical completeness calculation.

- Holding time
- Laboratory blank contamination
- Field blank contamination (trip, equipment, ambient and rinse)
- Initial calibration verification
- CCV
- LCSs
- MS recovery
- MS precision
- Surrogate recovery

$$\text{\% Analytical Completeness} = \frac{\text{Number of Unqualified Results*}}{\text{Number of Results Reported}} \times 100\%$$

* *Determined by subtracting results qualified for any of the deficiencies from the total number of results.*

Technical Completeness

The technical completeness goal is set at 95 percent for all methods and is calculated as defined below. Results considered unusable (or rejected) for the intended purpose based on contractual or technical deficiencies will be included for the purposes of the technical completeness calculation.

$$\text{\% Technical Completeness} = \frac{\text{Number of Useable Results*}}{\text{Number of Results Reported}} \times 100\%$$

** Technical completeness (i.e., usability) will be determined by subtracting results rejected for any reason from the total number of results reported.*

Project-Required Reporting Limits – Sensitivity

Following the DoD QSM requirements, the laboratory will determine the MDLs for each method, instrument, analyte, and matrix by using the procedure described in Title 40 Code of Federal Regulations Part 136B. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero.

An MDL study involves preparation/digestion and analysis of seven replicates of a given matrix spiked with target analytes at concentrations two to five times greater than the estimated MDL. The MDLs for metals in soil will be derived from the MDLs for metals in water. At a minimum, the laboratory will conduct annual MDL studies. Alternatively, the laboratory will conduct quarterly MDL verifications.

Additionally, the laboratory will establish LOD and LOQ for each method, analyte, matrix, and instrument in accordance with the DoD QSM requirements (2009). The LOD is the smallest amount of a substance that must be present in a sample in order to be detected at a 99 percent confidence level. The LOQ is the lowest concentration of a substance that produces a quantitative result within specific limits of precision and bias. The laboratory will perform quarterly LOD and LOQ verifications to verify method sensitivity. The LOQ is greater than LOD and must be within the calibration range prior to sample analysis.

Project RL goals are presented in Worksheet #15a through 15d. The actual RLs may be higher when corrected for amount of sample used for analysis. The RLs for individual samples may also be higher if matrix interferences are encountered. For this project, the laboratory will report positive results down to MDL. Results below between the RL and MDL will be reported as estimated values.

References

DoD. 2009. *DOD Quality Systems Manual for Environmental Laboratories, Version 4.1*. Based on NELAC voted Revision 5 June 2003. April 22.

EPA. 2010. *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review, Final*. Office of Superfund Remediation and Technology Innovation (OSRTI). OSWER 8240.1-51 and USEPA-540-R-10-011. January.

EPA. 2009, *Regional Screening Levels (RSL) Master Table.* Available online at <www.epa.gov/...table/...Tables/.../master_sl_table_run_DECEMBER2009.pdf. December 10.

EPA. 2008. *USEPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review, Final.* Office of Superfund Remediation and Technology Innovation (OSRTI). OSWER 9240.1-48 and USEPA-540-R-08-01. June.

EPA. 2006. SW-846 On-Line, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, Office of Solid Waste*, Washington D.C., <http://www.epa.gov/epaoswer/hazwaste/test/main.htm>.

EPA. 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part I: UFP-QAPP Manual, Final, Version 1*. EPA-505-B-04-900A and DoD DTIC ADA 427785. Intergovernmental Data Quality Task Force. March.

EPA. 2002a. *Guidance for Quality Assurance Project Plans, EPA QA/G-5*. Office of Environmental Information, Washington, DC . EPA/240/R-02/009. December.

EPA. 2002b. *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers*, Ground Water Forum Issue Paper, March.

EPA. 1999. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)*. January.

EPA. 1984. Method TO-3, *Method for the Determination of Volatile Organic Compounds in Ambient Air using Cryogenic Perconcentration Techniques and Gas Chromatography with Flame Ionization and Electron Capture Detection, SW-84634A.* April 1.

EPA. National Primary Drinking Water Regulations. Available online at http://water.epa.gov/drink/contaminants/index.cfm.

MA DEP. 2008. *Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH).* December.

MA DEP. 2004. *Method for the Determination of Extractable Petroleum Hydrocarbons (EPH.)* May.

MA DEP. 2004. *Method for the Determination of Volatile Petroleum Hydrocarbons (VPH).* May.

NMED, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program. 2009. *Technical Background Document for Development of Soil Screening Levels, Revision 5.0.* August.

NMED. 2006. NMED Soil Screening Levels. December. Albuquerque, NM: NMED.

New Mexico. 2009. New Mexico Administrative Code, Attachment 4, Title 20 - Environmental Protection, Chapter 6 - Water Quality, Part 2 - Ground and Surface Water Protection. October.

USACE. 2005. *Guidance for Evaluating Performance Based Chemical Data*. Engineer Manual EM 200-1-10. June 30.

FIGURES

Figure 1. Project Organization Chart

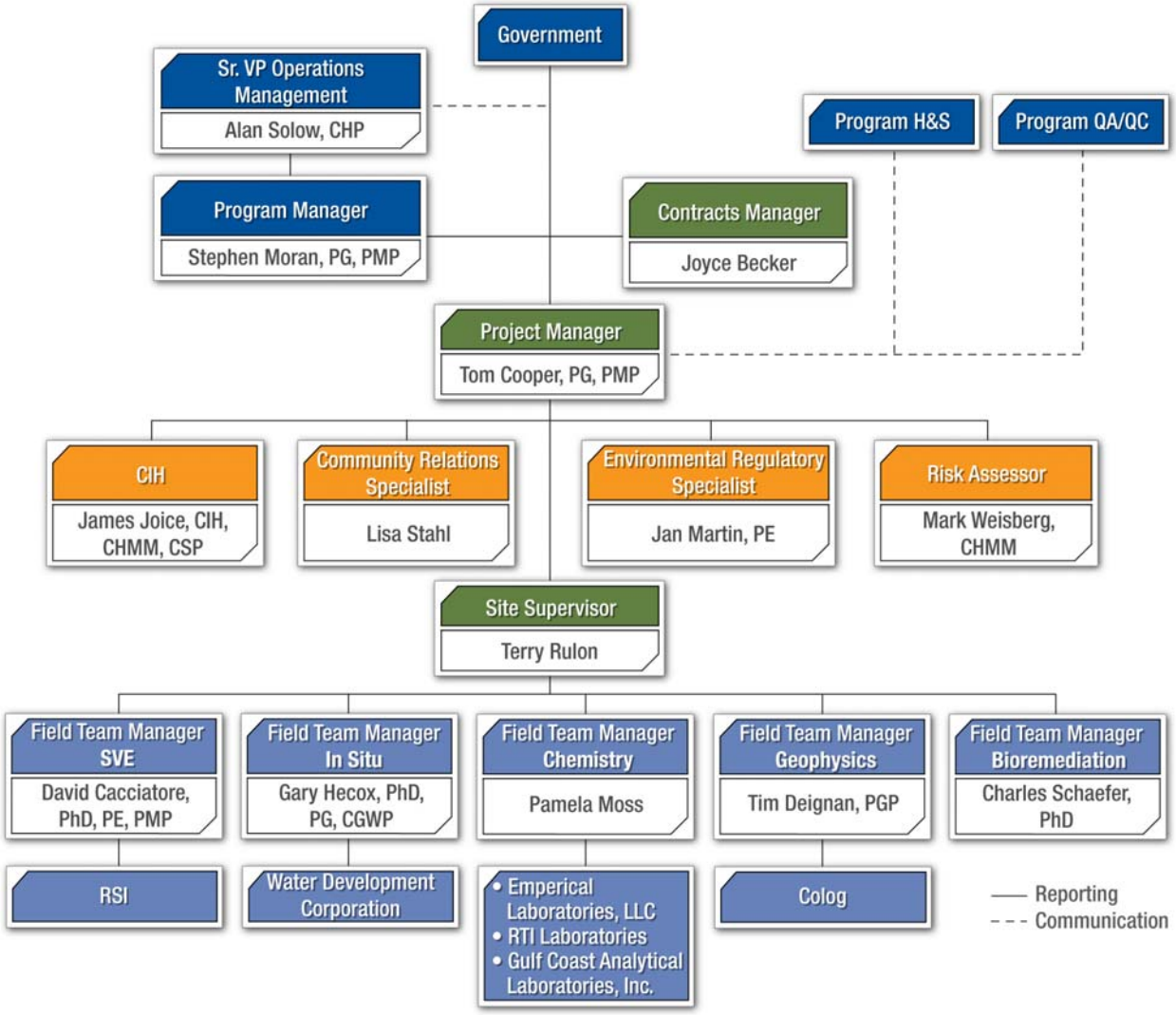

Figure 2. Site Map and Proposed Well Locations

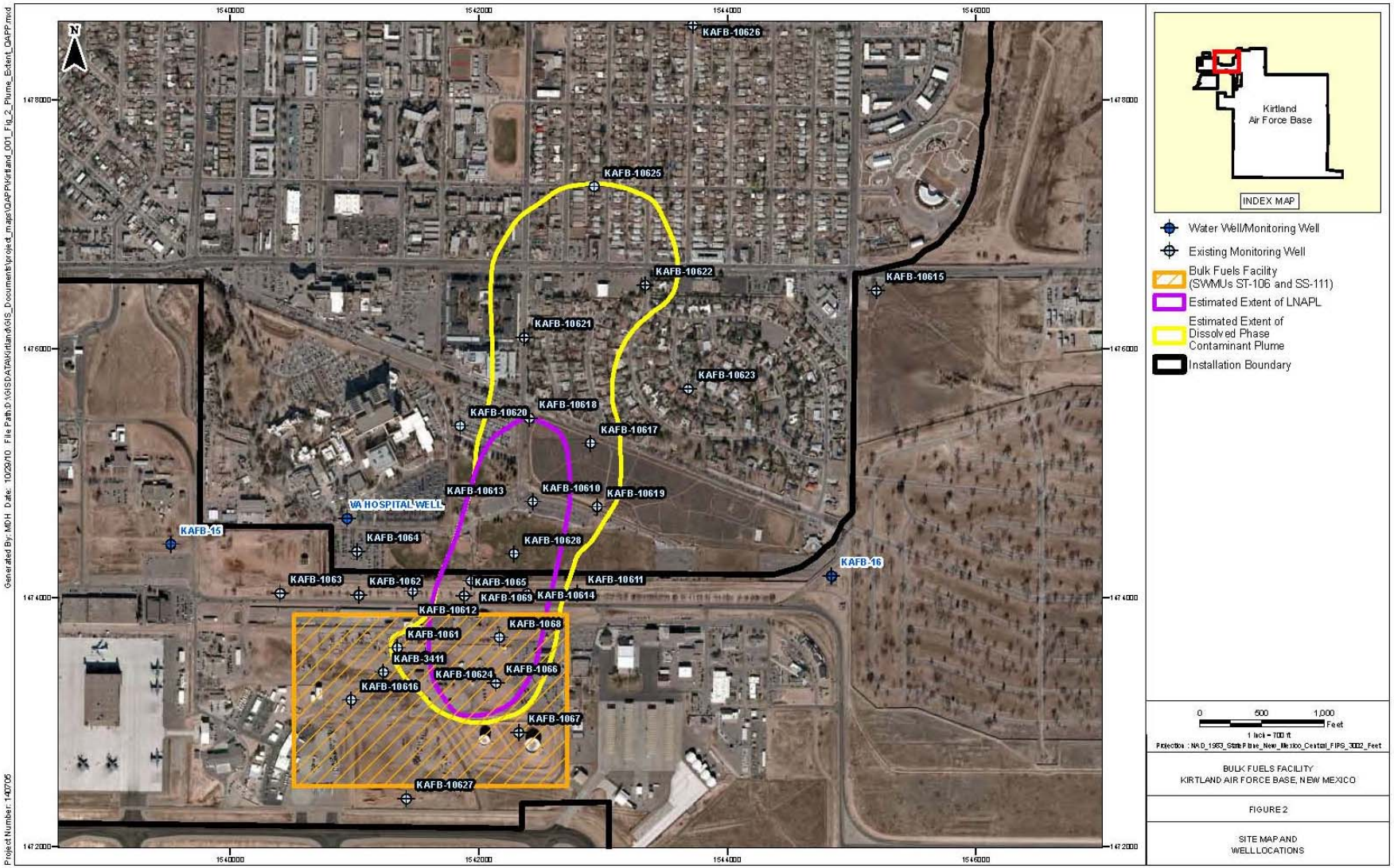

Figure 3. Chain of Custody

Shaw® Shaw E & I

FS003.1_0

Ref. Document # _____

Page _____ of ___

Shaw E & I Chain of Custody Form

Project Number: _____

Project Name / Location: _____

Purchase Order #: _____

Shipment Date: _____

Waybill/Airbill Number: _____

Lab Destination: _____

Lab Contact Name / ph. #: _____

Project Contact: _____ (Name & phone #)

Send Report To: _____

Phone/Fax Number: _____

Address: _____

City: _____

Sampler's Name(s): _____

Sample ID Number	Sample Description	Collection Information: Date	Time	G/C	Matrix	# of containers	Container type	Preservative: HCL	NaOH	HNO_3	H_2SO_4	Ice	Analyses Requested	Turn Around Time Requested

Special Instructions:

QC/Data Package Level Required:
I II III IV/Project Specific: _____

Relinquished By:	Date: / Time:	Received By:	Date: / Time:
Relinquished By:	Date: / Time:	Received By:	Date: / Time:
Relinquished By:	Date: / Time:	Received By:	Date: / Time:

G/C Codes

C = Composite G = Grab

Matrix Codes

DW = Drinking Water	SO =Soil
GW = Ground Water	SL = Sludge
WW = Waste Water	CP = Chip Samples
SW = Surface Water	WP = Wipe Samples
LIQ = Other Liquid	SOL = Other Solid
AS = Air Sample	SED = Sediment

Figure 3. Chain of Custody

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Shaw E & I COC Continuation Page

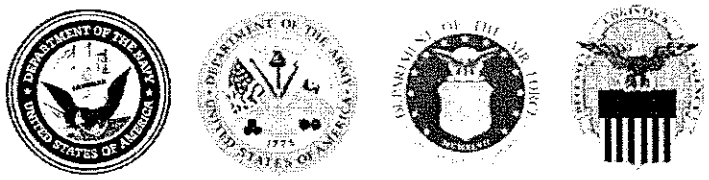
COC Ref. Document # _____ Page _____ of _____

Project Number: _____ Shipment Date: _____

Project Name / Location: _____

Sample ID Number	Sample Description	Collection Information			Matrix	# of containers	Container type	Preservative						Analyses Requested										Turn Around Time Requested
		Date	Time	G/C				HCL	NaOH	HNO_3	H_2SO_4	Ice												

APPENDIX A
SUMMARY OF CONTROL LIMITS FOR GROUNDWATER, SOIL GAS, AND SOIL SAMPLES
(from DoD QSM Version 4.1, April 22, 2009)



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5 June 2003

4/22/2009

presented in Table G-2. The lower control limit generated for alternative or modified methods must be greater than 10% to be considered acceptable.

G.6 Surrogates

The surrogate compounds for each method are added to all samples, standards, and blanks to assess the ability of the method to recover specific non-target analytes from a given matrix and to monitor sample-specific recovery. Control limits for these compounds were calculated in the same study as the other analytes on the target analyte lists. Below are the limits for some of the surrogates of Methods 8260, 8270, 8081, and 8082, based on 3 standard deviations around the mean (Table G-3). Sufficient data were not received for those analytes during the LCS study to perform statistically significant analyses. No ME limits are presented as marginal exceedances are not acceptable for surrogate spikes.

Note: DoD prefers the use of those surrogates not identified as poor performing analytes in Table G-2 above.

Table G-3. Surrogates

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
8260 Water:				
1,2-Dichloroethane-d_4	95	8	70	120
4-Bromofluorobenzene	98	7	75	120
Dibromofluoromethane	100	5	85	115
Toluene-d_8	102	6	85	120
8260 Solid:				
4-Bromofluorobenzene	101	6	85	120
Toluene-d_8	100	5	85	115
8270 Water:				
2-Fluorobiphenyl	79	10	50	110
Terphenyl-d_{14}	92	14	50	135
2,4,6-Tribromophenol	82	13	40	125
2-Fluorophenol	63	14	20	110
Nitrobenzene-d_5	76	11	40	110
8270 Solid:				
2-Fluorobiphenyl	72	10	45	105
Terphenyl-d_{14}	78	15	30	125
2,4,6-Tribromophenol	80	15	35	125
2-Fluorophenol	70	11	35	105
Phenol-d_5/d_6	71	10	40	100
Nitrobenzene-d_5	69	10	35	100
8081 Water:				
Decachlorobiphenyl	83	17	30	135
TCMX	81	19	25	140
8081 Solid:				
Decachlorobiphenyl	94	13	55	130
TCMX	97	9	70	125
8082 Water:				
Decachlorobiphenyl	88	15	40	135
8082 Solid:				
Decachlorobiphenyl	91	11	60	125

G.7 In-House LCS Control Limits

The acceptability of LCS results within any preparatory batch shall be based on project-specified limits or the following DoD-specified LCS control limits, if project-specific limits are not available. If DoD limits are not available, the laboratory must use its in-house limits for batch acceptance.

DoD strongly believes that it is important for laboratories to maintain their own in-house LCS limits. These in-house limits must be consistent with (i.e., within) the DoD limits (project-specific, if available; otherwise the following LCS-CLs). The laboratory in-house limits shall be calculated from the laboratory's historical LCS data in accordance with a documented procedure (e.g., SOP) that is consistent with good laboratory practice. That document must describe the process for establishing and maintaining LCS limits and the use of control charts.

The laboratory in-house limits are to be used for several purposes:

- Laboratories are expected to utilize their in-house limits as part of their quality control system, and to evaluate trends and monitor and improve performance.
- When a laboratory's in-house limits are outside the DoD control limits (upper and/or lower), they must report their in-house limits in the laboratory report (see Appendix E) even if the LCS associated with the batch fell within the DoD limits. Using this information, DoD will be able to determine how laboratory performance affects the quality of the environmental data.
- DoD may review the laboratory in-house limits and associated trends, as reflected in control charts, to determine whether the laboratory's overall performance is acceptable. If deemed unacceptable, this can allow DoD to decide not to use the laboratory again until substantial improvement has occurred.

Table G-4. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Water Matrix[2]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	105	8	80	130	75	135
1,1,1-Trichloroethane	100	11	65	130	55	145
1,1,2,2-Tetrachloroethane	96	11	65	130	55	140
1,1,2-Trichloroethane	100	8	75	125	65	135
1,1-Dichloroethane	101	11	70	135	60	145
1,1-Dichloroethene	99	10	70	130	55	140
1,1-Dichloropropene	102	10	75	130	65	140
1,2,3-Trichlorobenzene	99	14	55	140	45	155
1,2,3-Trichloropropane	98	9	75	125	65	130
1,2,4-Trichlorobenzene	100	11	65	135	55	145
1,2,4-Trimethylbenzene	103	10	75	130	65	140
1,2-Dibromo-3-chloropropane	91	14	50	130	35	145
1,2-Dibromoethane	100	7	80	120	75	125
1,2-Dichlorobenzene	96	9	70	120	60	130
1,2-Dichloroethane	100	10	70	130	60	140
1,2-Dichloropropane	100	8	75	125	65	135
1,3,5-Trimethylbenzene	102	10	75	130	65	140
1,3-Dichlorobenzene	100	8	75	125	65	130
1,3-Dichloropropane	100	9	75	125	65	135
1,4-Dichlorobenzene	99	8	75	125	65	130
2,2-Dichloropropane	103	11	70	135	60	150
2-Butanone	91	20	30	150	10	170

[2] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Total Xylene. Xylene may be reported on a project-specific basis as a total number; however, for the purposes of the DoD QSM, it will be analyzed and reported as m,p-Xylene and o-Xylene. Additional limits for poor performing compounds can be found in section G.5 and for surrogate compounds in section G.6.

Table G-4. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Water Matrix[2] (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
2-Chlorotoluene	100	9	75	125	65	135
2-Hexanone	92	12	55	130	45	140
4-Chlorotoluene	101	9	75	130	65	135
4-Methyl-2-pentanone	96	13	60	135	45	145
Acetone	91	17	40	140	20	160
Benzene	102	7	80	120	75	130
Bromobenzene	100	8	75	125	70	130
Bromochloromethane	97	11	65	130	55	140
Bromodichloromethane	98	8	75	120	70	130
Bromoform	99	10	70	130	60	140
Bromomethane	88	19	30	145	10	165
Carbon disulfide	100	21	35	160	15	185
Carbon tetrachloride	102	12	65	140	55	150
Chlorobenzene	102	7	80	120	75	130
Chlorodibromomethane	96	13	60	135	45	145
Chloroethane	99	12	60	135	50	145
Chloroform	100	12	65	135	50	150
Chloromethane	83	15	40	125	25	140
cis-1,2-Dichloroethene	99	9	70	125	60	135
cis-1,3-Dichloropropene	100	10	70	130	60	140
Dibromomethane	101	8	75	125	65	135
Dichlorodifluoromethane	93	21	30	155	10	175
Ethylbenzene	100	9	75	125	65	135
Hexachlorobutadiene	97	15	50	140	35	160
Isopropylbenzene	101	9	75	125	65	135
m,p-Xylene	102	9	75	130	65	135
Methyl tert-butyl ether	94	10	65	125	55	135
Methylene chloride	96	14	55	140	40	155
Naphthalene	96	14	55	140	40	150
n-Butylbenzene	103	11	70	135	55	150
n-Propylbenzene	101	9	70	130	65	140
o-Xylene	100	7	80	120	75	130
p-Isopropyltoluene	102	10	75	130	65	140
sec-Butylbenzene	100	9	70	125	65	135
Styrene	100	11	65	135	55	145
tert-Butylbenzene	99	10	70	130	60	140
Tetrachloroethene	96	18	45	150	25	165
Toluene	100	7	75	120	70	130
trans-1,2-Dichloroethene	99	13	60	140	45	150
trans-1,3-Dichloropropene	98	15	55	140	40	155
Trichloroethene	99	9	70	125	60	135
Trichlorofluoromethane	103	15	60	145	45	160
Vinyl chloride	99	16	50	145	35	165

Table G-5. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Solid Matrix[3]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	100	9	75	125	65	135
1,1,1-Trichloroethane	101	11	70	135	55	145
1,1,2,2-Tetrachloroethane	93	13	55	130	40	145
1,1,2-Trichloroethane	95	11	60	125	50	140
1,1-Dichloroethane	99	9	75	125	65	135
1,1-Dichloroethene	100	12	65	135	55	150
1,1-Dichloropropene	102	11	70	135	60	145
1,2,3-Trichlorobenzene	97	12	60	135	50	145
1,2,3-Trichloropropane	97	11	65	130	50	140
1,2,4-Trichlorobenzene	98	11	65	130	55	140
1,2,4-Trimethylbenzene	100	12	65	135	55	145
1,2-Dibromo-3-chloropropane	87	16	40	135	25	150
1,2-Dibromoethane	97	9	70	125	60	135
1,2-Dichlorobenzene	97	7	75	120	65	125
1,2-Dichloroethane	104	11	70	135	60	145
1,2-Dichloropropane	95	8	70	120	65	125
1,3,5-Trimethylbenzene	99	11	65	135	55	145
1,3-Dichlorobenzene	98	9	70	125	65	135
1,3-Dichloropropane	100	8	75	125	70	130
1,4-Dichlorobenzene	98	9	70	125	65	135
2,2-Dichloropropane	101	11	65	135	55	145
2-Butanone	94	22	30	160	10	180
2-Chlorotoluene	98	10	70	130	60	140
2-Hexanone	97	16	45	145	30	160
4-Chlorotoluene	100	9	75	125	65	135
4-Methyl-2-pentanone	97	17	45	145	30	165
Acetone	88	23	20	160	10	180
Benzene	99	9	75	125	65	135
Bromobenzene[4]	93	9	65	120	55	130
Bromochloromethane	99	9	70	125	60	135
Bromodichloromethane	100	9	70	130	60	135
Bromoform	96	13	55	135	45	150
Bromomethane	95	21	30	160	10	180
Carbon disulfide	103	19	45	160	30	180
Carbon tetrachloride	100	11	65	135	55	145
Chlorobenzene	99	8	75	125	65	130
Chlorodibromomethane	98	11	65	130	55	140
Chloroethane	98	20	40	155	20	175

[3] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Methyl tert-butyl ether and Total Xylene. Sufficient data to perform statistically significant analyses were not received for MTBE during the LCS study. Xylene may be reported on a project-specific basis as a total number; however, for the purposes of the DoD QSM, it will be analyzed and reported as m,p-Xylene and o-Xylene. Additional limits for poor performing compounds can be found in section G.5 and for surrogate compounds in section G.6.

[4] Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data become available.

Table G-5. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Solid Matrix[3] (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Chloroform	98	9	70	125	65	135
Chloromethane	90	13	50	130	40	140
cis-1,2-Dichloroethene	96	10	65	125	55	135
cis-1,3-Dichloropropene	99	9	70	125	65	135
Dibromomethane	100	9	75	130	65	135
Dichlorodifluoromethane[4]	85	17	35	135	15	155
Ethylbenzene	101	9	75	125	65	135
Hexachlorobutadiene	98	15	55	140	40	155
Isopropylbenzene	103	9	75	130	70	140
m,p-Xylene	102	8	80	125	70	135
Methylene chloride	97	14	55	140	40	155
Naphthalene	84	14	40	125	25	140
n-Butylbenzene	101	12	65	140	50	150
n-Propylbenzene	99	12	65	135	50	145
o-Xylene	101	8	75	125	70	135
p-Isopropyltoluene	104	10	75	135	65	140
sec-Butylbenzene	97	11	65	130	50	145
Styrene	101	9	75	125	65	135
tert-Butylbenzene	99	11	65	130	55	145
Tetrachloroethene	103	12	65	140	55	150
Toluene	99	9	70	125	60	135
trans-1,2-Dichloroethene	100	11	65	135	55	145
trans-1,3-Dichloropropene	96	10	65	125	55	140
Trichloroethene	101	8	75	125	70	130
Trichlorofluoromethane	106	27	25	185	10	215
Vinyl chloride	92	11	60	125	45	140

Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Water Matrix[5]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Polynuclear Aromatics						
2-Methylnaphthalene	75.0	9.5	45	105	35	115
Acenaphthene	77.6	10.1	45	110	35	120
Acenaphthylene	78.5	9.4	50	105	40	115
Anthracene	83.0	9.7	55	110	45	120
Benz[a]anthracene	82.7	8.9	55	110	45	120
Benzo[a]pyrene	81.3	9.5	55	110	45	120

[5] A number of sporadic marginal exceedances of the control limits are allowed depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Benzidine, 2,6-Dichlorophenol, and N-nitrosopyrrolidine. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.

Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Water Matrix[5] (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Benzo[b]fluoranthene	81.8	12.1	45	120	35	130
Benzo[k]fluoranthene	84.6	13.2	45	125	30	135
Benzo[g,h,i]perylene	80.5	14.1	40	125	25	135
Chrysene	82.1	8.9	55	110	45	120
Dibenz[a,h]anthracene	84.7	14.1	40	125	30	140
Fluoranthene	85.2	10.4	55	115	45	125
Fluorene	80.6	10.3	50	110	40	120
Indeno[1,2,3-cd]pyrene	84.3	13.6	45	125	30	140
Naphthalene	70.8	10.5	40	100	30	115
Phenanthrene	84.0	11.0	50	115	40	130
Pyrene	88.6	13.2	50	130	35	140
Phenolic/Acidic						
2,4,5-Trichlorophenol	79.7	10.3	50	110	40	120
2,4,6-Trichlorophenol	80.7	10.7	50	115	40	125
2,4-Dichlorophenol	76.3	9.6	50	105	40	115
2,4-Dimethylphenol	68.8	13.5	30	110	15	125
2,4-Dinitrophenol	75.8	20.6	15	140	10	160
2-Chlorophenol	71.3	11.4	35	105	25	115
2-Methylphenol	73.3	11.7	40	110	25	120
2-Nitrophenol	75.8	12.4	40	115	25	125
3-Methylphenol/4-Methylphenol	71.3	13.0	30	110	20	125
4,6-Dinitro-2-methylphenol	84.9	15.0	40	130	25	145
4-Chloro-3-methylphenol	78.6	10.7	45	110	35	120
Pentachlorophenol	77.6	13.3	40	115	25	130
Basic						
3,3'-Dichlorobenzidine	65.2	15.3	20	110	10	125
4-Chloroaniline	62.2	15.6	15	110	10	125
Phthalate Esters						
Bis(2-ethylhexyl) phthalate	84.2	14.0	40	125	30	140
Butyl benzyl phthalate	81.1	11.7	45	115	35	130
Di-n-butyl phthalate	84.8	10.3	55	115	45	125
Di-n-octyl phthalate	87.4	16.6	35	135	20	155
Diethyl phthalate	79.2	12.9	40	120	30	130
Dimethyl phthalate	75.9	16.9	25	125	10	145
Nitrosoamines						
N-Nitrosodi-n-propylamine	80.9	15.7	35	130	20	145
N-Nitrosodimethylamine	67.9	14.1	25	110	10	125
N-Nitrosodiphenylamine	79.6	10.6	50	110	35	120
Chlorinated Aliphatics						
Bis(2-chlorethoxy)methane	76.2	10.2	45	105	35	115
Bis(2-chloroethyl) ether	73.3	12.3	35	110	25	120
Bis(2-chloroisopropyl) ether	78.2	17.5	25	130	10	150
Hexachlorobutadiene	65.2	12.6	25	105	15	115
Hexachloroethane	60.9	11.1	30	100	15	105

Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Water Matrix[5] (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Halogenated Aromatics						
1,2,4-Trichlorobenzene	71.7	11.6	35	105	25	120
1,2-Dichlorobenzene	67.3	11.4	35	100	20	115
1,3-Dichlorobenzene	64.8	10.9	30	100	20	110
1,4-Dichlorobenzene	64.8	10.9	30	100	20	110
2-Chloronaphthalene	76.5	9.3	50	105	40	115
4-Bromophenyl phenyl ether	82.9	10.2	50	115	40	125
4-Chlorophenyl phenyl ether	80.6	10.3	50	110	40	120
Hexachlorobenzene	82.3	10.0	50	110	40	120
Nitroaromatics						
2,4-Dinitrotoluene	84.3	11.2	50	120	40	130
2,6-Dinitrotoluene	82.7	11.3	50	115	35	130
2-Nitroaniline	81.8	11.2	50	115	35	125
3-Nitroaniline	72.6	17.7	20	125	10	145
4-Nitroaniline	77.2	13.7	35	120	20	130
Nitrobenzene	76.8	10.8	45	110	35	120
Neutral Aromatics						
Carbazole	82.5	11.4	50	115	35	130
Dibenzofuran	80.3	8.8	55	105	45	115
Others						
1,2-Diphenylhydrazine	84.8	9.4	55	115	45	120
Benzyl alcohol	71.0	13.8	30	110	15	125
Isophorone	81.0	10.5	50	110	40	125

Table G-7. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Solid Matrix[6]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Polynuclear Aromatics						
2-Methylnaphthalene	77.3	10.0	45	105	35	115
Acenaphthene	77.3	10.3	45	110	35	120
Acenaphthylene	75.7	10.4	45	105	35	115
Anthracene	79.9	9.0	55	105	45	115
Benz[a]anthracene	81.6	9.8	50	110	40	120
Benzo[a]pyrene	80.7	10.3	50	110	40	120
Benzo[b]fluoranthene	79.7	11.4	45	115	35	125
Benzo[k]fluoranthene	83.8	12.9	45	125	30	135
Benzo[g,h,i]perylene	81.8	14.7	40	125	25	140
Chrysene	82.6	9.9	55	110	45	120

[6] A number of sporadic marginal exceedances (ME) of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Benzidine, 2,6-Dichlorophenol, 1,2-Diphenylhydrazine, and N-nitrosopyrrolidine. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.

Table G-7. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Solid Matrix[6] (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Dibenz[a,h]anthracene	82.9	13.9	40	125	25	140
Fluoranthene	83.9	10.1	55	115	45	125
Fluorene	78.3	9.8	50	110	40	115
Indeno[1,2,3-cd]pyrene	79.7	13.8	40	120	25	135
Naphthalene	73.4	11.1	40	105	30	120
Phenanthrene	80.1	10.0	50	110	40	120
Pyrene	84.4	12.8	45	125	35	135
Phenolic/Acidic						
2,4,5-Trichlorophenol	80.1	10.4	50	110	40	120
2,4,6-Trichlorophenol	76.3	11.0	45	110	30	120
2,4-Dichlorophenol	77.2	10.9	45	110	35	120
2,4-Dimethylphenol	67.3	11.9	30	105	20	115
2,4-Dinitrophenol	72.6	20.0	15	130	10	150
2-Chlorophenol	74.7	10.3	45	105	35	115
2-Methylphenol	71.7	10.6	40	105	30	115
2-Nitrophenol	76.2	11.5	40	110	30	120
3-Methylphenol/4-Methylphenol	73.9	10.9	40	105	30	120
4,6-Dinitro-2-methylphenol	83.1	18.0	30	135	10	155
4-Chloro-3-methylphenol	79.5	11.1	45	115	35	125
4-Nitrophenol	77.0	20.2	15	140	10	160
Pentachlorophenol	71.9	15.6	25	120	10	135
Phenol	69.7	10.2	40	100	30	110
Phthalate Esters						
Bis(2-ethylhexyl) phthalate	87.4	13.3	45	125	35	140
Butyl benzyl phthalate	86.4	12.3	50	125	35	135
Di-n-butyl phthalate	83.2	9.1	55	110	45	120
Di-n-octyl phthalate	86.4	15.2	40	130	25	145
Diethyl phthalate	82.2	10.6	50	115	40	125
Dimethyl phthalate	79.6	10.2	50	110	40	120
Nitrosoamines						
N-Nitrosodi-n-propylamine	76.8	12.3	40	115	30	125
N-Nitrosodimethylamine	66.1	15.9	20	115	10	130
N-Nitrosodiphenylamine	82.4	11.1	50	115	40	125
Chlorinated Aliphatics						
Bis(2-chlorethoxy)methane	75.5	10.9	45	110	30	120
Bis(2-chloroethyl) ether	71.1	11.2	40	105	25	115
Bis(2-chloroisopropyl) ether	68.4	15.7	20	115	10	130
Hexachlorobutadiene	78.2	12.9	40	115	25	130
Hexachloroethane	71.9	12.6	35	110	20	120
Halogenated Aromatics						
1,2,4-Trichlorobenzene	77.4	11.2	45	110	30	120
1,2-Dichlorobenzene	70.9	8.7	45	100	35	105
1,3-Dichlorobenzene	69.7	10.3	40	100	30	110
1,4-Dichlorobenzene	69.0	11.4	35	105	25	115

Table G-7. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Solid Matrix (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
2-Chloronaphthalene	75.2	9.9	45	105	35	115
4-Bromophenyl phenyl ether	81.7	11.8	45	115	35	130
4-Chlorophenyl phenyl ether	79.6	10.7	45	110	35	120
Hexachlorobenzene	82.5	11.7	45	120	35	130
Nitroaromatics						
2,4-Dinitrotoluene	82.0	11.4	50	115	35	130
2,6-Dinitrotoluene	80.2	10.7	50	110	35	125
2-Nitroaniline	81.0	12.2	45	120	30	130
3-Nitroaniline	68.8	13.8	25	110	15	125
4-Nitroaniline	73.6	13.1	35	115	20	125
Nitrobenzene	77.2	11.9	40	115	30	125
Neutral Aromatics						
Carbazole	80.4	12.3	45	115	30	130
Dibenzofuran	77.1	8.8	50	105	40	110
Others						
Benzyl alcohol	70.9	17.4	20	125	10	140
Isophorone	77.0	11.4	45	110	30	125

Table G-8. LCS Control Limits for Chlorinated Herbicides SW-846 Method 8151 Water Matrix[7]

Analyte	Median	Lower Control Limit	Upper Control Limit
2,4-D	88	35	115
2,4-DB	99	45	130
2,4,5-T	83	35	110
2,4,5-TP (Silvex)	87	50	115
Dalapon	62	40	110
Dicamba	86	60	110
Dichloroprop	91	70	120
Dinoseb	65	20	100
MCPA	93	60	145

[7] LCS control limits were generated using non-parametric statistics (see section G.1 for further explanation). LCS control limits are not available for MCPP. Sufficient data to perform statistically significant analyses were not received for the analyte during the LCS study.

Table G-9. LCS Control Limits for Chlorinated Herbicides SW-846 Method 8151 Solid Matrix[8]

Analyte	Median	Lower Control Limit	Upper Control Limit
2,4-D	88	35	145
2,4-DB	108	50	155
2,4,5-T	86	45	135
2,4,5-TP (Silvex)	90	45	125
Dicamba	90	55	110
Dichloroprop	99	75	140

Table G-10. LCS Control Limits for Polynuclear Aromatic Hydrocarbons SW-846 Method 8310 Water Matrix[9]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Acenaphthene	70	11	35	105	25	115
Acenaphthylene	74	13	35	115	20	125
Anthracene	77	12	40	110	30	125
Benz[a]anthracene	81	11	50	110	40	125
Benzo[a]pyrene	79	11	45	115	35	125
Benzo[b]fluoranthene	82	10	50	110	40	125
Benzo[k]fluoranthene	79	10	50	110	40	120
Benzo[g,h,i]perylene	77	14	35	120	20	135
Chrysene	83	11	50	115	40	125
Dibenz[a,h]anthracene	64	15	20	110	10	125
Fluoranthene	82	11	50	115	35	125
Fluorene	69	11	35	105	25	115
Indeno[1,2,3-cd]pyrene	80	11	45	110	35	125
Naphthalene	68	12	35	105	20	115
Phenanthrene	80	13	40	120	25	135
Pyrene	80	9	50	110	45	115

[8] LCS control limits were generated using non-parametric statistics (see section G.1 for further explanation). LCS control limits are not available for Dalapon, MCPA, and MCPP. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.

[9] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.

Table G-11. LCS Control Limits for Polynuclear Aromatic Hydrocarbons SW-846 Method 8310 Solid Matrix[10]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Acenaphthene	71	12	35	110	20	120
Acenaphthylene	73	13	35	115	20	125
Anthracene	86	13	45	125	35	140
Benz[a]anthracene	78	9	50	105	40	115
Benzo[a]pyrene	86	15	40	135	25	150
Benzo[b]fluoranthene	89	11	55	120	45	130
Benzo[k]fluoranthene	84	12	50	120	35	135
Benzo[g,h,i]perylene[11]	85	10	55	115	45	125
Chrysene	87	11	55	120	45	130
Dibenz[a,h]anthracene	81	11	45	115	35	125
Fluoranthene	88	16	40	135	25	150
Fluorene	76	10	45	105	35	115
Indeno[1,2,3-cd]pyrene	95	13	55	135	45	145
Naphthalene	80	11	50	110	40	120
Phenanthrene	91	12	55	125	45	135
Pyrene	82	11	50	115	40	125

Table G-12. LCS Control Limits for Explosives SW-846 Methods 8330 and 8330A Water Matrix[12]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,3,5-Trinitrobenzene	102	13	65	140	50	150
1,3-Dinitrobenzene	103	18	45	160	30	175
2,4-Dinitrotoluene	98	12	60	135	50	145
2,6-Dinitrotoluene	99	13	60	135	50	150
2,4,6-Trinitrotoluene (TNT)	98	15	50	145	35	160
2-Amino-4,6-dinitrotoluene[13]	101	17	50	155	35	170
2-Nitrotoluene	88	15	45	135	30	150
3-Nitrotoluene	90	14	50	130	35	145
4-Amino-2,6-dinitrotoluene[13]	104	16	55	155	40	170
4-Nitrotoluene	90	14	50	130	35	145
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	106	18	50	160	35	180
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)[13]	98	25	20	175	10	200
Nitrobenzene	94	15	50	140	35	155
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	99	6	80	115	75	120

[10] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.

[11] Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data become available.

[12] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits were generated using solid phase extraction with acetonitrile only, without removing outliers from the data set (see section G.1 for further explanation).

[13] Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data become available.

Table G-13. LCS Control Limits for Explosives SW-846 Methods 8330 and 8330A Solid Matrix[14]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,3,5-Trinitrobenzene	99	9	75	125	65	135
1,3-Dinitrobenzene	102	8	80	125	70	135
2,4-Dinitrotoluene	102	7	80	125	75	130
2,6-Dinitrotoluene	100	7	80	120	70	130
2,4,6-Trinitrotoluene (TNT)	99	14	55	140	45	155
2-Amino-4,6-dinitrotoluene	102	7	80	125	75	130
2-Nitrotoluene	101	7	80	125	70	130
3-Nitrotoluene	100	7	75	120	70	130
4-Amino-2,6-dinitrotoluene	101	7	80	125	75	130
4-Nitrotoluene	101	8	75	125	70	135
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	103	10	70	135	65	145
Nitrobenzene	100	8	75	125	70	130
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	100	9	75	125	65	135

Table G-14. LCS Control Limits for Organochlorine Pesticides SW-846 Method 8081 Water Matrix[15]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	88	20	25	150	10	170
4,4'-DDE	87	18	35	140	15	160
4,4'-DDT	92	15	45	140	30	155
Aldrin	83	19	25	140	10	155
alpha-BHC	94	11	60	130	50	140
alpha-Chlordane	93	10	65	125	55	135
beta-BHC	96	10	65	125	55	135
delta-BHC	91	15	45	135	30	150
Dieldrin	95	11	60	130	50	140
Endosulfan I[16]	80	10	50	110	40	120
Endosulfan II	79	17	30	130	10	150
Endosulfan sulfate	96	14	55	135	40	150
Endrin	95	13	55	135	45	145
Endrin aldehyde	96	14	55	135	40	150
Endrin ketone	102	8	75	125	70	135
gamma-BHC	82	18	25	135	10	155
gamma-Chlordane	94	11	60	125	50	135
Heptachlor	87	15	40	130	30	145
Heptachlor epoxide	96	11	60	130	50	140
Methoxychlor	103	16	55	150	40	165

[14] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. Additional limits for poor performing compounds can be found in section G.5.

[15] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene and Toxaphane. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.

[16] Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data becomes available.

Table G-15. LCS Control Limits for Organochlorine Pesticides SW-846 Method 8081 Solid Matrix [17]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	81	18	30	135	10	155
4,4'-DDE	97	10	70	125	60	135
4,4'-DDT	92	16	45	140	30	155
Aldrin	93	16	45	140	30	155
alpha-BHC	93	10	60	125	50	135
alpha-Chlordane	92	10	65	120	55	130
beta-BHC	95	11	60	125	50	135
delta-BHC	94	12	55	130	45	145
Dieldrin	96	10	65	125	55	135
Endosulfan I	74	20	15	135	10	155
Endosulfan II	89	17	35	140	20	160
Endosulfan sulfate	99	12	60	135	50	145
Endrin	97	12	60	135	50	145
Endrin aldehyde	92	18	35	145	20	165
Endrin ketone	100	11	65	135	55	145
gamma-BHC	91	11	60	125	50	135
gamma-Chlordane	96	10	65	125	55	135
Heptachlor	96	15	50	140	35	155
Heptachlor epoxide	98	11	65	130	55	140
Methoxychlor	100	14	55	145	45	155

Table G-16. LCS Control Limits for Polychlorinated Biphenyls SW-846 Method 8082 Water Matrix[18]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
Aroclor 1016	85	20	25	145
Aroclor 1260	87	19	30	145

Table G-17. LCS Control Limits for Polychlorinated Biphenyls SW-846 Method 8082 Solid Matrix[18]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
Aroclor 1016	90	16	40	140
Aroclor 1260	96	12	60	130

[17] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene, Hexachlorocyclopentadiene, and Toxaphane. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.

[18] LCS control limits are not available for Aroclors 1221, 1232, 1242, 1248, 1262, and 1268. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.

Table G-18. LCS Control Limits for Metals SW-846 Methods 6010 and 7470 Water Matrix[19]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Aluminum	97	5	80	120	80	120
Antimony	98	4	80	120	80	120
Arsenic	98	4	80	120	80	120
Barium	99	4	80	120	80	120
Beryllium	99	4	80	120	80	120
Cadmium	100	4	80	120	80	120
Calcium	98	4	80	120	80	120
Chromium	100	4	80	120	80	120
Cobalt	99	3	80	120	80	120
Copper	99	3	80	120	80	120
Iron	102	4	80	120	80	120
Lead	99	4	80	120	80	120
Magnesium	98	4	80	120	80	120
Manganese	100	4	80	120	80	120
Mercury	100	5	80	120	No ME	No ME
Molybdenum	95	5	80	120	75	120
Nickel	100	4	80	120	80	120
Potassium	98	4	80	120	80	120
Selenium	98	6	80	120	75	120
Silver	97	5	80	120	75	120
Sodium	99	4	80	120	80	120
Thallium	97	4	80	120	80	120
Vanadium	99	4	80	120	80	120
Zinc	100	4	80	120	80	120

[19] The as-generated limits have been adjusted to reflect Method requirements and acceptable calibration uncertainty. A number of sporadic marginal exceedances of the control limits are allowed for Method 6010, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.

Table G-19. LCS Control Limits for Metals SW-846 Methods 6010 and 7471 Solid Matrix [20]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Aluminum	95	5	80	120	75	120
Antimony	96	5	80	120	75	120
Arsenic	95	4	80	120	80	120
Barium	98	3	80	120	80	120
Beryllium	99	4	80	120	80	120
Cadmium	97	4	80	120	80	120
Calcium	97	4	80	120	80	120
Chromium	99	5	80	120	80	120
Cobalt	98	4	80	120	80	120
Copper	97	3	80	120	80	120
Iron	100	4	80	120	80	120
Lead	95	4	80	120	80	120
Magnesium	96	3	80	120	80	120
Manganese	97	4	80	120	80	120
Mercury	100	6	80	120	No ME	No ME
Molybdenum	96	5	80	120	75	120
Nickel	97	4	80	120	80	120
Potassium	96	4	80	120	80	120
Selenium	93	4	80	120	75	120
Silver	96	7	75	120	70	125
Sodium	96	4	80	120	80	120
Thallium	94	4	80	120	80	120
Vanadium	99	3	80	120	80	120
Zinc	95	5	80	120	75	120

[20] The as-generated limits have been adjusted to reflect Method requirements and acceptable calibration uncertainty. A number of sporadic marginal exceedances of the control limits are allowed for Method 6010, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.

Empirical Laboratories, LLC Control Limits

Method	Analyte	Laboratory Specific Control Limits		
		Lower	Upper	RPD
SW846 8260B	1,1,1,2-Tetrachloroethane	80	130	30
Waters	1,1,1-Trichloroethane	65	130	30
	1,1,2,2-Tetrachloroethane	65	130	30
	1,1,2-Ttrichloro-1,2,2-Trifluoroethane	60	130	30
	1,1,2-Trichloroethane	75	125	30
	1,1-Dichloroethane	70	135	30
	1,1-Dichloroethene	70	130	30
	1,1-Dichloropropene	75	130	30
	1,2,3-Trichlorobenzene	55	140	30
	1,2,3-Trichloropropane	75	125	30
	1,2,4-Trichlorobenzene	65	135	30
	1,2,4-Trimethylbenzene	75	130	30
	1,3,5-Trimethylbenzene	75	130	30
	1,2-Dibromo-3-Chloroprpane	50	130	30
	1,2-Dibromoethane	80	120	30
	1,2-Dichlorobenzene	70	120	30
	1,2-Dichloroethane	70	130	30
	1,2-Dichlropropane	75	125	30
	1,3-Dichlorobenzene	75	125	30
	1,3-Dichloropropane	75	125	30
	1,4-Dichlorobenzene	75	125	30
	1-Chlorohexane	75	125	30
	2,2-Dichloropropane	70	135	30
	2-Butanone	30	150	30
	2-Chloro Vinyl Ether	10	165	30
	2-Chlorotoluene	75	125	30
	2-Hexanone	55	130	30
	4-Chlorotoluene	75	130	30
	4-Methyl-2-Pentanone	60	135	30
	Acetone	40	140	30
	Acrolein	10	200	30
	Acrylonitrile	35	180	30
	Benzene	80	120	30
	Bromobenzene	75	125	30
	Bromochloromethane	65	130	30
	Bromodichloromethane	75	120	30
	Bromoform	70	130	30
	Bromomethane	30	145	30
	Carbon Disulfide	35	160	30
	Carbon Tetrachloride	65	140	30
	Chlorobenzene	80	120	30
	Chloroethane	60	135	30
	Chloroform	65	135	30
	Chloromethane	40	125	30

	cis-1,2-Dichloroethene	70	125	30
	cis-1,3-Dichloropropene	70	130	30
	Cyclohexane	60	130	30
	Dibromochloromethane	60	135	30
	Dibromomethane	75	125	30
	Dichlorodifluoromethane	30	155	30
	Di-Isopropyl Ether	60	130	30
	ETBE	50	150	30
	Ethyl Methacrylate	70	135	30
	Ethylbenzene	75	125	30
	Hexachlorobutadiene	50	140	30
	Iodomethane	50	140	30
	Isopropylbenzene	75	125	30
	Methyl Acetate	55	150	30
	Methyl Methacrylate	70	135	30
	Methyl tert-Butyl Ether	65	125	30
	Methylcyclohexane	60	125	30
	Methylene Chloride	55	140	30
	Naphthalene	55	140	30
	n-Butylbenzene	70	135	30
	n-Propylbenzene	70	130	30
	p-Isopropyltoluene	75	130	30
	sec-Butylbenzene	70	125	30
	Styrene	65	135	30
	t-Butyl Alcohol	60	130	30
	tert-Amyl Methyl Ether	50	150	30
Surrogates	Bromofluorobenzene	75	125	
	Dibromofluorobenzene	85	115	
	1,2 Dichloroethane-d4	70	120	
	Toluene-d8	85	120	

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits		
Method	**Analyte**	**Lower**	**Upper**	**RPD**
SW846 8270C	1-Methylnaphthalene	30	115	30
Waters	1,1'-Biphenyl	50	110	30
	1,2,4,5-Tetrachlorobenzene	50	125	30
	1,2,4-Trichlorobenzene	35	105	30
	1,2-Dichlorobenzene	35	100	30
	1,2-Diphenylhydrazine	55	115	30
	1,3-Dichlorobenzene	30	100	30
	1,4-Dichlorobenzene	30	100	30
	2,3,4,6-Tetrachlorophenol	50	125	30
	2,4,5-Trichlorophenol	50	110	30
	2,4,6-Trichlorophenol (TCP)	50	115	30
	2,4-Dichlorophenol (DCP)	40	110	30
	2,4-Dimethylphenol	30	110	30
	2,4-Dinitrophenol	15	140	30
	2,4-Dinitrotoluene (DNT)	50	120	30
	2,6-Dinitrotoluene	50	115	30
	2-Chloronaphthalene	50	105	30
	2-Chlorophenol	35	105	30
	2-Methylnaphthalene	45	105	30
	2-Methylphenol (o-Cresol)	40	110	30
	2-Nitroaniline	50	115	30
	2-Nitrophenol (ONP)	40	115	30
	3,3'-Dichlorobenzidine (DCB)	20	110	30
	3-Methylphenol	30	110	30
	3-Nitroaniline	20	125	30
	4,6-Dinitro-2-methylphenol (DNOC)	40	130	30
	4-Bromophenyl phenyl ether	50	115	30
	4-Chloro-3-methylphenol	45	110	30
	4-Chloroaniline	15	110	30
	4-Chlorophenyl phenyl ether	50	110	30
	4-Methylphenol (p-Cresol)	30	110	30
	4-Nitroaniline (PNA)	35	120	30
	4-Nitrophenol (PNP)	0	125	30
	Acenaphthene	45	110	30
	Acenaphthylene	50	105	30
	Acetaphenone	50	110	30
	Aniline	10	110	30
	Anthracene	55	110	30
	Benzidine	0	200	30
	Benzo(a)anthracene	55	110	30
	Benzo(a)pyrene	55	110	30
	Benzo(b)fluoranthene	45	120	30
	Benzo(g,h,i)perylene	40	125	30
	Benzo(k)fluoranthene	45	125	30

	Benzoic Acid	0	125	30
	Benzyl alcohol	30	110	30
	bis(2-Chloroethoxy)methane	45	105	30
	bis(2-Chloroethyl)ether (BCEE)	35	110	30
	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)	25	130	30
	bis(2-Ethylhexyl)phthalate (BEHP)	40	125	30
	Butyl benzyl phthalate (BBP)	45	115	30
	Carbazole	50	115	30
	Chrysene	55	110	30
	Dibenz(a,h)anthracene	40	125	30
	Dibenzofuran (DBF)	55	105	30
	Diethyl phthalate (DEP)	40	120	30
	Dimethyl phthalate (DMP)	25	125	30
	Di-n-butyl phthalate (DBP)	55	115	30
	Di-n-octyl phthalate (DNOP)	35	135	30
	Fluoranthene	55	115	30
	Fluorene	50	110	30
	Hexachlorobenzene (HCB)	50	110	30
	Hexachlorobutadiene (HCBD)	25	105	30
	Hexachlorocyclopentadiene (HCCPD)	10	110	30
	Hexachloroethane (HCE)	30	95	30
	Indeno(1,2,3-cd)pyrene	45	125	30
	Isophorone	50	110	30
	Naphthalene	40	100	30
	Nitrobenzene	30	110	30
	N-Nitrosodimethylamine	25	110	30
	N-Nitroso-di-n-propylamine (NDPA)	35	130	30
	N-nitrosodiphenylamine (NDPHA)	50	110	30
	Pentachlorophenol	40	115	30
	Phenanthrene	50	115	30
	Phenol	0	115	30
	Pyrene	50	130	30
	Pyridine	10	110	30
Surrogates:	2-Fluorobiphenyl	50	110	
	2-Fluorophenol	20	110	
	Nitrobenzene-d5	40	110	
	Phenol-d5	15	110	
	Terphenyl-d14	50	135	

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits		
Method	**Analyte**	**Lower**	**Upper**	**RPD**
SW846 8011	Ethylene Dibromide	70	130	20
Waters				

Empirical Laboratories, LLC Control Limits

Method	Analyte	Laboratory Specific Control Limits		
		Lower	Upper	RPD
SW846 8015B DRO	DRO C10- C28	50	150	50
Waters				
Surrogates:	2-Fluorobiphenyl	50	150	
	o-Terphenyl	30	140	

Method	Analyte	Laboratory Specific Control		
		Lower	Upper	RPD
SW846 8015B GRO	GRO C6-C8	50	150	50
Waters				
Surrogate:	Bromofluorobenzene	50	150	

Empirical Laboratories, LLC Control Limits

Method	Analyte	Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits Matrix Spikes		
		Lower	Upper	RPD	Lower	Upper	RPD
EPH MA DEP	C12 - C40	50	150	20	50	150	50
Waters							
Surrogate:	o-Terphenyl	50	150				

Method	Analyte	Laboratory Specific Control Limits		
		Lower	Upper	RPD
VPH MA DEP	C5-C8 Aliphatics	70	130	40
Waters	C9-C12 Aliphatics	70	130	40
Surrogate:	2,5 Dibromotoluene	70	130	

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits		
Method	**Analyte**	**Lower**	**Upper**	**RPD**
SW846 6010B	Dissolved Iron	80	120	20
Waters	Dissolved Manganese	80	120	20
	Lead	80	120	20
	Sodium	80	120	20
	Potassium	80	120	20
	Calcium	80	120	20
	Magnesium	80	120	20

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS		
Method	**Analyte**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**
SW846 9056	Nitrate	90	110	20	80	120	20
Waters	Nitrite	90	110	20	80	120	20
	Sulfate	90	110	20	80	120	20
	Chloride	90	110	20	80	120	20

Empirical Laboratories, LLC Control Limits

Method	Analyte	Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS		
		Lower	Upper	RPD	Lower	Upper	RPD
SM2320B	Alkalinity	80	120	20	75	125	20
Waters							

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS		
Method	**Analyte**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**
SM4500SCF	Sulfide	80	120	20	75	125	20
Waters							

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS		
Method	**Analyte**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**
SW846 9060	TOC	80	120	20	75	125	20
Waters							

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS		
Method	**Analyte**	**Lower**	**Upper**	**RPD**
RSK175	Methane	80	120	30
Waters	Ethane	80	120	30
	Ethene	80	120	30

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS/MSD		
Method	**Analyte**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**
EPA 351.2	TKN	80	120	20	75	125	20
Waters							

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS/MSD		
Method	**Analyte**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**
SM4500PE	Ortho phosphate	80	120	20	75	125	20
Waters							

Empirical Laboratories, LLC Control Limits

		Laboratory Specific Control Limits LCS			Laboratory Specific Control Limits MS/MSD		
Method	**Analyte**	**Lower**	**Upper**	**RPD**	**Lower**	**Upper**	**RPD**
SM4500NH3BG	Ammonia	80	120	20	75	125	20
Waters							

RTI QA Acceptance Criteria
ASTM 2504

10/21/2010

ASTM 2504					CCV			DUP	LCS/LCSD			
	&Analyte	Units	MDL	PQL	SPK	Low	High	RPD	SPK	Low	High	RPD
	Carbon dioxide	%	0.1	0.1	1	85	115	20	0.25	70	130	20
	Carbon Monoxide	%	0.1	0.1	1	85	115	20	0.25	70	130	20
	Ethane	%	0.5	0.5	1	85	115	20	0.25	70	130	20
	Hydrogen	%	0.5	0.5	1	85	115	20	0.25	70	130	20
	Methane	%	0.5	0.5	1	85	115	20	0.25	70	130	20
	Nitrogen	%	0.1	0.1	1	85	115	20	0.25	70	130	20
	Oxygen	%	0.1	0.1	1	85	115	20	0.25	70	130	20

RTI QA Acceptance Criteria
TO-15

10/21/2010

TO-15					CCV			DUP	ICV		
	&Analyte	Units	MDL	PQL	SPK	Low	High	RPD	SPK	Low	High
	1,1,1-Trichloroethane	ppbv	0.33	1	9.6	70	130	25	9.6	70	130
	1,1,2,2-Tetrachloroethane	ppbv	0.42	1	10	70	130	25	10	70	130
	1,1,2-Trichloro-1,2,2-trifluoroethane	ppbv	0.31	1	9.8	70	130	25	9.8	70	130
	1,1,2-Trichloroethane	ppbv	0.23	0.5	9.8	70	130	25	9.8	70	130
	1,1-Dichloroethane	ppbv	0.38	1	9.7	70	130	25	9.7	70	130
	1,1-Dichloroethene	ppbv	0.65	2	9.9	70	130	25	9.9	70	130
	1,2,4-Trichlorobenzene	ppbv	0.52	2	9.1	70	130	25	9.1	70	130
	1,2,4-Trimethylbenzene	ppbv	0.42	1	9.8	70	130	25	9.8	70	130
	1,2-Dibromoethane	ppbv	0.19	0.5	9.6	70	130	25	9.6	70	130
	1,2-Dichlorobenzene	ppbv	0.37	1	9.7	70	130	25	9.7	70	130
	1,2-Dichloroethane	ppbv	0.33	1	9.7	70	130	25	9.7	70	130
	1,2-Dichloropropane	ppbv	0.23	0.5	9.8	70	130	25	9.8	70	130
	1,3,5-Trimethylbenzene	ppbv	0.38	1	9.7	70	130	25	9.7	70	130
	1,3-Butadiene	ppbv	1.34	3	9.8	70	130	25	9.8	70	130
	1,3-Dichlorobenzene	ppbv	0.36	1	9.7	70	130	25	9.7	70	130
	1,4-Dichlorobenzene	ppbv	0.45	1	9.6	70	130	25	9.6	70	130
	1,4-Dioxane	ppbv	1.8	5	9.6	70	130	25	9.6	70	130
	2-Butanone	ppbv	0.54	2	9.9	70	130	25	9.9	70	130
	2-Hexanone	ppbv	2.16	5	9.8	70	130	25	9.8	70	130
	2-Propanol	ppbv	0.44	1	10.1	70	130	25	10.1	70	130
	4-Methyl-2-pentanone	ppbv	1.07	5	10	70	130	25	10	70	130
	Acetone	ppbv	0.44	2	10	70	130	25	10	70	130
	Benzene	ppbv	0.39	1	9.6	70	130	25	9.6	70	130
	Benzyl chloride	ppbv	0.54	1	9.7	70	130	25	9.7	70	130
	Bromodichloromethane	ppbv	0.21	0.5	9.6	70	130	25	9.6	70	130
	Bromoform	ppbv	0.41	1	9.6	70	130	25	9.6	70	130
	Bromomethane	ppbv	0.71	2	9.3	70	130	25	9.3	70	130
	Carbon disulfide	ppbv	0.41	2	9.7	70	130	25	9.7	70	130
	Carbon tetrachloride	ppbv	0.35	1	9.5	70	130	25	9.5	70	130
	Chlorobenzene	ppbv	0.39	1	9.9	70	130	25	9.9	70	130
	Chlorodibromomethane	ppbv	0.34	1	9.2	70	130	25	9.2	70	130
	Chloroethane	ppbv	0.49	1	9.8	70	130	25	9.8	70	130
	Chloroform	ppbv	0.3	1	9.4	70	130	25	9.4	70	130

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	Chloromethane	ppbv	0.68	2	9.8	70	130	25	9.8	70	130
	cis-1,2-Dichloroethene	ppbv	1	1	9.8	70	130	25	9.8	70	130
	cis-1,3-dichloropropene	ppbv	0.24	0.5	9.5	70	130	25	9.5	70	130
	Cyclohexane	ppbv	0.37	1	9.8	70	130	25	9.8	70	130
	Dichlorodifluoromethane	ppbv	0.4	1	9.2	70	130	25	9.2	70	130
	Ethanol	ppbv	0.53	1	9.2	70	130	25	9.2	70	130
	Ethyl acetate	ppbv	0.55	1	9.8	70	130	25	9.8	70	130
	Ethylbenzene	ppbv	0.35	1	9.8	70	130	25	9.8	70	130
	Heptane	ppbv	0.37	1	9.9	70	130	25	9.9	70	130
	Hexachlorobutadiene	ppbv	0.54	2	9.4	70	130	25	9.4	70	130
	m,p-Xylene	ppbv	0.75	2	19.2	70	130	25	19.2	70	130
	Methylene chloride	ppbv	0.31	2	10	70	130	25	10	70	130
	n-Hexane	ppbv	0.31	1	10.1	70	130	25	10.1	70	130
	o-Xylene	ppbv	0.39	1	10	70	130	25	10	70	130
	Propylene	ppbv	0.37	1	10.2	70	130	25	10.2	70	130
	Styrene	ppbv	0.43	1	9.8	70	130	25	9.8	70	130
	tert-Butyl Methyl Ether	ppbv	0.61	2	9.9	70	130	25	9.9	70	130
	Tetrachloroethene	ppbv	0.21	0.5	9.6	70	130	25	9.6	70	130
	Tetrahydrofuran	ppbv	0.58	2	10	70	130	25	10	70	130
	Toluene	ppbv	0.24	0.5	9.8	70	130	25	9.8	70	130
	trans-1,2-Dichloroethene	ppbv	0.38	1	9.8	70	130	25	9.8	70	130
	trans-1,3-dichloropropene	ppbv	0.31	1	9.1	70	130	25	9.1	70	130
	Trichloroethene	ppbv	0.35	1	9.6	70	130	25	9.6	70	130
	Trichlorofluoromethane	ppbv	0.31	1	9.6	70	130	25	9.6	70	130
	Vinyl acetate	ppbv	0.31	1	9.9	70	130	25	9.9	70	130
	Vinyl chloride	ppbv	0.41	1	9.4	70	130	25	9.4	70	130
	Xylenes, Total	ppbv	1.14	3	29.2	70	130	25	29.2	70	130
SUR	4-Bromofluorobenzene	ppbv	0	0.5	12.5	70	130	25	12.5	70	130

RTI QA Acceptance Criteria
APH

10/21/2010

MADEP APH						CCV			DUP	ICV		
	&Analyte	Units	MDL	LOD	PQL	SPK	Low	High	RPD	SPK	Low	High
	C5-C8 Aliphatic	µg/m³	3.7	6	12	120	70	130	25	120	70	130
	C9-C12 Aliphatic	µg/m³	4.7	6	12	120	70	130	25	120	70	130
	C9-C10 Aromatic	µg/m³	1.9	5	8	80	70	130	25	80	70	130
	1,3-Butadiene	µg/m³	3.0	4.5	6.6	21.7	70	130	25	21.7	70	130
	tert-Butyl Methyl Ether	µg/m³	2.2	3.6	7.2	35.7	70	130	25	35.7	70	130
	Benzene	µg/m³	1.3	1.6	3.2	30.7	70	130	25	30.7	70	130
	Toluene	µg/m³	0.9	1.9	1.9	36.9	70	130	25	36.9	70	130
	Ethylbenzene	µg/m³	1.5	2.2	4.4	42.6	70	130	25	42.6	70	130
	m,p-Xylene	µg/m³	3.3	4.3	8.7	83.4	70	130	25	83.4	70	130
	o-Xylene	µg/m³	1.7	2.2	4.3	43.4	70	130	25	43.4	70	130
	Naphthalene	µg/m³	6.0	10.5	15.7	53.5	70	130	25	53.5	70	130
SUR	4-Bromofluorobenzene	µg/m³	0		3.6	89	70	130	25	89	70	130

Control Limits

Gulf Coast Analytical Laboratories

Method: SW-846 8260B

		LCS	
Analyte	**Name**	**LCL-UCL**	**Matrix**
630-20-6	1,1,1,2-Tetrachloroethane	77-122	S
71-55-6	1,1,1-Trichloroethane	70-130	S
79-34-5	1,1,2,2-Tetrachloroethane	66-129	S
79-00-5	1,1,2-Trichloroethane	74-120	S
75-34-3	1,1-Dichloroethane	71-126	S
75-35-4	1,1-Dichloroethene	68-129	S
563-58-6	1,1-Dichloropropene	70-138	S
87-61-6	1,2,3-Trichlorobenzene	69-130	S
96-18-4	1,2,3-Trichloropropane	63-132	S
120-82-1	1,2,4-Trichlorobenzene	64-135	S
95-63-6	1,2,4-Trimethylbenzene	75-130	S
96-12-8	1,2-Dibromo-3-chloropropane	60-123	S
106-93-4	1,2-Dibromoethane	74-122	S
95-50-1	1,2-Dichlorobenzene	76-125	S
107-06-2	1,2-Dichloroethane	68-126	S
78-87-5	1,2-Dichloropropane	72-129	S
108-67-8	1,3,5-Trimethylbenzene	74-136	S
541-73-1	1,3-Dichlorobenzene	77-127	S
142-28-9	1,3-Dichloropropane	77-121	S
106-46-7	1,4-Dichlorobenzene	74-123	S
544-10-5	1-Chlorohexane	68-136	S
594-20-7	2,2-Dichloropropane	74-129	S
78-93-3	2-Butanone	47-142	S
95-49-8	2-Chlorotoluene	75-132	S
591-78-6	2-Hexanone	47-137	S
106-43-4	4-Chlorotoluene	74-133	S
99-87-6	4-Isopropyltoluene	71-136	S
108-10-1	4-Methyl-2-pentanone	52-136	S
67-64-1	Acetone	38-152	S
107-02-8	Acrolein	34-158	S

107-13-1	Acrylonitrile	49-142	S
71-43-2	Benzene	73-128	S
108-86-1	Bromobenzene	73-124	S
74-97-5	Bromochloromethane	73-127	S
75-27-4	Bromodichloromethane	74-126	S
75-25-2	Bromoform	67-122	S
74-83-9	Bromomethane	48-139	S
75-15-0	Carbon disulfide	68-133	S
56-23-5	Carbon tetrachloride	71-133	S
108-90-7	Chlorobenzene	75-121	S
75-00-3	Chloroethane	57-144	S
67-66-3	Chloroform	74-124	S
74-87-3	Chloromethane	61-130	S
124-48-1	Dibromochloromethane	74-122	S
74-95-3	Dibromomethane	72-125	S
75-71-8	Dichlorodifluoromethane	59-138	S
100-41-4	Ethylbenzene	74-130	S
87-68-3	Hexachlorobutadiene	71-140	S
98-82-8	Isopropylbenzene (Cumene)	74-125	S
75-09-2	Methylene chloride	66-130	S
91-20-3	Naphthalene	54-132	S
100-42-5	Styrene	72-128	S
127-18-4	Tetrachloroethene	70-127	S
108-88-3	Toluene	74-121	S
79-01-6	Trichloroethene	78-127	S
75-69-4	Trichlorofluoromethane	64-141	S
108-05-4	Vinyl acetate	53-140	S
75-01-4	Vinyl chloride	67-131	S
1330-20-7	Xylene (total)	71-129	S
156-59-2	cis-1,2-Dichloroethene	72-130	S
10061-01-5	cis-1,3-Dichloropropene	72-129	S
136777-61-2	m,p-Xylene	72-128	S
104-51-8	n-Butylbenzene	68-144	S
103-65-1	n-Propylbenzene	73-137	S
95-47-6	o-Xylene	69-133	S
135-98-8	sec-Butylbenzene	72-141	S
1634-04-4	tert-Butyl methyl ether (MTBE)	69-126	S
98-06-6	tert-Butylbenzene	72-136	S
156-60-5	trans-1,2-Dichloroethene	67-134	S
10061-02-6	trans-1,3-Dichloropropene	72-126	S
17060-07-0	1,2-Dichloroethane-d4	62-125	Surrogate
460-00-4	4-Bromofluorobenzene	62-127	Surrogate

1868-53-7	Dibromofluoromethane	65-130	Surrogate
2037-26-5	Toluene-d8	71-132	Surrogate

Control Limits

Gulf Coast Analytical Laboratories

Method: SW-846 8260B

		LCSD	
Analyte	**Name**	**LCL-UCL**	**Matrix**
630-20-6	1,1,1,2-Tetrachloroethane	0-30	S
71-55-6	1,1,1-Trichloroethane	0-30	S
79-34-5	1,1,2,2-Tetrachloroethane	0-30	S
79-00-5	1,1,2-Trichloroethane	0-30	S
75-34-3	1,1-Dichloroethane	0-30	S
75-35-4	1,1-Dichloroethene	0-30	S
563-58-6	1,1-Dichloropropene	0-30	S
87-61-6	1,2,3-Trichlorobenzene	0-30	S
96-18-4	1,2,3-Trichloropropane	0-30	S
120-82-1	1,2,4-Trichlorobenzene	0-30	S
95-63-6	1,2,4-Trimethylbenzene	0-30	S
96-12-8	1,2-Dibromo-3-chloropropane	0-30	S
106-93-4	1,2-Dibromoethane	0-30	S
95-50-1	1,2-Dichlorobenzene	0-30	S
107-06-2	1,2-Dichloroethane	0-30	S
78-87-5	1,2-Dichloropropane	0-30	S
108-67-8	1,3,5-Trimethylbenzene	0-30	S
541-73-1	1,3-Dichlorobenzene	0-30	S
142-28-9	1,3-Dichloropropane	0-30	S
106-46-7	1,4-Dichlorobenzene	0-30	S
544-10-5	1-Chlorohexane	0-30	S
594-20-7	2,2-Dichloropropane	0-30	S
78-93-3	2-Butanone	0-30	S
95-49-8	2-Chlorotoluene	0-30	S
591-78-6	2-Hexanone	0-30	S
106-43-4	4-Chlorotoluene	0-30	S
99-87-6	4-Isopropyltoluene	0-30	S
108-10-1	4-Methyl-2-pentanone	0-30	S
67-64-1	Acetone	0-30	S
107-02-8	Acrolein	0-30	S

107-13-1	Acrylonitrile	0-30	S
71-43-2	Benzene	0-30	S
108-86-1	Bromobenzene	0-30	S
74-97-5	Bromochloromethane	0-30	S
75-27-4	Bromodichloromethane	0-30	S
75-25-2	Bromoform	0-30	S
74-83-9	Bromomethane	0-30	S
75-15-0	Carbon disulfide	0-30	S
56-23-5	Carbon tetrachloride	0-30	S
108-90-7	Chlorobenzene	0-30	S
75-00-3	Chloroethane	0-30	S
67-66-3	Chloroform	0-30	S
74-87-3	Chloromethane	0-30	S
124-48-1	Dibromochloromethane	0-30	S
74-95-3	Dibromomethane	0-30	S
75-71-8	Dichlorodifluoromethane	0-30	S
100-41-4	Ethylbenzene	0-30	S
87-68-3	Hexachlorobutadiene	0-30	S
98-82-8	Isopropylbenzene (Cumene)	0-30	S
75-09-2	Methylene chloride	0-30	S
91-20-3	Naphthalene	0-30	S
100-42-5	Styrene	0-30	S
127-18-4	Tetrachloroethene	0-30	S
108-88-3	Toluene	0-30	S
79-01-6	Trichloroethene	0-30	S
75-69-4	Trichlorofluoromethane	0-30	S
108-05-4	Vinyl acetate	0-30	S
75-01-4	Vinyl chloride	0-30	S
1330-20-7	Xylene (total)	0-30	S
156-59-2	cis-1,2-Dichloroethene	0-30	S
10061-01-5	cis-1,3-Dichloropropene	0-30	S
136777-61-2	m,p-Xylene	0-30	S
104-51-8	n-Butylbenzene	0-30	S
103-65-1	n-Propylbenzene	0-30	S
95-47-6	o-Xylene	0-30	S
135-98-8	sec-Butylbenzene	0-30	S
1634-04-4	tert-Butyl methyl ether (MTBE)	0-30	S
98-06-6	tert-Butylbenzene	0-30	S
156-60-5	trans-1,2-Dichloroethene	0-30	S
10061-02-6	trans-1,3-Dichloropropene	0-30	S

Control Limits

Gulf Coast Analytical Laboratories

Method: SW-846 8270

	LCS		
Analyte	**Name**	**LCL-UCL**	**Matrix**
95-94-3	1,2,4,5-Tetrachlorobenzene	60-120	S
120-82-1	1,2,4-Trichlorobenzene	46-120	S
95-50-1	1,2-Dichlorobenzene	44-120	S
122-66-7	1,2Diphenylhydrazine/Azobenzen	49-120	S
541-73-1	1,3-Dichlorobenzene	40-120	S
106-46-7	1,4-Dichlorobenzene	42-120	S
58-90-2	2,3,4,6-Tetrachlorophenol	60-120	S
95-95-4	2,4,5-Trichlorophenol	47-120	S
88-06-2	2,4,6-Trichlorophenol	46-120	S
120-83-2	2,4-Dichlorophenol	47-120	S
105-67-9	2,4-Dimethylphenol	47-120	S
51-28-5	2,4-Dinitrophenol	14-120	S
121-14-2	2,4-Dinitrotoluene	45-120	S
87-65-0	2,6-Dichlorophenol	60-120	S
606-20-2	2,6-Dinitrotoluene	47-120	S
91-58-7	2-Chloronaphthalene	52-120	S
95-57-8	2-Chlorophenol	48-120	S
91-57-6	2-Methylnaphthalene	43-120	S
88-74-4	2-Nitroaniline	44-120	S
88-75-5	2-Nitrophenol	49-120	S
91-94-1	3,3'-Dichlorobenzidine	35-120	S
99-09-2	3-Nitroaniline	29-120	S
534-52-1	4,6-Dinitro-2-methylphenol	29-120	S
101-55-3	4-Bromophenyl phenyl ether	51-125	S
59-50-7	4-Chloro-3-methylphenol	46-120	S
106-47-8	4-Chloroaniline	20-120	S
7005-72-3	4-Chlorophenyl phenyl ether	50-120	S
100-01-6	4-Nitroaniline	32-120	S
100-02-7	4-Nitrophenol	32-120	S
83-32-9	Acenaphthene	50-120	S

208-96-8	Acenaphthylene	53-120	S
62-53-3	Aniline	21-131	S
120-12-7	Anthracene	52-120	S
56-55-3	Benzo(a)anthracene	48-120	S
50-32-8	Benzo(a)pyrene	44-120	S
205-99-2	Benzo(b)fluoranthene	31-130	S
191-24-2	Benzo(g,h,i)perylene	29-134	S
207-08-9	Benzo(k)fluoranthene	36-122	S
111-91-1	Bis(2-Chloroethoxy)methane	51-120	S
111-44-4	Bis(2-Chloroethyl)ether	46-120	S
108-60-1	Bis(2-Chloroisopropyl)ether	46-120	S
117-81-7	Bis(2-Ethylhexyl)phthalate	46-129	S
85-68-7	Butyl benzyl phthalate	46-130	S
86-74-8	Carbazole	47-120	S
218-01-9	Chrysene	51-120	S
84-74-2	Di-n-butyl phthalate	50-120	S
117-84-0	Di-n-octyl phthalate	41-122	S
53-70-3	Dibenz(a,h)anthracene	27-129	S
132-64-9	Dibenzofuran	50-120	S
84-66-2	Diethyl phthalate	36-120	S
131-11-3	Dimethyl phthalate	50-120	S
206-44-0	Fluoranthene	39-120	S
86-73-7	Fluorene	48-120	S
118-74-1	Hexachlorobenzene	48-120	S
87-68-3	Hexachlorobutadiene	46-120	S
77-47-4	Hexachlorocyclopentadiene	23-121	S
67-72-1	Hexachloroethane	40-120	S
193-39-5	Indeno(1,2,3-cd)pyrene	43-132	S
78-59-1	Isophorone	49-120	S
91-20-3	Naphthalene	48-120	S
98-95-3	Nitrobenzene	45-120	S
608-93-5	Pentachlorobenzene	60-120	S
87-86-5	Pentachlorophenol	30-124	S
85-01-8	Phenanthrene	53-120	S
108-95-2	Phenol	42-120	S
129-00-0	Pyrene	38-136	S
110-86-1	Pyridine	11-120	S
1319-77-3MP	m,p-Cresol	46-120	S
621-64-7	n-Nitrosodi-n-propylamine	46-120	S
55-18-5	n-Nitrosodiethylamine	60-120	S
62-75-9	n-Nitrosodimethylamine	34-126	S
86-30-6	n-Nitrosodiphenylamine	54-125	S
95-48-7	o-Cresol	46-120	S

118-79-6	2,4,6-Tribromophenol	44-121	Surrogate
321-60-8	2-Fluorobiphenyl	47-127	Surrogate
367-12-4	2-Fluorophenol	51-119	Surrogate
4165-60-0	Nitrobenzene-d5	46-123	Surrogate
4165-62-2	Phenol-d5	43-123	Surrogate
1718-51-0	Terphenyl-d14	38-167	Surrogate

Control Limits

Gulf Coast Analytical Laboratories

Method: SW-846 8270

		LCSD	
Analyte	**Name**	**LCL-UCL**	**Matrix**
95-94-3	1,2,4,5-Tetrachlorobenzene	0-40	S
120-82-1	1,2,4-Trichlorobenzene	0-40	S
95-50-1	1,2-Dichlorobenzene	0-40	S
122-66-7	1,2Diphenylhydrazine/Azobenzen	0-40	S
541-73-1	1,3-Dichlorobenzene	0-40	S
106-46-7	1,4-Dichlorobenzene	0-40	S
58-90-2	2,3,4,6-Tetrachlorophenol	0-40	S
95-95-4	2,4,5-Trichlorophenol	0-40	S
88-06-2	2,4,6-Trichlorophenol	0-40	S
120-83-2	2,4-Dichlorophenol	0-40	S
105-67-9	2,4-Dimethylphenol	0-40	S
51-28-5	2,4-Dinitrophenol	0-40	S
121-14-2	2,4-Dinitrotoluene	0-40	S
87-65-0	2,6-Dichlorophenol	0-40	S
606-20-2	2,6-Dinitrotoluene	0-40	S
91-58-7	2-Chloronaphthalene	0-40	S
95-57-8	2-Chlorophenol	0-40	S
91-57-6	2-Methylnaphthalene	0-40	S
88-74-4	2-Nitroaniline	0-40	S
88-75-5	2-Nitrophenol	0-40	S
91-94-1	3,3'-Dichlorobenzidine	0-40	S
99-09-2	3-Nitroaniline	0-40	S
534-52-1	4,6-Dinitro-2-methylphenol	0-40	S
101-55-3	4-Bromophenyl phenyl ether	0-40	S
59-50-7	4-Chloro-3-methylphenol	0-40	S
106-47-8	4-Chloroaniline	0-40	S
7005-72-3	4-Chlorophenyl phenyl ether	0-40	S
100-01-6	4-Nitroaniline	0-40	S
100-02-7	4-Nitrophenol	0-40	S
83-32-9	Acenaphthene	0-40	S

208-96-8	Acenaphthylene	0-40	S
62-53-3	Aniline	0-40	S
120-12-7	Anthracene	0-40	S
56-55-3	Benzo(a)anthracene	0-40	S
50-32-8	Benzo(a)pyrene	0-40	S
205-99-2	Benzo(b)fluoranthene	0-40	S
191-24-2	Benzo(g,h,i)perylene	0-40	S
207-08-9	Benzo(k)fluoranthene	0-40	S
111-91-1	Bis(2-Chloroethoxy)methane	0-40	S
111-44-4	Bis(2-Chloroethyl)ether	0-40	S
108-60-1	Bis(2-Chloroisopropyl)ether	0-40	S
117-81-7	Bis(2-Ethylhexyl)phthalate	0-40	S
85-68-7	Butyl benzyl phthalate	0-40	S
86-74-8	Carbazole	0-40	S
218-01-9	Chrysene	0-40	S
84-74-2	Di-n-butyl phthalate	0-40	S
117-84-0	Di-n-octyl phthalate	0-40	S
53-70-3	Dibenz(a,h)anthracene	0-40	S
132-64-9	Dibenzofuran	0-40	S
84-66-2	Diethyl phthalate	0-40	S
131-11-3	Dimethyl phthalate	0-40	S
206-44-0	Fluoranthene	0-40	S
86-73-7	Fluorene	0-40	S
118-74-1	Hexachlorobenzene	0-40	S
87-68-3	Hexachlorobutadiene	0-40	S
77-47-4	Hexachlorocyclopentadiene	0-40	S
67-72-1	Hexachloroethane	0-40	S
193-39-5	Indeno(1,2,3-cd)pyrene	0-40	S
78-59-1	Isophorone	0-40	S
91-20-3	Naphthalene	0-40	S
98-95-3	Nitrobenzene	0-40	S
608-93-5	Pentachlorobenzene	0-40	S
87-86-5	Pentachlorophenol	0-40	S
85-01-8	Phenanthrene	0-40	S
108-95-2	Phenol	0-40	S
129-00-0	Pyrene	0-40	S
110-86-1	Pyridine	0-40	S
1319-77-3MP	m,p-Cresol	0-40	S
621-64-7	n-Nitrosodi-n-propylamine	0-40	S
55-18-5	n-Nitrosodiethylamine	0-40	S
62-75-9	n-Nitrosodimethylamine	0-40	S
86-30-6	n-Nitrosodiphenylamine	0-40	S
95-48-7	o-Cresol	0-40	S

Control Limits

Gulf Coast Analytical Laboratories

Method: Massachusetts EPH & VPH

	LCS		
Test	**Name**	**LCL-UCL**	**Matrix**
Mass EPH	C9-C18 Aliphatic Hydrocarbons	40-140	S
Mass EPH	C19-C36 Aliphatic Hydrocarbons	40-140	S
Mass EPH	C11-C22 Aromatics Hydrocarbons	40-140	S
Mass EPH	1-Chlorooctadecane	40-140	EPH Surr
Mass EPH	o-Terphenyl	40-140	EPH Surr
Mass VPH	C5-C8 Aliphatic Hydrocarbons	60-140	S
Mass VPH	C9-C12 Aliphatic Hydrocarbons	60-140	S
Mass VPH	C9-C10 Aromatic Hydrocarbons	60-140	S
Mass VPH	2,5-Dibromotoluene	60-140	VPH Surr

Control Limits

Gulf Coast Analytical Laboratories

Method: Massachusetts
EPH & VPH

		LCSD	
Test	**Name**	**LCL-UCL**	**Matrix**
Mass EPH	C9-C18 Aliphatic Hydrocarbons	0-40	S
Mass EPH	C19-C36 Aliphatic Hydrocarbons	0-40	S
Mass EPH	C11-C22 Aromatics Hydrocarbons	0-40	S
Mass VPH	C5-C8 Aliphatic Hydrocarbons	0-30	S
Mass VPH	C9-C12 Aliphatic Hydrocarbons	0-30	S
Mass VPH	C9-C10 Aromatic Hydrocarbons	0-30	S

Control Limits

Gulf Coast Analytical Laboratories

Method: SW-846 6010

	LCS		
Analyte	**Name**	**LCL-UCL**	**Matrix**
7439-92-1	Lead	80-120	S

Control Limits

Gulf Coast Analytical Laboratories

Method: SW-846 6010

	LCSD		
Analyte	**Name**	**LCL-UCL**	**Matrix**
7439-92-1	Lead	0-20	S