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TIER II SAMPLING AND ANALYSIS PLAN MODIFICATION DECISION UNIT 4-1 AT TANK
FARM 4 SITE 12 OPERABLE UNIT 11 (OU 11) NS NEWPORT RI
07/02/2014
RESOLUTION CONSULTANTS

TIER II SAMPLING AND ANALYSIS PLAN
MODIFICATION
Decision Unit 4-1 at Tank Farm 4 (Site 12)
Operable Unit 11
Naval Station Newport
Portsmouth, Rhode Island

Prepared for:



Department of the Navy
Naval Facilities Engineering Command, Mid-Atlantic
9742 Maryland Ave.
Norfolk, VA 23511-3095

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Prepared by:



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July 2, 2014

SAMPLING AND ANALYSIS PLAN (SAP) MODIFICATION
ADDITIONAL SAMPLING AT TARGET AREA 2
(PAH IMPACTS SURROUNDING SOIL BORING SB934)
DU 4-1, TANK FARM 4 (SITE 12), OPERABLE UNIT 11
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Background

On Thursday May 22, 2014, Resolution Consultants hosted a site inspection during which the Navy, RIDEM and USEPA representatives were present to inspect the on-going soil pre-design investigation (PDI) at Tank Farm 4 Decision Unit (DU) 4-1. While inspecting the vicinity of Target Area 2 (Polynuclear Aromatic Hydrocarbon (PAH) Impacts Surrounding Soil Boring SB934) the team discussed the impact a historic stone wall would have on the ability to conduct additional sampling in the northeast direction from the target boring SB934. While inspecting the stone wall, rusted pails/drums were observed adjacent to the stone wall. Additional discarded pails/drums were observed further to the north-northeast of the target area, approximately 25-30 feet into the wooded area.

USEPA and RIDEM requested that the drums be removed and that sampling be considered under these drums. The Navy stated that they would contact the base to determine if there was a protocol for removal/sampling of abandoned drums.

On June 12, 2014, during a follow up call to discuss the results of the Tank Farm 4 PDI, USEPA and RIDEM requested that sampling be conducted beneath the drums as part of the soil PDI. This document summarizes the planned sampling regime and serves as a modification to the Final Tier II Sampling and Analysis Plan (SAP) for DU 4-1, Tank Farm 4 (Site 12), Operable Unit 11 at NAVSTA Newport, Portsmouth, RI, dated May 5, 2014. If sampling results indicate that an expanded sampling event is necessary beyond the flexibility provided in this SAP Modification, then an additional SAP Modification will be provided to USEPA and RIDEM prior to that event. Per the Record of Decision (ROD), which was signed on September 30, 2013, and the Federal Facilities Agreement (FFA), the Remedy Implementation Date for the site is December 24, 2014. Therefore, in the interest of completing the soil PDI at Tank Farm 4 so that the Remedial Design for soil can be completed and the Remedy Implementation schedule for DU 4-1 can be maintained, this SAP Modification is considered sufficient to allow for the initial investigation of soil in the vicinity of the abandoned drums. Refer to Figure 1 for the regional location of Tank Farm 4 and Figure 3 for the location of DU 4-1 within Tank Farm 4, as well as the approximate location of the observed discarded drums.

Project Quality Objectives

The goal of this additional investigation is to collect soil samples from beneath and in the immediate vicinity of the abandoned drums to determine if soil conditions exceed RIDEM Industrial and Commercial Direct Exposure Criteria (ICDECs) or GA Leachability Criteria within in the top 2 feet. The top 2 feet of soil is the remediation depth identified in the ROD for Target Area 2 within DU 4-1, for comparison and compliance with Remedial Goals (RGs). The following data will be collected to characterize soil beneath the drums:

- Field screening – photoionization detector (PID), PetroFlag Screening Kit
- Subsurface soil sampling – volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs that include PAHs), pesticides, polychlorinated biphenyls (PCBs), metals (plus mercury), hexavalent chromium, and total petroleum hydrocarbons (TPH)

Clearing

Some vegetation clearing with hand held tools (eg. chain saws, machetes) will be required and Resolution will arrange for the vegetation to be cleared prior to the initiation of field activities. All samples will be collected with handheld samplers.

Utility Clearance

Prior to the initiation of intrusive field work, utility clearance will be conducted in accordance with SOP 3-01.

Soil Sample Collection

Two areas of abandoned drums were noted during the field inspection. Approximately 6 soil borings are planned to investigate these two areas. The area will be inspected further prior to sampling to obtain GPS coordinates of the drums and to determine if additional drums are present. Soil boring locations will be distributed to adequately characterize the two areas observed. Additional borings may be added if additional discarded drums are observed.

Soil borings will be advanced to a depth of 2 feet using a hand held Geoprobe or hand auger. Soil samples will be field screened, as noted above. Field measurements will be recorded in a field logbook and/or onto field data collection records. Field data will be compiled and stored in project folders, for subsequent use in evaluating analytical data and completing the soil investigation summary report which will be used to support the Soil Excavation Remedial Design. Soil to be submitted for laboratory analysis will be selected based on field observations and measurements of impacts (e.g. visual and/or olfactory evidence, PID and Petroflag Screening, etc.). Soil to be

submitted for laboratory analysis will be biased towards any soil exhibiting obvious signs of impacts based on the above observations. Soil will not be composited.

Samples will be picked up in the field or at a nearby office via laboratory-supplied courier. The samples will be preserved, chilled, etc. in accordance with the May 5, 2014 SAP. Samples will be analyzed using applicable analytical methods by a competent analytical laboratory certified by the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) to reduce measurement errors. All sample shipments will contain appropriate chain of custody (CoC) forms. Samples will be submitted for standard 10-day turnaround time for all analytes.

Quality Assurance/Quality Control

The QA/QC sample collection frequency is as follows:

- Equipment blanks – the more frequent of 1 per week of sampling or per 20 samples collected per method and matrix and type of equipment
- Trip blanks – 1 trip blank per day
- Field duplicates – (single blind samples) 1 per 10 samples per method and matrix
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) or MS/Matrix Duplicate – 1 per 20 samples per method and matrix

Worksheets #12, #15, #23, and #28 of the original SAP Version 1 have been modified to accommodate the expanded analyte list and analytical method set required for this additional sample testing (attached).

Equipment Decontamination

To the maximum extent possible, Resolution will use dedicated and disposable sampling equipment to avoid the potential for cross contamination of samples. The sampling equipment will include dedicated plastic scoops, disposable gloves, and laboratory supplied sample bottles.

Non-disposable or non-dedicated sampling equipment (e.g., stainless spoons, stainless bowls, etc.) will be decontaminated prior to sampling and between samples. Cleaning of equipment is performed to prevent cross-contamination between samples and to maintain a clean working environment for all personnel. Decontamination will generally consist of a water rinse station to remove gross contamination (if needed), followed by a non-phosphate detergent (e.g., Alconox) water rinse, and a rinse with de-ionized water.

Investigation-Derived Waste Management

It is not anticipated that any IDW will be generated as part of these investigations, but in the event that IDW is generated, it will be handled in accordance with RIDEM's *Policy Memo 95-01 Guidelines for the Management of Investigation Derived Wastes*, Investigation Derived Waste (IDW).

Land Surveying

GPS coordinates for each soil boring will be collected in the field.

Laboratory Coordination, Data Management and Validation

Refer to the May 5, 2014 SAP for details regarding data validation and sample management.

Figures




RESOLUTION CONSULTANTS
 Drawn: HM 12/17/2013
 Approved: MK 12/17/2013
 Project #: 60268619

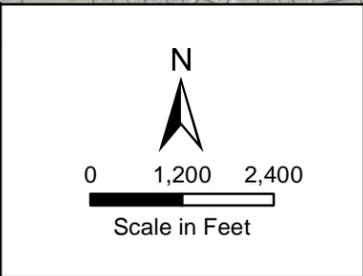
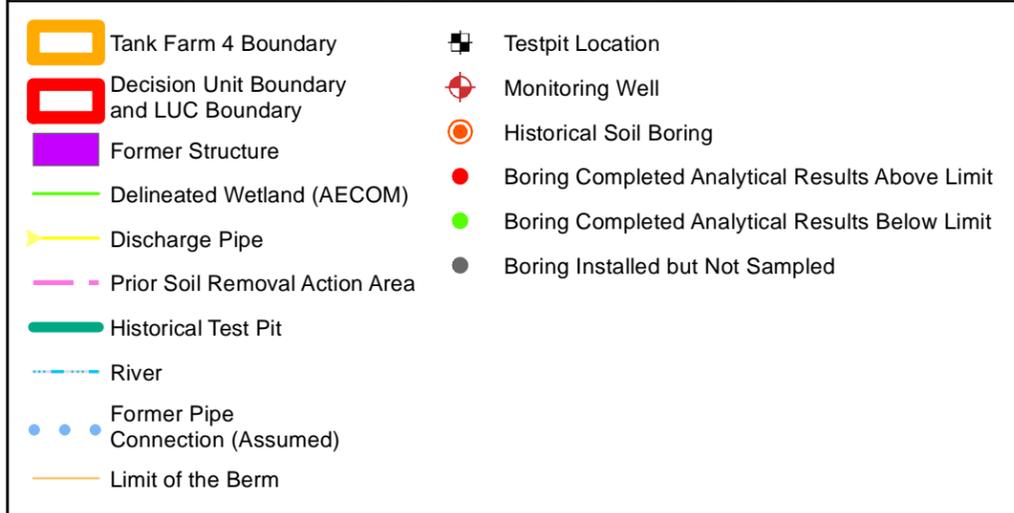
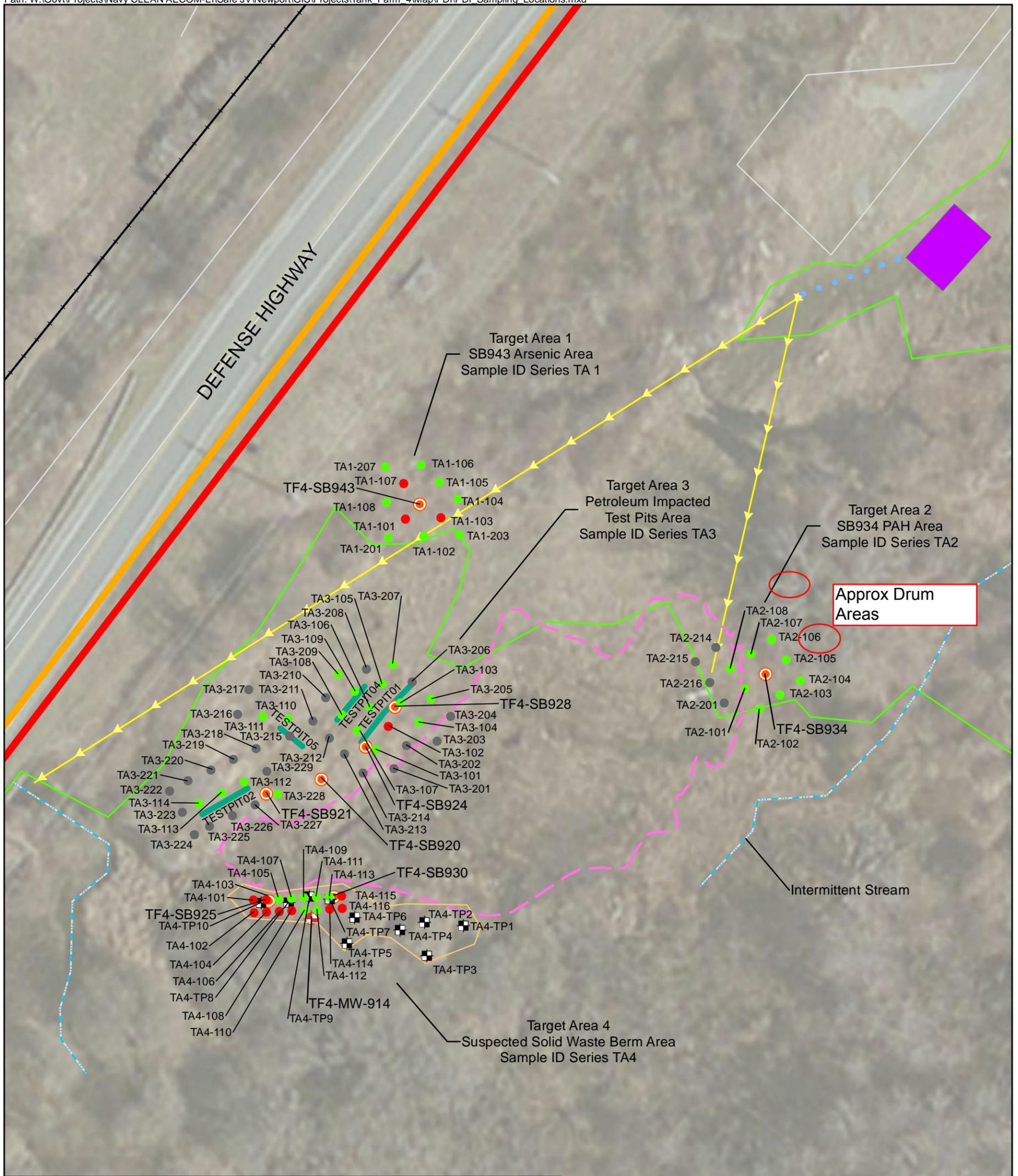


FIGURE 1
SITE MAP

NAVSTA NEWPORT, RHODE ISLAND



RESOLUTION CONSULTANTS
 Drawn: JB 06/05/2014
 Approved: NO 06/05/2014
 Project #: 60289139

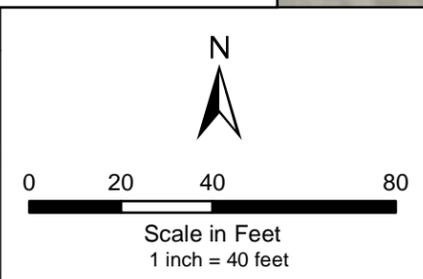


FIGURE 3
TANK FARM 4
TANK FARM 4 DU 4-1
SOIL PDI SAMPLING LOCATIONS
PRELIMINARY RESULTS
DRAFT
NAVSTA NEWPORT, RHODE ISLAND

SAP Worksheet #12-1: Measurement Performance Criteria – Field QC Samples for Polycyclic Aromatic Hydrocarbons

Matrix: Surface and Subsurface Soil

Analytical Group: Semivolatile Organic Compounds and Polycyclic Aromatic Hydrocarbons

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Equipment Rinsate Blank	Polycyclic Aromatic Hydrocarbons (Full Scan)	One per week of sampling or per twenty field samples (whichever is more frequent) per type of equipment used	Accuracy/Bias	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Cooler Temperature Indicator		One per cooler	Accuracy/Representativeness	Temperature ≤ 6 degrees Celsius.
Field Duplicate		One per ten samples per matrix	Precision	RPD ≤ 50% if both results are ≥ 2 x LOQ
Matrix Spike/Matrix Spike Duplicate		Submitted: One per twenty samples per matrix. Analyzed: More frequent of one per twenty samples or SDG per matrix.	Accuracy/Bias/Precision	Refer to Worksheet #28-1

SAP Worksheet #12-2: Measurement Performance Criteria – Field QC Samples for Metals

Matrix: Soil

Analytical Group: Metals

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Equipment Rinsate Blank	ICP-AES Metals	One per week of sampling or per twenty field samples (whichever is more frequent) per type of equipment used	Accuracy/Bias	No target metals > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. For negative blanks, absolute value must be < LOD. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Field Duplicate		One per ten samples per matrix	Precision	RPD ≤ 50% if both results are ≥ 5 x LOQ. Diff ≤ LOQ if values are < 5x LOQ
Matrix Spike		Submitted: One per twenty samples per matrix. Analyzed: Most frequent of one per twenty samples or SDG per matrix, or one per prep batch per matrix.	Accuracy/Bias	Refer to Worksheet #28-2

SAP Worksheet #12-3: Measurement Performance Criteria – Field QC Samples for Gasoline Range Organics

Matrix: Surface and Subsurface Soil

Analytical Group: Gasoline Range Organics (C6-C12)

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Trip Blank	Gasoline Range Organics (C6-C12)	One per cooler containing VOC samples	Accuracy/Bias	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Equipment Rinsate Blank		One per day of sampling per type of equipment used	Accuracy/Bias	No analytes detected > ½ LOQ and > 1/10 the amount measured in any sample or 1/10 the PAL (whichever is greater). Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Cooler Temperature Indicator		One per cooler	Accuracy/Representativeness	Temperature ≤ 6 degrees Celsius.
Field Duplicate		One per ten samples per matrix	Precision	RPD ≤ 50% if both results are > 5 x LOQ

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Matrix Spike/Matrix Spike Duplicate		Submitted: One per twenty samples per matrix. Analyzed: More frequent of one per twenty samples or SDG per matrix.	Accuracy/Bias/Precision	Refer to Worksheet 28-2

SAP Worksheet #12-4: Measurement Performance Criteria – Field QC Samples for Diesel Range Organics

Matrix: Surface and Subsurface Soil

Analytical Group: Diesel Range Organics (C10-C36)

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Equipment Rinsate Blank	Diesel Range Organics (C10-C36)	One per day of sampling per type of equipment used	Accuracy/Bias	No analytes detected > ½ LOQ in any sample or 1/10 the PAL (whichever is greater). Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Cooler Temperature Indicator		One per cooler	Accuracy/Representativeness	Temperature ≤ 6 degrees Celsius.
Field Duplicate		One per ten samples per matrix	Precision	RPD ≤ 50% if both results are > 5 x LOQ
Matrix Spike/Matrix Spike Duplicate		Submitted: One per twenty samples per matrix. Analyzed: More frequent of one per twenty samples or SDG per matrix.	Accuracy/Bias/Precision	Refer to Worksheet 28-4

SAP Worksheet #12-5: Measurement Performance Criteria Field Quality Control Samples

[\(UFP-QAPP Manual Section 2.6.2\)](#)

Matrix: Soil

Analytical Group: Volatile Organic Compounds

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria
Trip Blank	Volatile Organic Compounds (Full Scan)	One per cooler containing VOC Samples	Accuracy/Bias	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Equipment Rinsate Blank		One per day of sampling per type of equipment used	Accuracy/Bias	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).
Cooler Temperature Indicator		One per cooler	Accuracy/Representativeness	Temperature ≤ 6 degrees Celsius.
Field Duplicate		One per twenty samples per matrix	Precision	Relative Percent Difference (RPD) ≤ 50% if both results are ≥ 2 x LOQ
Matrix Spike/Matrix Spike Duplicate		Submitted: One per twenty samples per matrix. Analyzed: More frequent of one per twenty samples or SDG per matrix.	Accuracy/Bias/Precision	Refer to Worksheet #28-18

SAP Worksheet #12: Notes

|Diff| – Absolute Difference

DoD QSM – Department of Defense Quality Systems Manual

DQI – Data Quality Indicator

LOD – Limit of Detection

LOQ – Limit of Quantitation

PAL – Project Action Limit

RPD – Relative Percent Difference

SDG – Sample Delivery Group

SAP Worksheet #15: Reference Limits and Evaluation Tables

Method/Analyte	CAS No.	PAL (mg/Kg)	Basis ^(a)	PQL Goal (mg/Kg) ^(b)	Laboratory Specific Limits (mg/Kg)		
					LOQ	LOD	DL
PAHs							
Benzo(a)anthracene	56-55-3	7.8	SSCL	2.6	0.33	0.133	0.033
Benzo(a)pyrene	50-32-8	0.8	SSCL, SBCL	0.27	0.33	0.133	0.031
Benzo(b)fluoranthene	205-99-2	7.8	SSCL	2.6	0.33	0.133	0.04
Dibenzo(a,h)anthracene	53-70-3	0.8	SSCL	0.27	0.33	0.133	0.035
Metals							
Arsenic	7440-38-2	15	EC	5	1	0.5	0.41
Manganese	7439-96-5	1,030	SSCL	343	2.5	0.15	0.13
Gasoline Range Organics							
TPH-GASOLINE RANGE C6-C12 ¹	-3544	2,500 ^c	ICDEC ^c	800	2.5	2.0	1.8
Diesel Range Organics							
TPH-C10-C36 BUNKER FUEL ¹	-235	2,500 ^c	ICDEC ^c	800	5.0	3.8	2.2

Notes:

CAS - Chemical Abstracts Service

DL - Detection Limit

EC – Excavation Criteria as specified in the ROD (NAVFAC, 2013)

ICDEC - RIDEM's Industrial/Commercial Direct Exposure Criteria

LOD - Limit of Detection

LOQ - Limit of Quantitation

PAH – Polycyclic Aromatic Hydrocarbon

PAL - Project Action Limit

PQL – Project Quantitation Limit

ROD - Record of Decision

SSCL - Industrial Surface Soil Cleanup Level as specified in Table 2-5 of the ROD and reiterated in Tables 4 through 7 herein (NAVFAC, 2013)

SBCL - Industrial Subsurface Soil Cleanup Level as specified in Table 2-5 of the ROD and reiterated in Tables 4 through 7 herein (NAVFAC, 2013)

TPH – Total Petroleum Hydrocarbons

(a) For all analytes except arsenic and TPH, the soil PAL is the lower of the Industrial Surface Soil Cleanup Level and the Industrial Subsurface Soil Cleanup Level. For arsenic, the soil PAL is the lower of the Industrial Surface Soil Cleanup Level, the Industrial Subsurface Soil Cleanup Level, and the excavation criteria as specified in the ROD (NAVFAC, 2013). For TPH the cleanup level is the Industrial Direct Exposure Criteria (DEC) of 2,500 mg/kg. Industrial Surface Soil Cleanup Level and the Industrial Subsurface Soil Cleanup Level are copied from Table 2-5 of the ROD (NAVFAC, 2013).

(b) The PQL Goal is conservatively set to one-third of the PAL. The LOQ for two PAHs is greater than the PQL Goal, but the LOD is below the PQL Goal, therefore the sensitivity for these two compounds is sufficient to meet data quality objectives.

(c) The PAL presented is for total petroleum hydrocarbon. Summing the C6-C12 and C10-C36 results will provide a conservative result for TPH because of some overlap in the C10-C12 range. Results for which the total GRO and DRO result is close to the PAL may be re-evaluated to determine what concentration is possibly attributed to double-counting of this hydrocarbon range.

SAP Worksheet #23-1: Analytical SOP References Table

Laboratory Name and Address: Spectrum Analytical, RI Division, 646 Camp Avenue, North Kingstown, RI 02852¹

Point of Contact Name: Edward Lawler

Phone Number: 401.732.3400 x 315

Lab SOP Number	Title, Revision Date, and Number ²	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
70.0011	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) Analysis by SW846 Method 8270D, Rev. 11, 7/11	Definitive	Surface Soil, Subsurface Soil / PAHs	GC/MS	None	N
50.0052	Preparation of Soil Samples by Sonication (Method 3550), Rev. 4 8/13	Definitive	Surface Soil, Subsurface Soil / PAHs	NA	None	N
50.0051	Preparation of Aqueous Samples by Separatory Funnel (Method 3510), Rev. 2 9/10	Definitive	Aqueous QC Samples / PAHs	NA	None	N
100.0111	Metals in Water and Wastes by Inductively Coupled Argon Plasma Atomic Emission Spectrometry by SW846 Method 6010C, Rev. 13, 12/10	Definitive	Aqueous QC Samples / Metals	ICP/AES	None	N
100.0104	Sample Preparation of Soils by Acid Digestion for ICP/AES (3050B/6010C), Rev.8, 3/10	Definitive	Surface Soil, Subsurface Soil / Metals	NA	None	N

Lab SOP Number	Title, Revision Date, and Number ²	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
100.0003	Sample Preparation of Aqueous Samples by Acid Digestion ICP and ICP/MS (3005/3010), Rev. 8, 2/10	Definitive	Aqueous QC Samples / Metals	NA	None	N

Notes:

1. Certificates of current certification by DoD ELAP and the State of Rhode Island and Providence Plantations are presented in Appendix B.
2. Each SOP is reviewed on an annual basis. Revision number and date are updated only when revision of the SOP is required.

SAP Worksheet #23-2: Analytical SOP References Table

Laboratory Name and Address: Katahdin Analytical Services, 600 Technology Way, Scarborough, Maine 04074¹

Point of Contact Name: Jennifer Obrin

Phone Number: 207.874.2400 x17

Lab SOP Number	Title, Revision Date, and Number ²	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
CA-315	Determination of Extractable Petroleum Hydrocarbons or Diesel Range Organics (DRO) by Modified Methods 8015 and 8100, 04/14, Revision 12.	Definitive	Sediment / DRO	Gas Chromatography (GC)/Flame Ionization Detector (FID)	No Variance	N
CA-316	Method for Determining Volatile Petroleum Hydrocarbons or Gasoline Range Organics (GRO) by Modified Method 8015, 04/14, Revision 12.	Definitive	Sediment / GRO	GC/FID	No Variance	N
CA-527	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Subsequent Extractable Total Petroleum Hydrocarbon (TPH) or Diesel Range Organic (DRO) Analysis, 04/12, Revision 7.	Definitive	Sediment / DRO	Not applicable (extraction)	No Variance	N
CA-535	Preparation of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Diesel Range Organics (DRO) or Total Petroleum Hydrocarbons (TPH) Analysis, 04/12, Revision 8.	Definitive	Sediment / DRO	Not applicable (extraction)	No Variance	N
CA-202	Analysis of VOAs by Purge and Trap GC/MS: SW-846	Definitive	Soil, Sediment, Groundwater	GC/MS	No Variance	N

Lab SOP Number	Title, Revision Date, and Number ²	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
	Method 8260, 04/14, Revision 15.		/ VOCs			
CA-214	Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil And Waste Samples Using SW846 Method 5035, 03/12, Revision 6.	Definitive	Soil, Sediment / VOCs	Not applicable (extraction)	No Variance	N
CA-226	Analysis of SVOAs by Capillary Column GC/MS: SW-846 Method 8270D, 04/13 Revision 4.	Definitive	Soil, Sediment, Groundwater / SVOCs and PAHs	GC/MS	No Variance	N
CA-213	Analysis of Semivolatile Organic Compounds By: SW 846 Method 8270 – Modified For Selected Ion Monitoring (SIM), 05/12, Revision 10.	Definitive	Soil, Sediment, Groundwater / PAHs	GC/MS	No Variance	N
CA-302	Analysis of Pesticides by Gas Chromatography/Electron Capture Detector (GC/ECD): SW-846 Method 8081. 06/14, Revision 14.	Definitive	Soil, Sediment, Groundwater / Pesticides	Gas Chromatography (GC)/ Electron Capture Detector (ECD)	No Variance	N
CA-329	Analysis Of PCBs As Total Aroclors By Gas Chromatography/Electron Capture Detector (GC/ECD): SW-846 Method 8082, 02/13, Revision 13.	Definitive	Soil, Sediment, Groundwater / PCBs	GC/ECD	No Variance	N
CA-500	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Pesticides/PCBs Analysis, 03/12, Revision 8.	Definitive	Soil, Sediment / Pesticides and PCBs	Not applicable (extraction)	No Variance	N
CA-502	Preparation Of Aqueous Samples For Extractable	Definitive	Groundwater / SVOCs and	Not applicable	No Variance	N

Lab SOP Number	Title, Revision Date, and Number ²	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
	Semivolatile Analysis, 04/12, Revision 7.		PAHs	(extraction)		
CA-512	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Extractable Semi-Volatiles Analysis, 04/12, Revision 9.	Definitive	Soil, Sediment / SVOCs and PAHs	Not applicable (extraction)	No Variance	N
CA-515	Preparation of Aqueous Samples for Pesticides/PCBs Analysis, 04/12, Revision 8.	Definitive	Groundwater / PCBs	Not applicable (extraction)	No Variance	N
CA-604	Acid Digestion of Aqueous Samples by USEPA Method 3010 for ICP Analysis of Total or Dissolved Metals, 04/10, Revision 5.	Definitive	Groundwater / TAL Metals	Not applicable (digestion)	No Variance	N
CA-605	Acid Digestion of Solid Samples by USEPA Method 3050 for Metals by ICP-AES and GFAA, 09/10, Revision 5.	Definitive	Soil, Sediment / TAL Metals	Not applicable (digestion)	No Variance	N
CA-608	Trace Metals Analysis By ICP-AES Using USEPA Method 6010, 05/13, Revision 14.	Definitive	Soil, Sediment, Groundwater / TAL Metals	Inductively Coupled Plasma (ICP) – Atomic Emission Spectroscopy (AES)	No Variance	N
CA-611	Digestion and Analysis of Solid Samples for Mercury by USEPA Method 7471, 06/14, Revision 10.	Definitive	Soil, Sediment / Mercury	Mercury Analyzer	No Variance	N
CA-615	Digestion and Analysis of Aqueous Samples for Mercury by USEPA Method	Definitive	Groundwater / Mercury	Mercury Analyzer	No Variance	N

Lab SOP Number	Title, Revision Date, and Number ²	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
	7470, 04/12, Revision 7.					
CA-625	Alkaline Digestion and Subsequent Determination of Hexavalent Chromium In Solid Samples Using EPA SW846 Methods 3060 and 7196, 05/13, Revision 6.	Definitive	Soil, Sediment / Hexavalent Chromium	Manual Spectrophotometer	No Variance	N
CA-627	Trace Metals Analysis By ICP-MS Using USEPA Method 6020, 06/14, Revision 10.	Definitive	Soil, Sediment, Groundwater / TAL Metals	ICP-MS	No Variance	N
CA-772	Colorimetric Analysis Of Hexavalent Chromium Using The Automated Konelab Multiwavelength Photometric Analyzer, 02/13, Revision 3.	Definitive	Groundwater / Hexavalent Chromium	Automated Spectrophotometer	No Variance	N

Notes:

1. Certificates of current certification by DoD ELAP and the State of Rhode Island and Providence Plantations are presented in Appendix B.
2. Each SOP is reviewed on an annual basis. Revision number and date are updated only when revision of the SOP is required.

SAP Worksheet #28-1: Laboratory QC Samples Table

Matrix: Surface and Subsurface Soil

Analytical Group: Semivolatile Organic compounds and Polycyclic Aromatic Hydrocarbons (Full Scan)

Analytical Method/ SOP Reference: SW846 8270D (Full Scan) / LAB SOPs 70.0011 and CA-226

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No target compounds > 1/2 LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Surrogate	Full Scan - 6 per sample: 2-Fluorophenol Phenol-d6 Nitrobenzene-d5 2-Fluorobiphenyl 2,4,6-Tribromophenol Terphenyl-d14	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits.	For QC and field samples, correct problem then re-prepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits. Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix E-1 of DoD QSM v4.2). Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per SDG or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be $\leq 30\%$.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
IS	Six per sample: 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of the ICAL midpoint.	Inspect mass spectrometer or gas chromatograph for malfunctions. Mandatory reanalysis of samples analyzed while system was malfunctioning. If obvious chromatographic interference with internal standard is present, reanalysis may not be necessary.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-2: Laboratory QC Samples Table

Matrix: Surface and Subsurface Soil

Analytical Group: Metals (ICP-AES)

Analytical Method/ SOP Reference: SW846 6010C / Lab SOPs 100.0111 and CA-608

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No target metals > 1/2 LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. For negative blanks, absolute value must be < LOD. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per digestion batch of 20 or fewer samples of similar matrix (varies by lot).	%R must be within DoD QSM limits, allowing for the marginal exceedances presented in DoD QSM Table G-1.	Re-digest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
MS	One per digestion batch or SDG or every 20 samples.	%R should be within the DoD QSM limits for LCS, if sample < 4x spike added.	Flag results for affected analytes for all associated samples with "N."	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits for LCS.
Post-digestion Spike	When dilution test fails or analyte concentration in all samples < 50x LOD	%R within 75-125%.	Run associated samples by method of standard addition or flag results.	Analyst, Laboratory Department Manager	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Laboratory Duplicate	One per digestion batch or SDG or every 20 samples.	Project-specific criteria: If values are $\geq 5x$ LOQ, RPD should be $\leq 20\%$. If values are $< 5x$ LOQ, Absolute Difference should be \leq LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Precision	RPD $< 20\%$
ICP Serial Dilution	One per preparation batch of 20 or fewer samples of similar matrix.	If original sample result is at least $50x$ LOQ, 5-fold dilution must agree within $\pm 10\%$ of the original result.	Flag results for affected analytes for all associated samples with "E."	Analyst, Laboratory Department Manager	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-3: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Gasoline Range Organics (C6-C12)

Analytical Method/ SOP Reference: SW-846 8015C / CA-316

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the PAL (whichever is greater). Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, report samples which are < LOQ and >10X the blank. Otherwise, reprepare a blank and the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	Same as Method/SOP QC Acceptance Limits.
Surrogates	Bromofluorobenzene	%R must be within Katahdin's statistically-derived QC limits	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be repped within hold time.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within Katahdin's statistically-derived QC limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be repped within hold time.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS/MSD	One per SDG or every 20 samples.	%R should be within Katahdin's statistically-derived QC limits. RPD ≤ 30%	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix; otherwise contact client.	Analyst, Supervisor, QA Manager	Precision/Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

SAP Worksheet #28-4: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Diesel Range Organics (C10-C36)

Analytical Method/ SOP Reference: SW-846 8015C / CA-315

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analytes detected > 1/2 LOQ in any sample or 1/10 the PAL (whichever is greater). Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, report samples results which are < LOQ and >10X the blank. Otherwise, reprepare a blank and the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	Same as Method/SOP QC Acceptance Limits
Surrogates	ortho-Terphenyl,	%R must be within Katahdin's statistically-derived QC limits.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reprep within hold time.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within Katahdin's statistically-derived QC limits.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be reprep within hold time.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS/MSD	One per SDG or every 20 samples.	%R should be within Katahdin's statistically- derived QC limits. RPD ≤ 30%	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix; otherwise contact client.	Analyst, Supervisor, QA Manager	Precision/Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

SAP Worksheet #28-5: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Polycyclic Aromatic Hydrocarbons (Selected Ion Monitoring)

Analytical Method/ SOP Reference: SW-846 8270D / CA-213

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No target compounds > 1/2 LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
Surrogate	3 per sample: 2-Methylnaphthalene-d10 Fluorene-d10 Pyrene-d10	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits.	For QC and field samples, correct problem then reprepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reprepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits. Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix E-1 of DoD QSM v4.2). Contact Client if samples cannot be reprepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per SDG or every 20 samples. Full Scan MS/MSD may be applied.	%R should be within the same limits as for the LCS. RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
IS	Six per sample: 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of the ICAL midpoint.	Inspect mass spectrometer or gas chromatograph for malfunctions. Mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-6: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Organochlorine Pesticides

Analytical Method/ SOP Reference: SW846 8081B / CA-302

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix.	No target compounds > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
Surrogates	Two per sample: Decachlorobiphenyl Tetrachloro-m-xylene	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived or nominal QC limits.	For QC and field samples, correct problem then re-prepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparation batch of 20 or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits (Refer to Worksheet #28-6a). Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS/MSD	One per SDG or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be $\leq 30\%$.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/ Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be RPD $\leq 40\%$.	None. Apply qualifier if RPD $>40\%$ and discuss in the case narrative. The higher of the two results will be reported unless matrix interference is apparent.	Analyst, Laboratory Department Manager, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-7: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Polychlorinated Biphenyls (as Aroclors)

Analytical Method/ SOP Reference: SW846 8082A / CA-329

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix.	No target compounds > ½ LOQ and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits
Surrogates	Two per sample: Decachlorobiphenyl Tetrachloro-m-xylene.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived or nominal QC limits.	For QC and field samples, correct problem then re-prepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparation batch of 20 or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits (Refer to Worksheet #28-7a). Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS/MSD	One per SDG or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be $\leq 30\%$.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix, otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/ Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be $RPD \leq 40\%$.	None. Apply qualifier if $RPD > 40\%$ and discuss in the case narrative. The higher of the two results will be reported unless matrix interference is apparent.	Analyst, Laboratory Department Manager, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-8: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: ICP-MS Metals

Analytical Method/ SOP Reference: SW846 6020A / CA-627

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No target metals > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. For negative blanks, absolute value < LOD. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits
LCS	One per digestion batch of 20 or fewer samples of similar matrix.	%R must be within 80-120%, allowing for the marginal exceedances presented in DoD QSM Table G-1.	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
MS	One per digestion batch SDG or every 20 samples.	Same as Method/SOP QC Acceptance Limits for LCS.	Flag results for affected analytes for all associated samples with an "N."	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Post-digestion Spike	When dilution test fails or analyte concentration in all samples < 50x LOD	%R should be within 75-125%.	Run associated samples by method of standard addition or flag results.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Duplicate	One per digestion batch or SDG or every 20 samples.	Project-specific criteria: If values are ≥ 5x LOQ, RPD should be ≤ 20%. If values are < 5x LOQ, Absolute Difference should be ≤ LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Precision	RPD < 20%

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DOI	Measurement Performance Criteria
ICP Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x LOQ, 5-fold dilution must agree within $\pm 10\%$ of the original result.	Flag results for affected analytes for all associated samples with "E."	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
IS	Appropriate IS required for all analytes in all samples. Mass of IS must be <50 amu different from that of analyte	For each sample, IS intensity must be within 30-120% of that of initial calibration standard.	Reanalyze affected samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

SAP Worksheet #28-9: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Mercury (CVAA)

Analytical Method/ SOP Reference: SW846 7471B / CA-611

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No mercury > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. For negative blanks, absolute value < LOD. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per digestion batch of 20 or fewer samples of similar matrix.	Water and Sediment: %R must be within 80-120%.	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
MS	One per digestion batch or SDG or every 20 samples.	%R should be within 80-120% if sample < 4x spike added.	Flag results for affected analytes for all associated samples with "N."	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits for LCS.
Laboratory Duplicate	One per digestion batch or SDG or every 20 samples.	Project-specific criteria: If values are ≥ 5x LOQ, RPD should be ≤ 20%. If values are < 5x LOQ, Absolute Difference should be ≤ LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Precision	RPD < 20%
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ	NA	Analyst, Supervisor	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-10: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Surface and Subsurface Soil

Analytical Group: Hexavalent Chromium (SW-846 7196A)

Analytical Method/ SOP Reference: SW846 7196A / CA-625

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No analyte > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. For negative blanks, absolute value must be < LOD. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per digestion batch of 20 or fewer samples of similar matrix (varies by lot).	%R must be within 80-120%	Re-digest and reanalyze all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
Sample matrix verification (also known as matrix spike)	Once for every sample matrix analyzed.	Spike recovery within 85-115%.	If check indicates interference, dilute and reanalyze sample; persistent interference indicates the need to use alternative method or analytical conditions, or to use method of standard additions.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias/Contamination	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS (Soluble)	Once for every sample matrix analyzed.	Spike recovery within 75–125%.	First failure: Re-digest and reanalyze all associated samples for affected analyte and MSs and MSi analysis. Conduct ferrous iron, sulfide, and TOC analysis on matrix spike sample. Second failure: If reducing conditions are not indicated by the auxiliary analyses conducted, contact AECOM. Samples may be submitted for analysis by Method 7199.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS (Insoluble)	Once for every sample matrix analyzed.	Spike recovery within 75–125%.	First failure: Re-digest and reanalyze all associated samples for affected analyte and MSs and MSi analysis. Conduct ferrous iron, sulfide, and TOC analysis on matrix spike sample. Second failure: If reducing conditions are not indicated by the auxiliary analyses conducted, contact AECOM. Samples may be submitted for analysis by Method 7199.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Post-digestion Spike	One per preparatory batch	%R within 85–115%.	Correct problem and rehomogenize, redigest, and reanalyze samples. Persistent interference indicates the need to use an alternative method or analytical conditions, or to use method of standard additions.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Duplicate	One per preparatory batch	Project-specific criteria: If values are $\geq 5x$ LOQ, RPD should be $\leq 30\%$. If values are $< 5x$ LOQ, Absolute Difference should be \leq LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Precision	RPD $< 30\%$
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-18: Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4\)](#)

Matrix: Groundwater

Analytical Group: Volatile Organic Compounds (Full Scan)

Analytical Method/ SOP Reference: SW846 8260B / CA-202

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No target compounds > ½ LOQ (> LOQ for common laboratory contaminants) and > 1/10 the amount measured in any sample or 1/10 the PAL, whichever is greater. Blank result must not otherwise affect sample results (see DoD QSM Box D-1).	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Laboratory Department Manager, and Data Validator	Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
Surrogate	Four per sample: Dibromofluoromethane 1,2-Dichloroethane-d4 Toluene-d8 4-Bromofluorobenzene (BFB)	%R must be within DoD QSM limits.	For QC and field samples, correct problem then reprepare and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Contact Client if samples cannot be reanalyzed within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	%R must be within DoD QSM limits, if available; otherwise, within laboratory's statistically-derived QC limits (Refer to Worksheet #28-17a). Allow for the number of marginal exceedances presented in DoD QSM Table G-1.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be reanalyzed within hold time.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per SDG or every 20 samples.	%R should be within the same limits as for the LCS. RPD should be ≤ 30%.	Corrective actions will not be taken for samples when recoveries are outside limits if likely due to matrix; otherwise contact client.	Analyst, Laboratory Department Manager, and Data Validator	Precision/Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
IS	Four per sample: Pentafluorobenzene Chlorobenzene-d5 1,4-dichlorobenzene-d4 1,4-difluorobenzene	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of the ICAL midpoint standard.	Inspect mass spectrometer or gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Results between DL and LOQ	Not applicable (NA)	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Laboratory Department Manager, and Data Validator	Accuracy	Same as QC Acceptance Limits.