APPENDICES

APPENDIX A

SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN)

SAP Worksheet #1 – Title and Approval Page

FINAL
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
Remedial Action/Non-Time Critical Removal Action Installation Restoration Site 12 - Former Naval Station Treasure Island, San Francisco, California

September 2018

Prepared for:
Base Realignment and Closure Program Management Office - West
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Document Control Number: GLBN-0005-F4239-0011

Prepared under:
Contract Number N62473-17-D-0005
Contract Task Order CTO F4239

Reviewed by: Kristen Carlyon Peyton 9/13/18
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Program Chemist, Gilbane

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Quality Assurance Program Manager, Gilbane

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Joseph Arlauskas Date
Quality Assurance Officer
U.S. Navy, NAVFAC SW

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EXECUTIVE SUMMARY

INTRODUCTION

This Sampling and Analysis Plan (SAP) provides guidance to Gilbane Federal (Gilbane) and its project subcontractors in the performance of sampling and analysis to perform remedial action (RA) activities to be performed in the non-Solid Waste Disposal Areas (SWDA) within Installation Restoration (IR) Site 12 (Old Bunker Area) and to continue the Site 12 non-time critical removal action (NTCRA) at the Northpoint SWDA at the former Naval Station Treasure Island (NSTI) in San Francisco, California (Figure 1). Groundwater monitoring in the Gateview Arsenic/Total Petroleum Hydrocarbon (TPH) Area that is within IR Site 12 will also be performed. This SAP was prepared by Gilbane, as requested by the United States Department of the Navy (Navy) under the Radiological Multiple Award Contract (RADMAC II) Number N62473-17-D-0005, Contract Task Order (CTO) F4239, based on the Performance Work Statement (PWS) received from the Navy on March 22, 2017.

IR Site 12 contains soil and groundwater with elevated concentration of the following chemicals of concern (COCs).

- Soil
    - Lead
    - Polycyclic aromatic hydrocarbons (PAHs) as benzo(a)pyrene equivalents (BaP EQ)
    - Polychlorinated biphenyls (PCBs) as total Aroclors
    - Dioxins as 2,3,7,8- tetrachlorodibenzo-p-dioxin toxicity equivalent (TCDD TEQ)
- Groundwater
    - Arsenic
- Radium 226 (Ra-226) (applicable to both matrices)

As stated in the Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12 (Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island San Francisco, California (IR Site 12 Non-SWDA/Non-Radiological ROD; Navy, 2017), the Navy will address other chemical in soil, although these chemicals were not identified as COCs in the human health or ecological risk assessments. The Navy has identified remediation goals for pesticides and chromium. The other chemicals being addressed in soil are as follows:

    - Total Chromium
    - Pesticides (4,4-dichlorodiphenyldichloroethane [4,4-DDD] and alpha-benzene hexachloride [alpha-BHC]

The intent of this remedial action/NTRCA is to complete the work to support no further action for COCs in the IR Site 12 non-SWDAs and the North Point SWDA as described in the following documents:

- IR Site 12 Non-SWDA/Non Radiological ROD (Navy, 2017)
- *Action Memorandum/Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas, Installation Restoration Site 12, Old Bunker Area* (Navy, 2007).

The remedial/removal action objectives (RAOs) are to reduce risk to current and future residents by minimizing the dermal contact, incidental ingestion, and inhalation with soil containing known COCs. The RAOs will be achieved by excavating discrete locations of soil with COCs above the remediation goals (RGs) and disposing of the soil off-site. This includes confirming that Ra-226 soil concentrations are below the release criteria. Groundwater monitoring is associated with this project, but achieving the RAOs for groundwater is not a performance objective.

A secondary objective of the IR Site 12 non-SWDA remedial action is to collect radiological data representative of post-remedial action or “as-left” conditions of each excavation to refine the Site 12 conceptual site model (CSM) for non-SWDAs as to the presence and extent of radioactive contamination due to housing construction grading.

This SAP (Appendix A of the Work Plan) addresses critical requirements such as project organization and responsibilities, data quality objectives (DQOs), sampling design, field and analytical procedures, quality control (QC), and quality assurance (QA) for sampling at the former NSTI. The QA/QC elements in this SAP were prepared in accordance with the U.S, Environmental Protection Agency (EPA) Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP; EPA, 2005) and Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA, 2006) to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

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SAP Worksheets (Table of Contents)

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Acronyms

ºC	degrees Celsius
°F	degrees Fahrenheit
%R	percent recovery
amu	atomic mass unit
AOI	area of interest
BaP	benzo(a)pyrene
bgs	below ground surface
BCT	Base Closure Team
BRAC	Base Realignment and Closure
CA	corrective action
CARB	California Air Resources Board
CAS	Chemical Abstracts Service
CCB	continuing calibration blank
CCSF	City and County of San Francisco
CCV	continuing calibration verification
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
COC	chain of custody; chemical of concern
CSM	conceptual site model
CSO	Caretaker Site Office
CTO	Contract Task Order
CVAA	cold vapor atomic absorption
CY	cubic yard
D	difference
DER	Duplicate Error Ratio
DL	detection limit
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DQI	data quality indicator
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
EBS	environmental baseline survey
ECD	electron capture detector
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency Region 9
EU	exposure unit
EWI	Environmental Work Instruction

FCR	Field Change Request
FID	flame ionization detector
FS	Feasibility Study
g	gram(s)
GC	gas chromatograph
GFPC	gas flow proportional counting
Gilbane	Gilbane Federal
GPS	Global Positioning System
HHRA	Human Health Risk Assessment
HRASTM	Historical Radiological Assessment Supplemental Technical Memorandum
HRGC	high resolution gas chromatography
HRMS	high resolution mass spectrometry
IC	ion chromatography
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively coupled plasma spectrophotometer
ICP/MS	inductively coupled plasma/mass spectrometer
ICS	interference check solution
ICV	initial calibration verification
IR	Installation Restoration
IS	internal standard
IUPAC	International Union of Pure and Applied Chemistry
keV	kilo-electron volt(s)
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDR	Linear Dynamic Range
LOD	limit of detection
LOQ	limit of quantitation
LRPM	Lead Remedial Project Manager
m	meter(s)
MB	method blank
MDC	minimum detectable concentration
MDL	method detection limit
mg/kg	milligrams per kilogram
mL	milliliters
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level
NA	not applicable

NAVFAC SW	Naval Facilities Engineering Command Southwest
Navy	United States Department of the Navy
NCR	Nonconformance Report
NEDD	Navy Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
NSTI	Naval Station Treasure Island
NTCRA	Non-time critical removal action
OSHA	Occupational Safety and Health Organization
OU	Operable Unit
oz.	ounce(s)
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PA/SI	preliminary assessment and site inspection
Pb	lead
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PM	Project Manager
PMO-W	Program Management Office - West
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PSL	project screening limit
PT	performance testing
PWS	performance work statement
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QCPM	Quality Control Program Manager
QCSR	Quality Control Summary Report
QL	quantitation limit
QSM	Quality Systems Manual
Ra-226	Radium-226
RA	removal action
RAB	Restoration Advisory Board
RACR	Removal Action Completion Report
RADMAC	Radiological Multiple Award Contract
RAO	remedial/removal action objective
RAP	remedial action plan
RASO	Radiological Affairs Support Office
RAWP	Remedial Action Work Plan
RBC	risk-based criteria
RD	Remedial Design
RER	relative error ratio
RG	remediation goal

RI	Remedial Investigation
ROD	record of decision
ROICC	Resident Officer in Charge of Construction
RPD	relative percent difference
RPM	Remedial Project Manager
RSD	relative standard deviation
RSL	regional screening level
RSO	Radiation Safety Officer
RT	retention time
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDG	sample delivery group
SF	square foot/feet
SLERA	screening-level ecological risk assessment
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SVOC	semivolatile organic compounds
SWDA	Solid Waste Disposal Area
SWDIV	U.S. Navy, Southwestern Division
TBD	to be determined
TCRA	time-critical removal action
TEQ	toxicity equivalent
TI	Treasure Island
TICD	Treasure Island Community Development
TIDA	Treasure Island Development Authority
TPH	total petroleum hydrocarbons
TPH-e	total petroleum hydrocarbons - extractable
TPH-p	total petroleum hydrocarbons – purgeable
TSA	technical systems audit
TtECI	TetraTech EC, Inc.
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
UST	underground storage tank
Validata	Validata Chemical Services, Inc.
VOA	volatile organic analysis
VOC	volatile organic compounds
Water Board	San Francisco Bay Regional Water Quality Control Board
WWII	World War II

SAP Worksheet #2 – SAP Identifying Information

Site Name/Number:	**Former Naval Station Treasure Island**
Operable Unit:	**Installation Restoration Site 12**
Contractor Name:	**Gilbane Federal**
Contract Number:	**N62473-17-D-0005**
Contract Title:	**RAD MAC II**
Work Assignment Number (optional):	**CTO F4239**

1. This SAP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP; EPA, 2005) and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* (EPA, 2002). Additional guidance taken from the following sources:

- *Quality Systems Manual for Environmental Laboratories, Version 5.1* (QSM; U.S. Department of Defense [DoD], 2017)
- *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006)
- Environmental Work Instruction (EWI) #2, *Review, Approval, Revision, and Amendment of Sampling and Analysis Plans* EV3.2 (NAVFACSW, 2011)

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This SAP is a: Project-Specific SAP.

4. List dates of scoping sessions that were held:

Scoping/kickoff meeting	8/15/2017

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

Title	Date
*Final Sampling and Analysis Plan Non-Time Critical Removal Action for Bigelow Court Solid Waste Disposal Area, Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California (*CB&I)	5/9/2014
Final Sampling and Analysis Plan Non-Time Critical Removal Action, Solid Waste Disposal Areas Westside, Bayside, and North Point, Former Naval Station Treasure Island, San Francisco, California (CB&I)	6/19/2015
Final Sampling and Analysis Plan Time Critical Removal Action Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California (CE2-Kleinfelder)	7/20/2016

6. List organizational partners (stakeholders) and connection with lead organization:
Oversight by the California Department of Toxic Substances Control (DTSC); California Department of Public Health (CDPH), Division of Drinking Water and Environmental Management; the California

Regional Water Quality Control Board-San Francisco Bay Region (Water Board); and the United States Environmental Protection Agency (EPA), and the Treasure Island Development Authority (TIDA)

7. Lead organization:

U.S. Department of the Navy (Navy)

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

None

SAP Worksheet #2 – SAP Identifying Information (Continued)

SAP elements and required information that are not applicable to the project.

UFP-QAPP Worksheet #	**Required Information**	**Crosswalk to Related Information**
A. Project Management		
Documentation		
1	Title and Approval Page	
2	Table of Contents SAP Identifying Information	
3	Distribution List	
4	Project Personnel Sign-Off Sheet	
Project Organization		
5	Project Organizational Chart	
6	Communication Pathways	
7	Personnel Responsibilities and Qualifications Table	
8	Special Personnel Training Requirements Table	
Project Planning/ Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	
11	Site-Specific Project Quality Objectives	
12	Measurement Performance Criteria Table	
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	
14	Summary of Project Tasks	
15	Reference Limits and Evaluation Table	
16	Project Schedule/Timeline Table	
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Map(s)	
19	Analytical Methods/SOP Requirements Table	
20	Field Quality Control Sample Summary Table	
21	Project Sampling SOP References Table Sampling SOPs	
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	
24	Analytical Instrument Calibration Table	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	

SAP Worksheet #2 – SAP Identifying Information (Continued)

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	
Quality Control Samples		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	
Data Management Tasks		
29	Project Documents and Records Table	
30	Analytical Services Table Analytical and Data Management SOPs	
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	
32	Assessment Findings and Corrective Action Responses Table	
33	QA Management Reports Table	
D. Data Review		
34	Verification (Step I) Process Table	
35	Validation (Steps IIa and IIb) Process Table	
36	Validation (Steps IIa and IIb) Summary Table	
37	Usability Assessment	

SAP Worksheet #3 – Distribution List

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
David Clark	Navy Lead Remedial Project Manager (LRPM)	Base Realignment and Closure (BRAC) PMO West	619-524-6870	david.j.clark2@navy.mil
Leo Larson	Navy Remedial Project Manager (RPM)	BRAC PMO West	619-524-5257	llarson@scst.com
Joseph Arlauskas	Navy Quality Assurance Officer (QAO)	NAVFAC SW	619-532-4125	joseph.arlauskas@navy.mil
Dave Weyant	Radiological Technical Manager	Navy Radiological Affairs Support Office (RASO)	757-887-7650	david.weyant@navy.mil
Izzat Amadea	Navy Resident Officer in Charge of Construction (ROICC)	Navy San Francisco Bay Area	510-333-3889	izzat.amadea@navy.mil
Glenwood “Thomas” Ivey	Point of Contact	Navy Caretaker Site Office (CSO)	415-743-4729	glenwood.ivey@navy.mil
Sheetal Singh	Regulatory Agency Representative	CDPH	916-449-5691	sheetal.singh@cdph.ca.gov
Nina Bacey	Regulatory Agency Representative	DTSC	510-540-2480	juanita.bacey@dtsc.ca.gov
Nadia Hollan Burke	Regulatory Agency Representative	EPA	415-972-3187	burke.nadiahollan@epa.gov
Myriam Zech	Regulatory Agency Representative	Water Board	510-622-5684	mzech@waterboards.ca.gov
Robert P. Beck	Treasure Island Director	TIDA	415-274-0662	bob.beck@sfgov.org
John Baur	Project Manager (PM)	Gilbane	925-946-3212	jbaur@gillbaneco.com
Laura Tryboski	Quality Control Program Manager (QCPM)	Gilbane	925-946-3192	ltryboski@gillbaneco.com
Christopher Bryson	Site Radiation Safety Officer (RSO)	Envirachem	925-784-7719	chris.bryson@envirachem.com
Teresa Ruha	Project Quality Control Manager (PQCM)	Gilbane	925-946-3177	truha@gilbaneco.com
Kristen Carlyon Peyton	Program/Project Chemist	Gilbane	925-946-3180	kcarlyon@gillbaneco.com
Tony Olmstead	Site Superintendent	Gilbane	925-946-3365	tolmstead@gilbaneco.com
Ashish Mogera	Site Health & Safety	Gilbane	925-946-3172	amogera@gilbaneco.com

SAP Worksheet #4 – Project Personnel Sign-Off Sheet
(UFP-QAPP Manual Section 2.3.2)

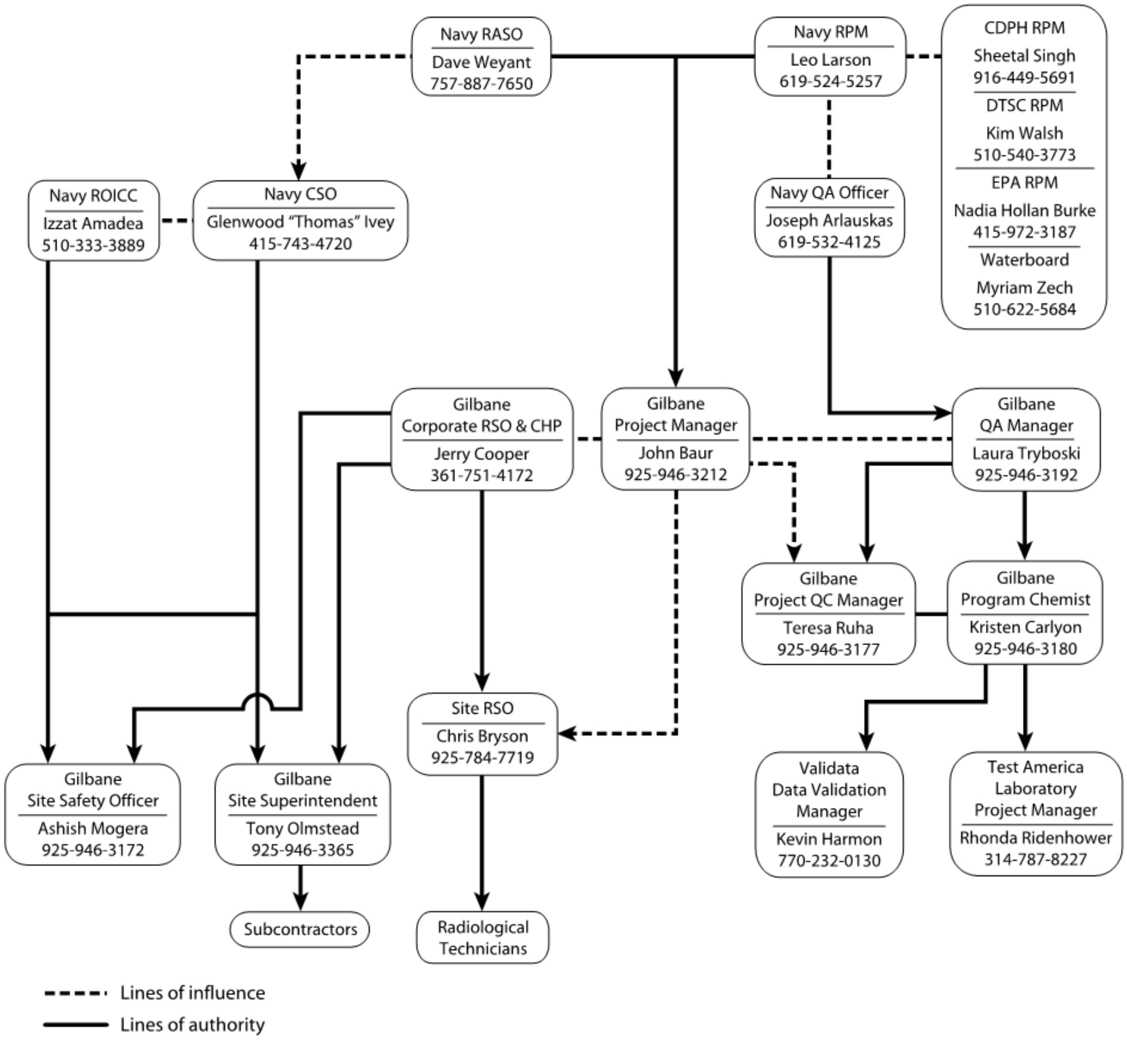
Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
John Baur	Gilbane/PM	925-946-3212		All	
Chris Bryson	Envirachem/Site RSO	925-784-7719			
Tony Olmstead	Gilbane/Site Superintendent	925-946-3365		All	
Teresa Ruha	Gilbane/PQCM	925-946-3177		All	
Rhonda Ridenhower	TestAmerica St. Louis/Laboratory PM	314-787-8227		All	
Kevin Harmon	Validata Chemical Services, Inc. (Validata)/Data Validator (3rd Party)	770-232-0130		All	
TBD[2]	Gilbane/Field Crew	Various		All	
TBD[2]	Gilbane/Field Crew	Various		All	
TBD[2]	Gilbane/Field Crew	Various		All	
TBD[2]	Gilbane/Field Crew	Various		All	

Note:

[1] To be determined. The indicated team member has yet to be selected. These fields will be completed before submission of the Final SAP.

[2] Field crew members will be selected at task startup. Persons identified by the PQCM will read the SAP and sign this worksheet as required. Their identities and the number of required personnel have not been determined at the time of publication.

SAP Worksheet #5 – Project Organizational Chart



SAP Worksheet #6 – Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Approvals	Navy QAO Navy RPM RASO	Joseph Arlauskas Leo Larson Dave Weyant	joseph.arlauskas@navy.mil llarson@scst.com david.weyant@navy.mil	Gilbane PM to request approval of SAP from QAO and approval of Remedial Action Work Plan (RAWP) from Navy RPM via email, with radiological review and concurrence of both plans to be obtained from RASO. Draft WP/Appendices to be submitted as hard copy to regulatory agencies for comments via email in 30 days. Gilbane PM to respond to regulatory comments via email within 2 weeks and revise as necessary to obtain concurrence on WP/Appendices. PM to acquire approval to initiate field work from Navy RPM and QAO after appropriate agency concurrence has been obtained.
Project management	Gilbane PM	John Baur	jbaur@gilbane.com	If changes are necessary, the PM communicates the changes via phone and/or email to the project staff and is authorized to stop work, if necessary. PM to provide Navy RPM and ROICC with all project-required notifications within 24 hours.
SAP review	Gilbane Program Chemist Gilbane QCPM	Kristen Carlyon Peyton Laura Tryboski	kcarlyon@gilbaneco.com ltryboski@gilbaneco.com	The SAP is written by the Program Chemist and reviewed by the QCPM prior to submittal to the Navy QAO for review.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
SAP procedure revision during field activities	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	The Project Chemist (or designee) will prepare a Field Change Request (FCR) for any minor changes in sampling procedures that occur due to conditions in the field.
SAP amendments	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	Significant changes to the SAP, such as the addition of sampling methods or analyses, will require that the Project Chemist prepare an addendum, which will be reviewed and approved by the Navy QAO prior to initiating the affected field activities. Any SAP addendum also will be submitted to the regulatory agencies for review. Regulatory agencies will be notified via email within 1 week of all significant changes to the SAP that do not require approval.
Notification of non-usable analytical data	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	If significant problems are identified by the laboratory or the project team that impact the usability of the data (i.e., the data is rejected or the DQOs are not met), the Project Chemist will notify the PM; Navy RPM and Navy QAO will be notified within 24 hours or the next business day.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Coordination of laboratory supplies for field sampling activities	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	The Project Chemist will contact the subcontract laboratory to provide necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered to the site prior to commencement of field sampling activities and throughout the course of the project.
Reporting laboratory data quality issues or analytical corrective actions	TestAmerica St. Louis/ Laboratory PM	Rhonda Ridenhower	rhonda.ridenhower@testamericainc.com	Data quality issues will be reported to the Project Chemist within 24 hours. Any corrective actions will be documented and verified by the Project Chemist, who will notify the PQCM, Site RSO (if applicable) and the PM in writing. The PM will notify the BRAC RPM and RASO (if applicable).
Stop work issues	All Gilbane and Navy Staff	Various	Various	The initiator of a stop work order verbally notifies Navy ROICC and Gilbane PM immediately. For stop work initiated by the Navy, the Contracting Officer must be verbally notified within 24 hours.
Field corrective actions	Gilbane PQCM	Teresa Ruha	truha@gilbaneco.com	Field corrective actions will be documented in writing by the PQCM, who will notify the Site RSO (if applicable) and PM in writing. The PM will notify the BRAC RPM and RASO (if applicable). Regulatory agencies will be notified via email within one week of all substantive field corrective actions.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table
(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Leo Larson	Navy Project Manager	BRAC PMO	Oversees project execution and coordination with site representatives, regulatory agencies, and Navy management. Actively participates in the DQO process, and provides management and technical oversight during data collection. Is notified of delays in or changes to field work and has authority to stop work and initiate corrective action at any time.
Joseph Arlauskas	Navy QAO	NAVFAC SW	Responsible for QA issues for all Navy work; provides government oversight of the QA program for contractors. Reviews and approves the SAP and any significant SAP modifications or amendments; has the authority to suspend project activities if Navy quality requirements are not met.
Dave Weyant	Project Manager	RASO	Reviews radiological laboratory on a routine basis. Performs on-site reviews of all radiological site operations. Reviews and approves final reports. Performs quality reviews on chains of custody (COCs) to ensure samples are handled in accordance with the Work Plan (WP) and SAP. Provides review and concurrence on data for proposed radiological actions. Ensures that all necessary sample results are provided and are consistent with proposed radiological actions.
Laura Tryboski	QC Program Manager (QCPM)	Gilbane	Reviews QC processes, issues corrective action orders; assures adherence to requirements of the QC program, including the QA/QC Plan, and SAP, as appropriate. Can receive communication from the PM, Program Chemist, PQCM, and field staff. Has the authority to stop work and initiate corrective action.
Teresa Ruha	PQCM	Gilbane	Implements field-related quality control activities, issues nonconformance reports (NCRs), initiates necessary rework and/or corrective actions, and communicates with the PM, QCPM, Superintendent, and Project Chemist.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
John Baur	Project Manager	Gilbane	Develops and implements all Task Order documents and activities. Assures overall project quality, implementation of three-phase quality control activities, and compliance with project schedule; and performs contract management, technical oversight, and report generation. Responsible for notifying the RPM of significant project information, including (but not limited to) project progress, schedule compliance, modifications to work, delays, analytical data quality issues, and safety-related issues.
Kristen Carlyon Peyton	Program/Project Chemist	Gilbane	Assists the QC Program Manager and assesses the propriety of the proposed analytical methodology; assists in the preparation of the SAP and with management of project tasks associated with sampling; reviews preservation requirements; coordinates SAP review/approval and other QA issues with the Navy QAO; conducts general oversight of and communication with the field personnel in relation to sampling activities; coordinates sample collection and analysis with the analytical laboratory; implements appropriate quality control activities and corrective actions; coordinates data validation activities and the uploading of data to appropriate databases. Coordinates third-party data validation of all definitive laboratory data. Reviews data validation reports.
Jerry Cooper	Corporate RSO/Certified Health Physicist	Gilbane	Oversees overall radiological operations. Insures that Site RSO and filed sampling personnel have adequate training in radiological sample collection. Oversees the preparation of remediation plans and the performance of remediation activities when sampling activities indicate the presence of radioactive materials at levels above the release criteria. Acts as a technical resource for radiological data collection for analysis, and technical discussions with stakeholders. Reviews radiological data to ensure the DQOs have been met. Provides critical analysis and interpretation of radiological data.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Chris Bryson	Site RSO	Envirachem	Supervises day-to-day radiological operations. Oversees performance of radiological static surveys. Collects and maintains records of instrument calibration and maintenance. Collects and maintains completed survey forms, chain of custody records, field log sheets, and other field data. Integrates field, graphical information system (GIS), and global positioning system (GPS) data and plot data on maps.
Tony Olmstead	Superintendent	Gilbane	Conducts oversight of all field activities; ensures implementation of individual elements of site or task-specific work plans; oversees the work of subcontractors performing field-related tasks; and oversees the collection of samples and coordinates shipments with laboratories. Ensures that the sampling protocol is followed in accordance with the SAP.
Rhonda Ridenhower	Laboratory PM	TestAmerica St. Louis	Performs chemical analyses; assures compliance with project requirements regarding performance of analytical procedures; supplies sample containers; handles and preserve samples in accordance with project-specified protocols.
Kevin Harmon	Data Validator	Validata	Performs data validation on analytical data used for project decisions.

SAP Worksheet #8 – Special Personnel Training Requirements Table
(UFP-QAPP Manual Section 2.4.4)

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Radiation-impacted area sampling	Radiation Safety Awareness Training	Gilbane	Prior to field work	All project field personnel	Gilbane / Excavation or Demolition Subcontractors	Gilbane, Concord, CA

Training Requirements

Project personnel are required to meet the U.S. Occupational Safety and Health Organization (OSHA) training requirements defined in Title 29 Code of Federal Regulations (Title 29 CFR) Part 1910.120(e). These requirements are: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. In addition, training will be provided to all field team members working in radiation-impacted areas according to the requirements of 10 Code of Federal Regulations (CFR) 19.12, Instructions to Workers.

SAP Worksheet #9 – Project Scoping Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1)

Project Name:	Former Naval Station Treasure Island
Site Name:	Installation Restoration Site 12
Site Location:	San Francisco, California
Projected Date(s) of Sampling:	March 2018 through June 2018
Project Manager:	John Baur
Date of Scoping Session:	August 15, 2017
Scoping Session Purpose:	Describe scope of work

Scoping Session Participants:

Name	Title	Affiliation	Phone	E-mail Address	Project Role
Dave Clark	Lead RPM	Navy BRAC	619-524-6870	David.j.clark@navy.mil	Lead RPM
Chris Yantos	RPM	Navy BRAC	619-524-6023	Christopher.yantos@navy.mil	RPM
John Baur	Project Manager	Gilbane	925-946-3212	jbaur@gilbaneco.com	PM

Comments/Decisions:

No decisions were made at the scoping meeting. The following issues were discussed:

- Community relations logistics will need to be worked out and closely coordinated by Gilbane and Navy.
- Project Schedule and sequencing of field work.
- Submittal of Project Plans.
- Changes in Navy organization for the project. New RPM will be starting and will take over as RPM for this project. Will work very closely with Chris and Dave.

Action Items:

(1) Gilbane to revisit project schedule regarding duration of field work for continuing excavation of the previously started NTCRA.

(2) Navy will provide schedule for tenants moving out of buildings scheduled to be demolished so Gilbane can schedule boarding and fencing the buildings.

(3) Navy will look into availability of B570 for office use during RA.

Consensus Decisions:

No consensus decisions were reached at the meeting.

SAP Worksheet #10 – Problem Definition

(UFP-QAPP Manual Section 2.5.2)

As the lead federal agency, the Navy, including RASO, is working with DTSC and the Water Board to develop and implement the remedial action/NTCRA. These entities make up the planning group. The Navy coordinates activities at NSTI with the regulatory agencies under the terms of the 1992 Federal Facility Site Remediation Agreement. Navy, DTSC, and Water Board representatives are collectively referred to as the BRAC Cleanup Team (BCT) for NSTI. In addition, the CDPH works with DTSC to provide technical support on the radiological program. Other agencies and organizations also provide support to the BCT and the environmental program, including TIDA, the Treasure Island Community Development (also known as TICD), the Restoration Advisory Board (also known as RAB), the EPA, and other public groups.

The intent of this remedial action/NTCRA is to complete the work to support no further action for COCs in the IR Site 12 non-SWDAs and the North Point SWDA. The RAOs are to reduce risk to current and future residents by minimizing the dermal contact, incidental ingestion, and inhalation with soil containing known COC concentrations by excavating discrete locations with COCs above their RGs and disposing of the soil off-site. This includes confirming that Ra-226 soil concentrations are below release criteria. Groundwater monitoring is associated with this project, but achieving the RAOs for groundwater is not a performance objective. A secondary objective of this project is to collect radiological data representative of post-remedial action or "as-left" conditions of each excavation to refine the Site 12 CSM for areas outside of the SWDAs; specifically to address the presence and extent of radioactive contamination due to housing construction grading.

10.1 Site Description and History

NSTI is located in the City and County of San Francisco (CCSF), California, between San Francisco and Oakland in the San Francisco Bay (Figure 1). NSTI consists of two contiguous islands connected by a causeway. Treasure Island encompasses approximately 403 acres, and the southern island, Yerba Buena Island, encompasses approximately 147 acres. Treasure Island was constructed of materials dredged from the San Francisco Bay from 1936 to 1937 for the Golden Gate International Exposition of 1939 and 1940. Yerba Buena Island is a natural rock island (Navy, 2017).

In 1940, the U.S. Department of the Navy (Navy) began leasing TI from the CCSF and later, during World War II, gained full ownership of Treasure Island. The island became a major Navy base and was used primarily for training, administration, housing, and other support services to the U.S. Pacific Fleet. In 1993, the Base Realignment and Closure (BRAC) Commission, pursuant to the Defense BRAC Act of 1990, recommended closure of NSTI. The base was closed on September 30, 1997 (Navy, 2017).

Site 12 is located on the northeastern part of the island (Figure 1). During the Golden Gate International Exposition in 1939 and 1940, the majority of the area that now encompasses IR Site12 was used for vehicle parking. After the Navy took over the lease of NSTI and throughout the 1940s, 1950s, and 1960s, ammunition bunkers were located in the northern half of IR Site 12.

SAP Worksheet #10 – Problem Definition (Continued)

From the early 1940s until about 1968, 21 ammunition bunkers were located in the IR Site 12 area. Disposal units and general solid waste disposal areas (SWDAs) were in the vicinity of some bunkers. The southern part of IR Site 12 also included part of a former runway, general storage, fueling station, and miscellaneous buildings. From approximately 1966 to 1988, four military housing series (1100, 1200, 1300, and 1400 series) were constructed at IR Site 12. The 1100, 1200, 1300 and 1400 series buildings were completed in 1966, 1969, 1974 and 1988, respectively (Navy, 2017).

Site 12 was entered in the CERCLA process in 1988 because of findings in the Final Preliminary Assessment/Site Inspection report (Dames and Moore, 1988). These findings documented the potential for soil and groundwater contamination from debris that may not have been entirely removed during housing construction. The concentrations and distribution of COCs and solid waste within the residential housing areas are uncertain because the distribution of solid waste and COCs resulting from grading operations is variable. In 2002, the Site 12 boundary was expanded to include all existing residential areas (Navy, 2017).

10.2 Site Characteristics

The prevailing wind direction for the Bay area is from the northwest. Wind speed is less than 6 miles per hour more than 50 percent of the time and exceeds 12 miles per hour approximately 10 percent of the time. The strongest winds are associated with winter storms. In the winter, winds from the north and east sometimes bring low temperatures to the Bay area. Westerly winds predominate during the summer when cool marine air flows east toward the warm Central Valley region of California. These winds are strongest in the late afternoon and early evening (TriEco-Tt, 2012).

Temperature at Treasure Island is influenced by the Pacific Ocean and the resulting maritime climate. Temperature data have been collected at the Oakland Museum (the nearest weather station) for a 30-year period of record. The average annual temperature is 59.5 degrees Fahrenheit (°F), the average summer temperature is 64.8 °F, and the average winter temperature is 52.2 °F. The warmest month of the year is usually September (average temperature 74.6 °F). Daily extremes for the period of record are 107 °F (recorded on June 8, 1973) and 26 °F (recorded on December 9, 1972) (Navy, 1987). Mean annual evaporation is 48 inches; the greatest evaporation occurs during July (Navy, 1987).

Precipitation data have been collected at the Oakland Museum for a 30-year period of record. The average annual precipitation is 21.3 inches. The average precipitation by season is the spring is 4.8 inches in spring, 0.3 inches in summer, 4.3 inches in fall, and 11.9 inches in winter. Approximately 90 percent of the annual precipitation occurs from November to April with 19.2 inches of rain. Localized showers are infrequent and storms are generally moderate in duration and intensity. The maximum rainfall recorded in a 24-hour period was 4.74 inches on January 4, 1982. Mean annual evaporation is 48 inches; the greatest evaporation occurs during July (Navy, 1987).

SAP Worksheet #10 – Problem Definition (Continued)

Relative humidity during the winter is approximately 50 to 60 percent during the day, increasing to approximately 80 to 90 percent at night. Humidity decreases in the spring; however, by summer, it increases when frequent fogs occur, particularly at night or in the morning. Humidity is lowest in the fall, ranging from approximately 50 percent during the day to 70 percent at night (Navy, 1987).

Treasure Island is a relatively flat manmade island, consisting primarily of sediment dredged from the Bay and retained by a perimeter of rock and sand dikes. In general, the soil found is poorly graded, fine-grained sand with occasional discontinuous lenses of silt and clay. The groundwater table is encountered at an average depth of approximately 5 feet below ground surface (bgs) but may be shallower in the removal action areas. Generally, groundwater flow is radial from the center of the island toward the shoreline.

IR Site 12 is flat, consisting of open grassy areas between buildings, paved roads, and parking areas.

Site 12 was leased to TIDA, and TIDA subsequently subleased select housing units. Currently, Site 12 contains residential buildings (about 900 housing units) that are two-story structures constructed with slab-on-grade foundations with four to eight residential units per building.

Following environmental restoration of the site, the entirety of IR Site 12 will be transferred to the CCSF. Redevelopment plans by the CCSF are described in the Naval Station Treasure Island Reuse Plan-Public Review Draft (CCSF, 1996) and the Treasure Island/Yerba Buena Island Final Environmental Impact Report (CCSF, 2011). Redevelopment plans include designated areas for Residential/Open Space/Publicly Oriented Uses/Shoreline Open Space.

10.3 Previous Investigations and Removal Actions

Table 10-1, adapted from Table 1 of the Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12(Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island, San Francisco, California (ROD/Final RAP; Navy, 2017) summarizes the previous investigations completed for Site 12 in the first section, followed by the previous and ongoing removal actions in the second section.

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
PA/SI	1988	A PA/SI (preliminary assessment/site inspection) was completed for NSTI to identify and assess sites where contamination from past hazardous materials operations posed a potential threat to human health or the environment. The PA/SI identified 26 sites at NSTI including Site 12. Site 12 was identified based on the ammunition bunkers, cell-type disposal units, and general debris disposal areas.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Preliminary Risk Assessment	1992	A preliminary risk assessment was completed to assess potential health risks from exposure to contamination at Site 12. The Navy performed a geophysical survey using ground-penetrating radar. Soil samples were collected from areas with ground-penetrating disturbances and debris areas. Soil samples were analyzed for metals, pesticides, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Based on the results, additional soil samples were collected. The results of the soil sampling were included in the remedial investigation (RI) data set.
Groundwater Monitoring	1992-present	The Navy has conducted groundwater monitoring at Site 12 since 1992. The groundwater monitoring identified elevated concentrations of arsenic in groundwater in the vicinity of Buildings 1311 and 1313 (now known as the Gateview Arsenic/TPH Area). Elevated petroleum concentrations in soil and groundwater were also reported in that area. The elevated concentrations were most likely the result of releases from a suspected former waste oil tank in the area. In 2005, an investigation into the elevated concentrations of arsenic concluded that the petroleum conditions caused naturally occurring arsenic in soil to be mobilized into the groundwater.
Tidal Mixing Studies	1995-2002	In 1995, an initial study assessed the inland extent of tidal influence on near-shore groundwater levels at former NSTI. During the first study, fluctuations in the groundwater table between high and low tides ranged from 1.81 feet at a distance of 30 feet from San Francisco Bay to 0.12 foot at a distance of 250 feet from San Francisco Bay. The tidal fluctuation in San Francisco Bay was measured at 5.37 feet during the corresponding period. A follow-up study was performed between December 2001 and March 2002 to assess the degree of subsurface mixing of groundwater and surface water immediately inland of the shore at Treasure Island. The findings from these studies estimated that physical mixing of surface water and groundwater takes place over distances ranging from 60 to 150 feet inland of the Treasure Island mean lowest low water shoreline.
Ambient Metals Studies	1996-2001	Ambient concentrations were established for metals in soil and groundwater to assess whether the presence of any metal was the result of a site-specific release or if it was from naturally occurring or regional anthropogenic sources. A study of the ambient concentrations of metals in soil was conducted in 1996; the ambient groundwater metals concentrations study was completed in 2001. These studies are included as Appendices D and E of the final Site 12 RI report.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	**Date**	**Investigation Summary**
Previous Investigations		
Draft Final Onshore RI	1997	An RI was completed for all sites identified in the PA/SI, including Site 12, to assess the nature and extent of potential petroleum and metals contamination and to evaluate whether the debris disposal areas, former ammunition bunker areas, and the former buried oil tank (in the Gateview Arsenic/TPH Area were continuing sources of contamination. The RI was completed in three phases (I, IIA, and IIB). Phase I consisted of installing and monitoring four groundwater monitoring wells. Phase IIA, consisted of completing groundwater hydraulic parameter tests, a tidal influence study, and groundwater sampling. Phase IIB consisted of collecting two to three soil samples and one groundwater sample from each of the 108 direct-push borings. The samples were analyzed for VOC, SVOCs, TPH, explosives, metals, and dioxins at selected locations. Results of the RI indicated that metals, PAHs, and TPH concentrations were detected throughout the site, and dioxins were detected in localized areas. PAHs, VOCs, pesticides, PCBs, explosives, metals, and TPH were detected in groundwater, with VOCs and TPH being detected most frequently in the southwestern corner of the site. After this RI, the Site 12 boundary was expanded to include a rubbish disposal area (SWDA A & B, now referred to as SWDA Westside).
EBS	1997-1998	The Navy completed an environmental baseline survey (EBS) in 1997 and a revision to the EBS in 1998. Reuse Zone 4 encompasses most of Site 12 and included EBS parcels T96, T97, T100, T101, and T103. The EBS provided recommendations for areas suitable for lease, and areas where restrictions should be applied until further investigation was completed.
Draft Site 12 Operable Unit RI	1999	In early 1998, Site 12 was separated from the other onshore sites based on the additional data collected at Site 12 and unexpected delays in completing the onshore RI report. In addition, the City of San Francisco had announced its plans to lease the former housing areas within the site as public rental units. The RI concluded that risks associated with SWDA Westside and the remainder of the site were within the risk management range of 10^{-4} to 10^{-6} for residential users, recreational users, commercial/industrial users, and construction workers. The noncancer hazard risk for all users was less than 1, except for residential exposure to surface soil in SWDA Westside, which was equal to 1. Lead in soil at both the SWDA Westside and the remainder of the site was found at concentrations well below the screening concentrations for the residential user based on the DTSC blood lead model and modified DTSC model.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Exploratory Trenching and Sampling	2000-2003	The Navy pothole sampled back yards in Buildings 1205 and 1211 in August 2000. There were no significant detections in the backyards of Building 1205. There were varied detections of lead, PCBs, and PAHs above screening criteria in the four Building 1211 backyards. The Navy conducted additional trenching and sampling at 15 buildings scheduled for leasing. Sampling results identified three hotspots. Two hotspots were outside previously known areas of contamination and the third was behind Building 1413. Interim measures such as fencing off areas of known debris contamination and installation of cover in several backyards of occupied residents were also undertaken. Fencing was installed around SWDA Westside, SWDA Bayside, and SWDA North Point. Warning signs were posted around the perimeter of the fenced area. Back yards where samples exceeded criteria were covered with either sod or concrete pavers. In September and October 2003, the Navy conducted additional trenching, excavating 581 exploration trenches, seven step-out trenches, and seven step-out hand auger locations and collected samples. The investigation was limited to common areas outside of the SWDAs, specifically excluding areas previous remediated, areas scheduled for future remediation, and hardscape areas. The results of this investigation helped further refine the SWDA boundaries.
Initial Soil Gas Investigation with SWDA A & B (now known as SWDA Westside)	2000	The Navy completed a shallow soil gas survey to investigate potential VOCs and methane generation and migration within the SWDA A & B and to evaluate the nature and extent of VOC and methane suspected during previous investigations at Site 12. Soil gas samples were collected from 70 locations within Site 12. VOCs were present at concentrations exceeding screening criteria in only one location, near Building 1323. Methane was detected at numerous locations in SWDA Westside, Northpoint Drive, and Gateview Avenue areas. Additional soil gas samples were collected to delineate these VOC and methane detections. The results of the step-out sampling delineated the extent of VOC contamination to a small area between Building 1323 and a riprap area. The methane detections in the SWDA Westside, Northpoint Drive, and Gateview Avenue areas correlated with natural gas pipelines. In January 2002, the Navy capped the natural gas pipeline in the SWDA, allowed remaining gas to dissipate, and then resampled locations along the line. Results showed methane was no longer present at concentrations exceeding screening criteria. Methane in soil gas at concentrations above screening criteria continued to be detected near Buildings 1319 and 1321. Chloromethane was detected in soil gas samples collected from the vicinity of Building 1323 within SWDA Westside and in indoor air at Building 1323. However, chloromethane from soil gas was determined not to be the source of the chloromethane in indoor air because concentrations in soil gas were low.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Offshore Sediment RI	2001	In 1996, the Navy designated the offshore area at NSTI as its own OU. The offshore area of Site 12 was designated as Area G. Sampling included chemical analysis of sediment, stormwater, and sediment pore water. One of the primary focuses of the sampling was to evaluate potential contamination to offshore sediment from stormwater outfalls. The RI found that chemical concentrations in the sediment were low and no debris was present in the sediment. As a result, the RI concluded that no further action was necessary for Area G of the offshore sediment. The Navy and the state signed a No Action ROD for the offshore sediment in 2005.
HRA	2006	An Historical Radiological Assessment (HRA) was completed in 2006 to designate sites on former NSTI as either impacted by radionuclides, meaning the site has, or at one time had, the potential for residual radioactive contamination; or non-impacted, meaning there is no reasonable possibility for residual radioactive contamination. The HRA found the four SWDAs (SWDA Westside, SWDA Bayside, SWDA North Point, and SWDA Bigelow Court) could contain radioluminescent devices. Therefore, radiological surveys were recommended for the SWDAs. The HRA also identified the USS Pandemonium, a full-scale mockup of a patrol craft training ship used for radiological decontamination training. It was located on the northwest part of Treasure Island, at what is currently part of Site 12, until 1969. The HRA concluded that the former location of the USS Pandemonium was not impacted.
SLERA	2007	An ecological survey of Site 12 was conducted in March 2006 as part of a screening-level ecological risk assessment (SLERA) for former NSTI. The survey concluded that Site 12 consisted of residential areas with landscaped vegetation and that former NSTI was not a natural ecosystem. The SLERA concluded that no further evaluation of ecological risk was necessary for Site 12 because of the overall poor quality of habitat on former NSTI and because future exposure would be limited to species adapted to urban, landscaped habitats similar to what was currently present.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Technical Memorandum for PCBs in Indoor Air at Halyburton Court, IR Site 12	2007	In October 2000, indoor air sampling was conducted at Halyburton Court, focusing on Building 1100. Results indicated the presence of low-molecular-weight PCBs that are potentially volatile and could partition in the vapor phase. Additional samples were collected, and the Navy completed an evaluation of the vapor intrusion pathway. Buildings 1100, 1102, 1104, and 1106 in Halyburton Court have remained unoccupied as a result of the analysis.
Targeted Investigation of Volatile Organic Compounds in Soil Gas	2009	The Navy investigated VOCs in soil gas to characterize the vapor intrusion pathway and identify any existing soil gas plumes. Soil vapor from 95 distinct locations within four areas (Exposure Units [EUs] 8, 15, and 17 and Area of Interest [AOI] Mariner Drive) was sampled an analyzed in a mobile laboratory. The Navy collected an additional 40 samples in other EUs to augment the risk assessment dataset where samples for VOCs had not been previously collected for soil gas or groundwater. Benzene was the only compound that exceeded its individual California Human Health Screening Level (CHHSL) at three locations (two in EU 16 and one in EU 10). Benzene was the largest contributor to the risk at the location where the cumulative CHHSL was exceeded. No soil gas plumes were identified. Methane detections were attributed to subsurface natural gas pipelines, and on further investigation by the San Francisco Public Utilities Commission were found not to be a hazard with no major pipeline leakage.
RI	2012	The Navy completed an RI for Site 12 to: (1) characterize site conditions; (2) evaluate the nature and extent of contamination in soil, groundwater, and soil gas; and (3) assess the risk to human health and the environment. Site 12 was divided into two regional areas: Site 12 north and Site 12 south. Site 12 north and south were further subdivided into 19 EUs, six AOIs, seven groundwater exposure areas, and the four SWDAs. Three petroleum areas were identified: (1) the Building 1311/1313 area (now known as the Gateview Arsenic/TPH petroleum area); (2) the Mariner Drive petroleum area, located 600 feet inland from the northern shore of the island; (3) suspected UST 267, located near the northeastern corner of Site 20 within Site 12. The Navy was unable to locate the underground storage tank (UST), and it was concluded that the UST did not exist. In 2003, the Water Board concurred with the Navy's request for no further action for UST 267. A total of 4,039 samples were collected from Site 12 (3,607 soil samples, 322 water samples, and 110 soil gas samples). The samples were analyzed for TPH, VOCs, SVOCs, pesticides, PCBs, metal, explosives, and dioxins and furans. Sampling results were compared with screening criteria to identify chemicals that exceeded the screening criteria. Chemicals in soil exceeding the screening criteria include petroleum, PAHs,

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
		PCBs, pesticides, metals, and dioxins. Chemicals in groundwater exceeding the screening criteria include petroleum and metals. Chemicals in soil gas exceeding the screening criteria include benzene and chloroform. A baseline human health risk assessment (HHRA) was also completed in the RI.
FS	2014	The Navy completed a feasibility study (FS) to: (1) supplement the site characterization information from the 2012 RI with a data gaps investigation; (2) identify applicable or relevant and appropriate requirements (ARARs); (3) identify RAO and remediation goals; and (4) evaluate remedial alternatives. The Navy completed a data gaps investigation and documented the results in the FS. The objective of the data gap investigation was to define the lateral and vertical extent of the COCs identified in the RI. The data gaps investigation included collection of samples to define the lateral and vertical extent of contamination for: • Lead at EU 6, EU 7, EU 14, and AOI Mariner Drive • Hexavalent chromium at EU 4, EU 5, and AOI Mariner Drive • Dioxins and furans at EU 16, EU 17, AOI 1201/1203/1220, and AOI Mariner Drive • PCBs at EU 9, AOI 1254, AOI Halyburton/Bigelow Court • PAHs at EU 5 and EU 6 • Pesticides at AOI 1254 • TPH Data indicated that the lateral and vertical extent of lead were defined, and lead was retained as a COC for EU 6, EU 7, EU 14, and AOI Mariner Drive. Data indicated that hexavalent chromium was present at EU 4, EU 5, and AOI Mariner Drive, so chromium was retained as a COC for these locations. Data indicated the lateral and vertical extent of PCBs were defined at EU 9 and AOI Halyburton/Bigelow Court, and PCBs were retained as a COC at these locations. Data also confirmed the removal of PCB contamination at AOI 1254 from a previous removal action, so PCBs were not retained as a COC for AOI 1254. Data indicated the lateral and vertical extent of PAHs at EU 5 and EU 6 were defined, so BaP EQ was retained as a COC for these locations. Data confirmed the removal of pesticide contamination at AOI 1254 when the previous PCB removal action was completed. Data indicated that the lateral and vertical extent of the TPH in the Gateview Arsenic/TPH Area were defined. The alternatives developed and evaluated in the FS were superseded by the alternatives developed and evaluated in the FS addendum.
HRASTM	2014	In 2014, the Navy completed additional research to better understand the radiological materials that were found on Treasure Island and the historical disposal processes for the low-level radioactive waste. As a result of the research, new areas at former NSTI were designated as potentially radiologically impacted. This area included all of Site 12, because it was a

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
		former site of the USS Pandemonium and a gyro compass repair shop, and the presence of the SWDAs (which was identified in the HRA) with the potential for low-level radiological objects or contamination to have been spread outside of the SWDAs during development of the housing areas. The Historical Radiological Assessment Supplemental Technical Memorandum (HRASTM) recommended a characterization survey, remediation of radiologically impacted areas, and a gamma walkover survey for areas outside the radiologically impacted SWDA boundaries. The ROD/Final RAP does not address potential radiological contamination at Site 12. Radiological contamination is being addressed by separate CERCLA documents.
FS Addendum	2015	The Navy completed an FS addendum to: (1) update site characterization information from the 2012 RI and 2014 FS with another data gaps investigation; (2) investigate potential contamination from a rubbish area identified on historical figures; (3) reassess the 2007 SLERA; (4) present basis for no further action determination at groundwater exposure area GW-S5 based on monitoring results; and (5) develop and evaluate remedial alternatives. Eight trench locations were excavated to assess the presence and extent of contamination in the rubbish area. The trenches were dug approximately 4 feet wide by 6 feet long and up to 8 feet bgs. Data indicate that there is no chemical contamination above remediation goals in the eight trenches and household debris was discovered only in trenches 6 and 7, and was minimal and localized. Soil sampling was performed in EU 3, EU 4, and EU 19 to assess a discrepancy in data for PAHs and in EU 17 to address a discrepancy in data for dioxins. Data from the data gaps sampling indicated that PAHs are not present at concentrations above the remediation goal in the discrepancy locations in EU 3, EU 4. As a result PAHs were not retained as a COC for EU 3 and EU 4. Data also indicated that PAHs were not present above the remediation goal in locations identified as having a discrepancy in data at EU 19; however, concentrations of PAHs above the remediation goal remain at other locations. As a result, BaP EQ was retained as a COC for EU 19. Data confirmed the dioxin contamination at EU 17, so 2,3,7,8-TCDD TEQ was retained as a COC for EU 17. Soil samples were collected in eight EUs and three AOIs to assess whether contamination extended underneath buildings. Results of the data gaps sampling indicated that lead, dioxins, and PCBs did not extend underneath buildings; however, PAHs at concentrations above the remediation goal extended underneath Building 1217. Samples were also collected in the Gateview Arsenic/TPH area to further define the lateral and vertical extent of petroleum contamination. Results from the data gaps sampling indicated that petroleum contamination did not extend

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
		outside of the previously defined source area. Soil gas samples were collected to further define the lateral and vertical extent of soil gas COCs in EU 16. Results from data gaps sampling indicate that concentrations of benzene in soil gas are no longer detectable and do not require further investigation or remediation. Groundwater monitoring conducted from 2007 to 2009 indicated concentrations of arsenic in groundwater have been below the screening criteria (36 µg/L) since 2008. Based on the results, no further action is necessary for groundwater area GW-S5.
Previous and Ongoing Removal Actions		
Removal Action of Lead-Contaminated Soil, SWDA Bayside and North Point	1999-2000	A soil removal action for lead was conducted in 1999 in the vicinity of Buildings 1207 and 1209 in the northern portion of IR Site 12 in which approximately 2,200 cubic yards of soil were excavated and replaced with clean fill. As a result of the findings, the additional investigations in August 2000 in the vicinity of Buildings 1235, 1205, and 1211 lead to the expansion of SWDA North Point to include Building 1235 and the back yard of Building 1237 Unit A, and SWDA Bayside to include Building 1211.
Removal Action of PCB-Contaminated Soil, Halyburton Court Area	2000	Soil investigations in late 1999 revealed soil concentrations of PCBs that exceeded the cleanup goal of 1 mg/kg in the Halyburton Court area. The Navy undertook a removal action to excavate and dispose of PCB-contaminated soil off-site. The excavation also removed collocated concentrations of PAHs. Soil was excavated to a maximum depth of 4 feet bgs in an approximately 2-acre area. Confirmation samples collected from the floor of the excavation at depths below 4 feet bgs and in some sidewalls beneath structures indicated PCBs exceeding 1 mg/kg were left in place. Approximately 11,300 cubic yards of soil was removed. Excavated soil was transported off site for disposal. The removal action was completed in August 2000.
Time-Critical Removal Action for PCB- and PAH-Contaminated Soil	2002	In October 2001, the Navy undertook a time-critical removal action in the area behind Building 1413 in Flounder Court, Building 1252 Exposition Drive, Building 1254 13th Street, and Buildings 1246 and 1248 Gateview Court. The objective of the removal action was to remove soil contaminated with lead, PCBs, and PAHs. The maximum depth of the excavations was 4 feet bgs. Approximately 800 cubic yards of soil was removed. Excavated soil was transported off site for disposal. The removal action was completed in January 2002.

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Phase I Non-Time-Critical Removal Action for PCBs, PAHs, Dioxin/Furans, Lead, and Ra-226 at SWDA Northpoint	2007	In 2007, the Navy undertook a non-time-critical removal action at at SWDA North Point. The objective of the project was to remove soil contaminated with lead, PCBs, PAHs, and dioxin/furans. The maximum depth of the excavations was 4 feet bgs. Six sidewall sample locations with chemical results above the project action levels were left in place to avoid comprising the structural integrity of adjacent buildings. Six Ra-226 samples with results counted by the on-site gamma spectroscopy lab with results exceeding the project screening criterion were also left in place. These samples were located along building foundations or at the edge of the project-specified excavation extent.
Previous and Ongoing Removal Actions		
Time-Critical Removal Action for Soil at IR Site 12	2015-2017	In October 2015, the Navy signed an action memorandum that documented its decision to undertake another removal action for soil at Site 12. The removal action will address petroleum contamination in the Gateview Arsenic/TPH Area and discrete locations of soil in the southern portion of Site 12. The Navy will excavate the petroleum contaminated soil in the Gateview Arsenic/TPH source area near Buildings 1311 and 1313 and will add a biostimulation compound to further treat the petroleum. The objective of this portion of the removal action is to remove and treat the residual petroleum that creates conditions conducive to reducing concentrations of arsenic that have leached from the soil into the groundwater. The Navy demolished Buildings 1311 and 1313 to reach the contaminated soil. In addition, the Navy excavated discrete locations of soil dispersed throughout the southern portion of Site 12. The Navy removed soil contaminated with lead, PAHs, PCBs, and dioxins and furans. The Navy demolished Buildings 1100, 1102, 1104, and 1106[2] to reach the contaminated soil. The removal action began in April 2016 and was completed in August 2017.
Phase III Non-Time-Critical Removal Action for PCBs, PAHs, Dioxin/Furans, Lead, and Ra-226 at SWDA Northpoint	2017	In 2017, the Navy undertook a non-time-critical removal action (NTCRA) at at SWDA North Point. The objective of the NTCRA was to address the residual material that exceeded the project screening criteria identified in the 2007 Phase I NTCRA, and to collect additional data to address data gaps enabling SWDA North Point to meet unrestricted radiological release requirements and chemical no further action status. Approximately 15,000 cubic yards was excavated. The maximum depth of the excavations was 4 feet bgs. The work was stopped due to lack of funding at the time.

SAP Worksheet #10 – Problem Definition (Continued)

Notes:

[1] The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Site 12.

[2] In addition to Buildings 1100, 1102, 1104, and 1106, the following buildings have been demolished in Site 12: 1101, 1103, 1119, 1121, 1123, 1125, 1127, 1133, 1207, 1209, 1211, 1213, 1231, 1233, 1235, 1313, 1319, 1321, 1323, and 1325.

As described above, the *Final Feasibility Study Addendum for Installation Restoration Site 12, Old Bunker Area, Non-Solid Waste Disposal Area, Former Naval Station Treasure Island, San Francisco, California* (FS Addendum; KCH, 2015) outlines the nature and extent of contamination at Site 12 as summarized for this project in Section 10.4. The ROD/Final RAP (Navy, 2017) contains the details of the remedial action for the site as described for this project on Worksheet 17.

10.4 Nature and Extent of Contamination

As described in the ROD/Final RAP (Navy, 2017), the contamination at Site 12 resulted from waste disposal activities by the Navy previously identified on site and from existing debris that was not removed during housing construction. The chemicals potentially released at Site 12, including metals, dioxins and furans, PCBs and PAHs, are mostly attributed to waste disposal (including burning) activities by the Navy. The remedial action detailed in this SAP and RAWP is necessary to address potential risk to current and future residential receptors from dermal contact, ingestion, and inhalation of contaminants in soil. The remedial action will also address potential risk to off-site aquatic receptors in San Francisco Bay from arsenic-contaminated groundwater. (This portion of the remedial action was completed per the TCRA [CE2Kleinfelder, 2016] in 2017.)

A description of the components of the remedial action follow:

- 58 non-SWDA discrete excavations
  - 10 feet wide, 10 feet long, and depths to be determined based on Table 17-1.
- 2 building demolitions
  - Building 1126 (80 feet wide, 170 feet long); 4 feet of soil beneath the building is to be excavated.
  - Building 1217 (80 feet wide, 130 feet long); 4 feet of soil beneath the building is to be excavated.
  - Continuation of the excavation of the North Point SWDA NTCRA.

10.5 Remediation Goals

The COCs and their associated RGs are presented in Table 10-2. The values for the IR Site 12 non-SWDA remedial action COCs are taken from the ROD/Final RAP (Navy, 2017). The values for the North Point SWDA NTCRA COCs are the same as those for the non-SWDA remedial action. They are found in the Action Memorandum/ Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas Installation Restoration Site 12 Old Bunker Area Naval Station Treasure Island San Francisco, California (Action Memo; Navy, 2007).

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-2: Chemical Remediation Goals for Soil and Groundwater

Constituent	**Remediation Goals**	
	Soil (mg/kg)	**Groundwater[1] (ug/L)**
Lead	400	--
Total Chromium	280[2]	--
PAHs as BaP EQ	0.62	--
PCBs at total aroclors	1.0	--
Pesticide (4,4-DDD)	2.0[3]	--
Pesticide (alpha-BHC)	0.077[3]	--
Dioxins as 2,3,7,8-TCDD TEQ	12 ng/kg	--
Arsenic	N/A	36[4]

Notes:

1. TPH does not have a goal for groundwater. Qualitatively, the goal for dissolved TPH will be mass reduction via target cleanup goals in soil (including any measurable free product) to support the numeric remedial goal for arsenic in groundwater.
2. Total chromium is not a COC. However, the Navy will excavate isolated locations with an RBC goal of 280 mg/kg.
3. Pesticides (4,4-DDD and alpha-BHC) are not COCs. However, the Navy will excavate isolated locations with an RBC goal of 2.0 and 0.077, respectively.
4. Goal from Tier 1 Screening-Level Ecological Risk Assessment for Treasure Island (IR Sites 6, 12, 21, 24, 30 31, 32, and 33), Naval Station Treasure Island, San Francisco, California prepared by SulTech for U.S. Department of the Navy, BRAC PMO West, March 23.

Acronyms:

mg/kg	milligrams per kilogram	ug/L	micrograms per liter
ng/kg	nanograms per kilogram	RBC	risk-based concentration

The radionuclide of concern is Ra-226. Soil sampling will include confirming that soil concentrations are below the release criteria given in Table 10-3, which are from the revised Performance Work Statement for this task order dated May 4, 2017.

Table 10-3: Radiological Release Criteria for Ra-226

Materials Release Criteria	Table 3 of U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 8.23, *Radiation Safety Surveys at Medical Institutions* (NRC, 1981)
Soil Screening Level[1]	1.0 picocuries per gram (pCi/g) plus background, or 1.69 pCi/g
Soil Release Criteria	RESRAD modeling using 12 millirem per year and/or site specific data
Water	Currently, there are no release criteria and/or screening levels for water.

[1] Statewide Radiation Protection Plan – Revision 1, Treasure Island, San Francisco, California (CB&I, 2014)

This remedial action/NTCRA will also include radiological controls, surveying, screening, potential object retrieval, characterization, and sampling to ensure worker(s) and community health and safety within the project area footprint(s) as is described in the Radiological Management and Demolition Plan.

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

Step 1 **State the Problem**

IR Site 12 contains soil with concentrations of COCs above the PSLs (WS #15) which include PAHs, selected pesticides, PCBs, dioxin/furans, chromium, and/or lead. These COCs may potentially pose a risk to current and future Treasure Island residents and utility workers if not remediated. Radiological contamination has been detected in soil at IR Site 12 above the screening criteria (WS #15); confirmation sampling for radium-226 of excavations and radiological screening of excavated soils and removed buildings will be performed.

Step 2 **Identify the Goals of the Study**

The goals of the sampling activities are:

- Remove contaminated soil from the non-SWDA locations (SAP Worksheet # 18 and Figure 2), the footprints of Building 1126 and 1217 (Figure 2), and Northpoint SWDA (Figure 3).
- Determine whether imported fill materials meet acceptance criteria presented on SAP Worksheet #15.6 through #15.14.
- Document final concentrations of PAHs, selected pesticides, PCBs, dioxin/furans, chromium, lead, and/or radium-226 left-in-place in completed excavation areas (shown on Figure 2 and 3).
- Supplement the existing dataset consisting of monitored natural attenuation (MNA) parameters in groundwater at the Gateview Arsenic/TPH area (Figure 4) with four quarters of sampling for TPH, radium-226, total and dissolved metals, total dissolved solids (TDS), total suspended solids (TSS), sulfate, and ferrous iron in monitoring wells as listed on SAP Worksheet #18 to be provided to the basewide groundwater monitoring contractor.
- Collect radiological data representative of post-remedial action or "as-left" conditions of each excavation to better inform the IR Site 12 conceptual site model for non-SWDAs as to the presence and extent of radioactive contamination due to housing construction grading.
- Collect radiological data representative of groundwater in the Gateview TPH/Arsenic area to support the planned Feasibility Study Addendum.

The Study Questions Are:

- Do imported fill materials meet the acceptance criteria?
- Are concentrations of PAHs, selected pesticides, PCBs, dioxin/furans, chromium, lead, and/or radium-226 left-in-place below project screening limits (SAP Worksheet #15.1 through #15.6) after excavation?
- Are TPH and geochemical parameter data from the Gateview Arsenic/TPH area wells (SAP Worksheet #18) of quality suitable for supporting the basewide MNA program?

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 3 **Identify Information Inputs**

The following inputs will be used to make decisions for this project:

- Previous IR Site 12 soil sampling results that represent current in-place conditions, and the site-specific RAOs presented in the PWS.
- Post-excavation dioxin/furan, pesticide, PCB, PAH, lead, and chromium, and Ra-226 confirmation soil samples.
- Sampling of imported fill material per DTSC guidance (dependent on source of fill).
- Groundwater elevation and sampling data from 13 wells in the Gateview Arsenic/TPH area as listed on SAP Worksheet #18.

Step 4 **Define the Boundaries of the Study**

Figure 2, "IR Site 12 Non-SWDA Remedial Action Map," shows the estimated extent of excavations of the footprints of buildings 1126 and 1217 and the proposed discrete excavation areas. The total estimated volume with benching for all proposed excavations is 4,000 bank cubic yards (CY).

The Northpoint SWDA excavation area is located along the northern portion of Site 12 (Figure 3). The total estimated volume with benching for the excavations is 4,000 bank cubic yards (CY).

The project duration for the field activities of this RA is approximately 16 months, with excavation beginning and ending in September of 2018 and with groundwater monitoring completed in December 2019.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 5	**Develop the Analytical Approach**

The decision rules for this RA are:

Excavation and Confirmation Sampling:

- If, after initial excavation, concentrations of BAP EQ, TCDD TEQ, selected pesticides, total Aroclors, chromium, lead, and/or Ra-226 in confirmation samples are below their respective PSLs (WS #15-1 through 15-6) (or for COCs, chromium, and selected pesticides where the PSL is less than the limit of quantitation [LOQ], the COC, chromium, or selected pesticide is not detected), at the excavation boundaries (perimeter and bottom), then those samples are considered final.
- If, after initial excavation, confirmation sample concentrations of BAP EQ, TCDD TEQ, selected pesticides, total Aroclors, chromium, lead, and/or Ra-226 are above their respective PSLs (WS #15-1 through 15-6) (or for COCs, chromium, and selected pesticides where the PSLs are less than the LOQ and the COC, chromium, or selected pesticide is detected between the detection limit [DL] and LOQ) at the excavation boundaries (perimeter or bottom), then step-out(s) and/or over-excavation will be performed and additional confirmation samples collected in accordance with the Work Plan and Worksheet #17.

Imported fill material:

- If the required sampling frequency meets the requirements outlined in the DTSC *Information Advisory Clean Imported Fill Material* and the results meet the acceptance criteria presented in Worksheets #15-6 through #15-14, then the source will be considered suitable for backfill.
- If the required sampling frequency does not meet the requirements outlined in the DTSC *Information Advisory Clean Imported Fill Material*, and/or results do not meet the acceptance criteria presented in Worksheets #15-6 through #15-14, then the source will not be considered suitable for backfill.

Groundwater Sampling at Gateview Arsenic/TPH Area:

- If the results of the dataset for the groundwater monitoring have been validated and are complete, then they will be transferred to the Navy for supplementing the basewide groundwater MNA dataset.
- If the concentrations of COCs exceed the project screening criteria as listed on WS #15.15 though WS #15.17, then the results will be used to delineate the extent of contamination and to support site evaluations during the preparation of the planned FS Addendum.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 6	**Specify Performance or Acceptance Criteria**
To limit uncertainty in obtained environmental data, criteria for the precision, accuracy, representativeness, completeness, comparability, and sensitivity parameters and reporting limits for the chemicals of concern have been developed to meet the PSLs for the RA. Measurement errors will be controlled by using appropriate sampling and analytical methods, adhering to the Department of Defense (DoD) Quality Systems Manual (QSM) (version 5.1), following established SOPs, and having third-party data validation to verify laboratory processes. The field crews will review the SAP before sample collection to limit sample collection errors. The subcontract analytical laboratory will have a copy of the SAP and will adhere to DoD QSM guidance to limit measurement errors.	
Step 7	**Develop Plan for Obtaining Data**
A resource-effective plan for collecting data sufficient to fulfill study objective developed in Steps 1 through 6 of the DQO process is described in SAP Worksheet #17.	

SAP Worksheet #12 – Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table – Field QC Samples

Matrix: Soil

QC Sample[1]	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample (Assesses Error for Sampling [S], Analytical [A] or both [S&A])
Field Duplicate[1]	All	Not Applicable	Precision	Not Applicable	S & A
Equipment Rinse Blanks	Dioxin/Furans, VOCs, SVOCs/PAHs, TPH, Pesticides, PCBs, Metals	None if disposable sampling equipment used; 1 per day if using non-disposable sampling equipment	Accuracy/Bias – Contamination	< ½ limit of quantitation (LOQ)	S
Matrix Spikes[2]	Dioxin/Furans, Metals, VOCs, SVOCs/PAHs, PCBs, Pesticides, TPH	5%; one per 20 samples collected	Precision/Accuracy	Laboratory statistically derived control limits	A
Temperature Blanks[3]	Mercury, VOCs, SVOCs, PCBs, Pesticides, TPH, Cyanide	Every cooler shipped to the laboratory	Representativeness	< 6 degrees Celsius (°C)	S

Notes:

[1] Due to the heterogeneous distribution of contaminants typically found in soil matrix, field duplicates for soil samples are not considered reliable for determining precision, and will not be collected for this project. Sample data are not qualified based on field duplicate precision; matrix spike duplicate or lab replicate data will be used to access sample precision.

[2] Per DoD QSM 5.1.1 Table B-17 matrix spikes are not required for gamma spectroscopy.

[3] There are no temperature preservation requirements for metals, radionuclides, or asbestos; therefore, no temperature blanks are required.

SAP Worksheet #12 – Measurement Performance Criteria Table (Continued)

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table – Field QC Samples

Matrix: Water

QC Sample	Analytical Group[1]	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample (Assesses Error for Sampling [S], Analytical [A] or both [S&A])
Field Duplicate	TPH, Total and Dissolved Metals	10%	Precision	Relative percent difference (RPD) ≤40%	S & A
Trip Blank	TPH-g	1 per day	Representativeness	No analyte greater (>) than ½ LOQ	S & A
Equipment Blank	TPH, Total and Dissolved Metals	None if dedicated sampling equipment used; 1 per day if using non-dedicated sampling equipment	Accuracy/Bias – Contamination	< ½ limit of quantitation (LOQ)	S

Notes:

[1] Sulfate, TDS, and TSS are not COCs, have no screening criteria, and are being collected for informational purposes only. For this reason, no equipment blanks or field duplicates are necessary to achieve the data quality objectives for these parameters.

SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

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**
Historical Data	*Final Preliminary Assessment /Site Inspection (PA/SI), Naval Station Treasure Island, California. Prepared for Department of the Navy, Facilities Engineering Command, Naval Energy and Environmental Support Activity.* (April 1988)	Dames and Moore	Assessment of site conditions	None
Historical Data	*Final Phase III Non-Time Critical Removal Action, Solid Waste Disposal Areas, IR Site 12, Former Naval Station Treasure Island, San Francisco, California.* (June 2015)	CB&I	Assessment of site conditions	None.
Historical Data	*Final Post-Construction Summary Report, Non-Time Critical Removal Action for Bigelow Court, Solid Waste Disposal Area, IR Site 12, Former Naval Station Treasure Island, San Francisco, California.* (October 2015)	CB&I	Assessment of site conditions	None
Historical Data	*Final Feasibility Study for Installation Restoration Site 12, Old Bunker Area Non-Solid Waste Disposal Ares, Naval Station Treasure Island, San Francisco, California.* (March, 2014)	KCH	To guide work yet to be completed.	None

SAP 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**
Historical Data	*Final Feasibility Study Addendum for Installation Restoration Site 12, Old Bunker Area Non-Solid Waste Disposal Ares, Naval Station Treasure Island, San Francisco, California.* (June 2015)	KCH	To guide work yet to be completed.	None
Design Plans	*Proposed Plan/Draft Remedial Action Plan, Former Naval Station Treasure Island, Installation Restoration Site 12 (Excluding Solid Waste Disposal Areas and the Radiological Program.* (March 2016)	Navy	To guide work yet to be completed.	None

SAP Worksheet #14 – Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

14.1 Major Sampling Tasks

Tasks applicable to sampling activities performed by Gilbane for this project at IR Site 12 will include the following:

- Collect pre-excavation confirmation samples to determine the extent of soil contamination prior to excavation.
- Construct and operate RSY pads.
- Excavate soil with PAH, Dioxin/Furan, selected pesticides, chromium, lead, and/or Ra-226 contamination above the PSLs and collect post-excavation confirmation samples.
- Backfill excavated areas with clean imported fill.
- Perform quarterly sampling of monitoring wells in Gateview Arsenic/TPH Area.
- Review and validate data, and upload to Naval Installation Restoration Information Solutions (NIRIS).

14.1.1 Sample Collection Procedures

The following sections provide the sampling procedures for collection of samples associated with remediation activities for this project. Samples will be labeled, documented, and packaged according to procedures in SAP Worksheets #27 and 29. The types of samples to be collected are listed below:

Excavation Soil Samples

Soil samples will be collected from excavation sidewalls and bottom using disposable plastic scoops in accordance with Gilbane SOP PR-TC-02.02.01.01 (Attachment A). Samples will be collected either directly from shallow excavations or from the backhoe/excavator bucket using the general sampling technique described below:

1. Put on a new (unused) pair of sampling gloves and other appropriate personal protective equipment (PPE).
2. Obtain a new (unused) disposable sampling scoop (or other non-disposable decontaminated sampling equipment).
3. If the excavation is less than 4 feet in depth or is sloped, the excavation may be entered for sample collection.
4. If the excavation is greater than 4 feet and un-sloped, then the excavation will not be entered for sampling. Direct the backhoe operator to obtain a sample from the desired location. Allow excess water, if present, to drain from the soil before collecting the sample.
5. Collect the sample for the remaining analysis into the appropriate sample containers using a disposable sampling scoop. Sample containers are listed in SAP Worksheet #19.
6. Label, package, and prepare the samples for shipment to the laboratory in accordance with SOP PR-TC-02.04.01.01 (Attachment A).

SAP Worksheet #14 – Summary of Project Tasks (Continued)

7. Place the chemistry samples in an ice-filled cooler in accordance with SOP PR-TC-02.04.01.01 (Attachment A) after collection.

Terra Core® Soil Samples for Imported Fill Material Samples
Soil samples for VOC or TPH-p analyses will be collected using TerraCore sampling devices (or equivalent) following the procedure described in Gilbane SOP PR-TC-02.02.01.05 (Attachment A).

All samples will be documented, handled, and shipped in accordance with the provisions set forth by Worksheet #27.

Groundwater Elevation Measurements
Groundwater elevation measurements will be collected prior to groundwater sample collection in accordance with Gilbane SOP PR-TC-02.03.09.00 (Attachment A).

Groundwater Sampling Procedure
Groundwater sampling will be conducted using the low-flow technique in accordance with Gilbane SOP PR-TC-02.02.02.03 (Attachment A). Each well will be analyzed for the parameters listed on WS #18, in addition to the following field parameters: pH, temperature, conductivity, turbidity, oxidation-reduction potential (ORP), dissolved oxygen, and ferrous iron.

Dedicated bladder pumps are installed for most wells with a diameter larger than 1-inch. If the well does not have a dedicated pump, or the pump is not functional, then a decontaminated portable pump will be installed and lowered to the appropriate depth. The depth will be recorded on the sampling form (an example of which is found as an attachment to SOP PR-TC-02.02.02.03). If the well diameter will not accommodate a bladder pump, a peristaltic pump may be used to sample the well.

14.1.2 Decontamination Procedures

Prior to decontamination, non-disposable sampling equipment will be wiped down and radiologically surveyed. Total radioactivity will be measured using a hand-held alpha/beta survey meter. A smear sample will be collected and analyzed for removable radioactivity. If radioactivity exceeding the release limits shown below in Table 14-1 is detected, the sampling equipment will be wiped down again and re-surveyed.

Table 14-1

Type of Radiation	Removable (disintegrations per minute [dpm]/100cm^2	Total (dpm/100cm^2)
Alpha	20	100
Beta	1,000	5,000

Note: To eliminate the need for isotopic identification, alpha radioactivity is assumed to be Ra-226. An industry-standard default value is used for beta radioactivity since there are no beta-emitting ROCs.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

Once radioactivity is below the release limits, the non-disposable sampling equipment that comes into contact with samples will be decontaminated to prevent the introduction of extraneous material into samples, and to prevent cross-contamination between samples. All equipment will be decontaminated by steam cleaning or by washing with a non-phosphate detergent such as Liquinox^{TM} or equivalent. Decontamination water will be collected in 55-gallon U.S. Department of Transportation (DOT)-approved drums or a poly tank and handled as liquid waste in accordance with the Waste Management Plan.

The following procedures will be used to decontaminate non-disposable sampling equipment:

1. If mud or soil is adhering to the sampling equipment, first rinse with potable water. This step will decrease the gross contamination and reduce the frequency at which the non-phosphate detergent and water solution need to be changed.
2. Wash with the non-phosphate detergent and water solution. This step will remove remaining contamination from the equipment. Dilute the non-phosphate detergent as directed by the manufacturer.
3. Rinse with potable water. Change the water frequently.
4. Rinse twice with deionized water. This step will rinse any detergent solution and potable water residues. Rinsing will be done by applying the deionized water from a clean squeeze bottle (or equivalent) while holding equipment over a bucket.
5. Store unused decontaminated equipment in plastic or designated storage container to prevent contamination until next use.

14.4 Post-Sampling Field Tasks

Waste characterization and disposal will be performed as detailed in the Waste Management Plan (Appendix B of the RAWP). Site restoration and surveying will be performed as detailed in Section 8.1, and Section 6.0, respectively, of the project RAWP.

14.2 Analytical Tasks

The handling of the samples and transferring of custody must be well documented given the evidentiary nature of the analytical data. The integrity and traceability of samples from the time they are collected through the time the data are reported are essential in any sampling and analysis program. Sample custody and procedures are described in WS #27. Sampling locations and analytical methods are described further in WS #18 through #20.

14.3 Quality Control Tasks

Analytical methods will require the applicable QC tasks described in the respective methods and DoD QSM 5.1.1, including initial calibrations, continuing calibrations, tuning, reagent blanks, surrogates, replicates, control spikes, and others, as necessary.

Media-specific field quality control samples (as described on SAP Worksheet #12) include field duplicates to assess sampling and analytical precision, as well as trip blanks

SAP Worksheet #14 – Summary of Project Tasks (Continued)

and equipment blanks to assess sampling and analytical accuracy.

14.4 Data Management and Review Tasks

Analytical data generated by the fixed analytical laboratory will be reviewed by the laboratory using three levels of document review and reporting. Review processes will be documented using appropriate checklists, forms, or logbooks, which will be signed and dated by the reviewers. Field surveying data, field forms, and chain-of-custody (COC) records will be reviewed by the PQCM and/or the Project Chemist and maintained in the Gilbane project file in accordance with Gilbane standard operating procedure (SOP) PR-TC-01.04.01.00, Field Documentation.

The Site Superintendent or PQCM will e-mail a copy of the COC records to the Project Chemist the day any samples are sent to the laboratory. The Project Chemist will maintain a copy of the COC record until submitted to the Navy Administrative Record along with the hard-copy packages as described in SAP Worksheet #29. The laboratory will e-mail definitive analytical results within the turnaround time to the Project Chemist. This submittal will include surrogates, and matrix spike/matrix spike duplicates (MS/MSDs). The Project Chemist will review prior to distribution to the project team. Following this submittal, the laboratory will be required to submit a DoD Stage 2A-, 2B- or 4-suitable data packages package within 10 business days of the sample collection date as described in SAP Worksheet #29.

Information from the COC records for samples analyzed by the laboratory will be uploaded into a database following the procedures outlined in Gilbane SOP PC-TR-02.12.02.00, Sample Tracking and Electronic Data Management. The laboratories will provide electronic data deliverables (EDDs) in order to upload analytical results into the Gilbane database. The EDD will be checked for required values and project-specific requirements. Any discrepancies in the EDD will be corrected by the laboratory. Validated results will be exported for upload to NIRIS in accordance with Environmental Work Instruction (EWI) #6, Environmental Data Management and Required Electronic Delivery Standards (U.S. Navy, Southwest Division [SWDIV], 2005). The database will be backed up on electronic media or an independent server.

Survey data will be recorded by on-site personnel for all sample locations. Horizontal control information for upload into the database will be captured in the State Plane Coordinate System in feet, and vertical control standards will be in mean sea level. Survey data for upload into the NIRIS will be in accordance with EWI #6, (SWDIV, 2005).

DoD Stage 2B and Stage 4 hard-copy data packages will be stored until subsequent submittal to the Navy Administrative Record as described in SAP Worksheet #29.

14.5 Third Party Data Validation

Analytical results that represent definitive data will be validated by a third-party data validation service provider. The validation report is described in SAP Worksheet #29, and the validation qualifiers will be entered electronically in the Gilbane project database by the validator to the EDDs loaded by the laboratory.

SAP Worksheet #15.1 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Polycyclic Aromatic Hydrocarbons (PAHs) by EPA 8270DSIM

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[2] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Acenaphthene	80-23-9	NA	NA	0.0066	0.005	0.001	0.00047
Anthracene	120-12-7	NA	NA	0.0066	0.005	0.001	0.000395
Benzo(a)anthracene	56-55-3	NA	NA	0.0066	0.005	0.001	0.000303
Benzo(a)pyrene	50-32-8	NA	NA	0.0066	0.005	0.001	0.000399
Benzo(b)fluoranthene	205-99-2	NA	NA	0.0066	0.005	0.002	0.000505
Benzo(k)fluoranthene	207-08-9	NA	NA	0.0066	0.005	0.002	0.000760
Benzo(g,h,i)perylene	191-24-2	NA	NA	0.0066	0.005	0.003	.00100
Chrysene	218-01-9	NA	NA	0.0066	0.005	0.001	0.000347
Dibenz(a,h)anthracene	53-70-3	NA	NA	0.0066	0.005	0.003	0.00120
Fluoranthene	206-44-0	NA	NA	0.0066	0.005	0.001	0.000293
Fluorene	86-73-7	NA	NA	0.0066	0.005	0.001	0.00049
Indeno(1,2,3-cd)pyrene	193-39-5	NA	NA	0.0066	0.005	0.001	0.000479
Naphthalene	91-20-3	NA	NA	0.0066	0.005	0.001	0.000307
Pyrene	129-00-0	NA	NA	0.0066	0.005	0.001	0.000350
PAHs as BAP (EQ)[2]	NL	0.62	TI RBC[1]	NA	NA	NA	NA

Notes:

[1] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012)
[2] PAHs as benzo(a)pyrene equivalency [BAP (EQ)] will be calculated as described on Worksheet 17.2.
[3] Results will be reported on a dry-weight basis for comparison to the project action limits.
mg/kg = milligrams per kilogram
NA = not applicable
NL = not listed

SAP Worksheet #15.2 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Dioxin/Furans by EPA Method 8290

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit² (ng/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ng/kg)	Laboratory-specific		
					LOQ (ng/kg)	LOD (ng/kg)	DL (ng/kg)
2,3,7,8-TCDD	1746-01-6	NA	NA	1	1	0.40	0.15
1,2,3,7,8-PeCDD	40321-76-4	NA	NA	5	5	0.75	0.30
1,2,3,4,7,8-HxCDD	39277-28-6	NA	NA	5	5	2.0	0.71
1,2,3,6,7,8-HxCDD	57653-85-7	NA	NA	5	5	2.0	0.58
1,2,3,7,8,9-HxCDD	19408-74-3	NA	NA	5	5	2.0	0.58
1,2,3,4,6,7,8-HpCDD	35822-39-4	NA	NA	5	5	1.0	0.46
OCDD	3268-87-9	NA	NA	10	10	4.0	1.5
2,3,7,8-TCDF	51207-31-9	NA	NA	1	1	0.40	0.11
1,2,3,7,8-PeCDF	57117-41-6	NA	NA	5	5	0.75	0.27
2,3,4,7,8-PeCDF	57117-31-4	NA	NA	5	5	0.75	0.29
1,2,3,4,7,8-HxCDF	70648-26-9	NA	NA	5	5	0.75	0.30
1,2,3,6,7,8-HxCDF	57117-44-9	NA	NA	5	5	1.0	0.38
1,2,3,7,8,9-HxCDF	72918-21-9	NA	NA	5	5	1.0	0.43
2,3,4,6,7,8-HxCDF	60851-34-5	NA	NA	5	5	0.75	0.30
1,2,3,4,6,7,8-HpCDF	67562-39-4	NA	NA	5	5	1.0	0.38
1,2,3,4,7,8,9-HpCDF	55673-89-7	NA	NA	5	5	2.0	0.65
OCDF	39001-02-0	NA	NA	10	10	4.0	1.2
Dioxins as 2,3,7,8-TCDD TEQ	NL	12	TI Ambient Level[1]	NA	NA	NA	NA

Notes:

[1] TriEco-Tt, 2012. Final Remedial Investigation for IR Site 12 Naval Station Treasure Island San Francisco, California. June. The 2,3,7,8-TCDD TEQ (Dioxin TEQ) is based on the 2,3,7,8-TCDD congener and is calculated as described in Worksheet 17.

SAP Worksheet #15.2 – Reference Limits and Evaluation Table (Continued)

[2] Results will be reported on a dry-weight basis for comparison to the project action limits.

ng/kg = nanograms per kilogram
DL = detection limit
EMPC = estimated maximum potential concentration
HpCDD = heptachlorodibenzo-p-dioxin
HpCDF = heptachlorodibenzofuran
HxCDD = hexachlorodibenzo-p-dioxin
HxCDF = hexachlorodibenzofuran
LOD = limit of detection
NA = not applicable
NL = not listed
OCDF = octachlorodibenzofuran
PeCDD = pentachlorodibenzo-p-dioxin
PeCDF = pentachlorodibenzofuran
QL = quantitation limit
TCDD = tetrachlorodibenzo-p-dioxin
TCDF = tetrachlorodibenzofuran

SAP Worksheet #15.3 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Pesticides by EPA Method 8081B

Analyte	**Chemical Abstracts Service (CAS) Number**	**Project Screening Limit**[3] (mg/kg)	**Project Screening Limit Reference**	**Project Quantitation Limit Goal** (mg/kg)	**Laboratory-specific**		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
Alpha-BHC	319-84-6	0.077	TI RBC[2]	0.04	0.00170	0.0005	0.000220
4,4-DDD	72-54-8	2.0	TI RBC[2]	1.0	0.00170	0.0005	0.000260

Notes:

[1] Pesticides (4,4-DDD and alpha-BHC) are not COCs. However, the Navy will excavate isolated locations with the TI RBC goals presented above.

[2] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012).

[3] Results will be reported on a dry-weight basis for comparison to the project action limits.

mg/kg = milligrams per kilogram

SAP Worksheet #15.4 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: PCBs by EPA 8082A

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Aroclor 1016	12674-11-2	NA	NA	0.033	0.033	0.01	0.0034
Aroclor 1221	11104-28-2	NA	NA	0.033	0.033	0.015	0.0052
Aroclor 1232	11141-16-5	NA	NA	0.033	0.033	0.02	0.0064
Aroclor 1242	53469-21-9	NA	NA	0.033	0.033	0.02	0.0074
Aroclor 1248	12672-29-6	NA	NA	0.033	0.033	0.015	0.0057
Aroclor 1254	11097-69-1	NA	NA	0.033	0.033	0.01	0.0027
Aroclor 1260	11096-82-5	NA	NA	0.033	0.033	0.010	0.0029
Total Aroclors[1]	NL	1.0	TI RBC[2]	NA	NA	NA	NA

Notes:
[1] Total Aroclors will be calculated by summation of the seven listed Aroclors. Non-detected values will be included in the sum as one-half the value of the LOD.
[2] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012).
[3] Results will be reported on a dry-weight basis for comparison to the project action limits.
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
NA = not applicable
NL = not listed
mg/kg = milligram per kilogram
PCB = polychlorinated biphenyls

SAP Worksheet #15.5 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Metals by EPA Method 6010C

Analyte	**Chemical Abstracts Service (CAS) Number**	**Project Screening Limit**[3] (mg/kg)	**Project Screening Limit Reference**	**Project Quantitation Limit Goal** (mg/kg)	**Laboratory-specific**		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
Total Chromium	7440-47-3	280	TI RBC[1]	140	1.00	0.750	0.250
Lead	7439-92-1	400	TI RBC[1]	200	1.00	0.75	0.250

Notes:
[1] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012)
[2] Total Chromium is not a COC. However, the Navy will excavate isolated locations with the TI RBC goal presented above.
[3] Results will be reported on a dry-weight basis for comparison to the project action limits.

DL= detection limit
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram

SAP Worksheet #15.6 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (Imported fill material and Confirmation)

Analytical Group: Radium-226 by EPA 901.1M

Analyte[1]	**CAS Number**	**Project Screening Limit**[2] (pCi/g)	**Project Screening Limit Reference**	**Project Quantitation Limit Goal** (pCi/g)	**Laboratory-specific**
					MDC (pCi/g)
Radium-226	13982-63-3	1.69	Statewide Radiation Protection Plan[3]	0.5	0.5

Notes:

[1] Radium-226 will be reported based on the 609 keV bismuth-214 gamma energy peak after 21-day in-growth.

[2] Project Screening level is background plus the derived concentration guideline level (DCGL).

[3] *Statewide Radiation Protection Plan – Revision 1, Treasure Island, San Francisco, California* (CB&I, 2014)

keV = kilo-electron volts
MDC = minimum detectable concentration
NA = not applicable
MDL = method detection limit
RG = remediation goal
ROD = Record of Decision
pCi/g = picocuries per gram

SAP Worksheet #15.7 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: VOCs by EPA Method 8260C

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
1,1,1,2-Tetrachloroethane	630-20-6	2.0	HERO HHRA Note 3[2]	1	0.005	0.001	0.000410
1,1,1-Trichloroethane	71-55-6	8,100	EPA Residential RSL[1]	4,000	0.005	0.001	0.00036
1,1,2,2-Tetrachloroethane	79-34-5	0.61	HERO HHRA Note 3[2]	0.3	0.005	0.002	0.000680
1,1,2-Trichloroethane	79-00-5	1.1	EPA Residential RSL[1]	0.5	0.005	0.001	0.000440
1,1-Dichloroethane	75-34-3	3.6	HERO HHRA Note 3[2]	1.3	0.005	0.001	0.00029
1,1-Dichloroethene	75-35-4	230	EPA Residential RSL[1]	100	0.005	0.001	0.00026
1,2,3-Trichlorobenzene	87-61-6	63	HERO HHRA Note 3[2]	30	0.005	0.002	0.00075
1,2,4-Trichlorobenzene	120-82-1	24	EPA Residential RSL[1]	12	0.005	0.002	0.00075
1,2,4-Trimethylbenzene	95-63-6	300	EPA Residential RSL[1]	150	0.005	0.002	0.000510
1,2-Dibromo-3-chloropropane	96-12-8	0.0053	EPA Residential RSL[1]	0.005	0.010	0.002	0.00088
1,2-Dibromoethane (EDB)	106-93-4	0.036	EPA Residential RSL[1]	0.018	0.010	0.001	0.00027
1,2-Dichlorobenzene	95-50-1	1,800	EPA Residential RSL[1]	900	0.005	0.002	0.00064
1,2-Dichloroethane	107-06-2	0.46	EPA Residential RSL[1]	0.23	0.005	0.002	0.000730
1,2-Dichloropropane	78-87-5	2.5	EPA Residential RSL[1]	1.2	0.005	0.002	0.000600
1,3,5-Trimethylbenzene	108-67-8	270	EPA Residential RSL[1]	130	0.005	0.001	0.00035
1,3-Dichloropropane	142-28-9	1,600	EPA Residential RSL[1]	800	0.005	0.002	0.000570
1,3-Dichlorobenzene	541-73-1	16	TI SSC[3]	8	0.005	0.001	0.00030
1,4-Dichlorobenzene	106-46-7	2.6	EPA Residential RSL[1]	1.3	0.005	0.002	0.00078
2-Butanone	78-93-3	27,000	EPA Residential RSL[1]	13,000	0.010	0.005	0.0014
2-Chlorotoluene	95-49-8	480	HERO HHRA Note 3[2]	200	0.005	0.002	0.00062
2-Hexanone	591-78-6	200	EPA Residential RSL[1]	100	0.010	0.002	0.00074
4-Chlorotoluene	106-43-4	440	HERO HHRA Note 3[2]	200	0.005	0.002	0.00086
4-Methyl-2-pentanone	108-10-1	33,000	EPA Residential RSL[1]	15,000	0.010	0.002	0.000920
Acetone	67-64-1	61,000	EPA Residential RSL[1]	30,000	0.020	0.005	0.0014

SAP Worksheet #15.7 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: VOCs by EPA Method 8260C

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
Benzene	71-43-2	0.33	HERO HHRA Note 3[2]	0.015	0.005	0.001	0.00026
Bromobenzene	108-86-1	290	EPA Residential RSL[1]	150	0.005	0.002	0.00052
Bromochloromethane	74-97-5	150	EPA Residential RSL[1]	75	0.005	0.002	0.00094
Bromodichloromethane	75-27-4	0.30	HERO HHRA Note 3[2]	0.15	0.005	0.002	0.000530
Bromoform	75-25-2	20	HERO HHRA Note 3[2]	10	0.005	0.001	0.004
Bromomethane	74-83-9	6.8	EPA Residential RSL[1]	3.4	0.005	0.002	0.00086
Carbon disulfide	75-15-0	770	EPA Residential RSL[1]	330	0.01	0.001	0.00049
Carbon tetrachloride	56-23-5	0.099	HERO HHRA Note 3[2]	0.005	0.005	0.002	0.00053
Chlorobenzene	108-90-7	280	EPA Residential RSL[1]	140	0.005	0.001	0.00026
Chloroform	67-66-3	0.32	EPA Residential RSL[1]	0.15	0.005	0.001	0.00026
Chloromethane	74-87-3	110	EPA Residential RSL[1]	50	0.005	0.001	0.0005
cis-1,2-Dichloroethene	156-59-2	19	HERO HHRA Note 3[2]	10	0.005	0.002	0.00089
cis-1,3-Dichloropropene	10061-01-5	1.8	EPA Residential RSL[1]	0.9	0.005	0.002	0.000641
Dibromochloromethane	124-48-1	8.3	EPA Residential RSL[1]	4.0	0.005	0.001	0.00026
Dibromomethane	74-95-3	24	EPA Residential RSL[1]	12	0.005	0.002	0.00058
Dichlorodifluoromethane (Freon 12)	75-71-8	87	EPA Residential RSL[1]	43	0.005	0.002	0.00089
Ethylbenzene	100-41-4	5.8	EPA Residential RSL[1]	2.0	0.005	0.001	0.00034
Hexachlorobutadiene	87-68-3	1.2	HERO HHRA Note 3[2]	0.6	0.005	0.001	0.00033
Methyl tert-Butyl ether (MTBE)	1634-04-4	47	EPA Residential RSL[1]	23	0.005	0.002	0.0006
Methylene chloride	75-09-2	1.9	HERO HHRA Note 3[2]	1.0	0.005	0.002	0.00084
m,p-Xylenes	179601-23-1	550	EPA Residential RSL[1]	275	0.005	0.002	0.00081
o-Xylene	95-47-6	650	EPA Residential RSL[1]	325	0.005	0.001	0.00033
Styrene	100-42-5	6,000	EPA Residential RSL[1]	3,000	0.005	0.001	0.00031
Tetrachloroethene	127-18-4	0.59	HERO HHRA Note 3[2]	0.30	0.005	0.002	0.00061

SAP Worksheet #15.7 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: VOCs by EPA Method 8260C

Analyte	**CAS Number**	**Project Screening Limit**[4] (mg/kg)	**Project Screening Limit Reference**	**Project Quantitation Limit Goal** (mg/kg)	**Laboratory-specific**		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
Toluene	108-88-3	1,100	HERO HHRA Note 3[2]	500	0.005	0.002	0.00061
trans-1,2-Dichloroethene	156-60-5	1,300	HERO HHRA Note 3[2]	600	0.005	0.001	0.00038
Trichloroethene	79-01-6	0.94	EPA Residential RSL[1]	0.45	0.005	0.002	0.0006
Trichlorofluoromethane	75-69-4	1,200	HERO HHRA Note 3[2]	600	0.005	0.001	0.00034
Vinyl chloride	75-01-4	0.0088	HERO HHRA Note 3[2]	0.005	0.005	0.001	0.00036

Notes:

[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.

[2] Values are from the Human and Ecology Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 3 (DTSC, 2018).[3] TI SSC established for TI remediation projects (Shaw Environmental, Inc., 2005).

[4] Results will be reported on a dry-weight basis for comparison to the project screening limits.

DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
RSL = Regional Screening Level

SAP Worksheet #15.8 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: SVOCs by EPA Method 8270D with PAHs by 8270DSIM

Analyte	**CAS Number**	**Project Screening Limit**[4] (mg/kg)	**Project Screening Limit Reference**	**Project Quantitation Limit Goal** (mg/kg)	**Laboratory-specific**		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
2,4,5-Trichlorophenol	95-95-4	6,300	EPA Residential RSL[1]	3,200	0.330	.167	0.0830
2,4,6-Trichlorophenol	88-06-2	75	HERO HHRA Note 3[2]	35	0.330	0.167	0.0840
2,4-Dichlorophenol	120-83-2	190	EPA Residential RSL[1]	95	0.330	0.167	0.0890
2,4-Dimethylphenol	105-67-9	1,300	EPA Residential RSL[1]	650	0.500	0.333	0.167
2,4-Dinitrophenol	51-28-5	130	EPA Residential RSL[1]	65	2.00	0.333	0.214
2,4-Dinitrotoluene	121-14-2	1.7	EPA Residential RSL[1]	0.85	0.330	0.167	0.0890
2,6-Dinitrotoluene	606-20-2	0.36	EPA Residential RSL[1]	0.33	0.330	0.167	0.0990
2-Chloronaphthalene	91-58-7	4,800	EPA Residential RSL[1]	2,400	0.330	0.167	0.0810
2-Chlorophenol	95-57-8	390	EPA Residential RSL[1]	190	0.330	0.167	0.0880
2-Methylnaphthalene	91-57-6	240	EPA Residential RSL[1]	120	0.330	0.167	0.0850
2-Methylphenol	95-48-7	3,200	EPA Residential RSL[1]	1,600	0.330	0.167	0.0580
2-Nitroaniline	88-74-4	630	EPA Residential RSL[1]	310	1.60	0.333	0.0840
3,3’-Dichlorobenzidine	91-94-1	1.2	HERO HHRA Note 3[2]	1.6[5]	1.60	0.167	0.0940
3/4-Methylphenol	15831-10-4	3,200	EPA Residential RSL[1]	1,600	1.00	0.660	0.330
4-Chloroaniline	106-47-8	2.7	EPA Residential RSL[1]	1.3	0.330	0.167	0.0580
4-Nitroaniline	100-01-6	27	EPA Residential RSL[1]	13	1.60	0.167	0.0880
Acenaphthene (PAH)	83-32-9	3,600	EPA Residential RSL[1]	1800	0.005	0.001	0.00047
Anthracene (PAH)	120-12-7	18,000	EPA Residential RSL[1]	9,000	0.005	0.001	0.000395
Benzo(a)anthracene (PAH)	56-55-3	1.1	EPA Residential RSL[1]	0.5	0.005	0.001	0.000303
Benzo(a)pyrene (PAH)	50-32-8	0.11	EPA Residential RSL[1]	0.05	0.005	0.001	0.000399
Benzo(b)fluoranthene (PAH)	205-99-2	1.1	EPA Residential RSL[1]	0.5	0.005	0.002	0.000505
Benzo(k)fluoranthene (PAH)	207-08-9	11	EPA Residential RSL[1]	5.5	0.005	0.002	0.00076
Benzoic acid	65-85-0	250,000	EPA Residential RSL[1]	125,000	1.60	0.660	0.289
Benzyl alcohol	100-51-6	6,300	EPA Residential RSL[1]	3,000	0.510	0.367	0.170
bis(2-Chloroethoxy)methane	111-91-1	190	EPA Residential RSL[1]	95	0.330	0.167	0.0880
bis(2-Chloroethyl)ether	111-44-4	0.23	EPA Residential RSL[1]	0.33[5]	0.330	0.167	0.0810

SAP Worksheet #15.8 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: SVOCs by EPA Method 8270D with PAHs by 8270DSIM

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
bis(2-Ethylhexyl)phthalate	117-81-7	39	EPA Residential RSL[1]	19	0.330	0.167	0.098
Chrysene (PAH)	218-01-9	110	EPA Residential RSL[1]	55	0.005	0.001	0.000347
Dibenz(a,h)anthracene (PAH)	53-70-3	0.11	EPA Residential RSL[1]	0.05	0.005	0.003	0.00120
Dibenzofuran	132-64-9	73	EPA Residential RSL[1]	35	0.330	0.167	0.0860
Diethylphthalate	84-66-2	51,000	EPA Residential RSL[1]	25,000	0.330	0.167	0.090
Dimethylphthalate	131-11-3	100,000	TI SSC[3]	50,000	0.330	0.167	0.087
Di-n-butylphthalate	84-74-2	6,300	EPA Residential RSL[1]	3,200	0.330	0.167	0.097
Di-n-octylphthalate	117-84-0	6,300	EPA Residential RSL[1]	3,200	0.330	0.167	0.097
Fluoranthene (PAH)	206-44-0	2,400	EPA Residential RSL[1]	1,200	0.005	0.001	0.000293
Fluorene (PAH)	86-73-7	2,400	EPA Residential RSL[1]	1,200	0.005	0.001	0.000490
Hexachlorobenzene	118-74-1	0.21	EPA Residential RSL[1]	0.33[5]	0.330	0.167	0.089
Hexachlorobutadiene	87-68-3	1.2	EPA Residential RSL[1]	0.6	0.330	0.167	0.082
Hexachloroethane	67-72-1	1.8	EPA Residential RSL[1]	0.9	0.330	0.167	0.0810
Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	1.1	EPA Residential RSL[1]	0.5	0.005	0.001	0.000479
Isophorone	78-59-1	570	EPA Residential RSL[1]	280	0.330	0.167	0.093
Naphthalene (PAH)	91-20-3	3.8	EPA Residential RSL[1]	1.9	0.005	0.001	0.000307
Nitrobenzene	98-95-3	5.1	EPA Residential RSL[1]	2.5	0.330	0.167	0.076
n-Nitrosodiphenylamine	86-30-6	1,100	EPA Residential RSL[1]	550	0.330	0.167	0.096
Pentachlorophenol	87-86-5	1.0	EPA Residential RSL[1]	1.6[5]	1.60	0.167	0.0510
Phenol	108-95-2	19,000	EPA Residential RSL[1]	9,500	0.330	0.167	0.083
Pyrene (PAH)	129-00-0	1,800	EPA Residential RSL[1]	900	0.005	0.001	0.00035

Notes:

[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.

[2] Values are from the Human and Ecology Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 3 (DTSC, 2018).

[3] TI SSC established for TI remediation projects (Shaw Environmental, Inc., 2005).

[4] Results will be reported on a dry-weight basis for comparison to the project action limits.

[5] The LOQ does not meet the PAL; however, the LOD and DL are sufficient to meet the PAL. Non-detects will be reported to the LOD.

SAP Worksheet #15.8 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Notes (Continued):
DL= detection limit
EPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
PAH = polycyclic aromatic hydrocarbons
RSL = regional screening level

SAP Worksheet #15.9 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: PCBs by EPA Method 8082A

Analyte	CAS Number	Project Screening Limit[2] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Aroclor 1016	12674-11-2	4.1	EPA Residential RSL[1]	2.0	0.033	0.0100	0.0034
Aroclor 1221	11104-28-2	0.2	EPA Residential RSL[1]	0.1	0.033	0.0150	0.0052
Aroclor 1232	11141-16-5	0.17	EPA Residential RSL[1]	0.08	0.033	0.0200	0.0064
Aroclor 1242	53469-21-9	0.23	EPA Residential RSL[1]	0.12	0.033	0.0200	0.0074
Aroclor 1248	12672-29-6	0.23	EPA Residential RSL[1]	0.12	0.033	0.0150	0.0057
Aroclor 1254	11097-69-1	0.24	EPA Residential RSL[1]	0.12	0.033	0.0100	0.0027
Aroclor 1260	11096-82-5	0.24	EPA Residential RSL[1]	0.12	0.033	0.010	0.0029

Notes:

[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.

[2] Results will be reported on a dry-weight basis for comparison to the project action limits.

EPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
PCBs = polychlorinated biphenyls

SAP Worksheet #15.10 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Pesticides by EPA Method 8081B

Analyte	CAS Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
4,4'-DDE	72-54-8	1.9	EPA Residential RSL[1]	0.9	0.00170	0.0005	0.00022
4,4'-DDD	72-55-9	2.0	EPA Residential RSL[1]	1.0	0.00170	0.0005	0.00026
4,4'-DDT	50-29-3	1.9	EPA Residential RSL[1]	0.9	0.00170	0.001	0.0004
Aldrin	309-00-2	0.039	EPA Residential RSL[1]	0.019	0.00170	0.0005	0.00021
alpha-BHC	319-84-6	0.086	EPA Residential RSL[1]	0.040	0.00170	0.0005	0.00022
beta-BHC	319-85-7	0.3	EPA Residential RSL[1]	0.015	0.00170	0.001	0.00033
Chlordane (technical)	12789-03-6	1.7	EPA Residential RSL[1]	0.85	0.0250	0.02	0.0085
Dieldrin	60-57-1	0.034	EPA Residential RSL[1]	0.017	0.00170	0.00027	0.000091
Endosulfan I	959-98-8	470	EPA Residential RSL[1] for Endosulfan	235	0.00170	0.00027	0.0001
Endosulfan II	33213-65-9	470	EPA Residential RSL[1] for Endosulfan	235	0.00170	0.00027	0.0001
Endrin	72-20-8	19	EPA Residential RSL[1]	9	0.00170	0.00027	0.00011
gamma-BHC	58-89-9	0.57	EPA Residential RSL[1]	0.28	0.00170	0.0005	0.00017
Heptachlor	76-44-8	0.13	EPA Residential RSL[1]	0.065	0.00170	0.0005	0.00019
Heptachlor epoxide	1024-57-3	0.070	EPA Residential RSL[1]	0.035	0.00170	0.00027	0.00012
Methoxychlor	72-43-5	320	EPA Residential RSL[1]	160	0.00340	0.003	0.0013
Toxaphene	8001-35-2	0.49	EPA Residential RSL[1]	0.24	0.067	0.05	0.02

Notes:

[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.

[2] The LOQ does not meet the PAL; however, the LOD and DL are sufficient to meet the PAL. Non-detects will be reported to the LOD.

[3] Results will be reported on a dry-weight basis for comparison to the project action limits.

DL= detection limit
EPA = U.S. Environmental Protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
RSL = regional screening level

SAP Worksheet #15.11 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Total Petroleum Hydrocarbons (TPH) by EPA Method 8015B/8260_CALUFT

Analyte	**CAS Number**	**Project Action Limit**[3] (mg/kg)	**Project Action Limit Reference**	**Project Quantitation Limit Goal** (mg/kg)	**Laboratory-specific**		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
TPH as gasoline range organics (C6-C12)	-3544[1]	100	Water Board Tier 1 ESL[2]	1	0.500	0.200	0.05
TPH as diesel range organics (C12-C24)	-3527[1]	230	Water Board Tier 1 ESL[2]	25	2.0	1.0	0.5
TPH as oil range organics (C24-C36)	-3528[1]	5,100	Water Board Tier 1 ESL[2]	25	20.0	10.0	3.77

Notes:
[1] CAS number listed is from the Navy Electronic Data Deliverable (NEDD) valid value list since a CAS number is not available for this analyte.
[2] Water Board Tier 1 Environmental Screening Level (ESL) based on residential land use (Feb. 2016, Rev. 3)
[3] Results will be reported on a dry-weight basis for comparison to the project action limits.
DL = detection limit
LOD=limit of detection
LOQ=limit of quantitation
mg/kg = milligrams per kilogram

SAP Worksheet #15.12 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Metals by EPA Method 6020A/7471B

Analyte	CAS Number	Project Action Limit[3] (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Antimony	7440-36-0	31	EPA Residential RSL[1]	15	0.500	0.400	0.200
Arsenic	7440-38-2	0.11	HERO HHRA Note 3[2]	1.0[5]	1.00	0.800	0.400
Barium	7440-39-3	15,000	EPA Residential RSL[1]	7,500	2.00	1.00	0.500
Beryllium	7440-41-7	1,600	HERO HHRA Note 3[2]	800	0.100	0.0800	0.0400
Cadmium	7440-43-9	2,100	HERO HHRA Note 3[2]	1,000	0.0500	0.0480	0.0240
Chromium	7440-47-3	120,000	EPA Residential RSL[1]	6,000	1.00	0.900	0.450
Cobalt	7440-48-4	23	EPA Residential RSL[1]	10	0.200	0.150	0.0750
Copper	7440-50-8	3,100	EPA Residential RSL[1]	1,500	1.00	0.800	0.400
Lead	7439-92-1	80	HERO HHRA Note 3[2]	40	0.300	0.250	0.125
Mercury	7439-97-6	1	HERO HHRA Note 3[2]	0.5	0.0330	0.0300	0.0110
Molybdenum	7439-98-7	390	EPA Residential RSL[1]	190	0.500	0.400	0.200
Nickel	7440-02-0	1,500	HERO HHRA Note 3[2]	750	0.500	0.400	0.200
Selenium	7782-49-2	390	EPA Residential RSL[1]	190	0.500	0.400	0.320
Silver	7440-22-4	390	HERO HHRA Note 3[2]	190	0.200	0.150	0.0750
Thallium	7440-28-0	0.78	EPA Residential RSL[1]	0.50	0.500	0.400	0.200
Vanadium	7440-62-2	390	HERO HHRA Note 3[2]	190	1.00	0.800	0.400
Zinc	7440-66-6	23,000	EPA Residential RSL[1]	11,000	5.00	4.00	2.00

Notes:

[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.

[2] Values are from the Human and Ecology Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 3 (DTSC, 2018).

[3] Results will be reported on a dry-weight basis for comparison to the project action limits

[5] The LOQ does not meet the PAL; however, the method represents the best available technology. Non-detects will be reported to the LOD and uncertainty in any non-detects will be addressed in the QCSR.

DL = detection limit
EPA = U.S. Environmental Protection Agency

LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligrams per kilogram

SAP Worksheet #15.13 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Asbestos by CARB 435 or equivalent

Analyte	CAS Number	Project Screening Limit (%)	Project Screening Limit Reference	Project Quantitation Limit Goal (%)	Laboratory-specific	
					QL (%)	MDL
Asbestos	132207-33-1	0.25	Bay Area Air Quality Management District	0.25	0.25	1 fiber

Notes:

QL = quantitation limit
MDL = method detection limit

SAP Worksheet #15.14 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: pH by EPA Method 9045D

Analyte	CAS Number	Project Screening Limit (pH Units)	Project Screening Limit Reference	Project Quantitation Limit Goal (pH Units)	Laboratory-specific		
					LOQ (pH Units)	LOD (pH Units)	DL (pH Units)
pH	-9[1]	6.5 < pH < 8.5	Water Board[2]	0.1	0.1	0.1	0.1

Notes:
[1] CAS number listed is from the Navy Electronic Data Deliverable (NEDD) valid value list since a CAS number is not available for this analyte.
[2] Remediation goal from the *San Francisco Bay (Region 2) Water Quality Control Plan (Basin Plan)* (Water Board, 2011).
Water Board = San Francisco Bay Water Quality Control Board

SAP Worksheet #15.15 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Water
Analytical Group: TPH by EPA 8015B

Analyte	CAS Number	Project Screening Limit (mg/L)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific		
					LOQ (mg/L)	LOD (mg/L)	DL (mg/L)
TPH as gasoline range organics (C6-C12)	8006-61-9	NA[1]	Not Applicable	0.100	0.05	0.0300	0.015
TPH as diesel range organics (C12-C24)	-3527[1]	NA[1]	Not Applicable	0.500	0.05	0.04	0.0160
TPH as oil range organics (C24-C36)	-3546[21]	NA[1]	Not Applicable	0.500	0.500	0.400	0.166

Notes:

[1] TPH does not have a site-specific numeric goal for groundwater. Qualitatively, the goal for dissolved TPH will be mass reduction via target cleanup goals in soil (including any measurable free product) to support the numeric remedial goal for arsenic in groundwater.

[2] International Union of Pure and Applied Chemistry (IUPAC) CAS Number not available. Navy Electronic Data Deliverable (NEDD) compound code number used.

DL = detection limit

LOD = limit of detection

LOQ = limit of quantitation

SAP Worksheet #15.16 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Water
Analytical Group: Total and Dissolved Metals by EPA Method 6020A/7470A

Analyte	CAS Number	Project Screening Limit[1] (ug/L)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific		
					LOQ (ug/L)	LOD (ug/L)	DL (ug/L)
Aluminum	7429-90-5	27	Ambient[4]	50[2]	50.0	40.0	20.0
Antimony	7440-36-0	1.7	Ambient[4]	5[3]	5.00	4.00	2.00
Arsenic	7440-38-2	36	RG[7]	15	10.0	8.00	4.00
Barium	7440-39-3	120	Ambient[4]	60	2.00	1.80	0.900
Beryllium	7440-41-7	0.04	Ambient[4]	0.5[3]	0.500	0.400	0.200
Cadmium	7440-43-9	8.8	NRWQC[5]	4	0.500	0.400	0.200
Calcium	7440-70-2	NE	Not Applicable	100	100	90.0	45.0
Chromium	7440-47-3	50	NRWQC[5]	25	10.0	8.00	4.00
Cobalt	7440-48-4	1.4	Ambient[4]	2[2]	2.00	1.80	0.900
Copper	7440-50-8	6.6	Ambient[4]	3	3.00	0.800	0.400
Iron	7439-89-6	200	Ambient[4]	100	50.0	40.0	20.0
Lead	7439-89-6	2 (5.6)	Ambient[4](Toxicity Screening Criteria)	3[2]	3.00	2.00	1.00
Magesium	7439-95-4	NE	Not Applicable	100	50.0	40.0	20.0
Manganese	7439-96-5	900	Ambient[4]	450	2.00	1.80	0.900
Mercury	7439-97-6	0.1	Ambient[4]	0.2[2]	0.200	0.150	0.0600
Molybdenum	7439-98-7	6.5	Ambient[4]	5	5.00	4.00	2.00
Nickel	7440-02-0	8.2	NRWQC[5]	5	5.00	4.00	2.00
Potassium	7440-09-7	NE	Not Applicable	100	100	90.0	45.0
Selenium	7782-49-2	71	NRWQC[5]	35	5.00	4.00	2.00
Silver	7440-22-4	2.2	Ambient[4]	2	2.00	1.80	0.900
Sodium	7440-23-5	NE	Not Applicable	100	100	90.0	45.0
Thallium	7440-28-0	426	NRWQC[5]	200	2.00	1.80	0.900
Vanadium	7440-62-2	4.2	Ambient[4]	2	10.0	8.00	4.00
Zinc	7440-66-6	81	NAWQC[6]	40	20.0	15.0	7.50

SAP Worksheet #15.16 – Reference Limits and Evaluation Table (Continued)

Notes:

[1] Project screening levels apply to dissolved metals results only. Total metals results are collected for informational purposes only, due to possible bias by non-mobile sediment particles in the sample.

[2] The LOQ does not meet the PSL; however, the LOD and/or DL are sufficient to meet the PSL. Non-detects will be reported to the LOD.

[3] The LOQ, LOD, and DL do not meet the PSL; however, the limits will be the lowest achievable using the best available technology by the laboratory's DoD ELAP-accredited methods. The laboratory will report to the lowest reporting limit (DL), but the value will be qualified as estimated ("J" flagged). Data evaluation will be based on reported concentrations above the DL. In cases where the PSL is less that the DL and the results are nondetect, results will be discussed in the uncertainty analysis.

[4] TTEMI 2001b. "Final Technical Memorandum, Estimation of Ambient Concentrations of Metals in Groundwater, Naval Station Treasure Island, San Francisco, California"

[5] NRWQC for Saltwater Aquatic Life, chronic exposure value

[6] NAWQC for protection of saltwater aquatic life, 20 percent of acute concentration with lowest observed effect level

[7] Goal from Tier 1 Screening-Level Ecological Risk Assessment for Treasure Island (IR Sites 6, 12, 21, 24, 30, 31, 32, and 33), Naval Station Treasure Island, San Francisco, California." Prepared by SulTech for U.S. Department of the Navy, BRAC PMO West. March 23.

DL – detection limit
LOD – limit of detection
LOQ – limit of quantitation
NAWQC – National Ambient Water Quality Criteria
NE – not established
NRWQC – National Recommended Water Quality Criteria
RG – Remedial Action Goal
PSL – project screening level
TTEMI – Tetra Tech EMI

SAP Worksheet #15.17 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Water
Analytical Group: Radium-226 by EPA Method 903.0

Analyte	CAS Number	Project Screening Limit (pCi/L)	Project Screening Limit Reference	Project Quantitation Limit Goal (pCi/L)	Laboratory-specific		
					MDC (pCi//L)	LOD (pCi/L)	DL (pCi/L)
Radium-226	13892-63-3	5	California MCL[1]	1	1.00	NA	NA

Notes:
[1] The combined Ra-226 and Ra-228 California MCL is used as the screening criteria for Ra-226.

DL = detection limit
LOD = limit of detection
MCL = maximum contaminant level
MDC = minimum detectable concentration

SAP Worksheet #15.18 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Water

Analytical Group: General Chemistry by EPA Method 300.0 and Standards Methods 2540C and 2540D

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific		
					LOQ (mg/L)	LOD (mg/L)	DL (mg/L)
Sulfate	14808-79-8	NE	Not Applicable	1	1.00	0.150	0.049
TDS	-10[1]	NE	Not Applicable	10	10	10.0	5.40
TSS	-44[1]	NE	Not Applicable	10	5.0	5.0	5.0

Notes:

[1] International Union of Pure and Applied Chemistry (IUPAC) CAS Number not available. Navy Electronic Data Deliverable (NEDD) compound code number used.

DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
NE = not established
TDS = total dissolved solids
TSS = total suspended solids

SAP Worksheet #16 – Project Schedule /Timeline Table

(UFP-QAPP Manual Section 2.8.2)

The project schedule is included as Figure 6 of this SAP.

SAP Worksheet #17 – Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

The following sections describe the sampling designed to meet the project objectives.

17.1 Excavation of Contaminated Soils

Excavation will be conducted for the following four types of excavations:

- As per remedial alternative S-3 described in the ROD/Final RAP (Navy, 2017), non-SWDA discrete locations where COCs exceeded action levels in the soil during previous investigations (see Table 17-1). The discrete excavations will generally be 100 SF, and the total volume to be excavated is variable depending on the proposed depth of the excavation (Figure 2).
- The footprint of building 1126 after demolition. Chemical COCs, based on surrounding exceedances, are dioxin/furans, PAHs, lead, chromium (Figure 2).
- The footprint of building 1217 after demolition. Chemical COCs, based on surrounding exceedances, are PCBs, PAHs, and Pb (Figure 2).
- Continuation of the excavation of the North Point SWDA NTCRA. Chemical COCs are PCBs, dioxin/furans, PAHs, and Pb (Figure 3).

Table 17-1 COC Exceedances During Previous Investigations

Location ID	Sample Date	Sample Depth	COC	COC Value	COC Units	RG Value
1145E-1	8/27/2003	0.2	Total PCBs	1.43	mg/kg	1
1202E-1	9/2/2003	3.3	Total PCBs	3.83	mg/kg	1
1202E-1	9/2/2003	3.8	Total PCBs	8.05	mg/kg	1
1217E-1	9/2/2003	0.2	Benzo(a)pyrene TEQ	0.71	mg/kg	0.62
1225E-1	8/14/2003	0.4	Benzo(a)pyrene TEQ	0.98	mg/kg	0.62
1126C-1A	10/15/2003	2.7	Total PCBs	3.18	mg/kg	1
1126D-1	8/20/2003	0.4	Total PCBs	5.95	mg/kg	1
1126D-1	8/20/2003	2.7	Benzo(a)pyrene TEQ	12.82	mg/kg	0.62
1126D-3A	10/15/2003	0.7	Total PCBs	1.18	mg/kg	1
1128D-1	8/19/2003	0.4	Lead	1300	mg/kg	400
1128D-1	8/19/2003	1.2	Benzo(a)pyrene TEQ	2.98	mg/kg	0.62
1139A-1	8/27/2003	0.2	Benzo(a)pyrene TEQ	0.74	mg/kg	0.62
1147C-2	8/27/2003	0.7	Lead	670	mg/kg	400
1200DS004	2/23/2000	1	Benzo(a)pyrene TEQ	0.86	mg/kg	0.62
1200DS011	2/28/2000	4	Benzo(a)pyrene TEQ	1.06	mg/kg	0.62

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

Table 17-1 COC Exceedances During Previous Investigations

Location ID	Sample Date	Sample Depth	COC	COC Value	COC Units	RG Value
1202F-1	9/3/2003	4	Chromium	332	mg/kg	280
1203A-1	8/28/2003	0.4	Lead	1300	mg/kg	400
1203A-1	8/28/2003	0.9	Lead	531	mg/kg	400
1203A-1	8/28/2003	0.9	Total Dioxin Furan TEQ	69.77	ng/kg	12
1203C-2A	10/15/2003	0.6	Total Dioxin Furan TEQ	14.9	ng/kg	12
1217B-1	9/2/2003	3.9	Chromium	452	mg/kg	280
1217D-1	9/3/2003	2.7	Lead	507	mg/kg	400
1217D-1	9/3/2003	2.7	Total Dioxin Furan TEQ	14.23	ng/kg	12
1219A-1	9/3/2003	3.5	Lead	418	mg/kg	400
1222-B1	5/17/2001	0.3	Total PCBs	1.6	mg/kg	1
1222F-5A	10/15/2003	1.4	Total Dioxin Furan TEQ	115.71	ng/kg	12
1225A-2	8/13/2003	2.6	Benzo(a)pyrene TEQ	3.27	mg/kg	0.62
1226G-1	8/28/2003	3.2	Lead	2600	mg/kg	400
1226H-1	8/28/2003	0.2	Benzo(a)pyrene TEQ	0.92	mg/kg	0.62
1227F-1-0	1/8/1995	0	Lead	864	mg/kg	400
1228A-1	9/3/2003	2.1	Total Dioxin Furan TEQ	120.81	ng/kg	12
1230A-1	9/3/2003	0.4	Benzo(a)pyrene TEQ	0.63	mg/kg	0.62
1230F-1	9/4/2003	0.3	Total Dioxin Furan TEQ	16.1	ng/kg	12
1232F-1	8/14/2003	0.2	Benzo(a)pyrene TEQ	0.86	mg/kg	0.62
1236-A1	3/29/2001	0.3	Lead	809	mg/kg	400
1239B-2	8/14/2003	0.4	Benzo(a)pyrene TEQ	0.77	mg/kg	0.62
12-HP100	10/26/1995	1.8	Chromium	431	mg/kg	280
12-HP116	9/23/1996	3.3	Benzo(a)pyrene TEQ	2.76	mg/kg	0.62
12-HP154	11/11/1997	3.5	Lead	632	mg/kg	400
12-HP174	11/13/1997	1.5	Chromium	315	mg/kg	280
12TP1248W17	11/2/2001	1	Benzo(a)pyrene TEQ	1.54	mg/kg	0.62
12TPMD010	11/3/1999	4.5	Pesticides (4,4'-DDD)	2.4	mg/kg	2
12TPMD010	11/3/1999	4.5	Pesticides (alpha-BHC)	0.1	mg/kg	0.077

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

Table 17-1 COC Exceedances During Previous Investigations

Location ID	Sample Date	Sample Depth	COC	COC Value	COC Units	RG Value
12TPMD016	11/2/1999	4.8	Pesticides (4,4'-DDD)	2.2	mg/kg	2
12TPMD023	11/4/1999	5	Lead	523	mg/kg	400
KCH-1217-1	9/25/2014	2.5	Benzo(a)pyrene TEQ	10982	mg/kg	0.62
KCH-EU9-1	2/8/2013	4.5	Total PCBs	1.74	mg/kg	1
KCH-EU9-3	2/8/2013	3	Total PCBs	4.84	mg/kg	1
KCH-MDr-2	2/7/2013	1	Total Dioxin Furan TEQ	23.61	pg/g	12
KCH-MDr-3	2/7/2013	1	Total Dioxin Furan TEQ	17.2	pg/g	12
RA05-AOI-05	7/12/2017	5.0	Total PCBs	1,000	mg/kg	1
RA05-AOI-07	7/12/2017	5.0	Total PCBs	2.1	mg/kg	1
RA05-AOI-08	7/13/2017	8.0	Total PCBs	4.9	mg/kg	1
RA05-AOI-10	7/13/2017	8.0	Total PCBs	12	mg/kg	1
RA05-AOI-11	7/13/2017	8.0	Total PCBs	1.3	mg/kg	1
RA05-AOI-12	7/13/2017	8.0	Total PCBs	4.0	mg/kg	1
RA05-AOI-13	7/13/2017	5.0	Total PCBs	190	mg/kg	1
RA05-AOI-14	7/13/2017	5.0	Total PCBs	130	mg/kg	1
RA05-AOI-15	7/13/2017	5.0	Total PCBs	16	mg/kg	1
RA05-AOI-16	7/14/2017	5.0	Total PCBs	7.2	mg/kg	1
RA05-AOI-17	7/14/2017	5.0	Total PCBs	10	mg/kg	1
RA6B-AOI-07	7/11/2017	2.0	Total PCBs	10	mg/kg	1
RA7A-AOI-05	7/11/2017	2.0	Total PCBs	1.0	mg/kg	1
RA7D-AOI-07	7/11/2017	2.0	Total PCBs	6.4	mg/kg	1
RA7E-AOI-05	7/12/2017	1.7	Total PCBs	38	mg/kg	1
RA7E-AOI-06	7/12/2017	1.7	Total PCBs	17	mg/kg	1
RA7E-AOI-03	1/4/2017	1.7	Total PCBs	21 J	mg/kg	1

17.1.1 Chemical Confirmation Sampling

A combination of pre- and post-excavation confirmation sampling will be employed for this project. Pre-excavation samples will be collected in accordance with SOP PR-TC-02.02.01.03 (SAP Attachment

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

A) and the RAWP to determine the extent of soil contamination prior to excavation. When an excavation is completed to the proposed limits, post-excavation confirmation soil samples will be collected from the excavation in accordance with SOP PR-TC-02.02.01.01 (SAP Attachment A) and the RAWP. The rationale for confirmation sampling is presented in Table 17-2 below.

Table 17-2 Pre- and Post-Excavation Confirmation Sampling

Action	Location Description	Sampling Relative to Excavation	Basis for Sampling		
			Vertical Extent[a]	Lateral Extent[b]	Suspect Location[c]
IR Site 12 Non-SWDAs	Discrete Hot Spots	Before	✓		
		After		✓	✓
	Building Footprints	Before	✓[d]	✓[e]	
		After			✓
North Point NTCRA	RG Exceedances	Before	✓	✓	
		After			✓

Notes:

[a] also referred to as bottom sample; collected at excavation bottom (i.e., minimum 1 ft below point of exceedance); sampling frequency: one sample per 2,500 square ft of excavation bottom (based on 50 ft x 50 ft grid square)

[b] also referred to as sidewall sample; collected at excavation sidewall at midpoint depth between surface and excavation bottom; sampling frequency: one sample per 50 linear ft of sidewall

[c] i.e., visually discolored soil, high gamma scan reading; collected at discretion of field supervisor

[d] collected across building footprint at vertical sampling frequency following building demolition

[e] collected around building perimeter at lateral sampling frequency prior to building demolition

Pre-excavation confirmation samples will be collected from Non-SWDA discrete hot spots to delineate the vertical extent of the excavation at 1-ft and 2-ft below the point of exceedance, with the 2-ft sample being held for analysis at the laboratory pending the results of the 1-ft sample. In addition, at those locations where the lateral extent of the excavation is obstructed by the presence of sidewalks, roads, utility corridors, etc., pre-excavation samples will be collected at the edge of the obstruction at midpoint depth between surface and 1-ft below the depth of the point of the exceedance. To delineate the vertical and lateral extent of the Non-SWDA demolished buildings and the North Point NTCRA, pre-excavation confirmation samples will be collected across the building footprints and in the planned excavation area, respectively, in each area larger than a 50-foot by 50-foot survey grid and around the perimeter every 50 linear feet.

All confirmation samples will be sent to an off-site DoD and California Environmental Laboratory Accreditation Program (ELAP)-certified laboratory for analysis. Confirmation samples will be analyzed for the following: (1) PAHs by EPA Method 8270SIM, (2) Dioxin/Furans by EPA 8290, (3) selected pesticides (alpha-BHC and 4,4'-DDD), (4) total Aroclors, (5) lead, and/or (6) chromium.

Pre- and post-confirmation samples will be evaluated against the following criteria at each excavation: (1) if the PSL (listed in Worksheet 15) for one or more analyte is greater than the LOQ, the reported result will be compared to the PSL. A reported result greater than or equal to the PSL will result in over-excavation; a reported result less than the PSL or non-detection at the LOD will require no further action; (2) if the

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

PSL for the reported analyte is less than the LOQ, a detection of the analyte greater than the LOD will result in over-excavation; a non-detection of the analyte will result in no further action. Samples of either type requiring no further action will be used as final confirmation samples.

Samples requiring the analysis of lead or chromium in addition to organic analyses will have the metals analyzed on a short turn-around-time basis, with the organic analyses on hold until such time as the metals results have been shown to be less than the PSLs (WS # 15).

The following subsection discusses how over excavation will be performed.

17.1.2 Step-Out and/or Overexcavation Procedures

Step-outs and/or overexcavations will be performed if warranted based on analytical results. Excavations will be extended laterally (step-out) or vertically (overexcavation) if sidewall and/or floor post-excavation samples are found to contain contaminants exceeding the PSLs listed in Worksheet 15. Excavations may also be extended based on consultation with the Navy if there is visual confirmation of debris or if the soil is found to contain elevated radioactivity (in the form of elevated gamma activity).

For sidewall exceedances, an additional 2-foot lateral step-out will be excavated the length of the wall on either side of the sample location. For floor exceedances, an additional 2-foot vertical step-down will be excavated across a 2-foot by 2-foot floor area centered on the sample exceedance. The excavation step-out and step-down process will repeat until confirmation samples indicate COC concentrations are below the PSLs. The additional confirmation sample will be analyzed only for the analyte(s) exceeding remediation goals in the original confirmation sample.

17.1.3 Radiological Characterization

Radiological characterization will be completed in accordance with the RMDP (Appendix E of the Work Plan) once confirmation sampling confirms Dioxin/Furans, PAHs, selected pesticides, PCBs, lead, and/or chromium are below the PSLs based on MARSSIM guidance. The characterization samples will be located based on a random-start systematic grid in the sampling area with 20 samples per 1,000 square meters of excavation surface as further described in the RMDP. The samples will be analyzed for Radium-226 by EPA 901.1 Modified/DOE EML HASL 300 Method GA-01-R.

17.2 Benzo(a)pyrene and Dioxin Toxicity Equivalency Calculation

The BaPeq will be calculated by summing concentrations of carcinogenic PAH compounds after multiplying each concentration by their potency equivalence factors (PEFs). The PEFs used for this Project are from California Office of Environmental Health Hazard Assessment *Air Toxics Hot Spots Program Risk Assessment Guidelines* (2003). The PEFs for the carcinogenic PAHs are as follows:

• Benzo(a)pyrene	1.0
• Benzo(a)anthracene	0.1

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.0
Indeno(1,2,3-cd)pyrene	0.1

Two BaPeq values are calculated: BaPeq(0) is calculated using only the detected values of all seven analytes and BaPeq(½) is calculated using one-half of LOD values for analytes that are not detected. The greater BAP (EQ) calculated value is used to compare with the remediation goal.

The dioxin toxicity equivalency factors (TEFs) will be calculated in accordance with Gilbane Work Instruction *Calculating Toxic Equivalence (TEQ) for Dioxins, Furans and Dioxin-Like Compounds.*The Dioxin-TEF will be calculated by summing concentrations of carcinogenic chlorinated dioxin and furan compounds after multiplying each concentration by their toxic equivalence factor. The TEFs used for this project are from California Office of Environmental Health Hazard Assessment *Air Toxics Hot Spots Program Risk Assessment Guidelines* (2015) using the 2005 World Health Organization TEFs. The WHO/05 TEFs for the dioxins and furans are listed in the aforementioned Gilbane Dioxin TEQ Work Instruction included in Attachment A.

17.3 Import Material Sampling

All excavations will be backfilled with imported soil that meets the project's acceptance criteria. Imported fill material testing will include collection of samples for analysis of the site-specific chemicals of concern, and other contaminants based on the nature of the fill source at the frequency presented in the *Information Advisory Clean Imported fill Material* (DTSC, 2001). The imported fill material acceptance criteria for IR Site 12 are presented in Worksheets #15-6 through #15-14.

17.4 Groundwater Monitoring at Gateview Arsenic/TPH Area

The goal as described on WS #11 for groundwater monitoring at Gateview Arsenic/TPH Area is to evaluate MNA parameters in groundwater against the criteria presented on WS # 15.15 through 15.18 with four quarters of sampling for TPH, total and dissolved metals, total dissolved solids (TDS), total suspended solids (TSS), sulfate, Ra-226, and ferrous iron in monitoring wells as listed on SAP Worksheet #18. The data is to supplement existing data collected as part of the basewide monitoring program. Trend analysis will be conducted on the dataset as a whole by the basewide monitoring contractor.

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location/ID Number[3]	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At 1145E-1, **IR12-RA01-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1203C-2A, **IR12-RA02-ZZZ**	Soi1	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1147C-2, **IR12-RA03-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1203A-1, **IR12-RA04-ZZZ**	Soil	TBD[1]	Dioxin/furans, Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1222F-5A, **IR12-RA05-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1222-B1, **IR12-RA06-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1226G-1, **IR12-RA07-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1139A-1, **IR12-RA08-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1128D-1, **IR12-RA09-ZZZ**	Soil	TBD[1]	PAH, Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1226H-1, **IR12-RA10-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1200DS004, **IR12-RA11-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1225E-1, **IR12-RA12-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1225A-2, **IR12-RA13-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1200DS011, **IR12-RA14-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP116, **IR12-RA15-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1232F-1, **IR12-RA16-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At 1202E-1/KCH-EU9-1, **IR12-RA17-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At KCH-EU9-3, **IR12-RA18-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1126C-1A, **IR12-RA19-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1126D-3A, **IR12-RA20-001**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1126D-1, **IR12-RA21-ZZZ**	Soil	TBD[1]	PCB, PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TPMD023, **IR12-RA22-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1202F-1, **IR12-RA23-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1217B-1, **IR12-RA24-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1217E-1, **IR12-RA25-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TPMD016, **IR12-RA26-ZZZ**	Soil	TBD[1]	Pesticides, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At KCH-1217-1, **IR12-RA27-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP154, **IR12-RA28-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1217D-1, **IR12-RA29-ZZZ**	Soil	TBD[1]	Dioxin/furans, Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1219A-1, **IR12-RA30-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1230F-1/KCH-MDr-2, **IR12-RA31-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1228A-1, **IR12-RA32-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At KCH-MDr-3, **IR12-RA33-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, no bottom (Clean at 2' per FS for Dioxin/Furan)	SAP Worksheet #17
At 1230A-1, **IR12-RA34-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP100, **IR12-RA35-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1227-F-1-0, **IR12-RA36-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP174, **IR12-RA37-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TP1248W17, **IR12-RA38-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1236-A1, **IR12-RA39-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1239B-2, **IR12-RA40-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TPMD010, **IR12-RA41-ZZZ**	Soil	TBD[1]	Pesticides, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-05, **IR12-RA42-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-07, **IR12-RA43-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-08, **IR12-RA44-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-10, **IR12-RA45-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-11, **IR12-RA46-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-12, **IR12-RA47-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-13, **IR12-RA48-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-14, **IR12-RA49-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At RA05-AOI-15, **IR12-RA50-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-16, **IR12-RA51-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-17, **IR12-RA52-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA06B-AOI-07, **IR12-RA53-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07A-AOI-05, **IR12-RA54-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07D-AOI-07, **IR12-RA55-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07E-AOI-05, **IR12-RA56-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07E-AOI-06, **IR12-RA57-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07E-AOI-03, **IR12-RA58-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
Building 1126					
IR12-1126-ZZZ	Soil	TBD[1]	Dioxin/furans, PAH, Pb, Cr, Ra-226	6 floor, 10 sidewall	SAP Worksheet #17
Building 1217					
IR12-1217-ZZZ	Soil	TBD[1]	PCB, PAH, Pb, Ra-226	4 floor, 9 sidewall	SAP Worksheet #17
SWDA/Northpoint					
IR12-SWDA-ZZZ	Soil	TBD[1]	Dioxin/furans, PCB, PAH, Pb, Ra-226	8 floor, 12 sidewall	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Import Material					
IF-IR12-YYY-ZZZ	Soil	TBD[1]	VOCs, SVOCS, PCBs, Pesticides, Metals w/ Hg, TPH, Abestos, pH, Ra-226	TBD[4]	SAP Worksheet #17
Groundwater Monitoring at Gateview Arsenic/TPH Area[5]					
12-MW05-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW07-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW20R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW21R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW22R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW23-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW24R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW33-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW34-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW35-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW36-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW37-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW38R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Notes:
[1] TBD = To be determined. The depths of the excavations will be based on the information in Table 17-1. The exact depths of the excavations will be determined by field conditions and professional judgment of the project team.
[2] Estimated numbers of samples presented is for chemical samples. Numbers of radiological samples will be determined per Section 17.1.3 after the extent of the excavation is determined.
[3] ZZZ and YYY and MMYY in the sample name will be replaced as per Worksheet #27.
[4] Number of samples is dependent upon volume of imported fill material needed and will be determined as described in Section 17.3.
[5] Field duplicates will be collected at a rate of one per every 10 samples for groundwater samples. Field duplicate sample locations will be selected in the field. Sample ID of the field duplicate will end with “D.”
[6] Each location will be collected as a discrete sample.

SAP Worksheet #19 – Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	**Analytical Group**	**Analytical and Preparation Method // SOP Reference**	**Containers** (number, size, and type)	**Sample volume**[1] (units)	**Preservation Requirements**[2] (chemical, temperature, light protected)	**Maximum Holding Time** (preparation / analysis)
Soil	PAHs	EPA 8270D SIM/3550B//WS-MW-0008	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	Dioxin/Furans	EPA 8290/ WS-IDP-0005 // WS-ID-0005	1 X 4-oz Jar	30 g	<6°C	30 days/45 days
Soil	Pesticide	EPA 8081B/3550B//WS-GC-0001	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	PCBs	EPA 8082A/3550B//WS-GC-0002	1 X 4-oz Jar	30 g	<6°C	None
Soil	Metals	EPA 6010C/3050B//ST-MT-0003	1 X 2-oz Jar	2 g	None	180 days[3]
Soil	VOCs	EPA 8260C/5035//WS-MW-0007	3 X 5-g TerraCore™ Samplers[4,5,7] or equivalent	5 grams (g)	<6°C	48 hours/14 days
Soil	SVOCs	EPA 8270D/3550B// WS-MW-0008	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	TPH-purgeable	EPA 8260C/5035//WS-MW-0007	3 X 5-g TerraCore™ Samplers[4,5,8] or equivalent	5 g	<6°C	14 days
Soil	TPH-extractable	EPA 8015B/3550B//WS-GC-0007	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	Mercury	EPA 7471B//ST-MT-0007	1 X 2-oz Jar	2 g	<6°C	28 days[3]
Soil	Asbestos	CARB 435 or equivalent // EM-AS-S-1265	1 X 8-oz Jar or plastic baggie	8 ounce (oz.)	None	Not Applicable
Soil	pH	EPA 9045D//ST-WC-0011	1 X 2-oz Jar	10 g	<6°C	7 days

Matrix	Analytical Group	Analytical and Preparation Method // SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements[2] (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	Gamma Spectroscopy	EPA 901.1//ST-RD-0102	Gallon Ziploc bag then 250-milliliter (mL) tuna can	~1,000g (bag) ~300g (can)	None	None
Water	TPH-purgeable	EPA 8260C/5030B//WS-MW-0007	3x40-mL VOA Vial	40 mL	<6°C, (HCl to pH < 2 optional)	14 days
Water	Alpha Spectroscopy	EPA 903.0//ST-RC-0403	1-L Plastic	1-L	pH < 2, HNO_3	None
Water	TPH-extractable	EPA 8015B/3510C//WS-GC-0007	2 x 1-L mL Amber Glass	1 L	<6°C	7 days/40 days
Water	Metals (Total & Dissolved)	EPA 6020A/3010A//ST-MT-0001	250-mL Plastic	100 mL	pH <2, HNO_3	180 days
Water	Mercury (Total and Dissolved)	EPA 7470A//ST-MT-0005	250-mL Plastic	100 mL	<6°C, pH < 2, HNO_3	28 days
Water	Sulfate	EPA 300.0//WS-WC-0009	250-mL Plastic	50 mL	<6°C	28 days
Water	TDS	SM 2540C//WS-WC-0002	250-mL Plastic	100 mL	<6°C	7 days
Water	TSS	SM 2540D//WS-WC-0002	250-mL Plastic	100 mL	<6°C	7 days

Notes:

[1] Minimum sample volume or mass requirement if different from the container volume.

[2] Temperature compliance will be measured using temperature blanks included in the coolers used to ship the samples to the laboratory.

[3] The time listed is the maximum holding time for the analysis. Preparation time is included in the analytical method holding time.

[4] If TerraCore samplers cannot be used due to saturated soil, then only the 8-ounce jar (which will be filled without headspace) will be used, and VOC analysis will be conducted from the jar sample.

[5] TerraCore samples will be immediately transferred to suitable vials for transportation to laboratory per SOP PR-TC-02.02.01.05.

[6] Percent moisture will only be collected in a separate container when samples are to be analyzed for VOCs or TPH-purgeable only.

[7] Terracore kits for VOCs will consist of two unpreserved and one methanol-preserved vial because acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2-chloroethylvinyl ether (SOP PR-TC-02.02.01.05).

[8] Terracore kits for samples to be analyzed for TPH-purgeable only will consist of two bisulfate vials and one methanol vial.

SAP Worksheet #20 – Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab[4]
Soil (confirmation)	PAHs	124	None	7	None	None or 1 per/day[2]	None	None	124
Soil (confirmation)	Dioxin/Furans	70	None	4	None	None or 1 per/day[2]	None	None	70
Soil (confirmation)	PCBs	153	None	8	None	None or 1 per/day[2]	None	None	153
Soil (confirmation)	Pesticides	10	None	1	None	None or 1 per/day[2]	None	None	10
Soil (confirmation)	Metals (Cr)	20	None	1	None	None or 1 per/day[2]	None	None	20
Soil (confirmation)	Metals (Pb)	99	None	5	None	None or 1 per/day[2]	None	None	99
Soil (confirmation)	Radium-226	TBD[1]	None	None	None	None	None	None	TBD
Soil Imported Fill Material	Metals, VOCs, SVOCs, PAHs, PCBs, Pesticides, TPH, Ra-226	TBD[1]	None	2	None	None or 1 per/day[2]	None	None	TBD
Soil Imported Fill Material	Asbestos	TBD[1]	None	None	None	None	None	None	TBD
Water (GW Montitoring - 4 quarters)	TPH-purgeable	52[5]	8	4	None	None or 1 per/day[2]	12[3]	None	72
Water (GW Montitoring - 4 quarters)	TPH-extractable, Total and Dissolved Metals, General Chemistry	52[5]	8	4	None	None or 1 per/day[2]	None	None	60

SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

Notes:

[1] Actual sampling location (and thus the number of total samples to the laboratory) will be determined in the field based on the amount of excavated soil and the number of imported fill material sources sampled.

[2] None if disposable sampling equipment used; 1 per day if using non-disposable sampling equipment

[3] The actual number of trip blanks will depend on the number of coolers shipped containing samples for TPH-purgeable.

[4] The total number shipped to lab does not include MS/MSDs.

[5] The number of sampling locations is multiplied by four to account for the four planned sampling events.

PCB = polychlorinated biphenyl
PT = performance testing
TPH = total petroleum hydrocarbons
SVOC = semivolatile organic compound
VOA = volatile organic analysis
VOC = volatile organic compound

SAP Worksheet #21 – Project Sampling SOP References Table
(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
PR-TC-01.04.04.00	Field Documentation	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-02.12.02.00	Sample Tracking and Electronic Data Management	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-02.04.01.01	Sample Handling, Packaging and Shipping	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-04.01.00.00	Review, Verification, and Validation of Chemical Data	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-04.01.02.00	Review, Verification, and Validation of Radiological Data	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-02.02.01.05	Volatile Organic Compound (VOC) Sampling	Gilbane	Per EPA 5035	N	Attachment A of SAP
PR-TC-02.02.01.01	Surface Soil: Sampling with Trowel or Spoon	Gilbane	Various	N	Attachment A of SAP
PR-TC-02.02.01.03	Subsurface Soils: Direct-Push or Drill Rig	Gilbane	Various	N	Attachment A of SAP
PR-TC-02.03.09.00	Water: Measuring Water Levels	Gilbane	Electronic Sounder	N	Attachment A of SAP
PR-TC-02.02.02.03	Water: Low-Flow Sampling from Ground Water Monitoring Wells	Gilbane	Various	N	Attachment A of SAP
Work Instruction	Calculating Toxic Equivalence (TEQ) for Dioxins, Furans and Dioxin-Like Compounds	Gilbane	Not Applicable	N	Attachment A of SAP

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Photoionization Detector (PID)	• Calibration Check • Daily cleaning during field use • Proper storage when not in use	Daily (prior to field use)	Per manufacturer specifications	Recalibrate instrument, if still out, return instrument	Superintendent	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.
Global Positioning System (GPS)	• No calibration Required • Charge batteries • Clean of dust, dirt, and grease • Store instrument in case when not in use	Daily (prior to field use)	± 10 mm horizontally and 15 mm vertically	If the instrument can not connect to satellites, then the secondary unit will be used to verify that there are no connections	Superintendent	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.
Sodium Iodide Detector	Calibration Check	Daily (prior to field use)	Within 10% of the calculated activity isotope	Follow procedure as outlined in the manufacturer's instruction manaual or contact vendor for technical support.	Radiological Technician	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.

SAP Worksheet #23 – Analytical SOP References Table
(UFP-QAPP Manual Section 3.2.1)

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)
WS-GC-0007	Gas Chromatographic Analysis of Total Petroleum Hydrocarbons; (Revision 6.4)	Definitive	Soil & Water/TPH-extractable	GC/FID	TestAmerica	N
WS-MS-0007	Determination of Volatile Organics and Total Purgeable Petroleum Hydrocarbons by GC/MS (Methods 8260B, 8260C, 624, CA-LUFT and AK101); (Revision 5.6)	Definitive	Soil &Water/TPH-purgeable	Gas Chromatograph (GC)/Mass Spectrometer	TestAmerica	N
WS-GC-0002	Chromatographic Analysis Based on SW-846 Methods 8000B/8000C, 8082/8082A, Method 608, and Compendium Methods TO-4A and TO-10A; (Revision 5.3)	Definitive	Soil /PCBs	GC/Electron Capture Detector	TestAmerica	N
WS-GC-0001	Organochlorine Pesticides by Gas Chromatography Based on SW-846 Methods 8000B/8000C, 8081A/8081B, Method 608 and Compendium Methods TO-4A and TO-10A; (Revision 5.4)	Definitive	Soil/Pesticides	GC/Electron Capture Detector	TestAmerica	N
WS-MS-0008	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by GC/MS-SIM Internal Standard Technique; (Revision 2.7)	Definitive	Soil/SVOCs & PAHs	GC/Mass Spectrometer (MS)	TestAmerica	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)
WS-MS-0007	Determination of Volatile Organics and Total Purgeable Petroleum Hydrocarbons by GC/MS (Methods 8260B, 8260C, 624, CA-LUFT and AK101); (Revision 5.6)	Definitive	Soil/VOCs	GC/MS	TestAmerica	N
ST-MT-0001	Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometer[SW-846 6020; SW-846 6020A; SW-846 6020B; EPA 200.8] Revision 26	Definitive	Soil & Water/ICPMS Metals	ICP/Mass Spectrometer (MS)	TestAmerica	N
ST-MT-0003	Analysis of Metals by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) [SW-846 6010B; 6010C; 6010D; EPA 200.7] Revision 20	Definitive	Soil/ICP Metals	Inductively Coupled Plasma (ICP) Spectrophotometer	TestAmerica	N
ST-MT-0007	Preparation and Analysis of Mercury in Solid Samples by cold Vapor Atomic Absorption Spectroscopy [SW-846 7471B] Revision 17	Definitive	Soil/Mercury	Cold Vapor Atomic Absorption (CVAA)	TestAmerica	N
ST-MT-0005	Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption (SW846 7470A; MCAWW 245.1] Revision 18	Definitive	Water/Mercury	CVAA	TestAmerica	N

SAP Worksheet #23 – Analytical SOP References Table

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)
WS-ID-0005	Analysis of Samples for Polychlorinated Dioxins and Furans by HRGC/HRMS [Methods 8290, 8290A & TO-9A] Revision 7.9	Definitive	Soil/Dioxins/Furans	High Resolution (HR) GC/HRMS	TestAmerica	N
WS-WC-0044	EPA Method 0945C and 9045D pH Solids and Manual pH Aqueous (Revision 6.6)	Definitive	Soil/pH	Probe	TestAmerica	N
EM-AS-S-1265	Asbestos Analysis in Soils and Rock: CARB 435 using PLM, Revision 2	Definitive	Asbestos	Polarized Light Microscopy	EM Laboratories P&K	N
ST-RD-0102	Gammavision^R Analysis [EPA 901.1 and DOE GA-01-R] Revision 16	Definitive	Soil/Gamma Spectroscopy	Gamma Spectrometer	TestAmerica	N
ST-RD-0403	Low Background Gas Flow Proportional Counting (GFPC) System Analysis [EPA 900.0, EPA 903.0, EPA 904.0, EPA 905.0; HASL 300 Ba-01-R, Sr-02, and Sr-03-RC] , Revision 19	Definitive	Water/Radium-226	Gas Flow Proportional Counter (GFPC)	TestAmerica	N
WS-WC-0009	Determination of Anions by Ion Chromatography (Method 300.0A & 9056); (Revision 3.5)	Definitive	Water/General Chemistry	Ion Chromatograph	TestAmerica	N
WS-WC-0002	Determination of All Types of Residue in Water, Wastes, and Soil Samples; (Revision 4.7)	Definitive	Water/General Chemistry	Balance/Drying Oven	TestAmerica	N

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Initial Calibration Verification (ICAL) for Energy, Efficiency, and FWHM peak resolution	Prior to initial use, following repair or loss of control and upon incorporation of new or changed instrument settings	The energy difference should be within 0.05% for all calibration points or wthin 0.2 keV. Peak energy difference is within 0.1 keV of refernce energy for all points. Peak Full width at Half Maximum (FWHM) < 3 keV at 1332 keV. The efficiency difference should be within 8% of the true value for each point unless T.C.C calibration is performed.	Correct problem, then repeat ICAL.	Lab Manager / Analyst[1]	ST-RD-0102
Gamma Spectrometer	Initial Calibration Verification (ICV)	After ICAL for energy/efficiency and prior to analysis of samples.	Observed peaks of second source standard fall within ± 10% of initial calibration value relative to the true value.	Verify second source standard and repeat ICV to check for errors. If that fails, identify and correct problem and repeat ICV or ICAL and ICV as appropriate.	Lab Manager / Analyst[1]	ST-RD-0102
Gamma Spectrometer	Continuing Calibration Verification (CCV) (Daily Check)	Daily or prior to use. When working with long count times or batch sequences that run more than a day, CCV is performed at the beginning and end of each analytical batch as long as it not longer than a week.	Energy: ±0.5 keV at 60 keV; ± .75 keV at 1332 keV. FW HM: ±1.2x at 60 keV; ±1.8x at 662 keV; ±2.3x at 1332 keV. Activity Difference: %difference between the source activity and the reported activity ±5%	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Lab Manager / Analyst[1]	ST-RD-0102

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Background Subtraction Count Measurement (BSC) (Long count for subtracting background from blanks or test sources)	Immediately after ICAL and then performed on at least a monthly basis.	Background count rate of the entire spectrum with ±3σ of the average.	Recount and check control chart for trends. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze or qualify all impacted samples since last acceptable BSC.	Lab Manager / Analyst[1]	ST-RD-0102
Gamma Spectrometer	Instrument Contamination Check (ICC) (Short count for controlling gross contamination)	Daily or when working with long count times before and after each analytical batch. Check after counting high activity samples.	No extraneous peaks identified (i.e., no new peaks in the short background spectrum compared to previous spectra); Background count rate of the entire spectrum with ±3σ of the average.	Recount the background. If still out of control, locate and correct problem; reanalyze or qualify all impacted samples since last acceptable ICC. If background activity has changed, re-establish BSC and reanalyze samples.	Lab Manager / Analyst[1]	ST-RD-0102
Gas Flow Proportional Counter	Initial Calibration - Voltage Plateau (ICALV) (separate plateaus determined for alpha and beta activity)	Prior to initial use and after loss of control.	Slope of the plateau less than 5% over a range of 100V.	Correct problem, then repeat ICALV.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Initial Calibration - Efficiency (ICALE)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications for detector efficiency for both alpha and beta counting modes using electroplated sources.	Correct problem, then repeat ICALE.	Lab Manager / Analyst[1]	ST-RD-0403

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Flow Proportional Counter	Initial Calibration – Cross-talk Factors (ICALCT)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications for cross talk in alpha and beta channels.	Correct problem, then repeat ICALCT.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Initial Calibration – Self-Absorption Curve (ICALSA)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	For each radionuclide of interest (or isotope with similar energy profile), establish mathematical function (curve) of detector efficiency vs. source mass loading. Best fit of data with coefficient of determination (r2) ≥ 0.9.	Correct problem, then repeat ICALSA.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Efficiency Calibration Verification (IECV)	After ICALE for alpha and beta and prior to analysis of samples.	Individual points within ±30% of true value, average of points within ±10% of initial calibration value.	Correct problem and verify second source standard. Rerun IECV. If that fails, correct problem and repeat ICALE.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Continuing Calibration Verification (CCV)	After a counting gas change and daily for short test-source counting intervals.	Within tolerance or control chart limits ± 3% or 3σ of the mean.	Correct problem, rerun calibration verification. If that fails, then repeat ICALE. Reanalyze all samples since the last successful calibration verification.	Lab Manager / Analyst[1]	ST-RD-0403
HCGC/HRMS	Tune / Mass Resolution Check (PFK)	At the beginning and the end of each 12-hour period of analysis.	Resolving power ≥ 10,000 at m/z=304.9842 & m/z=380.9760 + 5ppm of expected mass. Lock-mass ion between lowest and highest masses for each descriptor and level of reference ≤ 10% full-scale deflection.	Retune instrument & verify. Assess data for impact if end resolution is less than 10,000 narrate or reinject as necessary.	Lab Manager / Analyst[1]	WS-ID-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
HRGC/HRMS	GC Column Performance Check (CPSM/WDM per method)	Prior to ICAL or calibration verification.	Peak separation between 2,3,7,8-TCDD and other TCDD isomers result in a valley of ≤ 25%; and identification of all first and last eluters of the eight homologue retentention time windows and documentation by labeling (F/L) on the chromatogram; and absolute retention times for switching from one homologous series to the next ≥ 10 seconds for all components of the mixture.	1) Readjust windows. 2) Evaluate system. 3) Perform maintenance. 4) Reanalyze CPSM. 5) No corrective action is necessary if 2,3,7,8-TCDD is not detected and the % valley is greater than 25%.	Lab Manager / Analyst[1]	WS-ID-0005
GC/HRMS	Minimum five-point initial calibration for target analytes, lowest concentration standard at or near the reporting limit. (ICAL)	ICAL prior to sample analysis, as needed by the failure of calibration verification, and when a new lot is used as a standard source for calib verification, internal standard or recovery standard solutions.	RSD ≤ 20% for response factors for 17 unlabelled isomers & 9 labelled IS, and ion abundance ratios within limits specified in SOP; and S/N ≥ 10:1for target analytes.	Evaluate standard and instrument response. If problem with instrument (autosampler failure, response poor, etc) or standards, correct as appropriate, then repeat initial calibration.	Lab Manager / Analyst[1]	WS-ID-0005
GC/HRMS	Second-source calibration verification	Immediately following ICAL.	Ion abundance ratios in accordance with SOP; and RF (unlabelled standards) within ± 20%D of average RF from ICAL; and RF (labelled standards) within ± 30%D of average RF from ICAL.	Evaluate standards and instrument response. If standard issue, repeat or remake then repeat standard as appropriate. If still fails, repeat initial calibration	Lab Manager / Analyst[1]	WS-ID-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/HRMS	Calibration Verification (CCV)	At the beginning of each 12-hour period, and at the end of each analytical sequence.	Ion abundance ratios in accordance with SOP; and RF (unlabelled standards) within ± 20%D of average RF from ICAL; and RF (labelled standards) within ± 30%D of average RF from ICAL.	Correct problem, repeat calibration verification. If fails, repeat ICAL and reanalyze all samples analyzed since last successful CCV End of Run CCV: If RF (unlabelled standards) > ± 20%D and ≤ ± 25%D and/or RF (labelled standards) > ± 30%D and ≤ ± 35%D of the average RF from ICAL use mean RF from bracketing CCVs to quantitate impacted samples. If bracketing CCVs differ by more than 25% RPD (unlabelled) or 35% RPD (labelled), run a new ICAL within 2 hours, and requantitate samples. Otherwise, reanalyze samples with positive detections.	Lab Manager / Analyst[1]	WS-ID-0005
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Percent relative standard deviation (%RSD)<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Second Source Calibration Verification (CV)	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun initial calibration verification (ICV) one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-MS-0002

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	CV	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20% difference (D) criteria for all analytes	Re-inject CV; if passes rerun previous ten samples and continue run; if 2nd CV fails, recalibrate	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis	Specific ion abundance criteria of 4-bromofluorobenzene (BFB) from method	Retune instrument and verify	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed.	N/A	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each reported analyte within +/- 0.06 RRT units	Correct problem, then rerun ICAL	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	ICAL – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	CV	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous ten samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis	Specific ion abundance criteria of DFTPP from method	Retune instrument and verify	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	Performance Check	At the beginning of each 12-hour period, prior to analysis of samples	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol shall be present at their normal responses, and shall not exceed a tailing factor of 2	Correct problem, then repeat performance checks	Lab Manager / Analyst[1]	ST-MS-0001

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A	Lab Manager / Analyst[1]	ST-MS-0001
GC	Retention Time (RT) window width	At method set-up and after major maintenance (e.g. column change)	RT width is +/- 0.3 times standard deviation for each analyte RT from the 72-hour study	N/A	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Mean RSD for each compound ≤ 20%	Recalibrate	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 30% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Confirmation of positive results (second column)	All positive results must be confirmed	Calibration and QC criteria are the same for the second column. RPD<40% between primary and second column results	Evaluate data, then report with flag to denote RPD > 40%. Narrate obvious matrix issues.	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC/FID	ICAL – five-point ICAL	Initial calibration prior to sample analysis	Linear mean RSD ≤ 20%	Recalibrate	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Rerun ICV one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-GC-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/FID	Calibration Verification (ICV and continuing [CCV])	ICV: Daily, before sample analysis. CCV: Every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 15% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	Retention Time (RT) window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used	N/A	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	RT window width	At method set-up and after major maintenance (e.g. column change)	RT width is +/- 0.3 times standard deviation for each analyte RT from the 72-hour study	N/A	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	ICAL – five-point ICAL	Initial calibration prior to sample analysis	Linear mean RSD ≤ 20%	Recalibrate	Lab Manager / Analyst[1]	ST-GC-0014
GC/FID	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Rerun ICV one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-GC-0014
GC/FID	Calibration Verification (ICV and continuing [CCV])	ICV: Daily, before sample analysis. CCV: Every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 15% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-GC-0014
GC/FID	Retention Time (RT) window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used	N/A	Lab Manager / Analyst[1]	ST-GC-0014

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/FID	RT window width	At method set-up and after major maintenance (e.g. column change)	RT width is +/- 0.3 times standard deviation for each analyte RT from the 72-hour study	N/A	Lab Manager / Analyst[1]	ST-GC-0014
ICP/AES	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months high a high standard at the upper limit of the range	Within + 10% of true value	Dilute samples within the calibration range, or re-establish/verify the LDR	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	3 standards and a blank. Correlation Coefficient of ≥ 0.998	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Calibration Blanks (ICB/CCB)	After ICV (ICB) and after every CCV (CCB)	All analytes less than LOQ	Correct problem and rerun ICB or CCB and all bracketing samples	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Low-level Calibration Check Standard (Low-level ICV)	Daily	All analytes within + 30% of expected value	Correct problem and repeat ICAL	Lab Manager / Analyst[1]	ST-MT-0003

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/AES	Interference Check Solutions (ICS)	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD(unless they are a verified trace impurity from one of the spike analytes). ICS-AB: within + 20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Lab Manager / Analyst[1]	ST-MT-0003
ICP-MS	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months high a high standard at the upper limit of the range	Within + 10% of true value	Dilute samples within the calibration range, or re-establish/verify the LDR	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Tuning	Prior to ICAL	Mass calibration < 0.1 amu from the true value; Resolution < 0.9 amu full width at 10% peak height	Retune instrument and verify	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	3 standards and a blank. Correlation Coefficient of ≥ 0.998	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Calibration Blanks (ICB/CCB)	After ICV (ICB) and after every CCV (CCB)	All analytes less than LOQ	Correct problem and rerun ICB or CCB and all bracketing samples	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Low-level Calibration Check Standard (Low-level ICV)	Daily	All analytes within + 20% of expected value	Correct problem and repeat ICAL	Lab Manager / Analyst[1]	ST-MT-0001

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-MS	Interference Check Solutions (ICS)	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD(unless they are a verified trace impurity from on e of the spike analytes). ICS-AB: within + 20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Lab Manager / Analyst[1]	ST-MT-0001
Cold Vapor AA	Initial Calibration (ICAL)	Daily initial calibration prior to sample analysis	Correlation coefficient R>=0.995 for linear regression	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
Cold Vapor AA	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected value (second source)	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
Cold Vapor AA	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence.	All analytes within + 20% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
CVAA	ICB/CCB	After ICV (ICB) and after every CCV (CCB)	All analytes less than LOQ	Correct problem and rerun ICB or CCB and all bracketing samples	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
Electronic Probe	Initial Calibration	Prior to sample analysis	A three point calibration is performed. Buffer solutions of 4, 7, and 10 are used. Readings must be within ±0.05 for each buffer solution.	Recalibrate	Lab Manager / Analyst[1]	ST-WC-0011
Electronic Probe	Continuing Calibration	Check the calibration by analyzing the calibration check standard (pH 7 buffer) after the initial calibration, every ten samples, and at the end of the analytical run	pH reading must be within ±0.05 of the ph 7 buffer.	Recalibrate – rerun samples bracketed by failing CCV	Lab Manager / Analyst[1]	ST-WC-0011

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Ion Chromatography (IC)	Initial Calibration (ICAL) – five-point calibration and a calibration blank	Weekly initial calibration prior to sample analysis	The intercept of the curve at zero must be < +/- the reporting limit. Correlation Coefficient of ≥ 0.995	Recalibrate	Lab Manager / Analyst[1]	ST-WC-0028
IC	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	Lab Manager / Analyst[1]	ST-WC-0028
IC	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-WC-0028

Notes:

[1] The analyst initiates the corrective action and the lab manager and analyst are responsible for the corrective action implementation.

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

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gamma Spectrometer	Clean cave; fill dewar with N2	Weekly	Acceptable background	Recalibrate	TestAmerica Analyst	ST-RD-0102
Gamma Spectrometer	QA Check of background and source (check deviation)	Daily	Within 3 sigma of measured population	Instrument maintenance and consult with Technical director	TestAmerica Analyst	ST-RD-0102
Gas Flow Proportional Counter (GFPC)	Clean Instrument	Daily	None applicable	Recalibrate	TestAmerica Analyst	ST-RD-0403
GFPC	Inspect windows	High counts and/or background	No physical defects	Instrument maintenance	TestAmerica Analyst	ST-RD-0403
GC-MS	Clean sources, maintain vacuum pumps	Service vacuum pumps twice per year, other maintenance as needed	Tune and CCV pass criteria	Recalibrate instrument	TestAmerica Chemist	WS-MW-0007, WS-MW-0008
GC-MS	Change septum, clean injection port, change or clip column, install new liner, change trap	As needed	Tune and CCV pass criteria	Re-inspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	TestAmerica Chemist	WS-MW-0007, WS-MW-0008
GC	Change septum, clean injection port, change or clip column, install new liner, replace column, filters and seals	As needed	CCV passes criteria	Re-inspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	TestAmerica Chemist	WS-GC-0001, WS-GC-0007
ICP/MS	Replace disposables, clean/change nebulizer, torch, and cones	As needed	Tune and CCV pass criteria	Recalibrate	TestAmerica Chemist	ST-MT-0001
ICP/AES	Clean/Replace sample lines/probe, FAST valve, torch, nebulizer, spray chamber	As needed	ICV and CCV pass criteria	Recalibrate	TestAmerica Chemist	ST-MT-0003
CVAA	Clean windows, optics, lamp. Inspect tubing and glassware	As needed	ICV and CCV pass criteria	Recalibrate	TestAmerica Chemist	ST-MT-0005

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

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/HRMS	Parameter Setup	Initially; prior to DCC	Correct Parameters	Reset if incorrect	TestAmerica Chemist	WS-ID-0005
GC/HRMS	Tune Check	Initially; prior to DCC	Compliance to ion abundance criteria	Correct the problem and repeat tune check	TestAmerica Chemist	WS-ID-0005
pH probe	Clean and inspect	Day of use	Meet method criteria	Clean probe; reanalyze any affected samples	TestAmerica Chemist	ST-WC-0011
Balance	Clean pan and weighing compartment	As needed	Balance meets criteria	Recalibrate	TestAmerica Chemist	WS-WC-0002
Ion Chromatograph	Change guard columns, Replace Tubing, Change Pump Seals	As needed	No interference/ carry over peaks; no leaks; stable retention times	Replace guard column, replace worn tubing, change pump seals	TestAmerica Analyst	WS-WC-0009

SAP Worksheet #26 – Sample Handling System

(UFP-QAPP Manual Appendix A)

SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Sampler / Gilbane
Sample Packaging (Personnel/Organization): Sampler / Gilbane
Coordination of Shipment (Personnel/Organization): Sampler / Gilbane
Type of Shipment/Carrier: Overnight shipping service such as FedEx or Laboratory Courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Laboratory receipt clerk / TestAmerica
Sample Custody and Storage (Personnel/Organization): Laboratory technician or custodian / TestAmerica
Sample Preparation (Personnel/Organization): Laboratory technician / TestAmerica
Sample Determinative Analysis (Personnel/Organization): Analyst / TestAmerica
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 calendar days
Sample Extract/Digestate Storage (Number of days from extraction/digestion): Up to 40 calendar days depending on method holding times
Biological Sample Storage (Number of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian / TestAmerica
Number of Days from Analysis: 90 calendar days

Notes:
NA = Not applicable

SAP Worksheet #27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Standardized sample custody procedures will be followed from sample collection, through transfer, storage, and analysis, to ultimate disposal in accordance with SOP PR-TC-02.04.01.01. Sample custody begins with shipment of the empty sample containers from the laboratory to the office or site. Sample containers will be shipped from the laboratory in sealed containers with appropriate seals and custody information. Sample containers will be properly labeled, and collected samples will be monitored for temperature control, as required, in the field and during laboratory transport and storage. Temperature blanks will be used in coolers containing samples requiring preservation at reduced temperature. Samples will be accompanied by a chain-of-custody record. When samples are transferred, both the individual relinquishing and the individual receiving the samples will sign, date, and note the transfer time on the COC record. Samples will be packaged for shipment with completed sample labels for each sample container, sample containers carefully packed upright and on ice (as required), and with a COC record in a Ziploc bag.

Custody seals will be used when samples are shipped via commercial courier service, and will be placed on the cooler so that the seals have to be broken before the cooler can be opened. The seals will be signed and dated by the field personnel. Samples may be hand-delivered to the laboratory, transported by commercial or laboratory couriers, or shipped to the laboratory using an overnight shipper.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

A designated laboratory sample custodian will accept custody of the samples and verify that the information on the sample labels matches that on the chain-of-custody form(s). Pertinent information as to sample condition, shipment, pickup, and courier will also be checked on the chain-of-custody form. The temperature inside the cooler and of the temperature blank will be measured immediately after the cooler is opened (as required), and the results will be recorded. Information on the date and time of receipt, method of shipment, and sample condition will also be recorded on a sample receipt form which will be forwarded to the Gilbane Project Chemist. The custodian will then enter the appropriate data into the laboratory sample tracking system. The sample custodian will use the sample numbers on the sample labels for tracking and also assign a unique laboratory number to each sample. The custodian will then transfer the samples to the proper analyst(s) or store the samples in the appropriate secure area. Data sheets and laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least three years. Samples and extracts will be retained by the analytical laboratory for a minimum of 90 days after the laboratory reports the data. Unless notified otherwise, samples may be disposed of by the laboratory in a manner consistent with local government regulations.

Chain-of-Custody Procedures:

A COC form will be completed for every group of samples sent to the analytical laboratory, to document sample possession from the time of collection to sample receipt by the laboratory; and a copy of the form will accompany the shipment. Each completed COC form will contain the

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

following information: sample identification number(s); name(s) and signature(s) of collectors, samplers, or recorders; Gilbane project number, project name, and location of project; the project manager's name and contact information; the date and time of collection; sample type(s) and analyses requested; and signatures of persons relinquishing and receiving the samples. When samples are transferred, the individuals relinquishing and receiving the samples will sign, date, and note the transfer time on the COC form.

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as described in SOP PR-TC-02.12.02.00, *Sample Handling and Electronic Data Management*.

Sample Numbering

The sample number will be recorded in the field logbook, on the labels, and on the chain-of-custody record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

Samples will be uniquely designated using a numbering system that identifies the CTO number, location/type of sample, and a sequential number as follows:

- Soil samples collected from building excavations: **XXXX-YYYY-ZZZ**, where:
    XXXX– IR designation (e.g., IR12)
    YYYY – four-character designation for the building (e.g., 1217)
    ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from the excavation

- Soil samples collected from SWDA/Northpoint excavation: **XXXX-YYYY-ZZZ**, where:
    XXXX– IR designation (e.g., IR12)
    YYYY – four-character designation for the excavation (e.g., SWDA)
    ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from the excavation

- Soil samples collected from 58 discrete point excavations: **XXXX-RAYY-ZZZ**:
    XXXX– IR designation (e.g., IR12)
    RA – indicates "Remedial Action"
    YY – two-character consecutive number (begins with 01) to designate the number of the excavation
    ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from the excavation

- Soil samples collected from imported fill material sources: **IF-XXXX-YYY-ZZZ**, where:
    IF – represents Import Fill
    XXXX – IR designation (e.g., IR12)
    YYY- three-character consecutive number (begins with 001) to designate the number of the source
    ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from a source

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

- RSY Survey Pads: **XXXX-RSY-QQQQ-UU**, where:
  - XXXX – IR designation (e.g., IR12)
  - QQQQ – Four-character consecutive pad number 0001; continues consecutively throughout the CTO with no repeated numbers
  - UU – Two-character consecutive sample number starting with 01 (number of samples collected from each reference area)

- Groundwater Monitoring Samples: **XX-YYYYY-MMDD**, where:
  - XX – Two character IR designation (e.g., 12)
  - YYYYY – Up to five character well designation (e.g. MW17)
  - MM – Two-character designation for the month in which the sample was collected
  - YY – Two-character designation for the year in which the sample was collected

Sample Packaging – Chemical Samples

Chemical samples will be packaged and shipped in accordance with SOP PR-TC-02.04.01.01, *Sample Handling, Packaging, and Shipping*.

Sample Packaging - Radiological Samples

Samples will be delivered for analysis to the laboratory via cooler, box, or other similar container (ice is not required if only radiological analyses will be performed), along with the completed COC. Samples to be sent off site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage.

For samples transported via commercial carrier, two custody seals will taped across the lid of the box or cooler: one seal in the front and one seal on the side. The COC will include the airbill number, and the "Received By" box will be labeled with the commercial courier's name. The COC will be sealed in a resealable bag and then taped to the inside of the sample cooler lid or placed inside the box. A copy of the COC will be maintained on site and a copy will be e-mailed to the Project Chemist. The box/cooler will be taped shut as necessary. The airbill will be completed for priority overnight delivery and placed in the pouch, which then will be secured to the box/cooler. If multiple boxes/coolers are being shipped, the original COC will be placed in one of the boxes/cooler, and copies of the COC will be placed in the other boxes/coolers. The number of packages should be included on each airbill (e.g., 1 of 2, 2 of 2). Prepared packages will be surveyed prior to shipment..

SAP Worksheet #28 – Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil
Analytical Group	Gamma Spectroscopy
Analytical Method / SOP Reference[1]	EPA 901.1M/ST-RD-0102

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank (MB)	One per preparation batch	No analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	Acceptable results per stated QC Acceptance Limits
Laboratory Control Sample (LCS)	One per preparation batch	Recovery limits: 87-120% for Cs-137, 87-115% for Co-60, 87-116% for Am-241	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.	Analyst, Supervisor	Accuracy/Bias	Acceptable QC Acceptance Limits
Sample Duplicate	One per preparation batch	RPD limit of 40% or Relative Error Ration <1	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not cuased by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	Acceptable QC Acceptance Limits

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Dioxin/Furans
Analytical Method / SOP Reference[1]	EPA 8290/ WS-ID-0005

QC Sample	**Frequency / Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
MB	One per preparation batch	Project specific criteria, if available. Otherwise, no target analytes detected ≥ 1/2 LOQ or ≥ 10% of the associated regulatory limit or ≥ 10% of the sample result for the analyte, whichever is greater. (OCDD is considered a common laboratory contaminant and treated accordingly).	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with DoD QSM requirements. "Totals" are not considered "target analytes" – no corrective action or flagging is necessary for "totals".	Chemist	Accuracy/Bias Contamination	No target analytes ≥ 1/2 LOQ
LCS	Every field sample, standard and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a critical chemical of concern as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for critical chemicals of concern, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager / Analyst	Accuracy/Bias Contamination	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Dioxin/Furans
Analytical Method / SOP Reference[1]	EPA 8290/ WS-ID-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS/MSD	One per 20 field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvious chromatographic interference is present, report with narrative comment. Otherwise, reextract and reanalyze.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Internal Standard (IS)	Every field sample, standard and QC sample	% recovery for each IS in the original sample (prior to dilutions) must be within 40-135%	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvious chromatographic interference is present, report with narrative comment. Otherwise, reextract and reanalyze.	Lab Manager / Analyst	Precisions and Accuracy/Bias	Meets all EPA Method requirements (40-135% Recovery)

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	SVOCs
Analytical Method / SOP Reference[1]	EPA 8270D/WS-MS-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IS	During acquisition of calibration standard, samples, and QC check samples	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within - 50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning in accordance with QSM requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Lab Manager/ Analyst	Accuracy	Acceptable recoveries per stated QC Acceptance Limits
MB	One per preparation batch	No target analytes ≥ ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants as noted below, no analytes detected >RL in accordance with QSM requirements Common lab contaminants are: bis-2-ethylhexylphthalate, di-n-octyl phthalate, butyl benzyl phthalate, di-n-butyl phthalate	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements.	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	SVOCs
Analytical Method / SOP Reference[1]	EPA 8270D/WS-MS-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a critical chemical of concern (CCoC) as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/ Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client prior to reporting data with narrative comment. Otherwise, reextract and reanalyze.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PAHs
Analytical Method / SOP Reference[1]	EPA 8270D/WS-MS-0008

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IS	During acquisition of calibration standard, samples, and QC check samples	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within - 50% to +100% of ICAL midpoint standard. On days with the ICAL is not analyzed, use the initial CCV.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning in accordance with QSM requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Lab Manager/ Analyst	Accuracy	Acceptable recoveries per stated QC Acceptance Limits
MB	One per preparation batch	No target analytes detected greater than one-half LOQ and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than LOQ.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements.	Lab Manager/ Analyst	Representative-ness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PAHs
Analytical Method / SOP Reference[1]	EPA 8270DSIM/WS-MS-0008

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a CCoC as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze if sufficient sample material is available.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PCBs
Analytical Method / SOP Reference[1]	EPA 8082A/ WS-GC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	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.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/ Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Laboratory technician	Precision/ Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

Matrix	Soil
Analytical Group	PCBs
Analytical Method / SOP Reference[1]	EPA 8082A/ WS-GC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze, if sufficient sample material available.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Pesticides
Analytical Method / SOP Reference[1]	EPA 8081B/ WS-GC-0001

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IS	One per preparation batch	RT within ± 0.06RRT units of RT of ICAL mid-point standard, Area within - 50% to +100% of ICAL midpoint standard. On days without ICAL, initial CCV may be used as reference.	Inspect GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning in accordance with QSM requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Lab Manager/ Analyst	Accuracy	Acceptable recoveries per stated QC Acceptance Limits
MB	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.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

Matrix	Soil					
LCS and/or LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a CCoC as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze, if sufficient sample material available.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil
Analytical Group	pH
Analytical Method / SOP Reference[1]	EPA 9045D / WS-WC-0044

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	Results within buffer ranges	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	Results within buffer ranges
LCS	One LCS per preparation batch per matrix	Percent Recoveries: 99-101% (lab-derived limits)	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Accuracy	Percent Recoveries: 99-101% (lab-derived limits)
Duplicate	One per prep batch	RPD Limit: 5% (lab-derived limits)	Correct problem, then re-reanalyze the DUP and all associated batch samples	Analyst	Precision	RPD Limit: 5% (lab-derived limits)
pH Buffer Ranges	Before beginning a sample run, at 4.0, 7.0, and 10.0 standard unit	Percent Recoveries: 99-101% (lab-derived limits)	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Percent Recoveries: 99-101% (lab-derived limits)

SAP Worksheet #28 – Laboratory QC Samples Table (continued)
(UFP-QAPP Manual Section 3.4)

Matrix	Soil and Water
Analytical Group	TPH-extractable
Analytical Method / SOP Reference[1]	EPA 8015B/WS-GC-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	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.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

Matrix	Soil and Water
Analytical Group	TPH-extractable
Analytical Method / SOP Reference[1]	EPA 8015B/WS-GC-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS /LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a critical chemical of concern (CCoC) as identified by the project team, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze, if sufficient sample material available.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil and Water
Analytical Group	Metals
Analytical Method / SOP Reference[1]	EPA 6010C/6020A/7471B//ST-MT-0003/ST-MT-0001/ST-MT-0007

QC Sample	**Frequency / Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
MB	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	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Correct problem, then re-prep and re-reanalyze the LCS and all associated batch samples for failed analytes, if sufficient sample volume is available and samples are within 2x the hold time. Qualify data accordingly if reprep & re-analysis cannot be performed or if reprep & reanalysis also has failed analytes	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil and Water
Analytical Group	Metals
Analytical Method / SOP Reference[1]	EPA 6010C/6020A/7471B//ST-MT-0003/ST-MT-0001/ST-MT-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Serial Dilution	Each new sample matrix	1:5 dilution must agree within ±10% of original determination.	Perform post-digestion spike if serial dilution does not meet criteria	TestAmerica - St. Louis Analyst	Accuracy	1:5 dilution must agree within ±10% of original determination.
Post-digestion Spike	When serial dilution or matrix spike fails	Recovery within 80-120%	Re-analyze post-digestion spike.	TestAmerica - St. Louis Analyst	Accuracy	Recovery within 80-120%

SAP Worksheet #28 -- Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Water
Analytical Group	Radium-226
Analytical Method / SOP Reference[1]	EPA 903.0 / ST-RD-0403

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank (MB)	One per preparation batch	No analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	Acceptable results per stated QC Acceptance Limits
Laboratory Control Spike	One per preparation batch	Recovery limits: 68-137% for Ra-226	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.	Analyst, Supervisor	Accuracy/Bias	Acceptable QC Acceptance Limits
Laboratory Duplicates	One per preparation batch	RPD limit of 40% or Relative Error Ratio <1	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not cuased by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	Acceptable QC Acceptance Limits
Barium Carrier	Every Sample	Recovery limits of 40-110%	Truncate carriers above 100% recovery to eliminate low biased results. Reprep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is noticed during sample preparation.	Analyst, Supervisor	Accuracy/Bias	Acceptable QC Acceptance Limits

SAP Worksheet #28 -- Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Water
Analytical Group	General Chemistry - Anions
Analytical Method / SOP Reference[1]	EPA 300.0/ WS-WC-0009

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
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	Acceptable results
LCS	One LCS per preparation batch per matrix	QSM limits (if available), otherwise recovery 90-110% for aqueous samples samples.	Reanalyze LCS once. If acceptable, report. Evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Accuracy	Acceptable Percent Recoveries and RPD

Matrix	Water					
MS/MSD	One MS per preparation batch per matrix	90-110% control limits for each analyte. RPD ≤ 15% between MS and MSD.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Acceptable Percent Recovery

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Water
Analytical Group	General Chemistry - Solids
Analytical Method / SOP Reference[1]	SM 2540 C & D/ WS-WC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
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.	Evaluate date. If all associated samples > 10 x level in the blank, narrate, and report. Otherwise, correct problem, then re-prepare and reanalyze the method blank and all samples less than 10 x the level in the blank.	Lab Manager/ Analyst	Representativeness	Acceptable results
LCS/LCSD	One LCS or LCSD per preparation batch per matrix	Percent Recoveries: 80% to 120% (lab-derived statistical limits)	Terminate analysis, identify and correct the problem, then re-prepare and reanalyze all affected samples and QC checks	Lab Manager/ Analyst	Accuracy	Percent Recoveries: 80% to 120% (lab-derived statistical limits)
Duplicate	One DUP per preparation batch per matrix	20% RPD between sample and dupicate.	Correct problem, then re-reanalyze the DUP and all associated batch samples	TestAmerica - St. Louis Analyst	Precision	RPD Limit: 20% (lab-derived statistical limits)

SAP Worksheet #29 – Project Documents and Records Table
(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
RAWP, which includes this SAP	Project file, NAVFAC SW Administrative Record
Field forms	Project file
Chain-of-custody forms	Project file, laboratories; NAVFAC SW will receive a copy of definitive data chain-of-custody records
Shipping Records	Project file
Audit/assessment checklists/reports	Project file and laboratory (if applicable)
Corrective action forms/reports	Project file and laboratory (if applicable)
Field change request forms	Project file
Analytical laboratory data packages (Level III- or Level IV-equivalent)	Laboratory and project file; NAVFAC SW Administrative Record
Data validation reports	Validator and project file; NAVFAC SW Administrative Record

Field documentation associated with sampling activities includes field forms, sample labels, chain-of-custody records, sample shipping records, field surveillance reports, and Field Change Request (FCR) forms. In addition, laboratory and data validator documentation will be generated during this project. These types are described in the following sections.

Field Logbooks/Forms

Field forms (or logbooks) will be handled in accordance with SOP PR-TC-01.04.04.00, *Field Documentation* (included in Attachment A of this SAP).

Sample Labels

For radiological analysis of fill material, a resealable plastic bag will be used to collect soil samples. Sample labels will be generated at the time the chain-of-custody record is prepared, and affixed to the resealable plastic bag and the prepared sample container (if one is used during sample processing). The label will contain the following:

- Sample identification number.
- Sample collection date (month/day/year)
- Analytical method.
- Time of collection.
- Sampler’s initials.

SAP Worksheet #29 – Project Documents and Records Table (Continued)

If containers are too small to fit all the sample information listed above, at a minimum the container will be labeled with the sample identification number, and the remaining information will be recorded on the chain of custody.

For chemical samples to be sent to the laboratory labels will be hand-written using indelible black or blue ink on a waterproof label and affixed to each sample container at the time of sample collection (or labels may be computer generated). The label will contain the following information:

- Sample identification number.
- Sample collection date (month/day/year).
- Time of collection (24-hour clock).
- Sampler's initials.
- Preservative (if any).

Chain of Custody

Chain-of-custody record information is described in SAP Worksheet #27.

Sample Shipping Records

For samples couriered to the laboratory, the chain of custody will be signed by the courier and a copy maintained on site in the project file. For samples shipped via FedEx, the chain-of-custody record will be packaged within the cooler, and the sender's copy of the airbill will serve as custody documentation and will be maintained on site in the project file. Sample shipping procedures are detailed in SAP Worksheet #27.

Field Surveillance Reports

Field surveillances will be performed in accordance with the three phases of inspection as required by the QC program. A Preparatory Inspection will be performed by the PQCM prior to the first sampling activities. This will include a general orientation for health and safety. An Initial Inspection will be conducted at the beginning of field sampling activities for this project. Daily field inspections and subsequent surveillances will be performed at the discretion of the PQCM or the QCPM throughout the duration of the project. The PQCM will use the Initial Inspection Checklist during inspection.

Field Change Request

An FCR will be prepared by the Program Chemist, or a designee, if a change to the SAP is needed during sampling activities. Any changes will be minor, and will not result in a change in scope or DQOs for this project. The FCR must be approved by the QCPM prior to field implementation.

SAP Worksheet #29 – Project Documents and Records Table (Continued)

Major changes to work scope affecting the DQOs or meeting criteria described in EWI #2, 3EVR.2, *Review, Approval, Revision, and Amendment of Sampling and Analysis Plans* (NAVFAC SW, 2006) will require preparation of a SAP Addendum. The SAP Addendum must be approved by the Navy QAO and the planning team identified on SAP Worksheet #10 prior to conducting sampling and analysis.

Laboratory Documentation

Relevant laboratory raw data and documentation, including but not limited to logbooks, data sheets, electronic files, and reports, will be maintained by the laboratory for at least 5 years. Gilbane must be notified 30 days before disposal of any relevant records. Laboratory data packages will be compliant the reporting requirements as described in Appendix A of the DoD QSM 5.1.1.

- Excavation confirmation soil samples and imported fill material used for backfill – 90 percent suitable for Stage 2B and 10 percent suitable for Stage 4.
- Groundwater Monitoring Samples – 90 percent suitable for Stage 2B and 10 percent suitable for Stage 4.
- Waste Characterization samples – 100 percent suitable for Stage 2A.

For Stage 2A-, 2B-, or 4-suitable data packages, an EDD will be uploaded directly to Gilbane's web-based portal at http://edms.gilbaneco.com. The hard-copy data package also will be uploaded in PDF format to the portal. Both the EDDs and the hard-copy data package will present results to two or three significant figures. For radiological results, at least three significant figures will be used. For organic results, at least two significant figures will be used. For inorganic results, at least two significant figures will be used for results less than 10, and at least three significant figures will be used for results greater than 10. Results for QC analyses (method blanks, MS/MSDs, LCSs, and duplicates) will be reported up to 3 significant figures.

When revisions to Stage 2A-, 2B-, or 4-suitable data packages are required, the report will be resubmitted in its entirety to both the portal and the Project Chemist, with the notation "amended or revised report." If the revisions affect the EDDs, the revised EDD also will be uploaded to the portal.

Data Validation Reports

Samples are to be validated in accordance with SAP Worksheet #36 and Gilbane SOP PR-TC-04.01.00.00 or PR-TC-04.01.02.00, as appropriate.

The validation report for definitive samples will include the data validation findings worksheets. Each laboratory sample delivery group (SDG) will have its own data validation report. The validation reports will contain the following information:

- Title page that contains project name, sample collection date, validator subcontractor name, report date, type of analysis, laboratory, sample delivery group (SDG), sample identifications (including MS/MSD, duplicate, reanalysis, or dilution samples), sample matrix (e.g., soil, water), and validation level (EPA Level III or IV).

SAP Worksheet #29 – Project Documents and Records Table (Continued)

- Introduction page including the number of samples per matrix, analytical method reference, validation guideline reference, section references to summary qualification flags, and identification of QC samples. The report body will include the acceptance criteria used to evaluate each QC parameter exceeding criteria, a list of all QC exceedances as well as the associated bias, the samples associated with each exceedance, and the qualifiers applied. Statements regarding flag classification (protocol/advisory) and whether a raw data check was performed also will be included.
- Evaluation and discussion of the following parameters:
    - Technical holding times.
    - GC/MS instrument performance check (tune) if applicable.
    - Calibration.
    - Laboratory blanks.
    - Accuracy and precision data for internal laboratory QC associated with each SDG.
    - Target compound identification.
    - System performance checks.
    - Analyte quantitation and quantitation limits (MDC and LOQs).
    - Field QC samples (if not applicable, report will note).
    - Overall assessment of data.
    - Qualifier classification.

The data validator will upload a PDF copy of the validation report to the project portal at http://edms.gilbaneco.com, and enter qualifiers directly to the database using the project portal.

The data validation subcontractor must maintain validation records for at least 5 years. Gilbane will be notified 30 days before disposal of any records.

SAP Worksheet #30 – Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	**Laboratory / Organization** (name and address, contact person and telephone number)	**Backup Laboratory / Organization** (name and address, contact person and telephone number)
Soil	Metals,	Samples as listed on SAP WS #18	Methods per SAP WS #19	10 Business Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamericainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Soil	PAHs, PCBs, Pesticides, VOCs, SVOCs, TPH, pH Dioxin/Furans	Samples as listed on SAP WS #18	Methods per SAP WS #19	20 Business Days	Subcontracted through St. Louis to: TestAmerica West Sac. 880 Riverside Parkway West Sacramento, CA 9560	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Soil	Ra-226	Samples as listed on SAP WS #18	E901.1M	20 Business Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamericainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Soil	Asbestos	Samples as listed on SAP WS #18	California Air Resources Board (CARB) 435	10 Business Days	Subcontracted through St. Louis to: EMPK Laboratories	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com

SAP Worksheet #30 – Analytical Services Table (Continued)

Matrix	**Analytical Group**	**Sample Locations/ ID Number**	**Analytical Method**	**Data Package Turnaround Time**	**Laboratory / Organization** (name and address, contact person and telephone number)	**Backup Laboratory / Organization** (name and address, contact person and telephone number)
Water	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate	Samples as listed on SAP WS #18	Methods per WS #19	10 Business Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamercainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Water	Ra-226	Samples as listed on SAP WS #18	E903.0	30 Calendar Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamericainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com

Selected laboratories will have successfully completed the DoD ELAP certification for the matrices and methods listed in SAP Worksheet #23 and will maintain current status throughout the duration of this project. Laboratories also will be certified by the California Water Board under the ELAP for all of the analytical methods listed in SAP Worksheet #23. Laboratories will be capable of providing the project QC and data deliverables required by this SAP and the DoD QSM for Environmental Laboratories version 5.0. Asbestos testing is a specialty testing and will not require DoD or California ELAP, but will have the National Voluntary Laboratory Accreditation Program certification to perform asbestos analysis. Status of laboratory certifications/accreditations will be verified prior to fieldwork and before samples are delivered to lab. Updates to lab accreditation to ensure the laboratory is qualified to perform the analysis will be made prior to sample testing.

SAP Worksheet #31 – Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Sampling Surveillance	Annually; at least one technical systems audit (TSA) at the start of field activities, with discretionary follow-ups	Internal	Gilbane	PQCM (Gilbane)	Project Manager (Gilbane)	Project Manager (Gilbane)	Project Manager and PQCM (Gilbane)
Management Review	Once during the project	Internal	Gilbane	QCPM (Gilbane)	Project Manager (Gilbane)	Project Manager (Gilbane)	PQCM (Gilbane)

SAP Worksheet #32 – Assessment Findings and Corrective Action Responses
(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Time-frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Time-frame for Response
Field Sampling Surveillance	Surveillance Report	Project Manager, Gilbane	7 days after completion of report	Corrective Action Report	Project Manager and QCPM, Gilbane	5 days after notification
Management Review	Surveillance Report	Project Manager, Gilbane	7 days after completion of report	Corrective Action Report	Project Manager, Gilbane	14 days after notification

SAP Worksheet #33 – QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Field Sampling Surveillance Report	Once, at startup of sampling	Determined during the project	PQCM, Gilbane	Project Manager and QCPM, Gilbane
Management Review Report	Once, after management review is completed	Determined during the project	QCPM, Gilbane	Project Manager and Program Manager, Gilbane

SAP Worksheet #34 – Verification (Step I) Process Table
(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Field notes/logbook	Field notes will be reviewed internally, at intervals as needed during the project and at the completion of the work, and placed in the project file. A copy of the field notes will be attached to the final report.	I	PQCM, Gilbane
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally in the field upon completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody form will be initialed by the reviewer. A copy of the form will be retained in the project file, and the original and remaining copies will be taped inside the cooler for shipment.	I I	PQCM, Gilbane Second-level review by Project Chemist, Gilbane
Sample receipt	For samples shipped to the lab via FedEx, the Project Chemist will verify receipt of samples by the laboratory the day following the shipment.	I	Project Chemist, Gilbane
Sample logins	Sample log-in information will be reviewed and verified for accuracy and completeness in accordance with the requirements in this SAP.	E[1]	Laboratory PM
Laboratory analytical results prior to release	Laboratory analytical results will be reviewed to verify that the requirements in this SAP have been met. Prior to release, results will be verified as follows:	E[1]	Laboratory PM
	• Analytical results (100 percent) comply with the method- and project-specific requirements, and any deviation or failure to meet criteria is documented for the project file.	E[1]	Laboratory PM
	• Manual entries (100 percent) are free of transcription errors, and manual calculations are accurate; computer calculations are spot-checked to verify program validity; results reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been used appropriately; reported values include dilution factors; and results are reasonable.	E[1]	Analyst

SAP Worksheet #34 – Verification (Step I) Process Table (Continued)
(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory analytical results prior to release (Continued)	• Analytical results reported are compliant with method- and project-specific QC; analytical methods are implemented in compliance with approved SOPs. (This review may be conducted after release of results, since reviews are done only on 10 percent of the results.)	E[1]	Laboratory PM
Laboratory analytical results due at turnaround time listed on chain-of-custody record	Laboratory analytical results will be verified as having been obtained following the protocols in this SAP and being of sufficient quality to satisfy DQOs.	I	Project Chemist, Gilbane
Laboratory Data Packages	Screening data reports and Stage 3- or 4-equivalent laboratory data packages will be verified by the laboratory performing the work for completeness and technical accuracy prior to submittal, in accordance with the requirements described in SAP Worksheet #29.	E[1]	Laboratory PM
Field and electronic data	One-hundred percent of manual entries will be reviewed against the hard-copy information, and 5 percent of electronic uploads will be checked against the hard copy.	I	Project Chemist, Gilbane
Analytical Procedures	Ensure that the analytical methods and deliverable requirements described in this SAP were followed (including holding times, analyte lists, and QC criteria).	E[1]	Laboratory PM
Laboratory Data Reports	Ensure that data reports are validated by the laboratory performing the work for technical accuracy and for meeting the requirements listed in SAP Worksheet #29 prior to submittal.	E[1]	Laboratory PM

Notes:

[1] The Laboratory Project Manager may direct the use of a designee for verification inputs as needed.

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

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Sample Collection	Ensure that the sampling procedures described in this SAP were used to collect samples and that any deviations from those procedures were documented in a FCR.	PQCM, Gilbane Project Chemist, Gilbane
IIa	Sample Handling	Ensure that the procedures described in this SAP for sample handling, packaging, and transport to the laboratory were followed.	PQCM, Gilbane Project Chemist, Gilbane
IIa	Sample Documentation	Ensure that the chain-of-custody record procedures described in this SAP were followed for sample collection, and that logbooks or field forms were completed as required.	PQCM, Gilbane Project Chemist, Gilbane
IIb	Sampling Procedures	Review sampling procedures to document any deviations that occurred and note any corrective actions required.	PQCM, Gilbane
IIb	Analytical Procedures	Review analytical procedures to document any deviations that occurred and note any corrective actions required.	Site RSO or designee, Envirachem/Gilbane Project Chemist, Gilbane Third Party Validator, Validata
IIb	Project Quantitation Limits and Laboratory QC Criteria	Ensure that project quantitation limits and laboratory QC criteria were followed and that any deviations were documented.	Site RSO or designee, Envirachem/Gilbane Project Chemist, Gilbane Third Party Validator, Validata

Notes:
The Laboratory PM may direct the use of a designee for verification inputs as needed.

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

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	All	All	In accordance with Laboratory SOPs listed in SAP Worksheet #23 and the DoD QSM 5.1.1.	Site RSO or designee, Envirachem/Gilbane Project Chemist, Gilbane
IIb	All	All	In accordance with NAVFAC SW EWI #1, this SAP, and Gilbane SOP PR-TC-04.01.00.00 and PR-TC-04.01.02.00	Third-Party data validator, Project Chemist

The validation strategy for definitive data for this project is 90% Stage 2B and 10% Stage 3/4, in accordance with Step IIb above. The 10% will be randomly chosen on the chain-of-custody record. Definitive data does not include samples collected for informational purposes. Any such samples will be validated at a Stage 2A.

EPA Level IV Data Validation

EPA Level IV data validation is a full validation that will be performed on the TI Site 12 summary and raw data packages. The data reviewer will request any missing information from the laboratory and copy the Project Chemist when missing information is requested. The data reviewer will validate all components of the data package even when an individual QC element has been rejected. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Level IV (Stage 3/4) Data Validation Elements

The QC elements to be reviewed for Level IV (Stage3/4) validation are listed below.

Radiological Analyses

- Holding times.
- Initial calibration.
- Continuing calibration.
- Blanks.
- Duplicate sample RPD or RER, as appropriate.
- Laboratory control sample recovery.
- Reporting limits and uncertainty.
- Review of reagent traceability summary, if applicable.

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table (continued)

- Calculation checks of quantified analytical data and QC samples.
- Overall assessment of data in the SDG.

Chemical Analyses

- Holding times and preservation.
- Blanks.
- Lab QC.
- Field QC, if applicable.
- Surrogates and internal standards, where applicable.
- Initial and continuing calibrations.
- Instrument performance checks.
- Review of raw data.
- Review of reagent traceability summary, if applicable.
- Calculation checks of quantified analytical data and QC samples.

EPA Level III (Stage 2B) Data Validation

EPA Level III (Stage 2B) data validation is a more cursory validation that will be performed on the summary packages (i.e., not on raw data). The data reviewer will request any missing information from the laboratory and copy the client's project manager when missing information is requested. The data reviewer will validate all components of the data package, even when an individual QC element has been rejected. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Level III (Stage 2B) Data Validation Elements

The QC elements to be reviewed for Level III validation are listed below.

Radiological Analyses

- Holding times.
- Initial calibration.
- Continuing calibration.
- Blanks.
- Duplicate sample RPD or RER, as appropriate.
- Laboratory control sample recovery.
- Reporting limits.
- Overall assessment of data in the SDG.

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table (continued)

Chemical Analyses

- Holding times and preservation.
- Blanks.
- Lab QC.
- Field QC, if applicable.
- Surrogates and internal standards, where applicable.
- Initial and continuing calibrations.
- Instrument performance checks

The following documents will be used as guidance for validating chemical analytical results:

- *General Data Validation Guidelines* (DoD, 2018)
- *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, EPA 540-R-2017-002 (EPA, 2017).
- *Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*, EPA 540-R-2017-001 (EPA, 2017).
- EWI #1, 3EN2.1, Chemical Data Validation (SWDIV2001).
- *Test Methods for Evaluating Solid Waste, Physical Chemical Methods*, SW-846, Third Edition and final updates (EPA, 1986).
- QSM v. 5.1 (DoD/Department of Energy [DOE], 2017).
- QC criteria specified in this SAP.

Radiological analytical results will be validated using Chapter 8 of the *Multi-Agency Radiological Laboratory Analytical Protocols Manual* (MARLAP), EPA 402-B-04-001A (EPA et al., 2004); and the QC criteria specified in the SAP.

SAP Worksheet #37 – Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

After the analytical results have been reviewed, verified, and validated in accordance with SAP Worksheets #34 through #36, a Quality Control Summary Report (QCSR) will be prepared as an appendix to the Removal Action Completion Report to assess data quality and usability. The QCSR will include review of the following, and will include enough information to support the data usability conclusions:

- Sample collection and analytical methods to verify that these were performed as discussed in SAP Worksheets #14 and #17.
- Project-specific QLs as listed in SAP Worksheets #15.1 through #15.18 to verify that project-specific remedial goals were met for each sample.
- DQOs to determine whether they have been achieved by the data collected.
- Project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters (including, but not limited to, assessment of analytical DQOs) as discussed below.

Precision

Precision is defined as the degree of mutual agreement between individual measurements of the same property under similar conditions, and provides a measurement of the reproducibility of an analytical result. Precision will be evaluated through the analysis of field duplicate samples, LCS and LCSD (if LCSD is run), and MS/MSD samples, as applicable (see SAP Worksheet #20). QC criteria failures will be documented in the case narrative and included in the Comprehensive Analytical Report from the analytical laboratory. The precision measurement will be determined using the RPD or RER between the duplicate sample results as follows:

$$RPD = \frac{|A-B|}{(A+B)/2} \; x \; 100\%$$

where: A = First duplicate concentration
B = Second duplicate concentration

RER = (result activity – duplicate activity)/(sample uncertainty + duplicate uncertainty)
using 2 sigma propagated uncertainty

As applicable, the RPD or RER limits for laboratory duplicates, MSDs, and LCSDs are presented in SAP Worksheet #28. Associated samples that do not meet the criteria will be evaluated by the validator.

Field duplicate precision will be evaluated for chemical and radiological analyses for those concentrations 5 times the reporting limit using the RPD presented on SAP Worksheet #12. For those concentration less than 5 times the reporting limit, the precision for chemical analyses will be evaluated by a “reporting limit check” in which the difference in concentration between the duplicate and the parent sample is compared to the reporting limit as the criterion. Field

SAP Worksheet #37 – Usability Assessment (Continued)

duplicate precision for gamma spectrometry with concentrations near the MDC will be evaluated using an RER criterion of less than or equal to 1.

For the MS and the MSD, sample heterogeneity and the presence of interfering compounds often negatively affect the precision of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. For these reasons, MS samples may not be truly representative of the precision of the analytical process. When the RPD obtained from the results of MS/MSD are out of criteria and the RPD of the LCS/LCSD is within criteria, the poor variance is attributed to the matrix of the sample and the effect on the project objectives has to be considered.

The overall precision will be discussed in the QCSR. If the precision is poor, the impacted data will be qualified as described in the EPA National Functional Guidelines. The impact will be documented along with the rationale for re-sampling or the limited or unlimited use of the data.

Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, or analytical techniques. A program of sample spiking will be conducted to evaluate laboratory accuracy. Accuracy will be evaluated by the percent recovery of the spiked compounds in the LCS, LCS duplicate, and MS/MSD samples. LCS and MS samples will be spiked prior to extraction with the method target compounds indicated in this SAP. MS/MSD and LCS or blank spike samples will be analyzed at a frequency of 5 percent or one per sample delivery group/analytical batch (sample sets are about 10 samples). The results of the spiked samples will be used to calculate the percent recovery for evaluating accuracy, using the following equation:

$$\text{Percent Recovery} = \frac{S-C}{T} \times 100$$

where:

S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike

SAP Worksheet #28 presents accuracy goals for this investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated on the basis of other QC samples.

For MS and MSD, sample heterogeneity and the presence of interfering compounds often negatively affect the accuracy and precision of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. For these reasons, MS/MSD

SAP Worksheet #37 – Usability Assessment (Continued)

samples may not be truly representative of the accuracy and/or precision of the analytical process.

If MS/MSD analyses do not meet the specified recovery criteria, the recoveries from the LCS will be evaluated. If the LCS accuracy criteria are met, the failure of the MS/MSD will be attributed to interference from the sample matrix, and no corrective action will be required. If the LCS accuracy criteria are not met, the associated primary and QC samples will be re-prepared and re-analyzed.

In cases where re-preparation and re-analysis of the samples is not possible, the QC criteria failures will be documented in the case narrative and included in the Comprehensive Analytical Report. The affected data will be qualified as described the guidelines described in SAP Worksheet #36, and the impact of the QC failures on the DQOs for the project will be assessed in the final report.

Trend Analysis for Precision and Accuracy

For each analytical method, the laboratory uses the MS/MSD and LCS/LCSD data to track and analyze trends in the laboratory. From these trends they can recognize deficiencies in the method and create in-house acceptance criteria. For this project, the limits are based on the most recent version of the DoD QSM if available. For methods where the limits are not available, the project criteria default to the laboratory criteria based on their tracked trending.

The precision and accuracy of the entire data set is used to determine if any systemic problems have occurred during the sampling event that will result in deficiencies in the data set. The occurrence of systemic problems and the resulting consequences will be discussed in the QCSR. The data reviewer will make every effort to identify any critical elements or trends that would result in non-usability of data as early as possible.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data also will be obtained through proper collection and handling of samples to avoid interference and minimize cross-contamination. Representativeness of data will also be ensured through consistent application of the appropriate established field and laboratory procedures. To aid in evaluating the representativeness of the sample results, field and laboratory blank samples will be evaluated for the presence of contaminants. Laboratory procedures will be reviewed to verify that standard operating procedures were followed and method requirements were met during the analysis of project samples. Laboratory sample storage practices, holding times, sub-sampling procedures, method blanks, and evidence of matrix interference will be assessed for potential impacts on the representativeness of the data.

SAP Worksheet #37 – Usability Assessment (Continued)

Data determined to be non-representative will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

Representativeness as it relates to field procedures refers to the collection of samples that allow accurate conclusions to be made regarding the composition of the sample media at the entire site. Representativeness will be assessed qualitatively by evaluating whether the procedures described in this SAP were followed. The site-sampling layout, including sampling locations, frequency of sampling, and timing of sampling activities, will be reviewed.

Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with the QC procedures outlined in this SAP and when none of the QC criteria that affect data usability is exceeded. When data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation. The evaluation of completeness will help determine whether any limitations are associated with the decisions to be made based on the data collected.

Completeness will be evaluated by reviewing the tasks that contribute to the sampling event, such as chain-of-custody procedures, adherence to the Work Plan, and adherence to this Sampling and Analysis Plan. The QC parameters to be evaluated in determining completeness include holding times, initial calibrations, continuing calibrations, surrogate recoveries, LCS recoveries, MS/MSD recoveries and RPDs, and laboratory duplicate RPDs. Completeness will be calculated based on the number of individual results (i.e., per analyte). The completeness goal for this project is 95%.

Comparability

Comparability expresses the confidence with which one dataset can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Analytical methods selected for this field investigation are consistent with the methods used during previous investigations of this type. To ensure the comparability of laboratory data, the contract laboratory will use standard test methods and means of sample preservation; standard units, detection limits, calculation procedures, and reporting formats; and standard measures of accuracy and precision. Only laboratories that have been approved by the DoD ELAP will perform chemical analyses of environmental samples to produce definitive data in support of this CTO.

Sensitivity

The DL, LOD, and LOQ will be evaluated by the project team prior to sample analysis to determine if the laboratory is able to attain the required sensitivity for the project. If project decision limits are too sensitive, it will be determined prior to sample analysis whether a

SAP Worksheet #37 – Usability Assessment (Continued)

sensitivity variance will be issued to the laboratory based on the method chosen and the technology available.

The DL is the minimum quantity of an analyte that can be reliably distinguished from background noise or from zero for a specific analytical method at a 99 percent confidence level. The DL protects against false positives. The LOD is the minimum quantity of an analyte that can be reliably detected for a specific analytical method at a 99 percent confidence level that the value is not a false negative. The LOD should be equivalent to the concentration of the DL verification standard. The LOQ represents the smallest quantity of an analyte that can be accurately and reproducibly quantified in a given sample matrix (e.g., three to five times the LOD). For this project, the minimum detectable concentration (MDC) pertains only to radiological analyses, defined as follows in accordance with the Multi-Agency Radiological Laboratory Analytical Protocols: the MDC is calculated as a sample specific value and typically these values assume both a Type I (α) and Type II (β) error of 5 percent. The LOD and/or the LOQ and MDC should be sensitive enough to meet the project decision limits (e.g., PSLs). The LOD , LOQ and MDC will be evaluated after sample analysis to determine if there were any matrix effects, operator errors, or analytical process errors that interfered with the ability to compare the results to the project decision limits. The LOD and MDC (as applicable) will be used to determine if no detectable amounts of contaminants of concern are present. If no detectable amounts are reported and all data are acceptable from the verification and validation, then the data is usable. The DL will be used to determine if any detectable amounts of contaminants of concern are present. If detectable amounts are reported and the verification and validation are acceptable, then the data is usable. Any detection falling between the DL and LOQ are qualified as estimated. If anomalies in sensitivity are present, the rationale for use or non-use of the affected samples will be discussed in the QCSR. Worksheet #15 presents the laboratory DL, LODs, LOQs, and MDCs (as applicable) for the selected analytical method(s) used to support the project decision limits.

FIGURES

Basemap Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand),

NAVFAC
Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 1
Treasure Island Location Map

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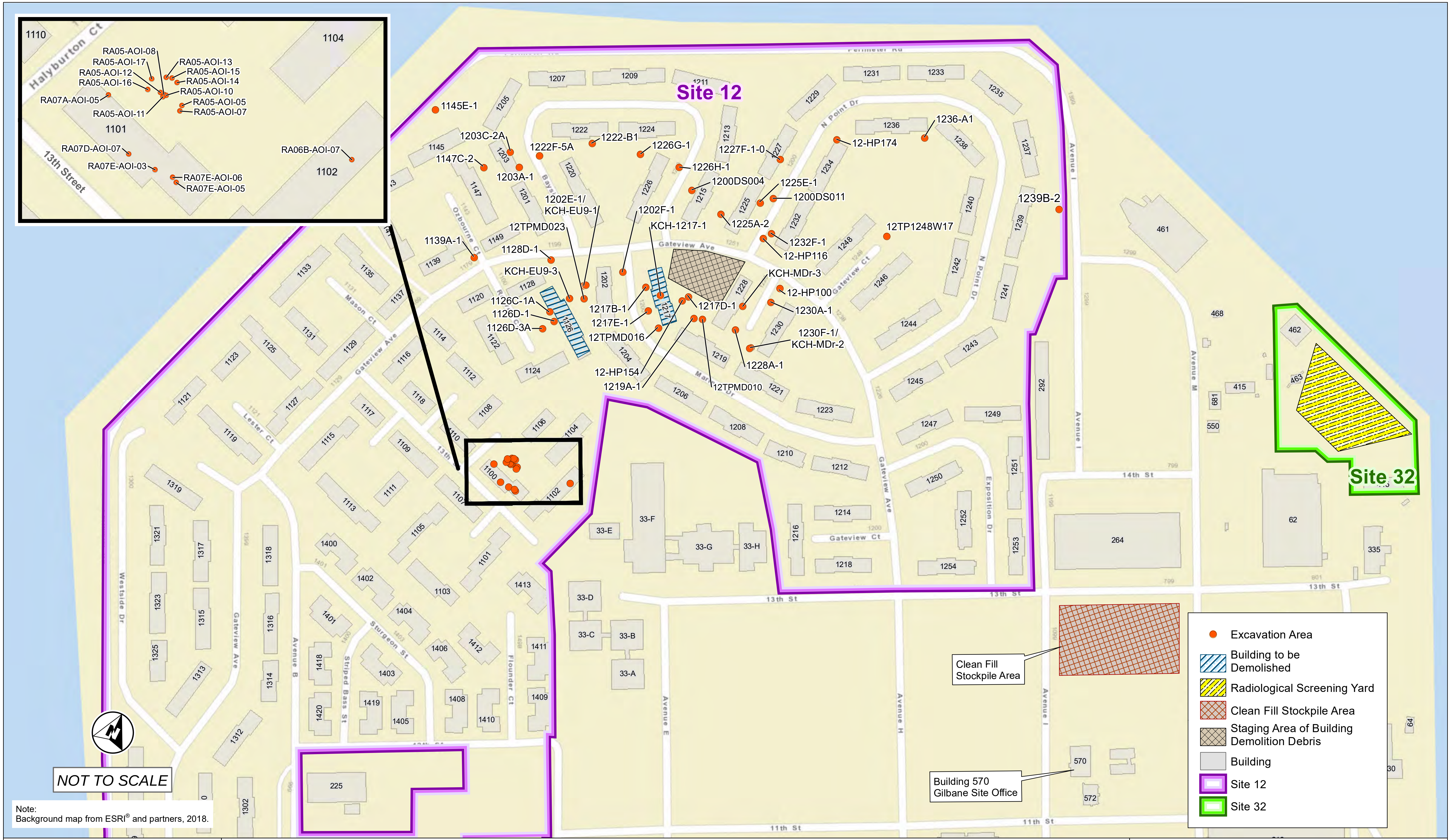

Note:
Background map from ESRI® and partners, 2018.

● Excavation Area
▨ Building to be Demolished
▨ Radiological Screening Yard
▨ Clean Fill Stockpile Area
▨ Staging Area of Building Demolition Debris
▭ Building
▭ Site 12
▭ Site 32

NAVFAC
Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 2
IR Site 12
Non-SWDA Remedial Action Map

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Basemap Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand),

NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 3
IR Site 12 North Point
SWDA NTCRA Map

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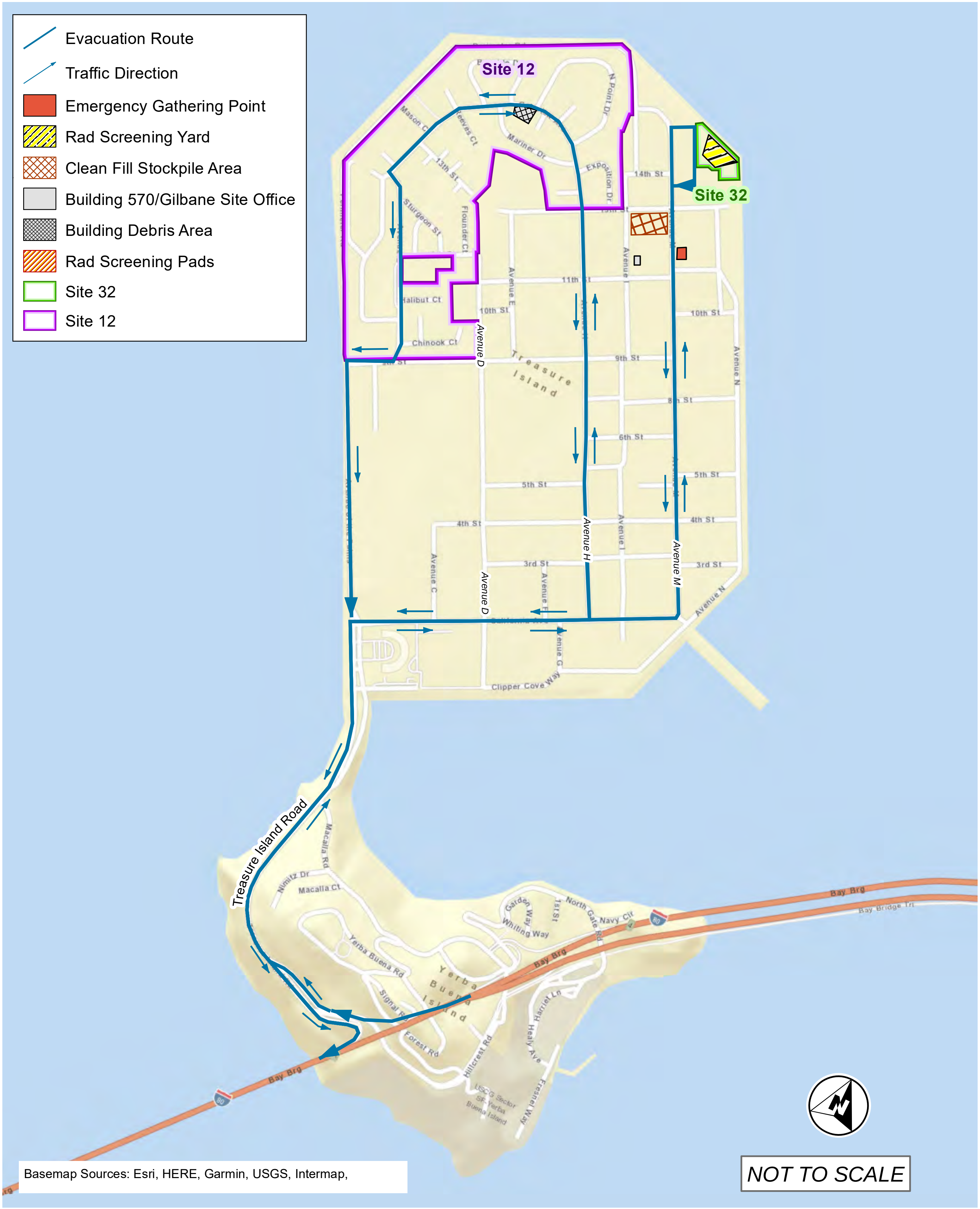

NAVFAC
Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 4
IR Site 12
Truck Route Map

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Basemap Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand),

NAVFAC
Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 5
Gateview Arsenic/TPH Area
Groundwater Monitoring Well Map

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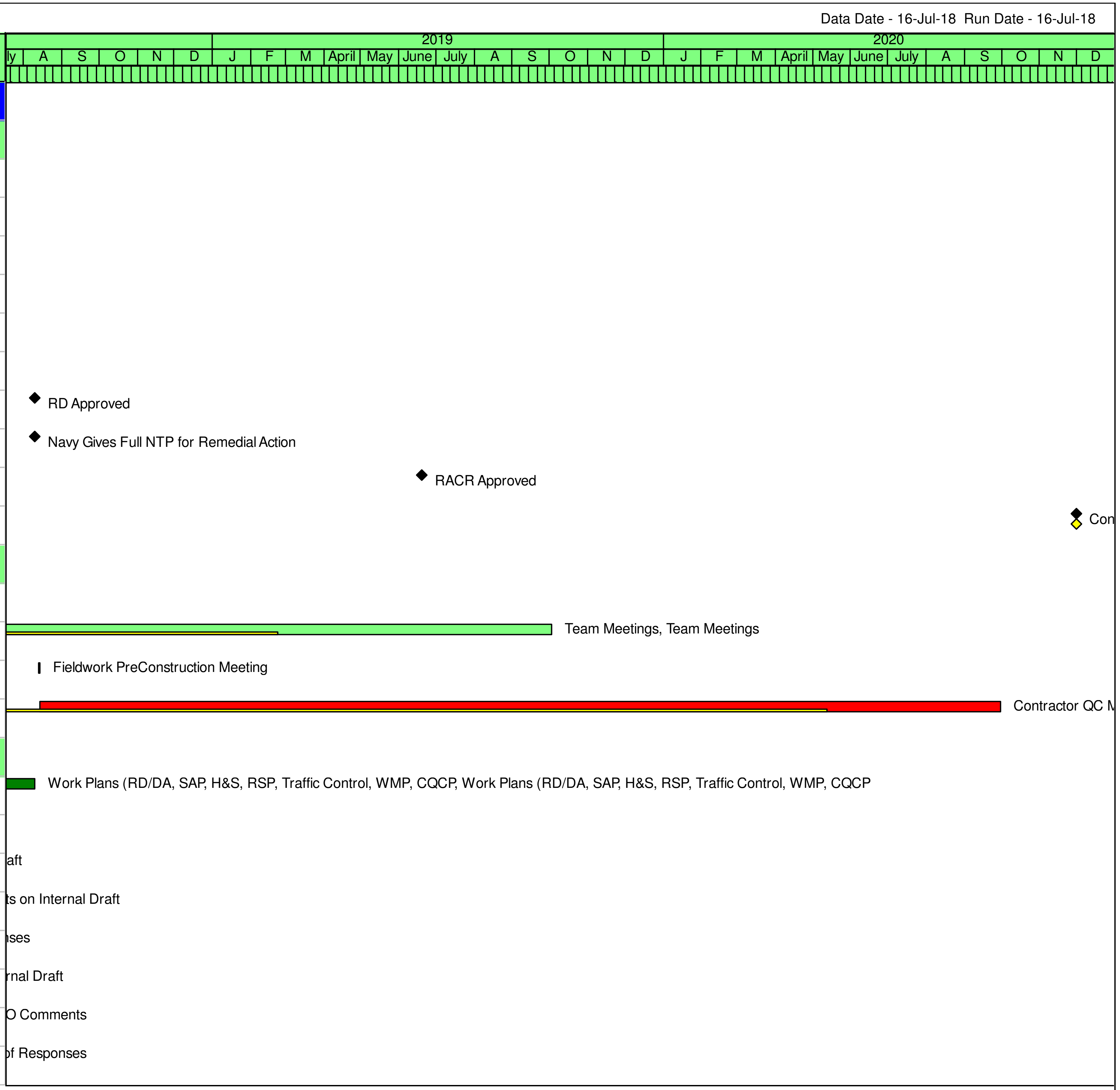
Figure 6 Project Schedule

Data Date - 16-Jul-18 Run Date - 16-Jul-18

Activity ID	Activity Name	At Completion Duration	Start	Finish
RADMAC II - Treasure Island				
Milestones				
MS0100	Contract Award	0	02-Aug-17 A	
MS0200	Submit Schedule and Agenda	0	15-Aug-17 A	
MS0300	Kick-off Meeting	0	15-Aug-17 A	
MS0400	Navy Gives 90-Day Notice to Bldg 1126 & 1217 Occupants	0	15-Aug-17 A	
MS0500	Navy Gives Limited NTP for PreRemedial Action Activities	0	15-Aug-17 A	
MS0600	Award of IDIQ Items	0	22-Sep-17 A	
MS0700	RD Approved	0	10-Aug-18	
MS0800	Navy Gives Full NTP for Remedial Action	0	10-Aug-18	
MS0900	RACR Approved	0	19-Jun-19	
MS1000	Contractural POP Date	0		30-Nov-20*
Project Management				
PM0100	Contract Kick-off Meeting	0	15-Aug-17 A	15-Aug-17 A
PM0200	Team Meetings	534	15-Aug-17 A	02-Oct-19
PM0300	Fieldwork PreConstruction Meeting	1	13-Aug-18*	13-Aug-18
PM0400	Contractor QC Meetings	534	14-Aug-18*	30-Sep-20
Project Plans				
PP0100	Work Plans (RD/DA, SAP, H&S, RSP, Traffic Control, WMP, CQCP	247	15-Aug-17 A	10-Aug-18
PP0110	Internal Draft	49	15-Aug-17 A	24-Oct-17 A
PP0120	Navy/BRAC/RASO Review of Internal Draft	54	25-Oct-17 A	18-Dec-17 A
PP0125	Response to BRAC/RASO Comments on Internal Draft	25	14-Dec-17 A	07-Jan-18 A
PP0126	BRAC/RASO Approve Responses	33	07-Jan-18 A	08-Feb-18 A
PP0127	Navy/QAO Review Internal Draft	34	09-Feb-18 A	14-Mar-18 A
PP0128	Response to Navy/QAO Comments	5	14-Mar-18 A	19-Mar-18 A
PP0129	Navy/QAO Approval of Responses	6	20-Mar-18 A	26-Mar-18 A



🟩 Remaining Level of Effort ◆ ◆ Milestone
🟦 Actual Level of Effort ▬ Project Baseline
🟦 Actual Work ◇ ◇ Project BL MIlestones
🟩 Remaining Work
🟥 Critical Remaining Work

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule
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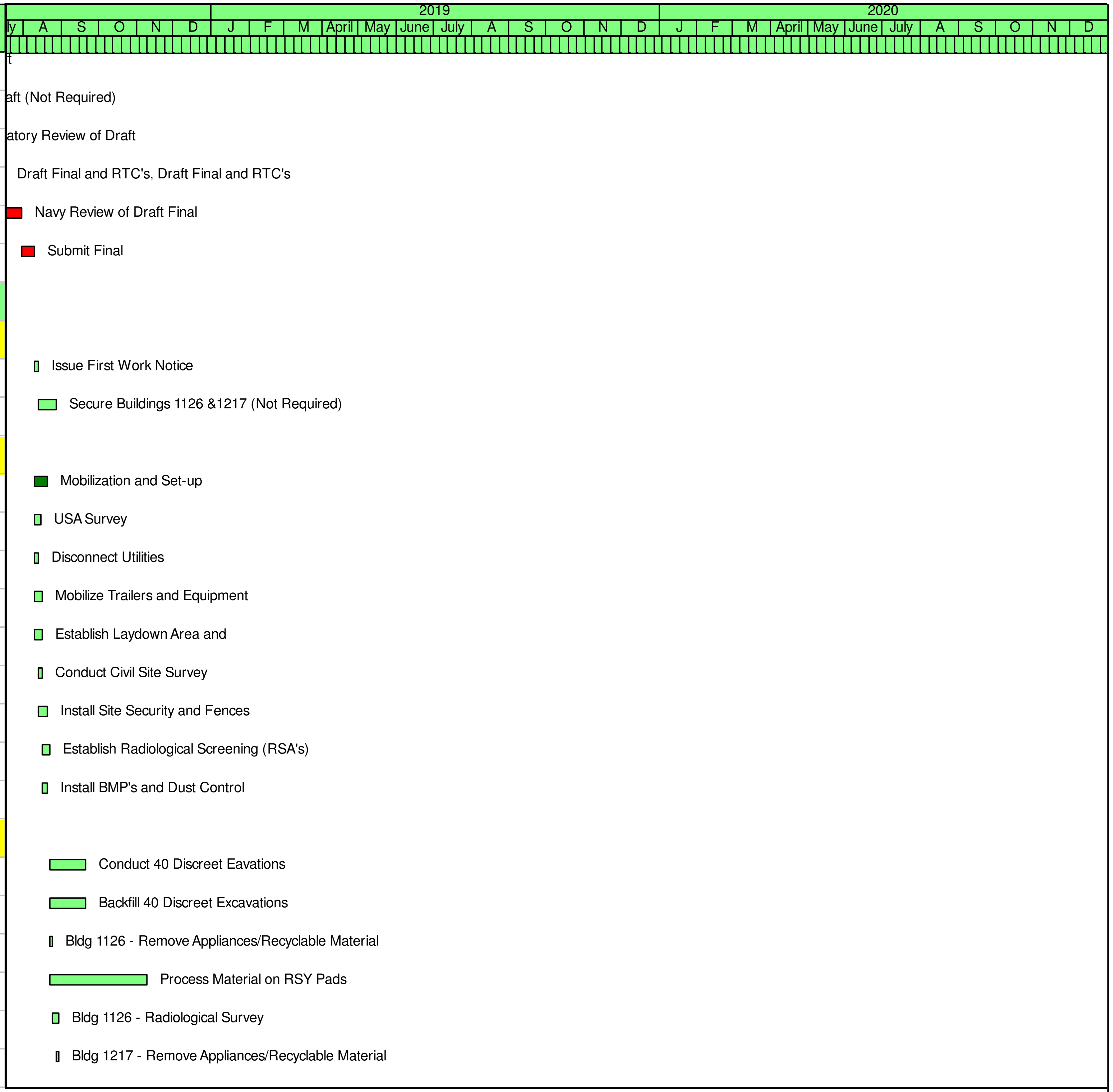
Figure 6 Project Schedule

Activity ID	Activity Name	At Completion Duration	Start	Finish
PP0130	Preparation of Draft	6	27-Mar-18 A	04-Apr-18 A
PP0140	Navy Review of Draft (Not Required)	0	05-Apr-18 A	05-Apr-18 A
PP0150	Regulatory Review of Draft	65	05-Apr-18 A	08-Jun-18 A
PP0160	Draft Final and RTC's	35	11-Jun-18 A	16-Jul-18
PP0170	Navy Review of Draft Final	10	16-Jul-18	30-Jul-18
PP0180	Submit Final	9	30-Jul-18	10-Aug-18
Remedial Action Implementation				
Pre-Remedial Actions				
PRE0100	Issue First Work Notice	1	10-Aug-18	13-Aug-18
PRE0200	Secure Buildings 1126 &1217 (Not Required)	10	13-Aug-18	27-Aug-18
Mobilization				
MM0100	Mobilization and Set-up	6	10-Aug-18	20-Aug-18
MM0110	USA Survey	3	10-Aug-18	15-Aug-18
MM0120	Disconnect Utilities	1	10-Aug-18	13-Aug-18
MM0140	Mobilize Trailers and Equipment	4	10-Aug-18	16-Aug-18
MM0150	Establish Laydown Area and	4	10-Aug-18	16-Aug-18
MM0130	Conduct Civil Site Survey	3	13-Aug-18	16-Aug-18
MM0170	Install Site Security and Fences	5	13-Aug-18	20-Aug-18
MM0160	Establish Radiological Screening (RSA's)	4	16-Aug-18	22-Aug-18
MM0180	Install BMP's and Dust Control	2	16-Aug-18	20-Aug-18
Remedial Action				
RA0100	Conduct 40 Discreet Eavations	20	22-Aug-18	20-Sep-18
RA0120	Backfill 40 Discreet Excavations	20	22-Aug-18	20-Sep-18
RA0130	Bldg 1126 - Remove Appliances/Recyclable Material	2	22-Aug-18	24-Aug-18
RA0220	Process Material on RSY Pads	55	22-Aug-18	09-Nov-18
RA0140	Bldg 1126 - Radiological Survey	3	24-Aug-18	29-Aug-18
RA0170	Bldg 1217 - Remove Appliances/Recyclable Material	2	27-Aug-18	29-Aug-18



🟩 Remaining Level of Effort
🟦 Actual Level of Effort
🟦 Actual Work
🟩 Remaining Work
🟥 Critical Remaining Work
◆ ◆ Milestone
— Project Baseline
◇ ◇ Project BL MIlestones

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July 16, 2018 Master Schedule
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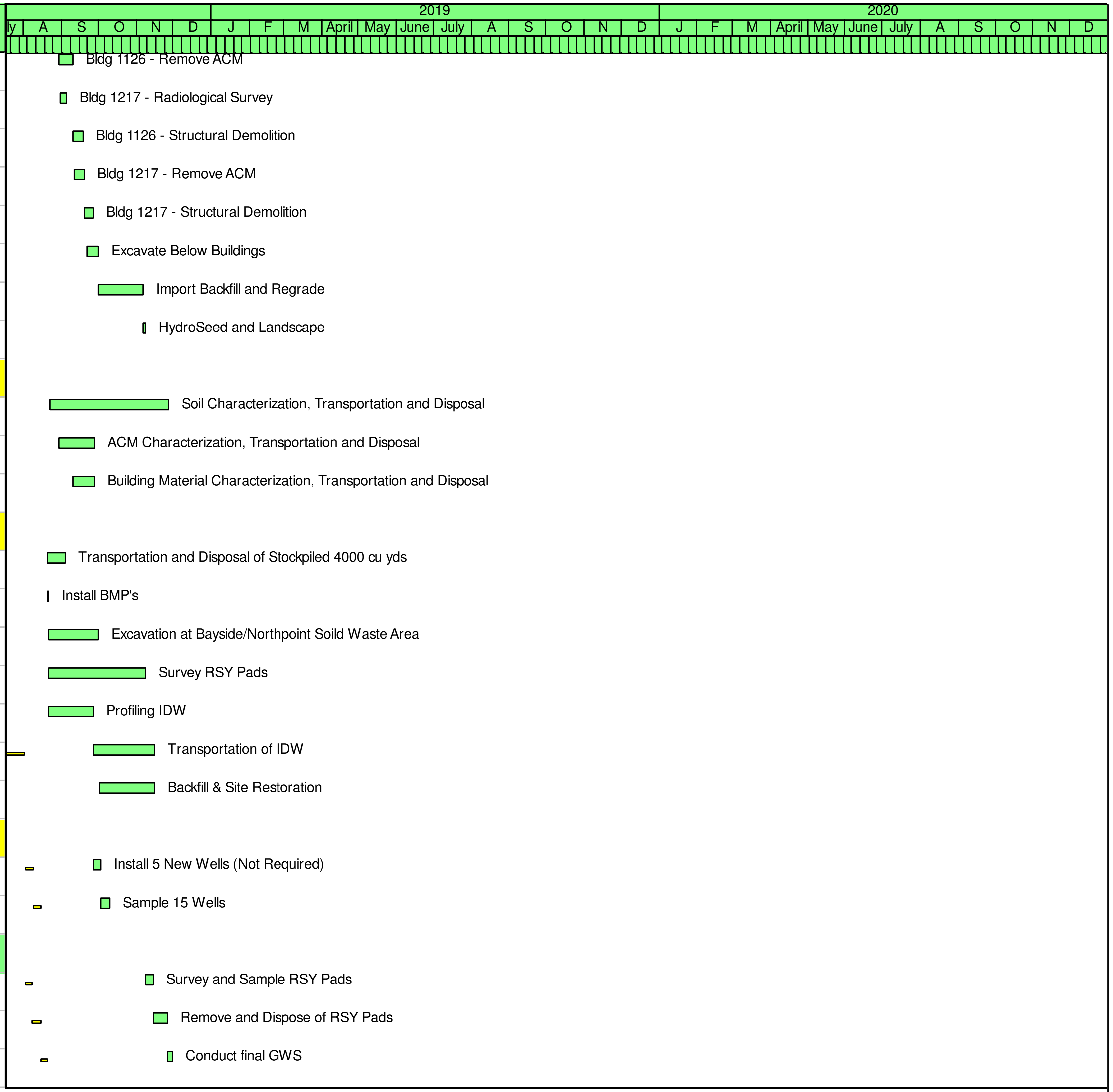
Gilbane

Figure 6 Project Schedule

Activity ID	Activity Name	At Completion Duration	Start	Finish
RA0150	Bldg 1126 - Remove ACM	7	29-Aug-18	10-Sep-18
RA0180	Bldg 1217 - Radiological Survey	3	30-Aug-18	05-Sep-18
RA0160	Bldg 1126 - Structural Demolition	6	10-Sep-18	18-Sep-18
RA0190	Bldg 1217 - Remove ACM	6	11-Sep-18	19-Sep-18
RA0200	Bldg 1217 - Structural Demolition	6	19-Sep-18	27-Sep-18
RA0210	Excavate Below Buildings	6	21-Sep-18	01-Oct-18
RA0230	Import Backfill and Regrade	25	01-Oct-18	06-Nov-18
RA0240	HydroSeed and Landscape	2	06-Nov-18	08-Nov-18
Waste Characterization, Transportation and Disposal				
RA0250	Soil Characterization, Transportation and Disposal	64	22-Aug-18	27-Nov-18
RA0270	ACM Characterization, Transportation and Disposal	20	29-Aug-18	27-Sep-18
RA0260	Building Material Characterization, Transportation and Disposal	13	10-Sep-18	27-Sep-18
Continuation of NTCRA Field Activities				
RA0280	Transportation and Disposal of Stockpiled 4000 cu yds	10	20-Aug-18	04-Sep-18
RA0290	Install BMP's	1	20-Aug-18	21-Aug-18
RA0300	Excavation at Bayside/Northpoint Soild Waste Area	28	21-Aug-18	01-Oct-18
RA0310	Survey RSY Pads	55	21-Aug-18	08-Nov-18
RA0340	Profiling IDW	25	21-Aug-18	26-Sep-18
RA0350	Transportation of IDW	35	26-Sep-18	16-Nov-18
RA0320	Backfill & Site Restoration	31	02-Oct-18	16-Nov-18
GW Monitoring Wells at Gateway Arsenic				
GW0100	Install 5 New Wells (Not Required)	5	26-Sep-18	03-Oct-18
GW0200	Sample 15 Wells	4	03-Oct-18	10-Oct-18
Demobilization and Close-out				
DM0100	Survey and Sample RSY Pads	4	08-Nov-18	15-Nov-18
DM0110	Remove and Dispose of RSY Pads	5	15-Nov-18	26-Nov-18
DM0120	Conduct final GWS	4	26-Nov-18	30-Nov-18



🟩 Remaining Level of Effort	◆ Milestone
🟦 Actual Level of Effort	— Project Baseline
🟦 Actual Work	◇ Project BL MIlestones
🟩 Remaining Work	
🟥 Critical Remaining Work	

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule
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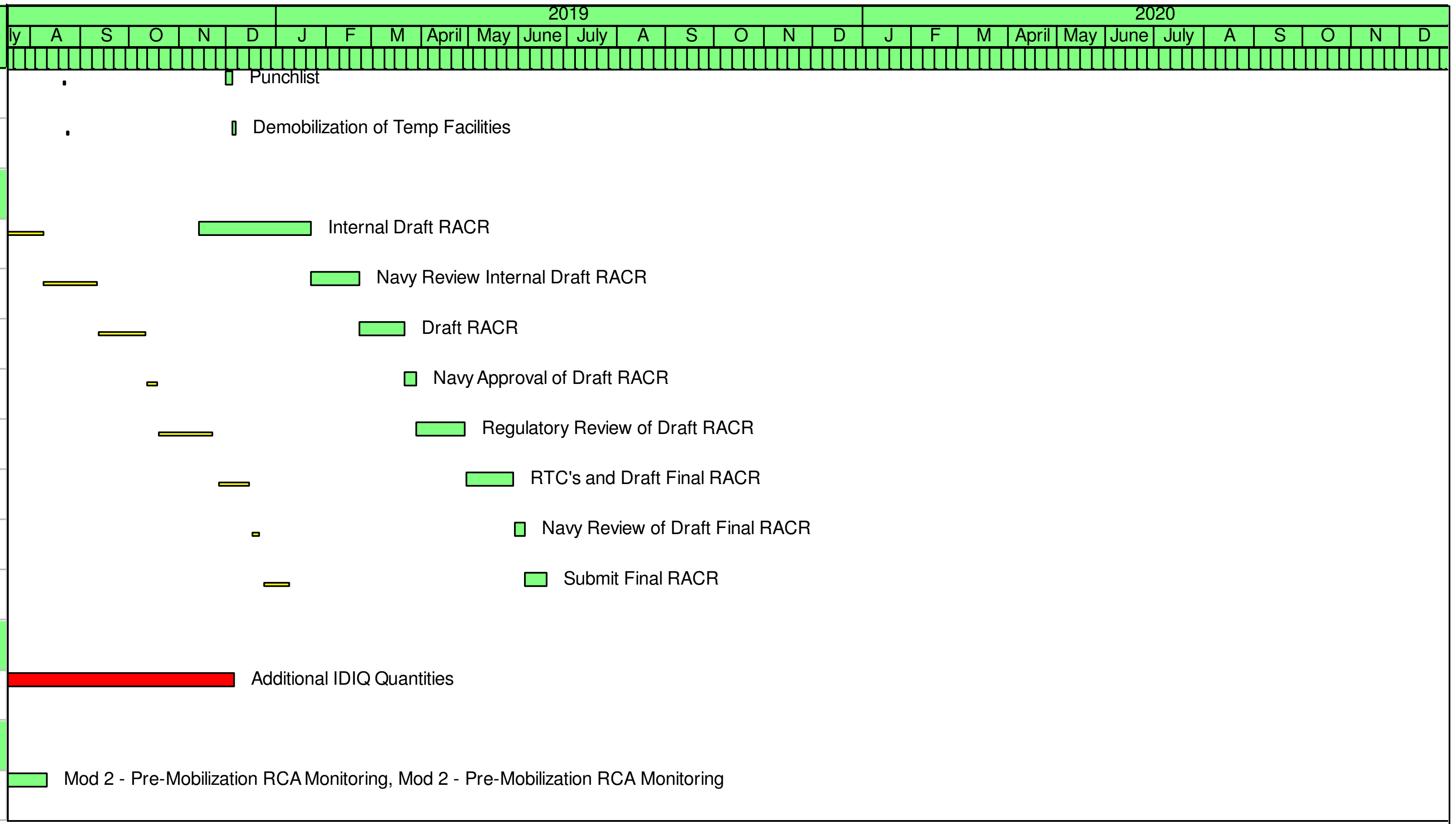
Gilbane

Figure 6 Project Schedule

Activity ID	Activity Name	At Completion Duration	Start	Finish
DM0130	Punchlist	2	30-Nov-18	04-Dec-18
DM0140	Demobilization of Temp Facilities	2	04-Dec-18	06-Dec-18
Reports and Data Submission				
RC0100	Internal Draft RACR	45	13-Nov-18	22-Jan-19
RC0110	Navy Review Internal Draft RACR	30	22-Jan-19	21-Feb-19
RC0120	Draft RACR	21	21-Feb-19	22-Mar-19
RC0130	Navy Approval of Draft RACR	5	22-Mar-19	29-Mar-19
RC0140	Regulatory Review of Draft RACR	30	29-Mar-19	28-Apr-19
RC0150	RTC's and Draft Final RACR	21	29-Apr-19	28-May-19
RC0160	Navy Review of Draft Final RACR	5	29-May-19	04-Jun-19
RC0170	Submit Final RACR	10	05-Jun-19	18-Jun-19
MOD 1 - Additional IDIQ Quantities				
IDIQ0010	Additional IDIQ Quantities	98	16-Jul-18*	05-Dec-18
MOD 2 - Early Establishment of RCA Monitoring				
MOD2 001	Mod 2 - Pre-Mobilization RCA Monitoring	103	19-Mar-18 A	10-Aug-18



🟩 Remaining Level of Effort
🟦 Actual Level of Effort
🟦 Actual Work
🟩 Remaining Work
🟥 Critical Remaining Work

◆ ◆ Milestone
— Project Baseline
◇ ◇ Project BL MIlestones

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule
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ATTACHMENT A
Gilbane Standard Operating Procedures

Gilbane

Standard Operating Procedure

Field Documentation

PR-TC-01.04.01.00 v3

Reviewed by: Kristen Carlyon Peyton Date: 15 Jul 2015
Kristen Carlyon Peyton, Senior Chemist

Reviewed by: Laura Tryboski Date: 15 Jul 2015
Laura Tryboski, Environmental QA/QC Manager

Approved by: Jeffrey Hess Date: 15 Jul 2015
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Date	Approval*
1.0	Initial Issue	NA	14 Mar 2011	NA
2.0	Updated and revised documentation requirements, and instructions for uploading completed daily field documents to eDMS and project servers.	All pages	05 Jun 2013	NA
3.0	Updated entire procedure. Edits completed by EBU Quality Council	All pages	10 Jul 2015	NA

- Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatories to the SOP.

Table of Contents

List of Attachments

Attachment A	Instructions on Uploading and Approving Documents in eDMS, and naming convention for uploaded documents.

1.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) provides an overview of required field documentation to be performed as part of an environmental site visit or field activity performed by Gilbane Federal (Gilbane). This documentation occurs through the use of specific field forms identified herein, and the use of other forms applicable to specific work activities that may be performed, as identified in SOPs, project specific plans, or by the client.

Complete documentation of field activities is a crucial part of any field activities, both for technical and legal defensibility. This SOP addresses the following field documents:

- Daily Activity Report (Section 4.1),
- Contractor Production Report (Section 4.2)
- Photo Documentation (Section 4.3)
- Field Change Request (Section 4.4)
- Health and Safety Forms (Section 4.5)
- Quality Control Forms (Section 4.6)
- Project Specific Forms (Section 4.7)
- Federal, State and Local Agency Forms (Section 4.8)

2.0 ACRONYMS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

APP: Accident Prevention Plan
CPR: Contractor Production Report
CQCP: Contractor Quality Control Plan
DAR: Daily Activity Report
DMS: Document Management System
DoD: Department of Defense
eDMS: environmental data management system
FCR: Field Change Request
FTL: Field Team Leader
GPS: global positioning system
HSP: Health and Safety Plan
PM: Project Manager
PgM: Program Manager
IDW: investigation-derived waste
QA: Quality Assurance
QCM: Quality Control Manager
SCL: Sample Collection Log

SAP: Sampling and Analysis Plan

SOP: Standard Operating Procedure

3.0 EQUIPMENT/MATERIALS

The list below represents the equipment and materials recommended to complete the tasks defined in the SOP:

- Daily Activity Report (DAR);
- Other field forms as appropriate for the project, including but not limited to:
  - Contractor Production Report (CPR)
  - Photo Log
  - Field Change Request
  - Health and safety forms
  - Quality control forms
- Indelible pen (fine-tip preferable).
- Camera (Global Positioning System [GPS] enabled if possible)
- GPS Equipment (if not included in camera or if greater precision needed)
- Wireless-enabled laptop or tablet

4.0 PROCEDURES

The Project Manager and assigned field staff shall schedule a kickoff meeting to establish expectations for record keeping of the project. The meeting shall include discussion of the project schedule, field activities, roles and responsibilities, work phases, field procedures, specific field forms, and record keeping processes. The expectations outlined in this meeting should be shared with all staff involved in the meeting who are responsible for documenting any aspect of the project.

The following items are applicable to completion of field documentation:

- Field documentation is kept to record the activities conducted on a project site. It is the official proof of work performed and, therefore, must be completed in its entirety with clear and accurate statements. The documentation should be completed the day the work is performed.
- Field documents must be completed using indelible ink (preferably black or blue color) and writing must be legible. Use of a computer or digital recorders may be used to complete documents only if specifically allowed for a given project, if permissible by program and client requirements, and with prior approval of the Project Manager (PM), Program Manager (PgM), and Quality Control Manager (QCM).
- All fields on forms shall be completed. Notes to reflect non-applicability (N/A), data not collected, etc., shall be used to clarify field activities. Blank spaces after end of notes or last data entry shall be lined out with a single line with the preparer's initials and date placed next to the line.

- Any errors made shall be corrected by striking out the error with a single line and placing the initials of the corrector and date next to the line. The correction is written next to the lined out error or provided on an attached page, as applicable.
- If an error is observed after the document has been finalized and/or submitted to the client, corrections shall be noted on a separate copy of the document or on a separate blank page. An explanation to describe the error and how it was corrected should be provided on the new page. The new page shall be attached to the original document and resubmitted to the original distribution of recipients and to project files.
- Documents requiring approval shall have the approver's name printed and signature completed in ink or attached as a password protected electronic signature (i.e. adobe software signature).
- The Gilbane logo is used on all field forms with the exception of Health and Safety and Quality Department forms. The Gilbane Federal logo is used to differentiate those forms from similar Gilbane Building Company forms.
- Field personnel shall adhere to the field reporting protocol, and ensure that all entries are recorded in a manner consistent with this SOP.

The following sections discuss the basic forms required for most environmental projects; be sure to consult other project specific documents (e.g. Sampling and Analysis Plan; Construction Quality Control Plan; and Health and Safety Plan, etc.) and the project contract for other required forms.

4.1 DAILY ACTIVITY REPORT

The DAR documents the daily activities and is considered the official representation of field operations. Accurate record keeping supports the production of periodic and final client reports, transferring information to project team members and legal defensibility of work.

Each Field Team Leader (FTL), Task Manager, or Site Superintendent overseeing or conducting field activities shall be responsible for completing and maintaining a DAR to document the activities performed each day in the field. For field operations with multiple activities being conducted, a DAR shall be generated by each FTL. A copy of the DAR is provided in Attachment A.

At a minimum the following information shall be recorded in the DAR:

- Project name and project job and phase code
- Site name and location
- Date(s) of field activity
- Name of individual reporting field notes
- Name, affiliation, and responsibilities of the personnel (both Gilbane and subcontractors) on site. For larger projects with significant field staff, this information may be entered into the CPR (discussed in Section 4.2)
- Arrival and departure times
- Daily weather conditions

- Chronology and location of field activities
- Pertinent field observations, including:
  - Physical description and sketch or map of the field activity location (to include details such as structures, sample points, borings, wells, stained areas, and any other pertinent information).
  - References to GPS data collected, if applicable (note, all locations where information is collected (such as sample locations, water quality testing locations, photographs of key features) should be located using a GPS).
  - References to photographs of the site and site activities, as applicable, including reference to photo log (see Section 4.3) or location, digital file number (if available) and direction faced when taken.
- Record of relevant daily telephone calls, project e-mails, and/or direct contact with individuals at the site (or offsite) where direction may have been received (e.g., from client, program or project management), comments or requests received from regulators, or issues brought up by subcontractors.

Other pertinent information should be included, with the specific nature of this information dependent on the type of field activity. For example, if the field activity involved the collection of samples for environmental or geotechnical analysis, relevant information to include in the DAR (or field logbook, when applicable) would consist of the following:

- Daily summary of equipment preparation procedures, as appropriate.
- A description of sampling methodology and type of equipment used.
- Time and locations of sample collection (unless reported in an appropriate Sample Collection Log [SCL]. If SCLs are used, reference the accompanying SCLs in the DAR and the focus of the DAR should then be on summarizing the day's activities–an example of the appropriate level of detail would be "Sampled MW-1 and MW-4…").
- Number of and type of samples collected, and sample identification numbers (unless reported in SCLs and summarized in the accompanying Sample Tracking Log. If SCLs are used, the emphasis should be on summarizing the day's production).
- Management and disposal of investigation-derived wastes (IDW). Describe type and quantities (approximate or known) of IDW generated, stored and disposed. Document the location, markings/postings, type of container and container number (unless using a IDW/Waste Inventory Form. If inventory form is used, just summarize information on DAR).

4.1.1 Field Logbook

Specific field programs, sites, regulatory or weather conditions may necessitate the use of bound field logbooks in addition to or in lieu of completing DAR forms.

- There are several types of acceptable logbooks, depending on the requirements of the field activity. One of two types of logbooks are recommended, if used: 1) permanently bound, sequentially numbered, pocket-sized logbook with water-resistant paper; or 2) custom logbook consisting of approved forms printed on water-resistant paper and spiral-bound to prevent pages from being added or removed in the field. Other options exist, but care should be taken if alternate logbooks are used to make sure the selection is consistent with the underlying requirement for use of a logbook in place of a DAR.

- Each page of the field logbook will be sequentially numbered and dated. When using field logbooks, all entries shall be legible and each day will be documented in chronological order, reflecting the order of each day's activities as they transpire. Unused partial pages (i.e., at the end of each workday) should be crossed-out, signed and dated. If an event is inadvertently not recorded in proper sequence, or was missed, the item should be flagged with an asterisk (*) at the beginning and end of the entry when it is added to the logbook, along with the time of the actual entry and the author's initials. If field logbook duties are transferred to another party, then the individuals relinquishing and receiving the logbook will both sign and date the logbook and record the transfer time.

Logbooks should not be used unless specifically required, as use of logbooks adds significantly to the efforts of scanning each page of the logbook for submittal electronically on a daily basis.

4.2 CONTRACTOR PRODUCTION REPORT

The CPR form is used when employing subcontractors, and is completed by the superintendent or field team lead. The CPR is used to record hours worked by employees and all subcontractor personnel onsite, generally by individual tradecraft. Recording of all hours worked on jobsites is required for all field personnel (Gilbane and subcontractors), and the total hours worked must be submitted to various DoD clients monthly or quarterly (per EM-385), and to Gilbane Health and Safety Department monthly. The CPR also covers construction equipment onsite and used each day and any equipment or materials that are received. A copy of the CPR is provided in Attachment A.

This form is used to track work hours performed and costs on a daily basis, because it contains a list of all personnel onsite on a daily basis, all equipment used, and all materials received. When coupled with the DAR and other appropriate forms listing other incurred costs (e.g., the number and type of samples collected, the volume and type of waste generated, etc.), the CPR provides:

- Detail to review and approve vendor invoices for subcontractor hours, materials, equipment, and waste transport and disposal.
- Near real-time monitoring of incurred costs on field projects – a necessity for some of cost-reimbursable government contracts and important on fixed-price projects to support any needed change order or request for equitable adjustment.

4.3 PHOTO DOCUMENTATION

Photographs to document "as found" or baseline conditions shall be collected. Photographs shall also be collected to document new work, changing conditions and project progress. Photo documentation should include, at a minimum, date of collection, name of photographer, directional location of photo, and brief description of the photo. An example of a Photo Log is provided in Attachment A.

4.4 FIELD CHANGE REQUEST

In the event that site conditions change or direction is received from client or regulatory agency personnel that will potentially result in changes to the scope of activities specified in the approved plans (e.g. work plan, sampling and analysis plan), the field staff must notify the Project Manager and obtain direction on what actions to take. A field change request (FCR) may be issued to document the changes or field direction for the project. The FCR form shall be completed and submitted to the Project Manager for approval and as applicable forwarded to client or regulatory agency personnel for their approvals prior to implementing changes to field work.

The directions for completing a FCR are provided in its own work instruction. Prior to using a FCR, obtain the current version of the form from the latest work instruction on g.net.

4.5 HEALTH AND SAFETY FORMS

The following forms are used to document health and safety activities on a project.

- Tailgate Safety Meeting form. This form is used to ensure all field personnel are informed of the nature of the work being performed and the safety precautions for that day. The form is provided in the site-specific Health and Safety Plan (HSP) or Accident Prevention Plan (APP).
- Equipment and Truck Inspection Checklist. This form is required for all heavy equipment used onsite, and is completed prior to or on receipt of each piece of equipment. The checklist may also be required for trucks and other motor vehicles accessing sites, to ensure compliance with site-specific requirements (i.e., presence of fire extinguisher in the vehicle, properly operating brake lights, etc.). This form is provided in the site-specific HSP or APP.
- Visitor Sign-in Log. This form is typically used for projects with extended field periods to document 3rd-party personnel onsite. This form is provided in the site-specific HSP or APP.
- Worker Acknowledgment of Site Health and Safety Requirements Form. This form is used to ensure all field personnel have read and understand the information provided in the site-specific HSP or APP.

The proper use of health and safety forms is covered by the site-specific health and safety plan (or accident prevention plan) and the forms are listed here for reference only.

4.6 QUALITY CONTROL FORMS

The Contractor Quality Control (CQC) Report serves as the basic record of the implementation and effectiveness of the QC Program. The CQC Report and any required attachments will contain the following information, as applicable:

- Inspections performed, including definable features of work and phase of control.
- Testing and/or control activities performed, with results, references to specification/drawings requirements; deficiencies found; and corrective actions implemented.
- Rework items requiring follow-up.
- Off-site surveillance/auditing activities conducted.
- Instructions given and received, and identified conflicts in plans and/or specifications.
- QC Manager's verification statement.

The QCM may include as attachments to the CQC Report any of the following:

- Three-phase checklists, including preparatory meetings, initial inspections, follow-up or ongoing inspections;
- Subcontractors' Daily Logs
- Material Receipt Inspection Reports
- Punch list
- Any test results and other pertinent logs or receipts,

Additional requirements will be outlined in the Construction Quality Control Plan (CQCP). The proper use of quality forms is covered by the site-specific CQCP and the forms are listed here for reference only.

4.7 PROJECT SPECIFIC FORMS

The following forms are examples of project specific forms that may be needed for some contracts or to document specific field activities:

- Field activity-specific forms - Various forms used to document specific field activities at environmental sites provided with their respective SOPs and the site-specific SAP. These can include, but are not limited to, the following:
    - Monitoring Well Water Level Measurement Forms
    - Instrument Calibration Records
    - Monitoring Well and Sample Forms
    - Sample Collection Logs
    - Sample Tracking Log
    - Soil Boring Log
    - Chains-of-Custody

Field personnel shall use these forms (and any other forms identified in the site-specific plans or by project management on a project- or task-specific basis), in addition to the DAR and CPR as described in Section 4.1 and Section 4.2, respectively, to assure that all activities are properly and fully documented at the time the work is performed.

4.8 FEDERAL, STATE, AND LOCAL AGENCY FORMS

Any forms required by federal, state, and/or local agencies (e.g. site access, hot work permits, Uniform Hazardous Waste Manifests, local drilling and well construction/abandonment permits, etc.) shall be completed and submitted in accordance with current federal, state, and local guidance requirements and regulations.

5.0 FIELD RECORDS MANAGEMENT

Field records management includes record completion, review, approval and document submittal. All records associated with the field activities shall be managed by the designated responsible party (e.g. FTL, Task Manager, Site Supervisor, QCM, site health and safety officer, or onsite Project Manager). The responsible party is responsible for the completion of the records, review, corrections and approvals. Any corrections made shall be made as described in Section 4.0.

5.1 DAILY FIELD DOCUMENTATION PACKAGES

All field forms documenting one day's activities after they are reviewed and approved are collected and submitted to the project point of contact (typically the QCM) and packaged together as one submittal. The original documents are initially kept together as a daily package for scanning and submittal to project files and to the client (per contract requirements).

A hard copy of the complete daily package must be kept on site for client or third party auditors, unless otherwise stipulated by the contract. If records are uploaded daily to eDMS, and web access is available from the site, then hard copy records for only the current field effort may be allowed with approval of the PM, PgM, and QCM. The originals are then placed in individual hard copy files. Project electronic files should include the complete daily package and individual files of the records included in the daily package (e.g. DAR, CPR, Tailgate Safety Meeting, SLC, chain of custody).

5.2 RECORD SUBMITTAL

Completed records shall be submitted by the QCM (or whoever is collecting and consolidating the daily records package) to the project files and to the client. The daily field documentation package should be uploaded to the project files at the end of each day, or no later than the morning of the following work day. Typically the daily package is also due to the client no later than 10:00 am the following business day.

Internally, Gilbane shall, at a minimum, submit project files to eDMS or DMS as appropriate based on project type:

- eDMS[1] for most all environmental projects and for field efforts involving the collection of environmental data (whether physical samples for fixed or mobile laboratory analysis, data collected from instrumentation in the field, or field observations of an environmental nature) supporting construction or fuels projects.
- DMS for field projects supporting construction or fuels, and not involving the collection of environmental data and with no required program or client portals.

Additional external submittal requirements will vary based on contract specifications. For example, there are program or client required portals (e.g., EPA, NAVFAC or USACE) for uploading field documentation and reports.

Daily uploading of the daily field documentation packages is critical for any project generating analytical data to allow for timely coordination between the sample crew, the project chemist, and the analytical laboratory. For projects that are not generating analytical data, uploading the

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[1] Instructions on both uploading and approving daily field documentation packages are provided in Attachment B. Directly uploading to eDMS has the advantage of being web-based and does not require logging into the VPN network, required when uploading the daily field documentation packages to project servers.

daily field documentation packages no later than the end of each week may be acceptable, with concurrence from the PM, PgM and QCM.

6.0 ATTACHMENTS/FORMS

6.1 ATTACHMENTS

Copies of the following documents are attached.

- Attachment A - Instructions on Uploading and Approving Documents in eDMS, and naming convention for uploaded documents.

6.2 FORMS

Copies of the following forms are attached. Additional approved activity-specific forms such as those identified above are provided with their respective SOPs, in project specific plans, or by the client.

- Daily Activity Report (DAR)
- Contractor Production Report (CPR)
- Photo Log

7.0 REFERENCES

Department of the Navy, Naval Facilities Engineering Command, 2000. *Construction Quality Management Program*, NAVFAC P-445, NAVFAC 0525-LP-037-7202, January.

Los Alamos National Laboratory, 2010. *SOP-5181 Environmental Programs Waste and Environmental Services for Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities.* 2010.

U.S. Army Corporation of Engineers, 2008. Manual, *Safety and Health Requirements*, EM-385-1-1, September.

U.S. Environmental Protection Agency (USEPA) Region 4, 2007. *Operating Procedure for Logbooks,* SESDPROC-010-R3. November.

USEPA, 2011. *Contract Laboratory Program Guidance for Field Samplers,* Office of Superfund Remediation and Technology Innovation, OSWER 9240.0-47, EPA 540-R-09-03. January.

Forms

- Contractor Production Report
- Daily Activity Report
- Photo Log

Contractor Production Report
(Attach Additional Sheets if Necessary)

Gilbane

Project Name:

Page of

Project No./Task Code:

Date:

Subcontractors:

Work Performed Today

Schedule Activity No.	Work Location and Description	Employer	Number	Trade	Hours

Job Safety

Was a tailgate safety meeting held this date? (If yes, attach copy of the sign-in sheet) ☐ YES ☐ NO

Were any vehicle/heavy equipment inspections done? (If yes, attach copies of the inspections performed) ☐ YES ☐ NO

Was any trenching/confined space/crane/manlift work done? (If yes, attach statement or checklist showing inspections performed) ☐ YES ☐ NO

Were there any lost time accidents this date? (If yes, attach copy of completed accident report) ☐ YES ☐ NO

Total Work Hours on Job Site Today (including any Continuation Sheets)	
Cumulative Total of Work Hours from Previous Reports	
Total Work Hours from Start of Field Activity	

Schedule Activity No.	List Safety Actions Taken Today/Safety Inspections Conducted ☐ Safety Requirements Have Been Met.

Equipment/Material Received Today To Be Incorporated In Job (Indicate Schedule Activity Number)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

Construction And Plant Equipment On Job Site Today (Indicate Hours Used And Schedule Activity Number)

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (include Make and Model)	Hours Used

Schedule Activity No.	Remarks

Prepared by:

Signature:

Daily Activity Report (DAR)

Gilbane

Project Name:	Page of
Project No./Task Code:	Date:

Description of Work:

Visitors / Subcontractors:

Weather:

Description of Field Activities

Prepared by:	Signature:

Photographic Log

Gilbane

Project Name:	Page of
Project No./Task Code:	Date:

Daily Photographs

Size photographs to 2” by 3”	
Photo 1: Photo caption	Photo 2: Photo caption
Photo 3: Photo caption	Photo 4: Photo caption
Photo 5: Photo caption	Photo 6: Photo caption

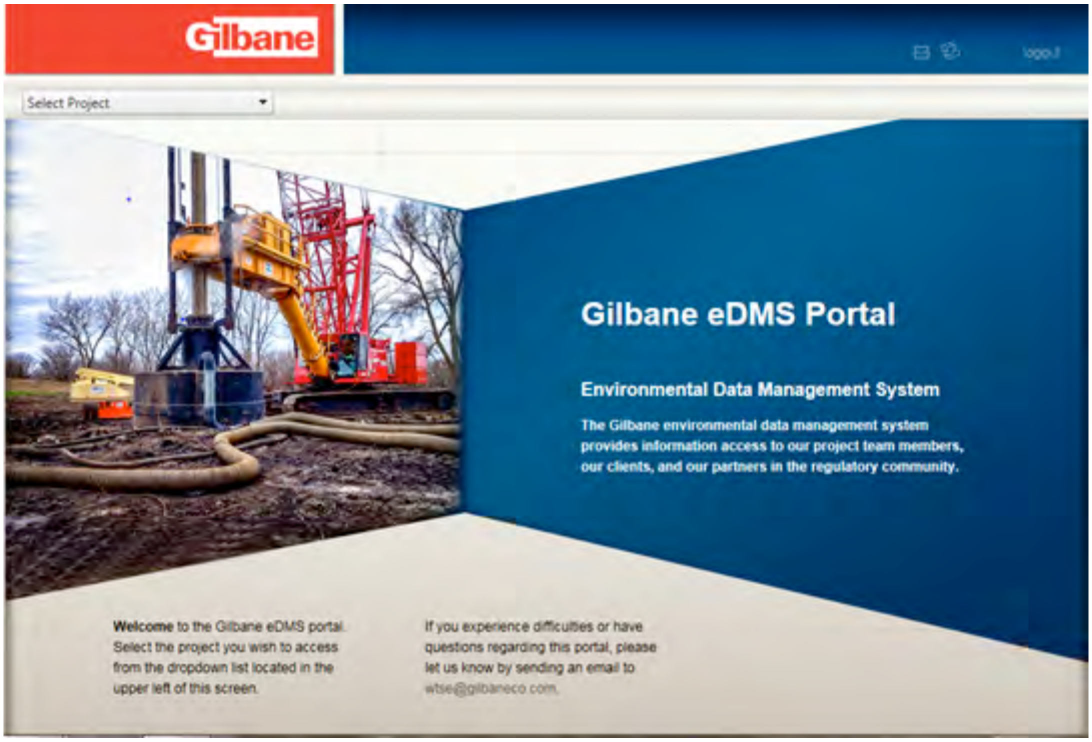
Attachment A

Instructions on Uploading and Approving Documents in eDMS:

- Uploading Documents in eDMS
- Approving Documents in eDMS
- File Naming Convention

Instructions
Uploading Documents in eDMS

Open your browser, and go to http://edms.itsi.com



Gilbane eDMS Portal

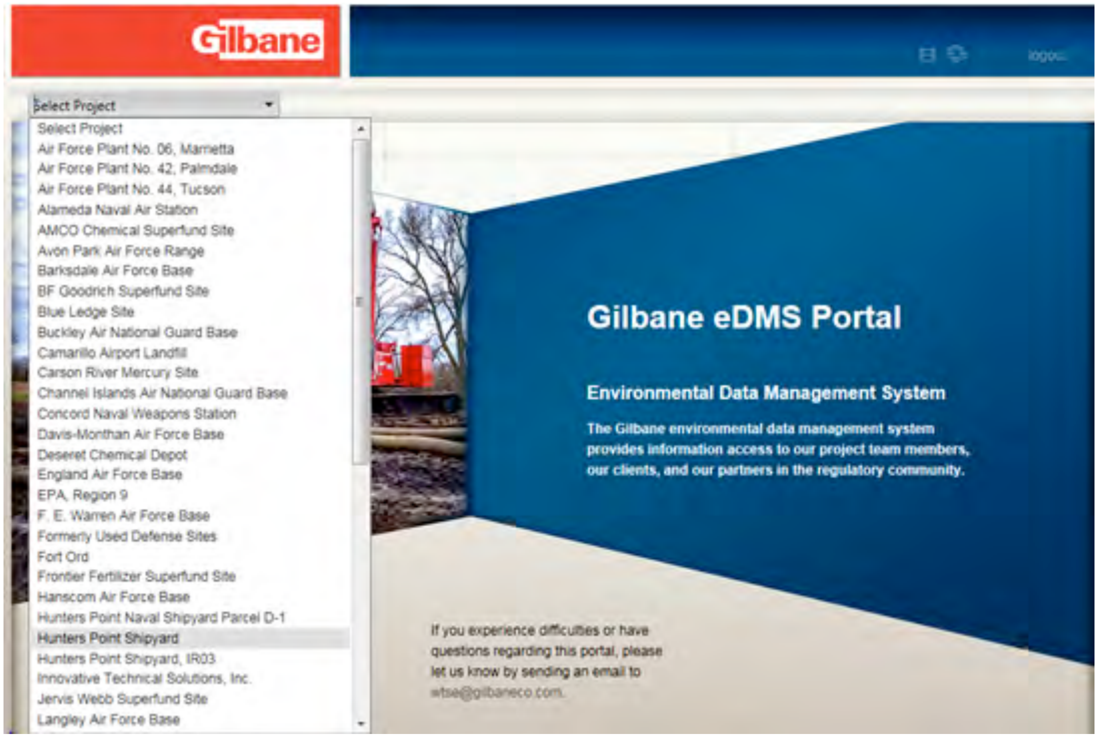
Environmental Data Management System

The Gilbane environmental data management system provides information access to our project team members, our clients, and our partners in the regulatory community.

Welcome to the Gilbane eDMS portal. Select the project you wish to access from the dropdown list located in the upper left of this screen.

If you experience difficulties or have questions regarding this portal, please let us know by sending an email to wtse@gilbaneco.com.

Select your project from the pull-down menu. Note, each person's list of projects will vary, as only those projects you have permissions for are shown.



Gilbane eDMS Portal

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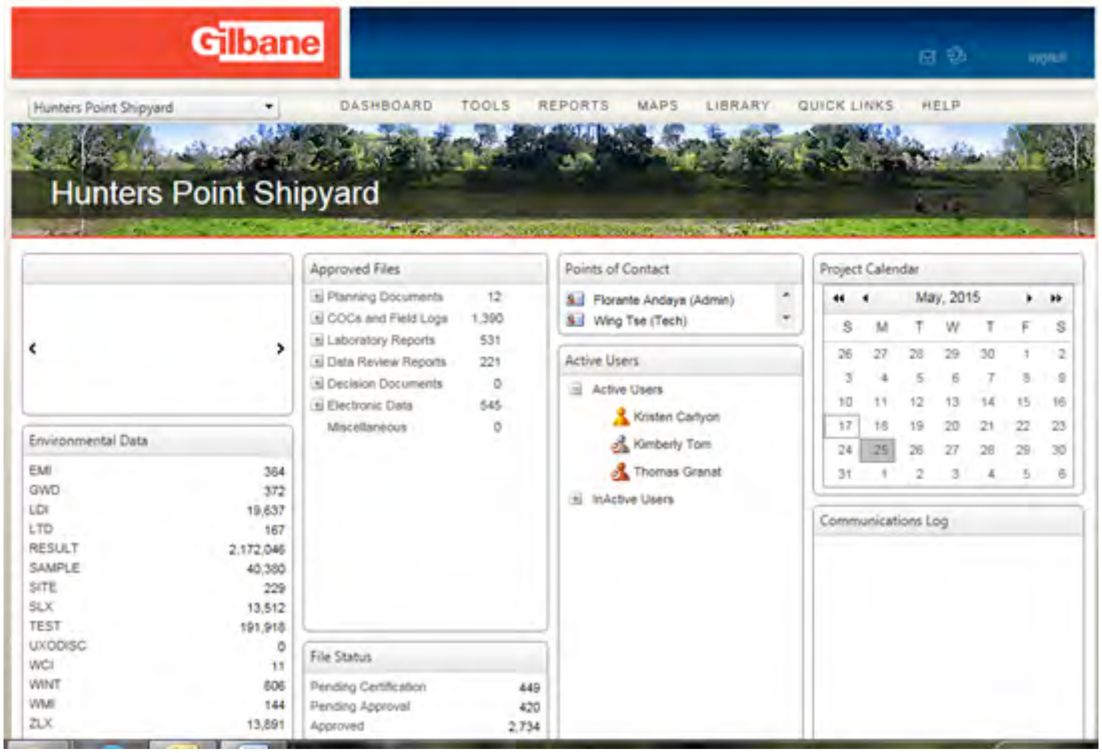
The screenshot below is of the “dashboard” for the Hunters Point project database under eDMS, as an example. The dashboard shows the status of various submittals, points of contact and project calendar.



Approved Files	
Planning Documents	12
COCs and Field Logs	1,390
Laboratory Reports	531
Data Review Reports	221
Decision Documents	0
Electronic Data	545
Miscellaneous	0

Environmental Data	
EMI	364
GWD	372
LDI	19,637
LTD	167
RESULT	2,172,046
SAMPLE	40,380
SITE	229
SLX	13,512
TEST	191,918
UXODISC	0
WCI	11
WINT	606
WMI	144
ZLX	13,891

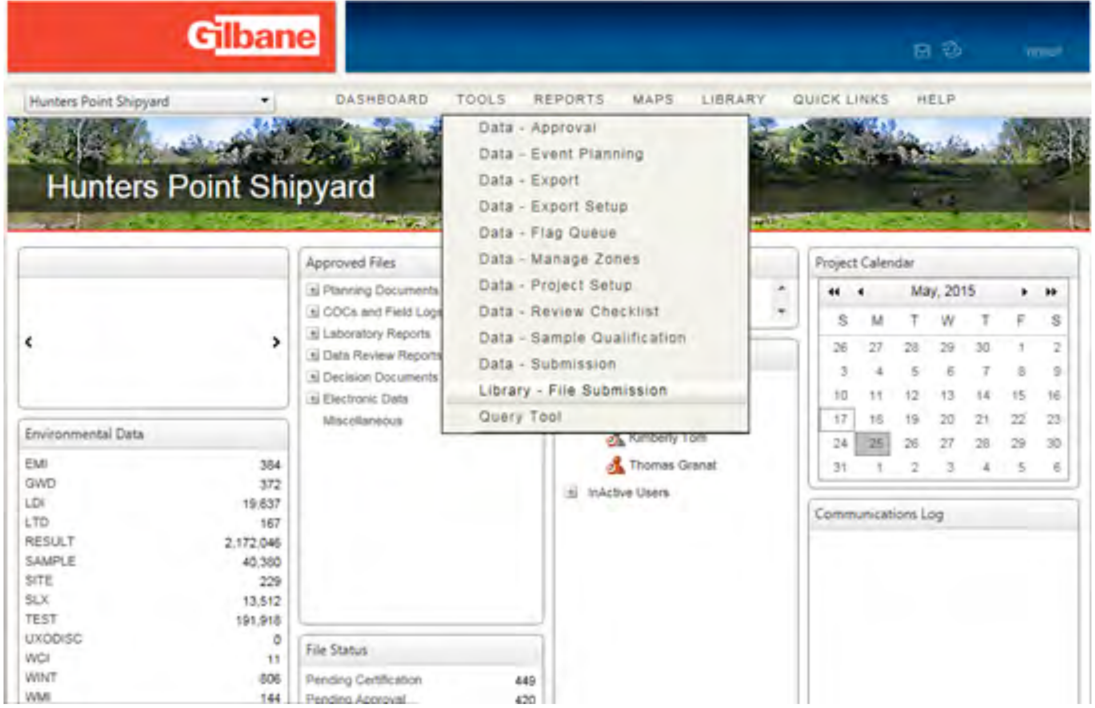
File Status	
Pending Certification	449
Pending Approval	420
Approved	2,734

Project Calendar

May, 2015

S	M	T	W	T	F	S
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

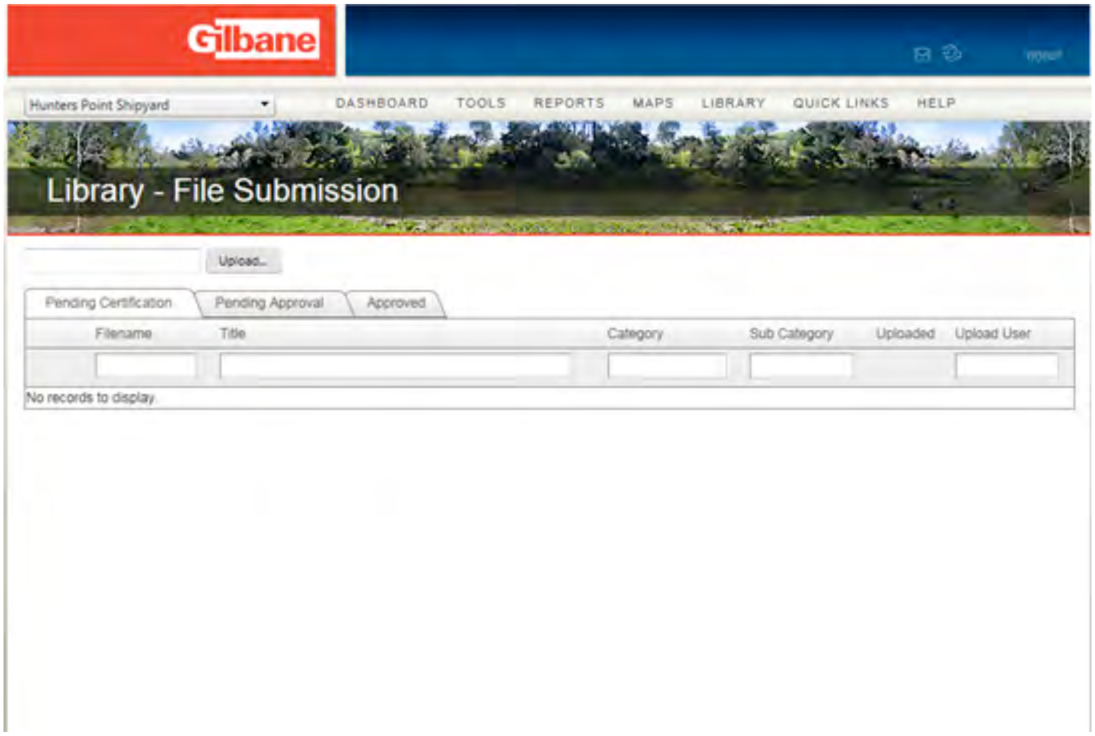
To upload documents to the library in the project database, click on the “Tools” menu and select “Library – File Submission”.



Environmental Data	
EMI	364
GWD	372
LDI	19,637
LTD	167
RESULT	2,172,046
SAMPLE	40,380
SITE	229
SLX	13,512
TEST	191,918
UXODISC	0
WCI	11
WINT	606
WMI	144

File Status	
Pending Certification	449
Pending Approval	420

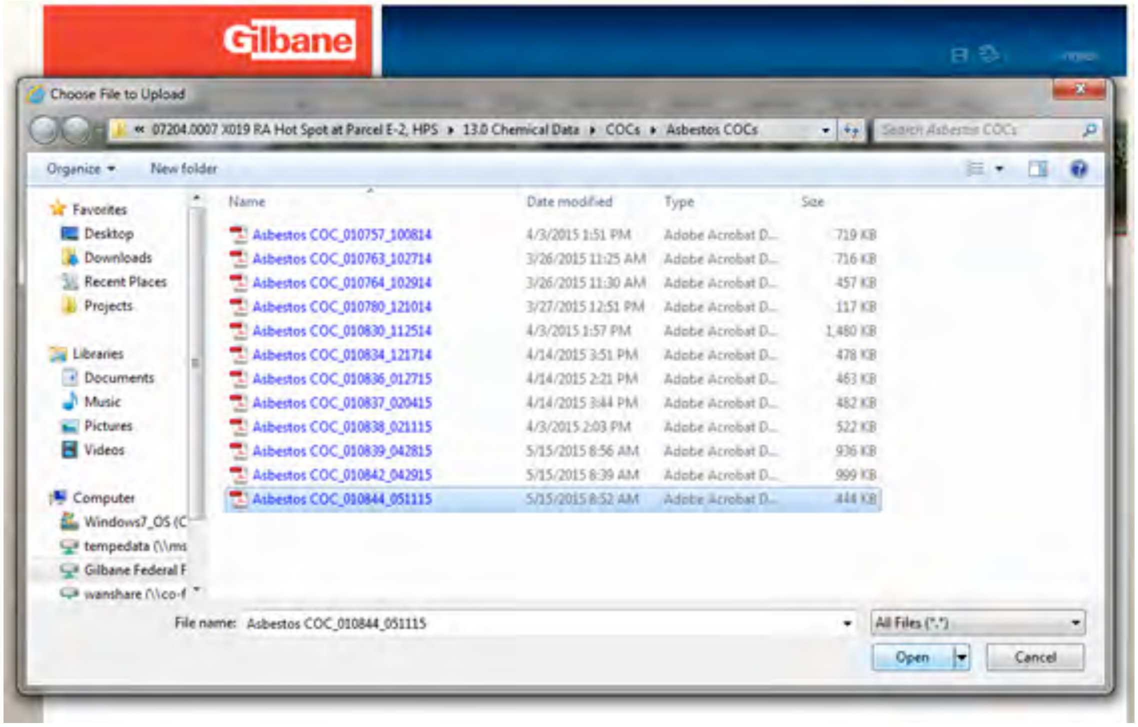
Select “Upload” and you will be directed to a separate screen from which you can browse to the desired file.



Filename	Title	Category	Sub Category	Uploaded	Upload User

No records to display.

One file at a time may be uploaded , with a 200 MB maximum upload.

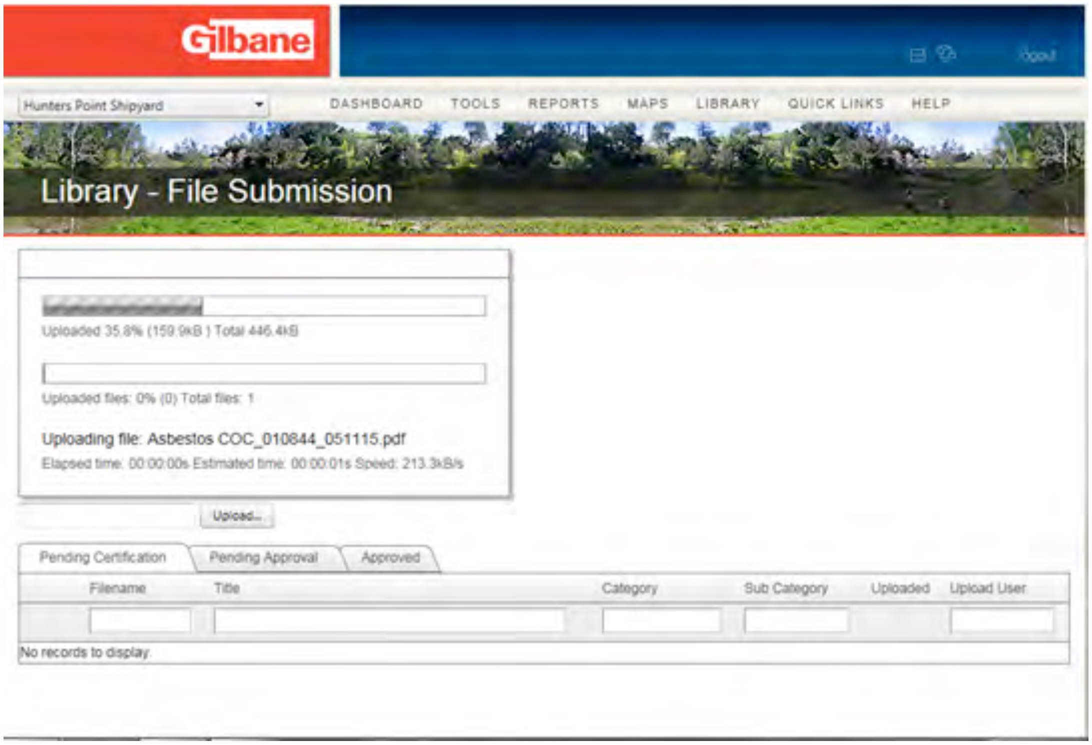


« 07204.0007 X019 RA Hot Spot at Parcel E-2, HPS ▸ 13.0 Chemical Data ▸ COCs ▸ Asbestos COCs

Name	Date modified	Type	Size
Asbestos COC_010757_100814	4/3/2015 1:51 PM	Adobe Acrobat D...	719 KB
Asbestos COC_010763_102714	3/26/2015 11:25 AM	Adobe Acrobat D...	716 KB
Asbestos COC_010764_102914	3/26/2015 11:30 AM	Adobe Acrobat D...	457 KB
Asbestos COC_010780_121014	3/27/2015 12:51 PM	Adobe Acrobat D...	117 KB
Asbestos COC_010830_112514	4/3/2015 1:57 PM	Adobe Acrobat D...	1,480 KB
Asbestos COC_010834_121714	4/14/2015 3:51 PM	Adobe Acrobat D...	478 KB
Asbestos COC_010836_012715	4/14/2015 2:21 PM	Adobe Acrobat D...	463 KB
Asbestos COC_010837_020415	4/14/2015 3:44 PM	Adobe Acrobat D...	482 KB
Asbestos COC_010838_021115	4/3/2015 2:03 PM	Adobe Acrobat D...	522 KB
Asbestos COC_010839_042815	5/15/2015 8:56 AM	Adobe Acrobat D...	936 KB
Asbestos COC_010842_042915	5/15/2015 8:39 AM	Adobe Acrobat D...	999 KB
Asbestos COC_010844_051115	5/15/2015 8:52 AM	Adobe Acrobat D...	444 KB

File name: Asbestos COC_010844_051115

Click on the “Open” button to upload from your computer. The upload process is then displayed.



Uploaded 35.8% (159.9kB) Total 446.4kB

Uploaded files: 0% (0) Total files: 1

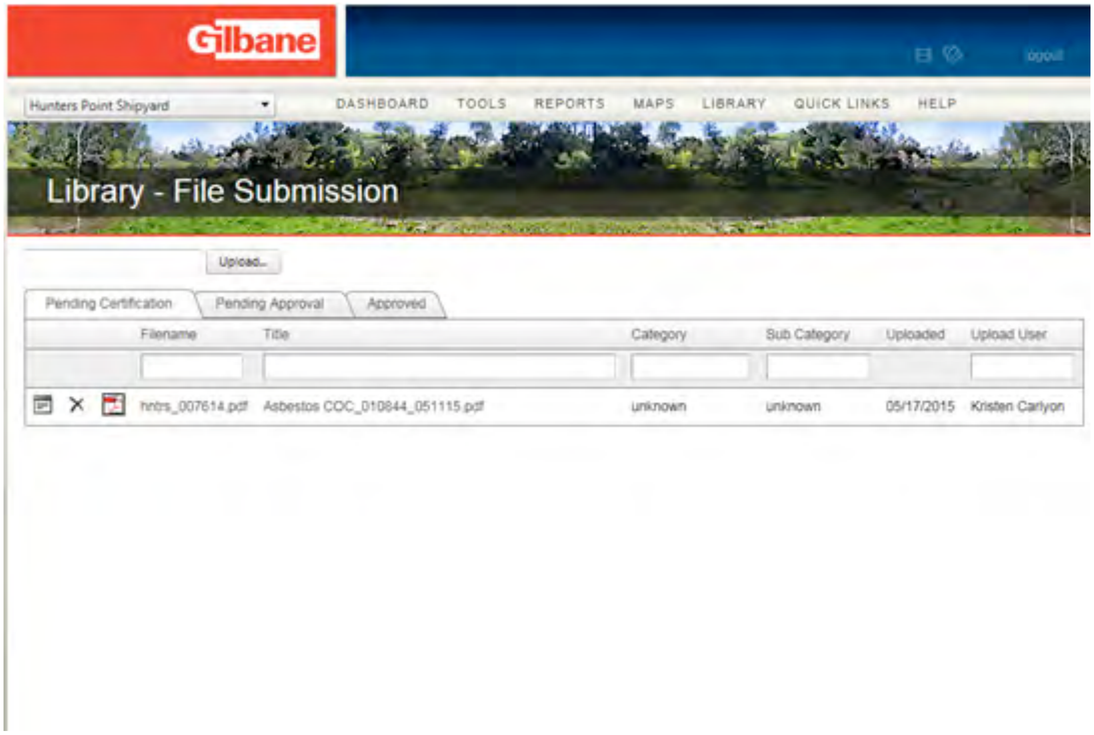
Uploading file: Asbestos COC_010844_051115.pdf

Elapsed time: 00:00:00s Estimated time: 00:00:01s Speed: 213.3kB/s

Filename	Title	Category	Sub Category	Uploaded	Upload User

No records to display.

The file is then listed in the "Pending Certification" screen. See below for further description.



	Filename	Title	Category	Sub Category	Uploaded	Upload User
	hntrs_007614.pdf	Asbestos COC_010844_051115.pdf	unknown	unknown	05/17/2015	Kristen Carlyon

Files have three states:

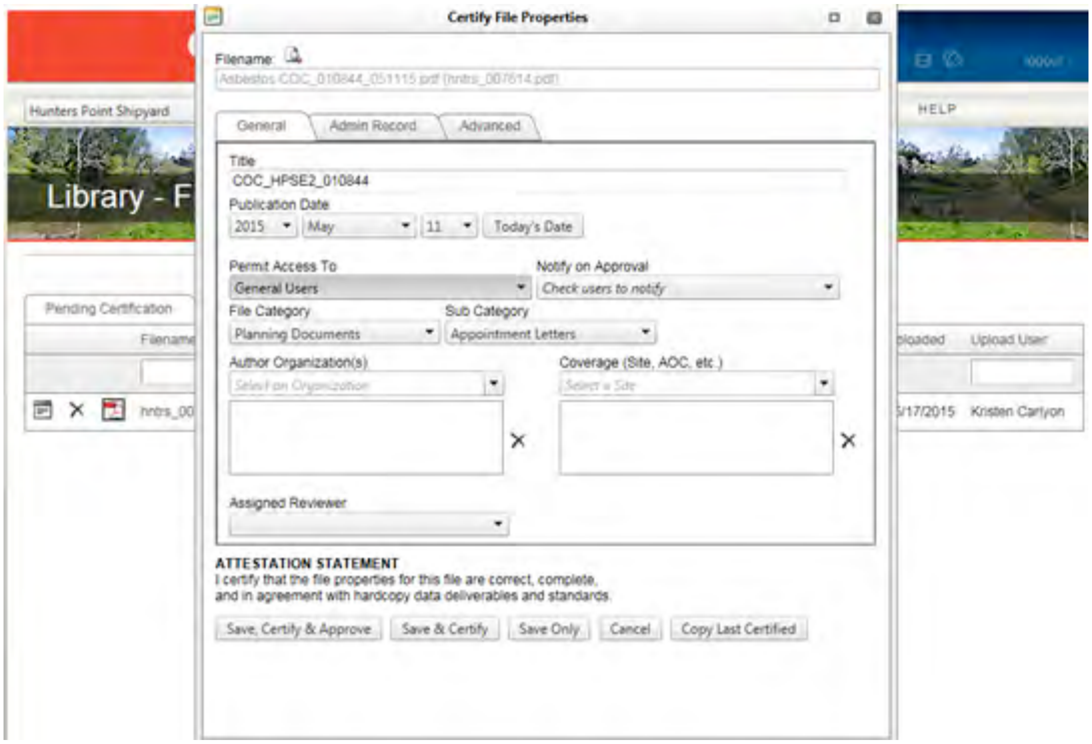
1) **Uncertified (Pending Certification)**. Uncertified files represent the initial uploaded document without completed metadata.
2) **Certified (Pending Approval)**. The file is complete from the perspective of the person uploading the file. The document and associated metadata is ready for QC, and is visible only to those parties with approval authority in the library submission module.
3) **Approved**. The document and associated metadata is complete and accurate, represents information collected consistent with the planning documents and other requirements of the project, and was successfully QC'ed by a second person. The "approved" document is now transferred to the general library and is viewable by all parties who have appropriate access to the project database.

Since the above document is still "Uncertified", the file upload process is not yet complete until additional information (the metadata) is input relative to the file, and the file is "certified" by the submitter.

To edit the metadata (source data) associated with the uploaded file, click on the far left box with the check mark and enter the appropriate information on the resulting "Certify File Properties" screen. This information includes (at a minimum):

- Title of the document (this is the name the document will have in the project library, so keep this consistent for the same type of document using the eDMS filing conventions in Attachment 1),
- Date of the document (or date the field or meeting notes represent)
- Permit access to (who can access the document, typically this is "general users" but the system does allow for the storage of confidential information available only to a select category of user)
- Document "file category" and "sub category" (these are important, as specific searches can be performed by sub category of document, such as requesting all chain-of-custodies on the project to date)
- Author organization (typically Gilbane for our reports, memorandums, field notes etc.)

An example of a completed certification screen is below:



Certify File Properties

Filename: Asbestos COC_010844_051115.pdf (hntrs_007614.pdf)

Title: COC_HPSE2_010844

Publication Date: 2015 May 11

Permit Access To: General Users

Notify on Approval: Check users to notify

File Category: Planning Documents

Sub Category: Appointment Letters

Author Organization(s): Select an Organization

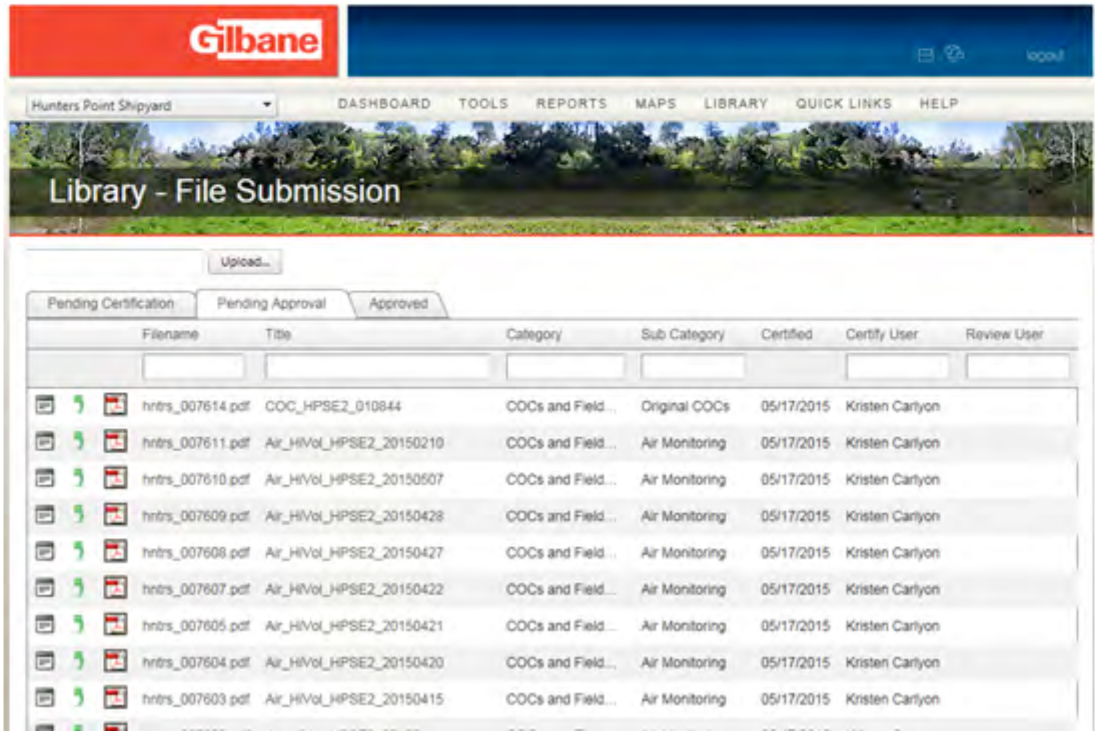
Coverage (Site, AOC, etc.): Select a Site

Assigned Reviewer:

ATTESTATION STATEMENT
I certify that the file properties for this file are correct, complete,
and in agreement with hardcopy data deliverables and standards.

Once the metadata is completely entered (at least the minimum set of information as identified above), click the "Save and Certify" button.

To verify the document has been saved and certified, navigate to the "Pending Approval" screen. The document should now appear under this list.

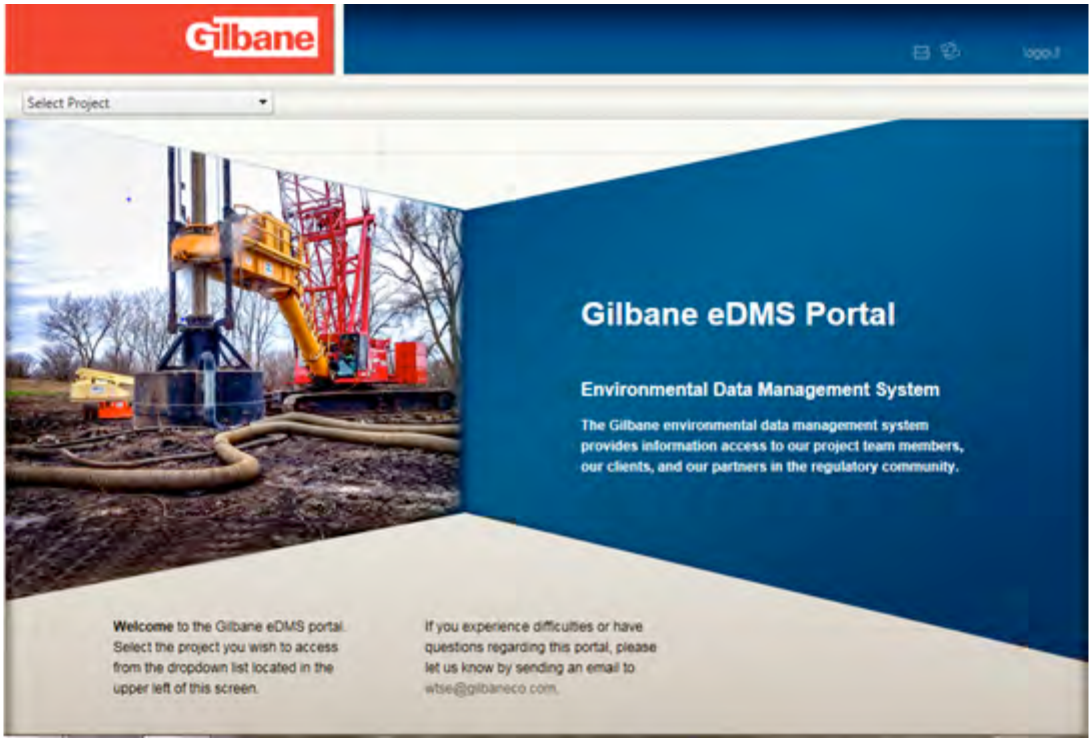


Filename	Title	Category	Sub Category	Certified	Certify User	Review User
hntrs_007614.pdf	COC_HPSE2_010844	COCs and Field...	Original COCs	05/17/2015	Kristen Carlyon	
hntrs_007611.pdf	Air_HiVol_HPSE2_20150210	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007610.pdf	Air_HiVol_HPSE2_20150507	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007609.pdf	Air_HiVol_HPSE2_20150428	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007608.pdf	Air_HiVol_HPSE2_20150427	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007607.pdf	Air_HiVol_HPSE2_20150422	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007605.pdf	Air_HiVol_HPSE2_20150421	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007604.pdf	Air_HiVol_HPSE2_20150420	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007603.pdf	Air_HiVol_HPSE2_20150415	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	

The document has now successfully been uploaded to the project library. However, at this step the document is only available to those who have library approval rights to the database, not general users. To make the document available to all users, the document must be QC checked and "approved". Separate instructions are provided for the approval process.

Instructions
Approving Documents in eDMS

Open your browser, and go to http://edms.itsi.com



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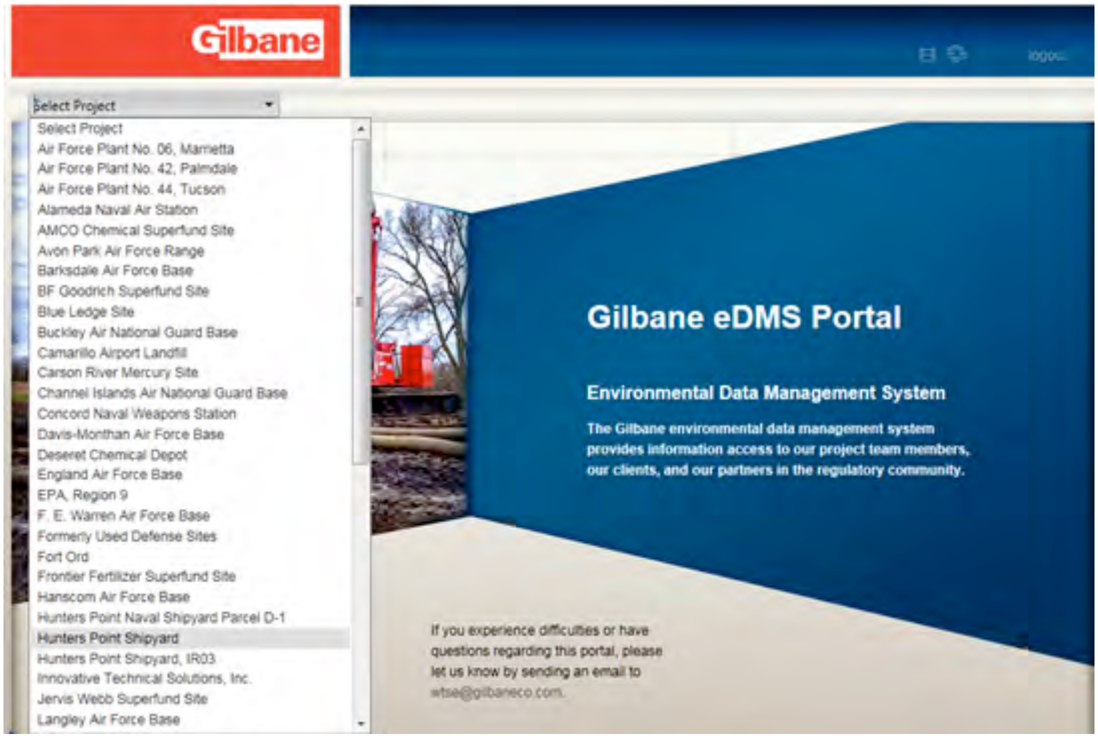
Select your project from the pull-down menu. Note, each person's list of projects will vary, as only those projects you have permissions for are shown.



Gilbane eDMS Portal

Environmental Data Management System

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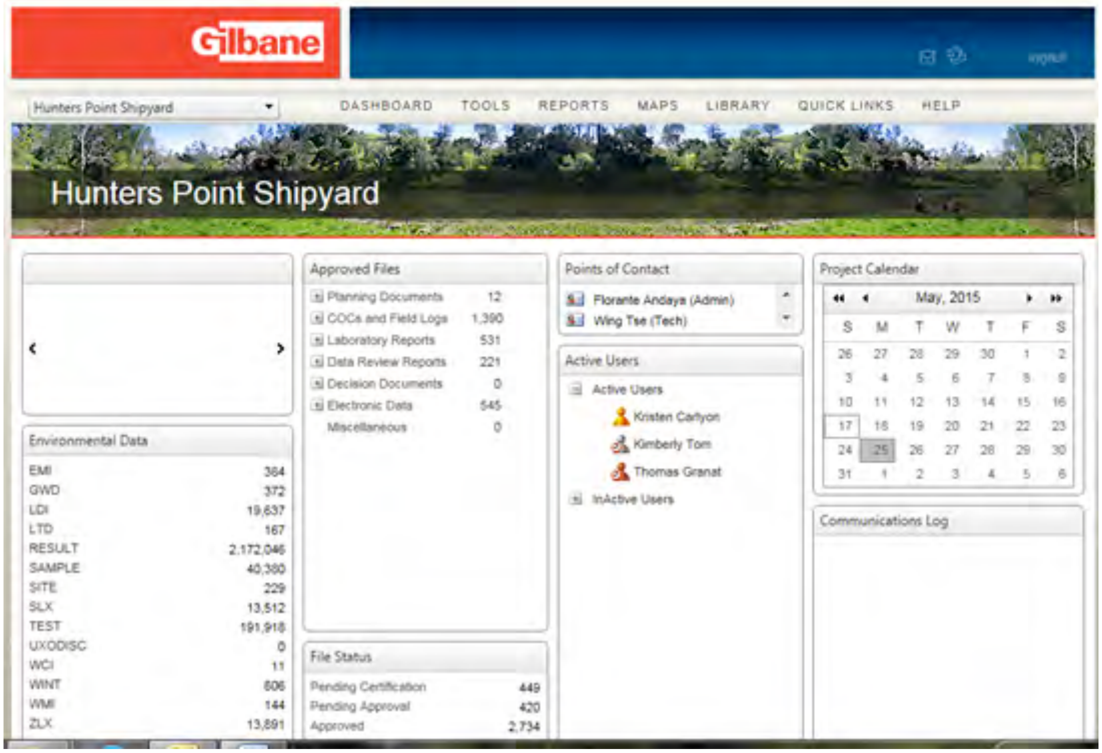
If you experience difficulties or have questions regarding this portal, please let us know by sending an email to wtse@gilbaneco.com.

The screenshot below is of the “dashboard” for the Frontier Fertilizer project database under eDMS, as an example. The dashboard shows the status of various submittals, points of contact, project calendar, and displays recent photos uploaded to the project database.



Environmental Data

EMI	364
GWD	372
LDI	19,637
LTD	167
RESULT	2,172,046
SAMPLE	40,380
SITE	229
SLX	13,512
TEST	191,918
UXODISC	0
WCI	11
WINT	606
WMI	144
ZLX	13,891

Approved Files

⊞ Planning Documents	12
⊞ COCs and Field Logs	1,390
⊞ Laboratory Reports	531
⊞ Data Review Reports	221
⊞ Decision Documents	0
⊞ Electronic Data	545
Miscellaneous	0

File Status

Pending Certification	449
Pending Approval	420
Approved	2,734

Points of Contact

Florante Andaya (Admin)
Wing Tse (Tech)

Active Users

- ⊟ Active Users
  - Kristen Carlyon
  - Kimberly Tom
  - Thomas Granat
- ⊞ InActive Users

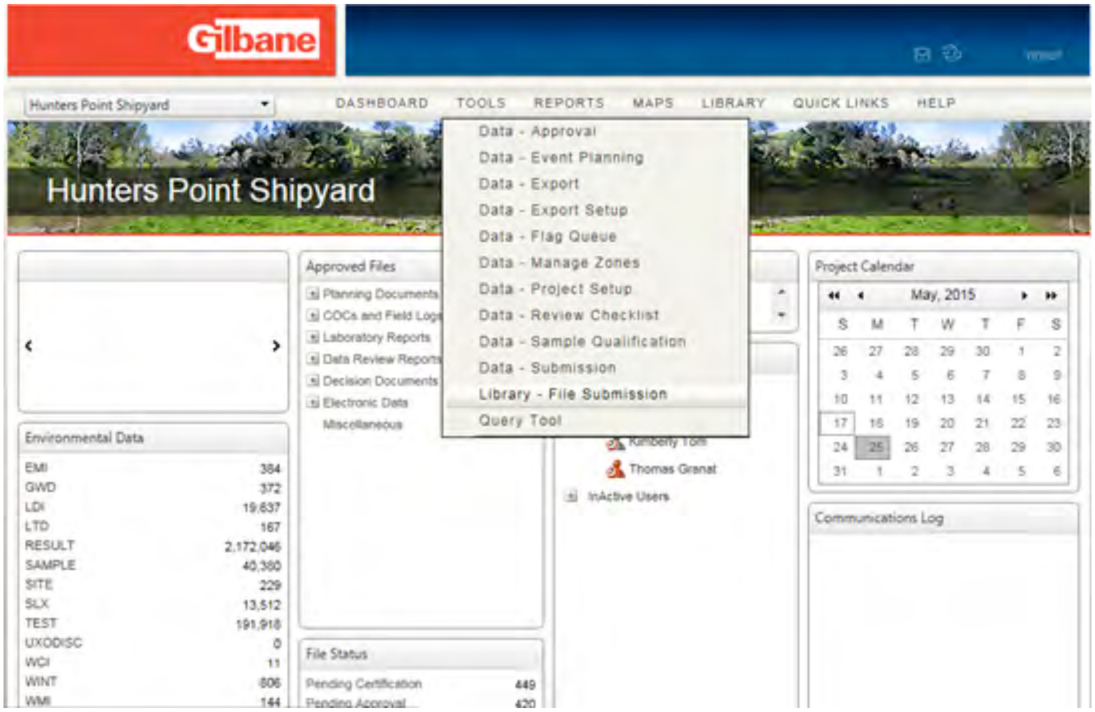
Project Calendar

May, 2015

S	M	T	W	T	F	S
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Communications Log

To QC and approve a document in the library in the project database, click on the “Tools” menu and select “Library – File Submission”.



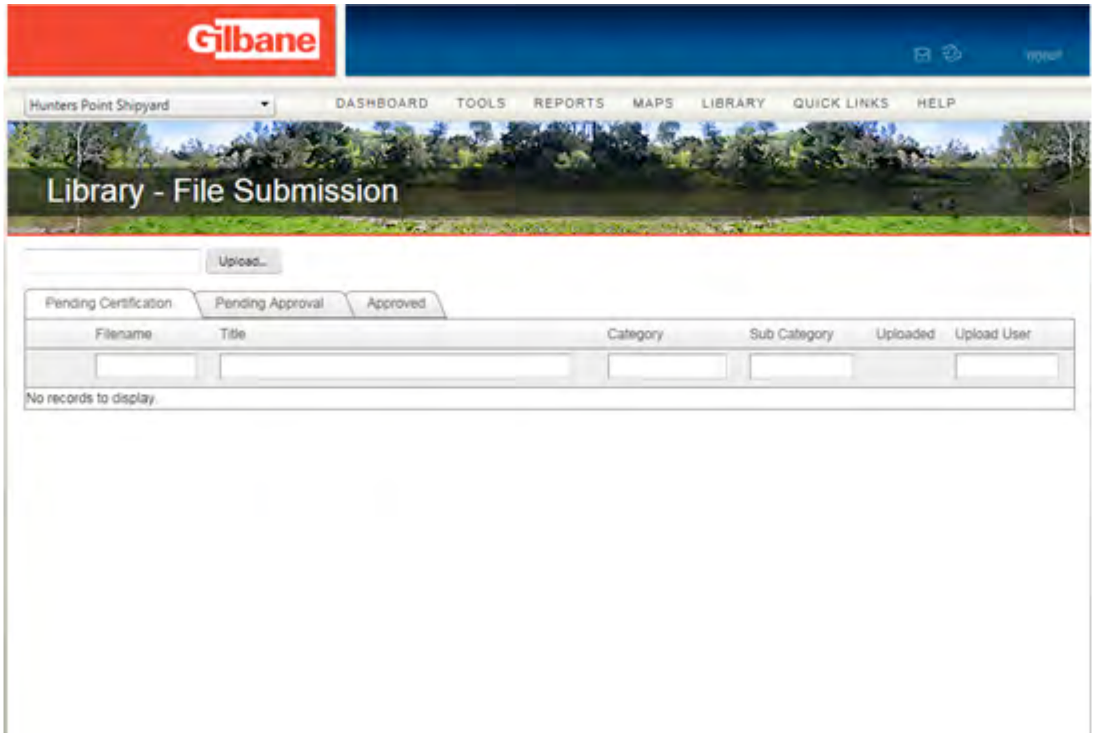
Environmental Data

EMI	384
GWD	372
LDI	19,637
LTD	167
RESULT	2,172,046
SAMPLE	40,380
SITE	229
SLX	13,512
TEST	191,918
UXODISC	0
WCI	11
WINT	806
WMI	144

File Status

Pending Certification	449
Pending Approval	420

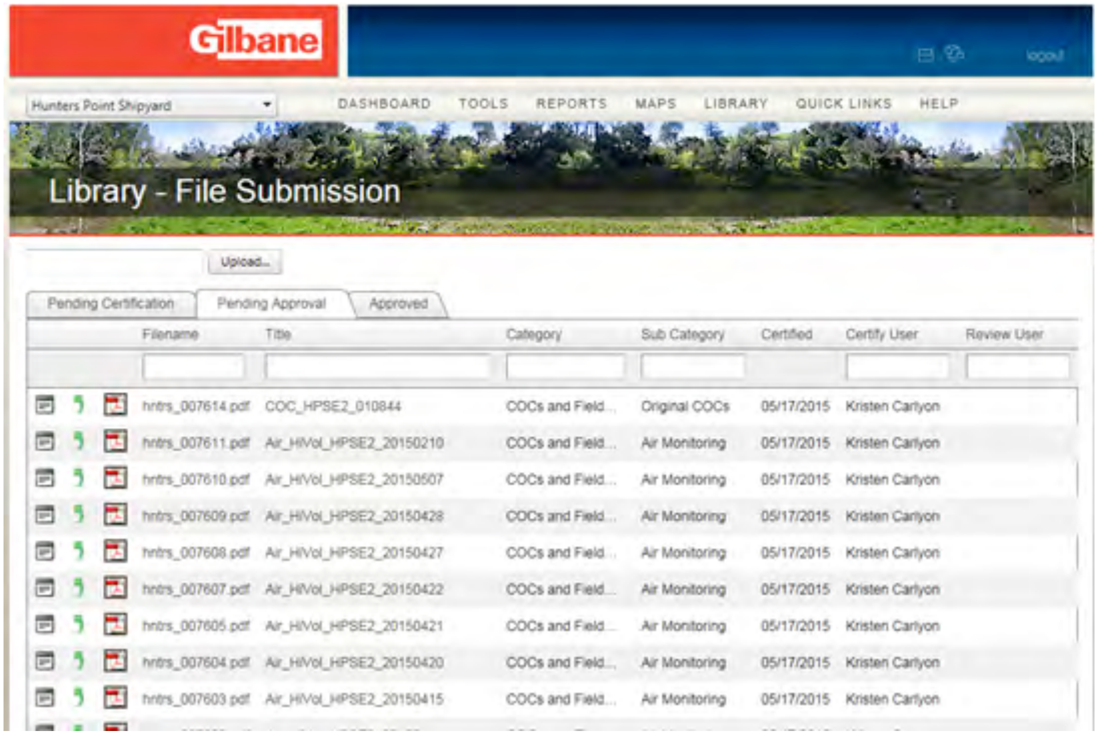
Select the “Pending Approval” tab from the library main menu.



Filename	Title	Category	Sub Category	Uploaded	Upload User

No records to display.

A list of documents will be displayed:



Filename	Title	Category	Sub Category	Certified	Certify User	Review User
hntrs_007614.pdf	COC_HPSE2_010844	COCs and Field...	Original COCs	05/17/2015	Kristen Carlyon	
hntrs_007611.pdf	Air_HiVol_HPSE2_20150210	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007610.pdf	Air_HiVol_HPSE2_20150507	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007609.pdf	Air_HiVol_HPSE2_20150428	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007608.pdf	Air_HiVol_HPSE2_20150427	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007607.pdf	Air_HiVol_HPSE2_20150422	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007605.pdf	Air_HiVol_HPSE2_20150421	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007604.pdf	Air_HiVol_HPSE2_20150420	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	
hntrs_007603.pdf	Air_HiVol_HPSE2_20150415	COCs and Field...	Air Monitoring	05/17/2015	Kristen Carlyon	

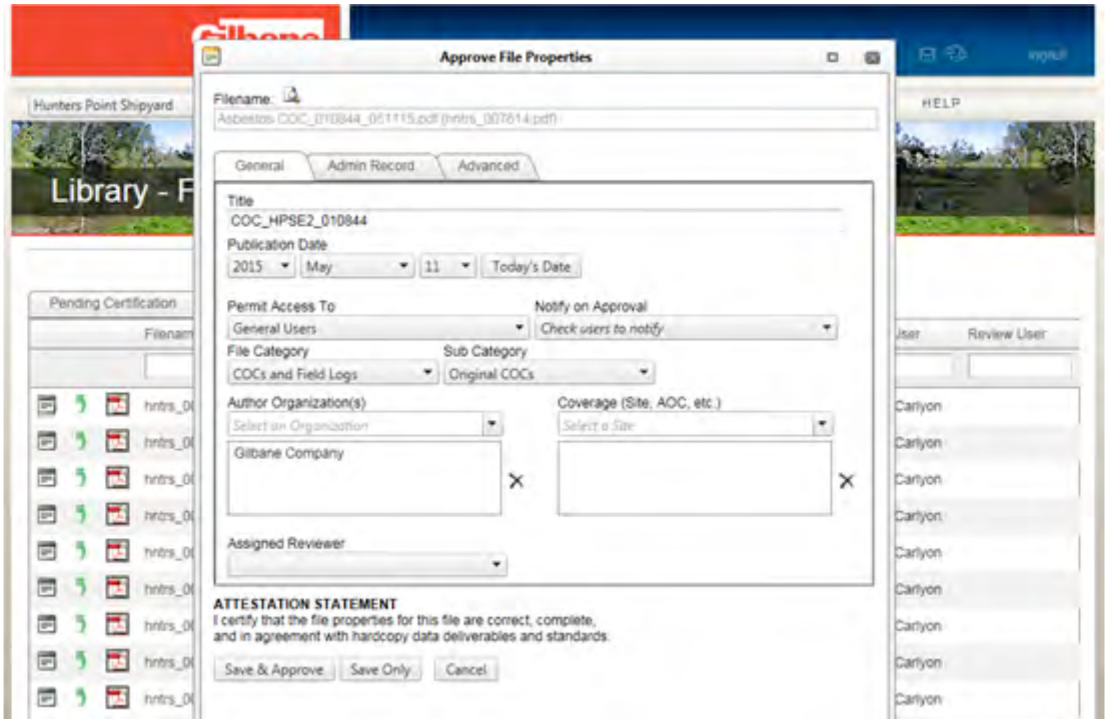
To review the file for approval:

Click on the PDF icon. This pulls the document up in a separate window to verify that the contents of the PDF match the title of the file.

1. If there are problems with the document and it needs to be corrected or amended by the submitter, click on the box containing the green back arrow and "uncertify" the document. This will return it to "uncertified" status and allow for the document to be replaced with a corrected version by the original submitter. The reviewer will then need to notify the original submitter regarding the necessary corrections and that the document will need to be re-uploaded once corrected.
2. If the document is ok, then click on the far left box. This pulls up the metadata (source data) associated with the document. Please verify the information is correct and make any changes needed to the metadata to complete the minimum required information and make it consistent with previous entries. The minimum needed metadata includes:
    a. Title of the document (this is the name the document will have in the project library, so keep this consistent for the same type of document using the eDMS filing conventions in Attachment 1),
    b. Date of the document (or date the field or meeting notes represent)
    c. Permit access to (who can access the document, typically this is "general users" but the system does allow for the storage of confidential information available only to a select category of user)

   d. Document “file category” and “sub category” (these are important, as specific searches can be performed by sub category of document, such as requesting all chain-of-custodies on the project to date)
   e. Author organization (typically Gilbane for our reports, memorandums, field notes etc.)

3. Once the metadata has been verified, click the “Save and Approve” button.



Approve File Properties

Filename: Asbestos COC_010844_051115.pdf (hntrs_007614.pdf)

Title: COC_HPSE2_010844

Publication Date: 2015 May 11

Permit Access To: General Users

Notify on Approval: Check users to notify

File Category: COCs and Field Logs

Sub Category: Original COCs

Author Organization(s): Select an Organization

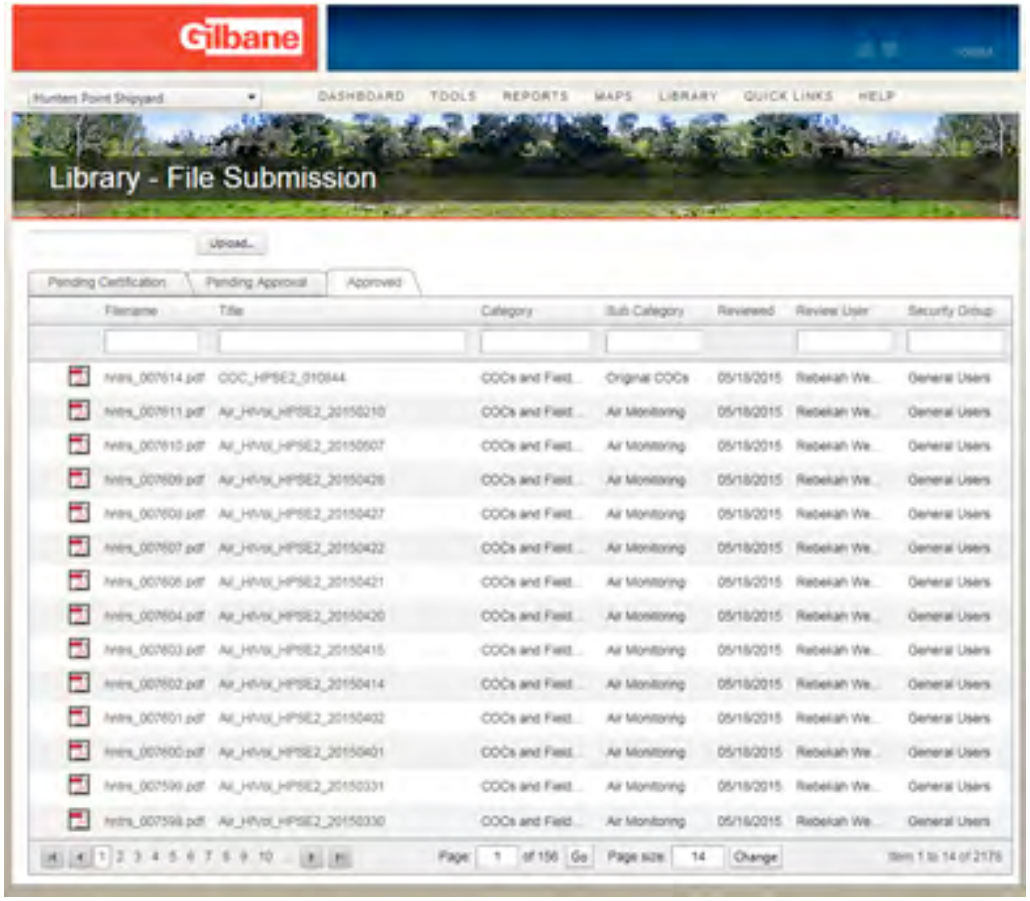
Gilbane Company

Coverage (Site, AOC, etc.): Select a Site

Assigned Reviewer:

ATTESTATION STATEMENT
I certify that the file properties for this file are correct, complete, and in agreement with hardcopy data deliverables and standards.

To verify the document has been saved and approved, select “Approved” from the pull down menu (“File Status”). The document will now appear in the list under “Approved”.



Filename	Title	Category	Sub Category	Reviewed	Review User	Security Group
hntrs_007614.pdf	COC_HPSE2_010844	COCs and Field...	Original COCs	05/18/2015	Rebekah We...	General Users
hntrs_007611.pdf	Air_HVol_HPSE2_20150210	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007610.pdf	Air_HVol_HPSE2_20150507	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007609.pdf	Air_HVol_HPSE2_20150428	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007608.pdf	Air_HVol_HPSE2_20150427	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007607.pdf	Air_HVol_HPSE2_20150422	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007606.pdf	Air_HVol_HPSE2_20150421	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007604.pdf	Air_HVol_HPSE2_20150420	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007603.pdf	Air_HVol_HPSE2_20150415	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007602.pdf	Air_HVol_HPSE2_20150414	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007601.pdf	Air_HVol_HPSE2_20150402	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007600.pdf	Air_HVol_HPSE2_20150401	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007599.pdf	Air_HVol_HPSE2_20150331	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users
hntrs_007598.pdf	Air_HVol_HPSE2_20150330	COCs and Field...	Air Monitoring	05/18/2015	Rebekah We...	General Users

The document has now successfully been approved for full access in the project library and is available to all users who possess the minimum permissions established for the document.

eDMS Filing Convention

File Type	Library Category	Library Subcategory	File Naming Convention
RSOR Appointment Letter	Planning Documents	Appointment Letters	RSOR_TMock
QCM Appointment Letter	Planning Documents	Appointment Letters	QCM_BWomack
Chain-of-Custody	Field Documents	COCs and SCLs	COC_XXXXXX where XXXXX represents the COC alphanumeric ID
Sample Collection Log	Field Documents	COCs and SCLs	SCL_20131009
Air Monitoring Log	Field Documents	COCs and SCLs	Air_20131009
Weather Data	Field Documents	COCs and SCLs	Weather_20131009
Daily Activity Reports	Field Documents	DARs and CPRs	DAR_20131009
Daily Production Report	Field Documents	DARs and CPRs	CPR_20131009
Contractor Quality Control Report	Field Documents	Contractor Quality Control Reports	CQCR_20131009
3-phase Inspection Reports			Bundled in above file (Ideally)
– Combined Form			“
– Preparatory Form			“
– Initial Inspection Form			“
Material Receipt Inspection Checklist			“
Other QC-related forms as needed			“
Tailgate Meetings	Field Documents	Health and Safety Reports	Safety_20131009
Equipment Inspections			
– Initial (R-150)			
– Daily			
– Weekly			
Radiological Safety – related Items	Field Documents	Health and Safety Reports	RadSafety_20131009
– Rad Work Access Log			Bundled in above file
– TLD Issue Form			“
– TLD Issue Log			“
Photo Logs	Field Documents	Photo Logs	PhotoLog_20131009
Rad Surveys	Field Documents	Radiological Survey Reports	RadSurvey_20131009

File Type	Library Category	Library Subcategory	File Naming Convention
Biological Monitoring	Field Documents	Biological Monitoring	BioMon_20131009

Notes:

1. For databases with multiple projects, the filing convention should contain a project designator after the initial code. For example, the hunters point database convention would be:
    - SCL_HPSE2_20151012
    - AIR_HPSC_20140914
2. Categories can vary slightly from database to database depending on age. Newer databases are more consistent. For example, the category “COCs and SCLs” is equivalent to “Original COCs” in the Hunters Point Shipyard database.

Gilbane

Standard Operating Procedure

Surface Soil: Sampling with Trowel or Spoon

PR-TC-02.02.01.01 v2.1a

Reviewed by: Clare Gilmore Date: 14 June 2013
Clare Gilmore, Senior Geologist

Reviewed by: Date: 14 June 2013
Jim Schollard, Program QA/QC Manager

Approved by: Jeffrey Hess Date: 14 June 2013
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval[*]
1.0	Initial Issue		1 Oct 2009	NA
2.0	Add provisions to retain weathered soil for non-VOC analysis, and option for placement of sample material directly into appropriate sample containers.	Pages 2-4	14 Jun 2013	NA
2.1	Updated organization name. No other changes needed.	All	6 Aug 2014	J. Hess
2.1a	Reviewed. No changes needed.	–	14 Oct 2016	

[*] Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the methods and procedure for sampling of surface soils using trowels or spoons (scoops). Trowels or spoons can be used when soil matrices are composed of relatively soft and non-cemented formations, and to depths of up to 12 inches into the ground surface, depending on site conditions.

Note: Samples for VOC analysis should not be collected via trowel or spoon method. However, a trowel or spoon may be used to penetrate and expose the undisturbed material to the desired depth for sampling using an approved VOC sampling device.

1.1 LIMITATIONS

Samples from depths greater than 12 inches below the surface, or in matrices that are difficult to penetrate using a spoon or a trowel, should be collected using an alternative method (see SOP PR-TC-02.02.01.02, Surface Soils: Drive Sampler, Hand Auger or Test Pit, and SOP PR-TC-02.02.01.03, Subsurface Soils: Direct Push or Drill Rig.)

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

COC:	**chain-of-custody form**
DAR:	**Daily Activity Report**
GPS:	**global positioning system**
HSP:	**Health and Safety Plan**
PPE:	**Personal protective equipment**
SCL:	**Sample Collection Log**
Scoop.	Used interchangeably with “spoon.” A sample collection device with a round metal blade attached to a handle.
SOP:	**Standard Operating Procedure**
Spoon.	Used interchangeably with “scoop.” A sample collection device with a round metal blade attached to a handle.
Surface Soil.	Soil that is removed from the surface (i.e., from a depth no greater than 12 inches below grade after vegetation, rocks, etc. have been cleared.
Trowel.	A sample collection device with a curved and pointed metal blade attached to a handle. All trace environmental samples should be collected using stainless steel blades or single-use disposable plastic trowels.
VOC:	**volatile organic compound**

3.0 PROCEDURES

The intent of these procedures is to identify the steps to be taken to assure that surface soil samples are collected efficiently and that the samples accurately reflect current conditions for the location and matrix from which they are collected.

3.1 SAMPLE COLLECTION

The following steps should be followed to collect samples of surface soil by hand using a trowel or spoon (NOTE: the words “trowel” and “spoon” are used interchangeably in the following text):

1. Don a pair of clean sampling gloves (e.g., Latex, Nitrile).
2. If desired, place plastic sheeting around the targeted location to keep sampled material in place. Use a knife or scissors to cut an access hole for the sample location.
3. If a larger volume of soil will be collected than necessary to fill the appropriate sample containers (due to heterogeneity of the soil at the sample location), place a clean stainless steel bowl large enough to hold the soil to be collected within reach of the sample location.
4. Remove any surficial debris (e.g., vegetation, rocks, etc.) from the sample location and surrounding area until the soil is exposed. Once exposed, the soil surface is designated as “at grade” or 0 inches.
5. If collecting a sample for volatile organic compounds (VOCs), use a trowel or spoon to scrape and remove the top 1/8 to 1/4 inch of weathered soil[1], if present. Otherwise, retain the material as part of the sample.
6. Collect all samples for VOC analysis first using an approved VOC sampling device.
7. Using a new/clean (i.e., disposable or decontaminated) trowel, place the point of the blade on the ground. While holding the handle of the trowel, partially rotate the blade in a clockwise/counter-clockwise motion while pushing downward at an angle until the blade is inserted to the required depth or the blade is nearly covered. Be certain that the trowel is not inserted to a depth where the soil will touch the handle or the sampler’s gloved hand.
8. With a prying motion, lift up the trowel with soil on the blade and place soil directly into the appropriate sample container(s) specified in the approved project plans or as provided by the analytical laboratory, or into the stainless steel mixing bowl.
9. Repeat steps 6 and 7 until the specified sampling depth is reached and the required amount of soil has been collected.
10. Measure the depth below grade of the sample location with an Engineer’s Rule or measuring tape to verify the sampling depth, obtain the GPS coordinates of the

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[1] Weathered soil is often the top 1/8 to 1/4 inch of soil that can be affected by factors such as heat from the sun, rain, and/or foot or vehicular traffic that can result in loss of VOCs present in the shallow soil.

sample location, and record the depth/interval and GPS coordinates on the Sample Collection Log (SCL) or in the Daily Activity Report (DAR), as appropriate.

11. When using a stainless steel mixing bowl, homogenize the non-volatile organic compound (VOC) sample media first as specified in the approved project plans, then transfer the sample directly into the appropriate sample container(s) specified in the approved project plans or as provided by the analytical laboratory.
12. If using a wide-mouth glass jar, seal the jar with a Teflon-lined cap. If using a stainless steel sample tube, cap both ends of the tube with plastic caps lined with Teflon sheets.
13. Clean off the surface of the sample container; complete the sample label and chain-of-custody (COC) documentation; attach the label to the jar or tube; place the sample containers in Ziplock® Freezer Bag or equivalent and place the sample into a sample cooler maintained at 4 degrees Celsius.

3.2 EQUIPMENT

The following equipment should be used when collecting samples with a spoon or trowel:

- Decontaminated stainless steel or new disposable trowel or spoon.
- Engineer’s Rule or stiff measuring tape.
- Decontaminated stainless steel mixing bowl.
- Sample container(s) as specified in the approved project plans.
- Sample collection supplies (e.g., caps, sample labels, coolers, ice, etc.).
- Plastic sheeting.
- DAR (or field logbook, when required) and SCLs for recording field notes and sample locations as specified in this SOP and/or in the project plans.
- GPS
- Digital camera/device to photograph the site, field activities and key features, as applicable
- Decontamination equipment & supplies.
- Personal protective equipment (PPE) as specified in the project-specific Health and Safety Plan (HSP).

3.3 QC SAMPLING

If non-disposable sampling equipment (e.g., trowel, mixing bowl) is re-used for multiple samples, then equipment rinsate should be collected and disposed of properly. Samples should be collected to verify that proper decontamination methods were performed between samples. A minimum of one sample per major sampling device should be collected per event, if not more frequently (i.e., one per day).

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- GPS coordinates for each sample location;
- Field notes provided on a DAR (or field logbook, when applicable);
- Sample Collection Form with descriptions of collected samples, depths, collection times, sample locations, etc.
- Chain-of-custody form.

5.0 ATTACHMENTS/FORMS

None.

6.0 REFERENCES

Innovative Technical Solutions, Inc. (ITSI), 2006. *Final Chemical Data Quality Management Plan*, 8(a) Remedial Action Contract Number N68711-005-D-6403. January.

Gilbane

Standard Operating Procedure

Subsurface Soils: Direct-Push or Drill Rig

PR-TC-02.02.01.03 v2

Reviewed by: ______________________ Date: 20 July 2015
Rogerio Leong, P.G., Geologist

Reviewed by: Tim Watchers Date: 21 July 2015
Tim Watchers, P.G., Geologist

Approved by: Jeffrey Hess Date: 22 July 2015
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Date	Approval*
1.0	Initial issue	NA	02 Mar 2010	NA
2.0	Update to include sonic drilling method	Section 3.3, pages 5-6	22 Jul 2015	NA

- Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatories to the SOP.

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1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to describe the requirements and procedures for the collection of relatively undisturbed subsurface soil samples from discrete depths during drilling activities. Typical drilling methods associated with subsurface soil sampling activities include but are not limited to: 1) direct push technique (DPT); 2) hollow-stem auger (HSA); 3) sonic; and 4) air rotary casing hammer (ARCH). These drilling methods utilize similar techniques for the collection and retrieval of soil samples from the subsurface, based on use of a solid or split core barrel, and either unlined or lined.

Note: Care should be taken in the selection and use of some drilling methods for the collection of subsurface soil samples suspected to contain volatile organic compounds (VOCs). Drilling methods that generate significant heat during drilling (sonic), or that employ significant volumes of air which may become heated (ARCH and similar methods) could potentially contribute to the loss of VOCs from soil samples collected using these methods.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

ARCH: air rotary casing hammer consists of a non-rotating flush-threaded casing driven in conjunction with a conventional air rotary drill string. Cuttings are cleared from the hole by bit rotation and air circulation. The cuttings are discharged through a cyclone, which separates the air from the formation cuttings to facilitate sampling and allow for the containment of the drill cuttings.

DPT: direct-push technique consists of typically small drill rigs equipped with a percussion hammer and hydraulic pressure to advance the drill string.

FSP: Field Sampling Plan

GPS: global positioning system

HSA: hollow-stem auger uses continuous flight helical augurs to penetrate the soil. As the augers are rotated, soil cuttings are conveyed to the ground surface via the auger flight.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

Sonic: A drilling method that uses mechanically generated vibrations to drive the drill string. The drill head, attached to drill string, consists of two counter rotating, out-of-balance rollers that cause the drill string to vibrate. Resonance occurs when the frequency of the vibrations equals to the natural frequency of the drill string. The resonance and weight of the drill string along with the downward thrust of the drill head permit penetration of the formation without the addition of drilling fluids.

VOC: volatile organic compound

3.0 PROCEDURES

This section presents several techniques employed to collect soil samples from the subsurface. Three techniques are presented:

1. DPT, which consists of both a method of advancing the drill string and associated soil sampling method together
2. Split-tube (or split-spoon) sampler equipped with sample liners, which can be used by most drilling techniques
3. Core barrel sampler, used by sonic drilling technique

3.1 DIRECT-PUSH TECHNIQUE (DPT)

The collection of subsurface soil samples using DPT employs either single-tube or dual-tube methods. Both methods consist of advancing a drill string using hydraulic pressure and a pneumatic hammer to the target depth. The two methods are described below:

- Single-tube method, as the name implies, involves the use of a single drill string composed of drill rods and/or sample tube to advance to the target depth. Soils can be either be continuously sampled or samples collected from a discrete depth using this method.
  - Continuous sampling of the subsurface soils can be performed using sample tubes ranging in length from 2 to 5 feet containing removable liners manufactured from a variety of materials (e.g., clear PVC, stainless steel, Teflon [PTFE], and clear plastic [PETG]). When the sample tube is full, the entire assembly is brought to the surface.
  - Discrete depth samples can be collected using a sample tube equipped with a retractable drive point. The sample tube is advanced to the desired depth, at which time a narrow rod is lowered through the center of the drill rod into the sample tube to unscrew the drive point. With the drive point loosened, the sample tube is driven the required depth to fill the open sample tube. When full, the sample tube is brought to the surface.

  Note: If samples are needed from deeper layers, the entire process is repeated, introducing the possibility of cross-contamination if the sample is collected from the same borehole. After the tool is removed, sidewall material may slough into the borehole. The acceptability of sloughing cross-contamination should be decided on a case-by-case basis, depending on data quality objectives. If this minimal amount of cross-contamination is not acceptable, samples must be collected from another borehole, or an alternative method employed, such as dual-tube DPT.

- Dual-tube method involves the use of an outer drive casing and inner drive rods. The rods can be attached to either a drive point or a sample tube with liners. In the drive point mode the tool is driven to the desired sampling depth where the drive point is withdrawn and replaced with the barrel sampler. The outer casing and sampler are then driven the length of the sample tube (2 to 5 feet depending upon the equipment) at which point the sample tube is withdrawn. Continuous sampling can be carried out quickly by using multiple samplers. The dual-tube sampling system is recommended for continuous sampling as the outer casing prevents sloughing and cross contamination from other depths.

The composition of the sample liners used to collect soil samples by DPT should be discussed with the project chemist to make certain there is no chemical reaction with the suspected constituents at the site.

3.1.1 Sample Liner

Sample collection procedures for soil samples obtained in sample tubes equipped with liners consist of the following:

1. Place a pre-cleaned liner of appropriate length in the sample tube. Advance the sampler the appropriate depth, then retrieve the sampler from the ground.
2. Retrieve the sampler with liner from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
3. Retrieve the sample liner from the sampler. Place the sample liner on a clean work surface.
4. Observe and classify the soil in the sample liner. Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.
5. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample liner (e.g., visible staining, fine-grained layer, etc.).
6. Hand saw the desired interval from the sample liner. The sample interval is typically 6 inches, but the actual length may depend on diameter of the sample liner, needed sample volume, target depth, etc., and will be specified in the site-specific QAPP.
7. Collect any required VOC samples from the target end of the sample using an approved VOC sampling device (as specified in the QAPP and consistent with SOP PR-TC-02.02.01.05).
8. The ends of the cut section of sample liner are fitted with Teflon patches, and then covered with plastic friction caps. (The end cap diameter can be stretched by hand if difficult to fit over the ends. Tipping the cap open to the side and partially sliding over the end of the tube and while twisting and pushing down helps.) The end caps should fit snugly. Security tape may be placed around the end caps to

prevent tampering, if specified in the QAPP.

9. The soil samples are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
10. Place the soil samples into plastic zip-lock type bags and place them in an iced and insulated cooler.

3.2 SPLIT-TUBE SAMPLERS

A split-tube (also known as split-spoon) sampler consists of a split-barrel typically of 18 inches in length (but can range in length to 5 feet) that can be left open or lined with sample sleeve(s). A typical application consists of lining an 18-inch split-tube sampler with pre-cut 6-inch sample sleeves composed of brass or stainless steel, but other applications include using longer split-tube samplers equipped with a liner composed of lexan or similar material.

Typically the split spoon sampler is driven to the target depth using a 140-pound hammer ahead of the drill bit while drilling has stopped, although split-tube samplers can be placed and advanced during drilling. In loose soils, a plastic or stainless steel sand catcher can be placed just inside of the sampler’s drive shoe to help retain the sample during retrieval.

The ARCH method employs significant volumes of air during drilling that may become heated, which could potentially contribute to loss of VOCs in the soil samples. For this reason, if VOC samples are needed and the ARCH drilling technique is being used, it is preferred to collect VOC samples from soil retrieved from a split-tube sampler driven ahead of the drill bit several feet after drilling has stopped.

3.2.1 Open Sampler

Sample collection procedures for soil samples obtained from split-tube samplers left open (without sample sleeves) consist of the following:

1. Advance a clean sampler the appropriate depth, then retrieve the sampler from the ground.
2. Retrieve the sampler from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
3. Place the sampler on a clean work surface, and break open the sampler by unscrewing the sampler head and sampler shoe from the ends of the sampler and separating the two halves of the sampler tube to expose the soil core.
4. Observe and classify the soil in the sampler tube and the soil remaining in the sample shoe (from the tip of the sampler). Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.
5. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample sleeves (e.g., visible

staining, fine-grained layer, etc.).

6. Collect the desired soil using a sampling spoon (clean stainless steel or Teflon, or disposable one-time use) and place into clean glass sample jars provided by the laboratory (due to the exposure of the soil core to the atmosphere, this method is not appropriate for soils suspected as containing VOCs). Security tape may be placed around the cap to prevent tampering, if specified in the QAPP.
7. The soil samples are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
8. Place the soil samples into plastic zip-lock type bags and place them in an iced and insulated cooler.

3.2.2 Sample Sleeves

Sample collection procedures for soil samples obtained from split-tube samplers equipped with 6-inch sample sleeves consist of the following:

1. Place the appropriate number of pre-cleaned 6-inch-long brass or stainless steel sleeves in the split-tube sampler. Advance the sampler the appropriate depth, then retrieve the sampler from the ground.
2. Retrieve the sampler with sleeves from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
3. Retrieve the sampler with sleeves from the driller. Place the sampler on a clean work surface, and break open the sampler by unscrewing the sampler head and sampler shoe from the ends of the sampler and separating the two halves of the sampler tube to expose the sample sleeves.
4. Observe and classify the visible soil in the ends of the sample sleeves and the soil remaining in the sample shoe (from the tip of the sampler). Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.
5. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample sleeves (e.g., visible staining, fine-grained layer, etc.).
6. Collect any required VOC samples from the target end of the sample using an approved VOC sampling device (as specified in the QAPP and consistent with SOP PR-TC-02.02.01.05).
7. The ends of the sample sleeve are fitted with Teflon patches, and then covered with plastic friction caps. (The end cap diameter can be stretched by hand if difficult to fit over the ends. Tipping the cap open to the side and partially sliding over the end of the tube and while twisting and pushing down helps.) The end caps should fit snugly. Security tape may be placed around the end caps to

prevent tampering, if specified in the QAPP.

8. The soil samples are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
9. Place the soil samples into plastic zip-lock type bags and place them in an iced and insulated cooler.

3.3 CORE BARREL SAMPLERS

The core barrel sampler is used in sonic drill rigs, with dual wall core barrels typically employed. The dual wall core barrel is designed to take continuous cores from rock and very hard layers. Sample cores are typically either 3 or 4 inches in diameter, and are typically solid but split-tube cores are available. The combination of the sonic head vibration, sonic casing rotation and down force causes the soil to loosen at the bit face, allowing the casing and sampling core barrel to advance. The core barrel advances within the sonic casing thereby obtaining a continuous core sample. In the typical case of solid core barrel sampler, the sample is extruded into a soft plastic liner or core box, as needed. If split-tube core barrel sampler with liner is used, then the technique would be consistent with the DPT technique presented in Section 3.1.1 above.

The sonic method generates significant heat during drilling that could potentially contribute to loss of VOCs concentrations of the soil samples. For this reason, if VOC samples are needed and the sonic drilling technique is being used, it is preferred to collect VOC samples from soil retrieved from a split-tube sampler driven ahead of the drill core several feet after drilling has stopped.

Sample collection procedures for soil samples obtained from a solid core barrel sampler consist of the following:

1. Retrieve the extruded sample from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
2. Place the extruded sample on a clean table surface. If soil core was extruded into a soft plastic liner, cut open the liner to expose the soil core.
3. Perform a vapor screening with a photoionization detector through the soil core to check on potential volatile organic vapors. Measure the core length to determine the recovery and sampling depths.
4. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample core (e.g., visible staining, fine-grained layer, etc.).
5. Split the soil core open with a stainless steel spatula and collect samples from the center of the sample core using a stainless steel or disposable scoop. Transfer soils to the sample jars.
6. Observe and classify the visible soil and the soil remaining in the sample shoe

(from the tip of the sampler). Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.

7. The soil samples in the jars are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
8. Pack each soil sample jar with bubble wrap and placed it into plastic zip-lock type bags and store it in an iced and insulated cooler.

3.4 EQUIPMENT

Besides the equipment mentioned above in each procedure, the following additional items may be required for this procedure:

- Commercial sampler and appropriate liners or sample sleeves
- Approved VOC sampling device (if needed for collection of VOC samples)
- Measuring tape
- Sample container(s), labels, coolers, etc., as specified in the SAP or FSP
- GPS unit
- Field logbook or sample collection logs and boring logs
- Knife or flat edged tool to cut open the remaining core for soil classification
- Munsell® soil color chart
- Dilute hydrochloric acid, if presence of carbonate soils is possible

3.5 QC SAMPLING

If sampling equipment is re-used between samples (i.e., sampler), then equipment rinsate samples should be collected to verify proper decontamination between samples. A minimum of one equipment rinsate sample per major sampling device should be collected per event, if not more frequently (i.e., one per day).

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- GPS coordinates
- Soil Boring Log
- Chains of Custody
- Field notes

5.0 ATTACHMENTS

None.

6.0 FORMS

None.

7.0 REFERENCES

Ohio Environmental Protection Agency, 2005. *Use of Direct Push Technologies for Soil and Ground Water Sampling, Technical Guidance for Ground Water Investigations, Chapter 15*, February.

U.S. Environmental Protection Agency (USEPA). *Soil and Soil-Gas Samplers.* http://www.clu-in.org/characterization/technologies/soilandsoilgassamp.cfm, 28 February 2010.

Standard Operating Procedure

Soil: Volatile Organic Compound (VOC) Sampling

PR-TC-02.02.01.05 v1.3

Reviewed by: Kristen Carlyon Peyton
Kristen Carlyon Peyton, Senior Chemist
Date: 02 March 2010

Reviewed by: Evelyn Dn
Evelyn Dawson, Senior Chemist
Date: 02 March 2010

Approved by: Jeffrey Hess
Jeffrey Hess, Director Technical Services
Date: 02 March 2010

Review / Revision History:

Version	Changes	Affects Section/Pages	Date	Approval*
1.0	Initial Issue	NA	02 Mar 2010	NA
1.1	Addition of Terra Core System to SCDs	3.2 and 3.3	05 Oct 2011	JH
1.2	Updated procedures to incorporate SW846 Update 4 changes to preservation and hold times.	Pages 3, 5-8, 11-12	30 Jul 2013	JH
1.3	Updated organization name. No other changes necessary.	All	20 Jul 2015	JHess

- Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatories to the SOP.

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1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for the collection, packaging and transport of soil samples for the analysis of volatile organic compounds (VOCs). This SOP is focused on the preparation and preservation of soil samples in compliance with United States Environmental Protection Agency (USEPA) Method 5035 (USEPA, 1997) and updated USEPA Method 5035A (USEPA, 2002) and associated agency guidance documents such as the United States Department of Defense (USDoD) Quality Systems Manual, Version 5.0 (DoD, 2013).

Note: There are several approaches to the collection of VOC soil samples. However, the methods and their associated sampling and/or storage devices are not interchangeable. Also, each of the methods has limitations in their application and use, so the decision on which method to use should consider both the benefits and limitations of each method.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

DQOs: data quality objectives
GPS: global positioning system
"high concentration": refers to concentrations of a volatile organic compound (VOC) greater than 200 ug/kg
"low concentration": refers to concentrations of a volatile organic compound (VOC) typically ranging from 0.5 ug/kg to 200 ug/kg
MFSD: multi-function sampling device
ml: milliliter
MS: matrix spike
MSD: matrix spike duplicate
PTFE: polytetrafluoroethylene
QAPP: Quality Assurance Project Plan
SCD: sub-coring device
USACE: United States Army Corps of Engineers
USEPA: United States Environmental Protection Agency
VOA: volatile organic analysis
VOC: volatile organic compound

3.0 PROCEDURES

The intent of this SOP is to present several acceptable procedures for the collection of VOC soil samples, consistent with EPA Method 5035A. The actual selected procedure will be specified in the project-specific QAPP. However, the following two steps are applicable to all the methods described in this SOP:

1. When the concentration of VOCs is unknown, a sample set typically is comprised of three (3) sub-samples of 5 grams of soil each.
2. To determine VOC concentrations on a dry weight basis, in the absence of an additional sample aliquot of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located with each sample.

Each procedure has its own set of benefits and limitations. Selection of the appropriate procedure should be based primarily on which procedure best addresses the data quality objectives (DQOs) while considering the limitations imposed by field conditions and sampling requirements. Attachment A provides a brief discussion of some of the limitations of the specific procedures. Some of the limitations of the different procedures include:

3.1 USE OF MULTI-FUNCTION SAMPLING DEVICE

Multi-function sampling devices (MFSDs), such as the En Core® Sampler, act as both a coring tool and sample storage container, allowing for the collection of soil samples directly into the storage container with zero or minimal headspace. Currently approved MFSDs include the following:

- En Core® Sampler
- Core N' One™ soil sampling system

The procedures for the collection of the soil samples using the approved MFSDs are provided below. A soil sample typically is comprised of a minimum of 3 MFSDs containing 5 grams of soil each.

3.1.1 Encore Sampler

3.1.1.1 Required Equipment

- En Core® T-Handle
- En Core® Samplers

3.1.1.2 Sampling Procedure

1. Assemble the En Core® Sampler by holding the coring body and pushing the plunger rod down until the small o-ring rests against the tabs. Depress the locking lever on the En Core® T-handle and place the plunger end of the coring body into the open end of the T-handle. Align the two slots on the coring body with the two locking pins in the T-handle. Twist the coring body clockwise to lock the pins in the slots. Finally, check to ensure that the coring body is locked in place.

2. Collect the En Core® sample by grasping the T-Handle with the open end of the coring body facing the soil sample. Using the T-Handle, push the sampler into soil until coring body is completely full. The coring body is full when the small o-ring is centered in the viewing hole in the T-Handle. Remove the sampler from the soil. Push and twist cap on the exposed end of the coring body until the ridges on the coring body snap into the grooves of the cap. Check to ensure that cap is properly secured.

3. Prepare the sample for shipment by removing the T-Handle from the En Core® Sampler by depressing the locking lever on T-Handle and then twist and pull the En Core® Sampler from T-Handle. Lock the plunger by rotating the extended plunger rod fully counter-clockwise until the wings rest firmly against the tabs. Attach the completed circular label to the cap of the coring body.

4. Return the full En Core® Sampler to the zipper bag. Seal the bag and immediately place the bag in an ice chest filled with ice.

3.1.2 Core N' One™ Sampling System

3.1.2.1 Required Equipment

- Core N' One™ Soil Handle
- Core N' One™ Soil Capsules

3.1.2.2 Sampling Procedure

1. Remove capsule from zip lock and insert prongs into the slots of the Core N' One™ handle. Make a one-quarter turn to the right to lock the capsule in place.
2. Unscrew the capsule cap and bore the beveled edge opening into the soil. You can determine if you have taken a full 5-gram sample by holding the capsule up to the light. The dark shading of the soil should be at the top level of the cap threads.
3. Screw the cap tight. The edge of the cap should touch the center rib of the capsule.
4. Insert the capsule into the zip lock for transport to the lab.

3.1.3 Additional Analytical Requirements

Using MFSDs require specific handling procedures for the samples after collection and by the analytical laboratory.

Field preservations options include the following:

a) Place the samples in an iced cooler and chill and maintain the sample at the appropriate temperature for the specified method (as identified in the project-specific plans and/or as listed in SOP PR-TC-02.04.01.01, Sample Handling, Packaging and Shipping). Deliver the samples to the laboratory quickly to allow for analysis or extraction of the samples by the laboratory within 48 hours of sample collection time.

b) Place the samples in a freezer and chill and maintain the sample at < -7°C, and deliver the samples to the laboratory quickly to allow for analysis or extraction of the samples by the laboratory within 48 hours of sample collection time.

Although alternative a) is the normal procedure for most soils, alternative b) is necessary with biologically active soils potentially containing aromatic hydrocarbons (i.e., benzene).

Extraction options for the analytical laboratory include the following:

1) Analysis of the sample within 48 hours of sample collection.
2) Extrude core into unpreserved pre-tared VOA vial at the laboratory. For low-level analysis, the soil can be extruded, weighed and placed into a pre-tared VOA vial containing reagent-grade extractant water (the preferred low-level method, see Section 3.1.4 below). The laboratory then freezes the sample at < -7°C. The sample must then be analyzed within 14 days of the sample collection date.
3) Extrude core into preserved VOA vial at the laboratory. For low-level analysis, the soil can be extruded, weighed and preserved in a pre-tared VOA vial containing sodium bisulfate solution (not recommended, see Section 3.1.4 below). For high-level analysis, the soil can be extruded, weighed, and preserved with methanol. After extrusion of the soil into an appropriate extraction fluid, the sample must be analyzed within 14 days of the sample collection date.

Additionally, in order to determine VOC concentrations on a dry weight basis, in the absence of one or more additional sample aliquots of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located to each sample collection point. Sample nomenclature that links this sample to the VOC sample containers that comprise a sample set should be used.

3.1.4 Method Incompatibilities

Biologically active samples may result in the rapid loss of aromatic hydrocarbons during the initial 48 hours after sampling, and thus should be immediately chemically preserved or frozen using dry ice.

Sample preservation with sodium bisulfate solution presents four potential problems:

i. Acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2- chloroethylvinyl ether.
ii. In soil samples with a high proportion of organic material, acid preservation may generate acetone as a byproduct.
iii. Calcareous soil samples may effervesce upon contact with sodium bisulfate solution and cause VOC loss.
iv. Calcareous soil samples may increase the pH of the preservation fluid above 2.0, producing a sample in an unpreserved state. Accordingly, the soils at the site should be evaluated for potential problems prior to sampling activities. In cases where preservation by acid is a potential problem, an alternate sample collection method should be utilized.

3.2 USE OF SUB-CORING DEVICE AND FIELD PRESERVATION

An alternative to using MFSDs consists of using sub-coring devices (SCDs) and field preservation of the samples. Benefits of this method include less-expensive sampling devices (e.g., Lock N' Load^{TM}), and potentially longer holding times. However, SCDs and field preservation involves more physical handling of the samples in the field, including weighing of the samples, potentially impacting production rates. Also, preservatives for low- or high-level analysis pose significant problems themselves. This method should be used with caution and only after full consideration of the inherent problems in the method.

Approved SCDs include:

- Lock N' Load^{TM} sampling system
- EasyDraw Syringe®
- Terra Core® Sampler

The procedures for the collection of the soil samples using the approved SCDs are provided below. A soil sample typically is comprised of a minimum of 3 field preserved vials containing 5 grams of soil each.

3.2.1 Lock N' Load^{TM} Sampling System

3.2.1.1 Required Equipment

- Lock N' Load^{TM} soil handle
- Lock N' Load^{TM} soil syringe
- VOA vials with preservative (pre-tared)

3.2.1.2 Sampling Procedure

1. Insert Lock N' Load^{TM} Syringe into Lock N' Load^{TM} Handle at base opening. Turn the locking portion of the syringe into the O gram setting. Remove end cap from the Lock N' Load^{TM} Syringe. Position the Lock N' Load^{TM} Handle to the desired soil sample volume (5 grams in triplicate). To do this, slide the slot portion of the handle down the fitted track, then turn the handle one quarter to the right at the desired setting.
2. Push the syringe into the soil until the plunger portion of the syringe makes contact with the base of the Lock N' Load^{TM} Handle.
3. Transfer the soil from the syringe into a pre-tared 40 ml VOA vial containing the appropriate preservative, if any, by turning the Lock N' Load^{TM} Handle one quarter to the left (back to the fitted track) and pushing down. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.2.2 EasyDraw Syringe® and PowerStop Handle®

3.2.2.1 Required Equipment

- PowerStop Handle®

- EasyDraw Syringe®
- VOA vials with preservative (pre-tared)

3.2.2.2 Sampling Procedure

1. Load Sampling Device. Insert the EasyDraw Syringe® into the appropriate slot on the Powerstop Handle® and remove end cap from syringe. For low-level analysis, insert syringe into one of the three positions of the device for collection of 5 gram samples. Use the heavy position for dense clay, the light position for dry sandy soil, and the medium position for all others.
2. Collect Sample. Push the EasyDraw Syringe® into freshly exposed soil. Continue pushing until the soil column inside the syringe has forced the plunger to the stopping point. The soil plug should be flush with the mouth of the sampler. The EasyDraw Syringe® delivers approximately 5, 10 or 13 grams. Actual weight will be determined at the laboratory.
3. Eject Sample Into Vial. Remove the syringe from the Powerstop Handle®. Insert syringe into open end of a pre-tared 40-ml VOA vial containing the appropriate preservative, if any. Extrude the sample into the vial by pushing on the syringe plunger. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.2.3 Terra Core® Sampler

3.2.3.1 Required Equipment

- Terra Core® Sampler
- VOA vials with preservative (pre-tared)

3.2.3.2 Sampling Procedure

1. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.
2. Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.
3. Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative, and quickly place the lid back on the 40ml VOA vial. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.2.4 Additional Analytical Requirements

Using field preservation requires specific handling procedures for the samples after collection and by the analytical laboratory. Requirements vary depending on the specific preservation method, so care needs to be taken to follow the specific procedure carefully.

Preservation options include the following:

b) Field preservation with methanol. After extruding the soil samples into pre-tared 40-ml VOA vials preserved with methanol, the vials are re-weighed in the field, and then are chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The samples must arrive at the laboratory within 48 hours of the sample collection time. The vials are weighed again at the stationary laboratory to verify that no methanol was lost during transport. The laboratory must prepare and analyze the samples within 14 days of the sample collection date. This technique applies only to high-level analysis so it should be used only if detection limits of greater than 200 ug/kg are appropriate.

c) Field preservation with sodium bisulfate solution. After extruding the soil samples into pre-tared 40-ml VOA vials preserved with sodium bisulfate solution, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The samples must arrive at the laboratory within 48 hours of the sample collection time. The laboratory must prepare and analyze the samples within 14 days of the sample collection date. This preservation technique provides detection limits to approximately 0.5 ug/kg (low-level analysis). However, sample preservation with sodium bisulfate solution presents four potential problems:

    i. Acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2- chloroethylvinyl ether.

    ii. In soil samples with a high proportion of organic material, acid preservation may generate acetone as a byproduct.

    iii. Calcareous soil samples may effervesce upon contact with sodium bisulfate solution and cause VOC loss.

    iv. Calcareous soil samples may increase the pH of the preservation fluid above 2.0, producing a sample in an unpreserved state. Accordingly, the soils at the site should be evaluated for potential problems prior to sampling activities. In cases where preservation by acid is a potential problem, an alternate sample collection method should be utilized.

d) Field extraction into reagent water and analysis within 48 hours. After extruding the soil samples into pre-tared 40-ml VOA vials containing reagent-grade extractant water, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. Upon receipt of the samples, the laboratory chills the vials to the required temperature and analyzes the samples within 48 hours of the sample collection time. This technique applies to samples for low-level and high-level analysis.

Note: Extruding soil samples into vials containing reagent-grade extractant water may have an adverse effect on sample results in that water may actually promote bacterial degradation of aromatic hydrocarbons. Likewise, some VOCs may be unstable in reagent water, such as 1,1,2,2-tetrachloroethane. Accordingly, reagent water-filled vials should only be used for chemicals that do not readily biodegrade or breakdown.

e) Field extraction into reagent water and field freezing. After extruding the soil samples into pre-tared 40-ml VOA vials containing reagent-grade extractant water, the samples are frozen to <-7°C in a cooler in the field and shipped with adequate dry ice to ensure that <-7°C is maintained during transport to the laboratory. The vials should not be frozen below -20°C due to potential problems with the vial seals. A temperature blank should be included with the samples so that the laboratory can verify the temperature upon receipt and the arrival temperature of the samples should be annotated on the chain-of-custody form. During the freezing process, the vials should be stored in a 45° angle to prevent water expansion from shattering the vials. To avoid potential rupture of the PTFE-lined septum caps, the dry ice should not directly contact the top of the vials. The laboratory must immediately freeze the sample vials to <-7°C upon receipt. The samples may be held at <-7°C for up to 7 days prior to analysis from the sample collection date. This technique applies to samples for low-level and high-level analysis. This option is used in the situations where it is difficult or impossible to deliver the samples to the laboratory within 48 hours of the sample collection time.

f) Field extraction into reagent water and laboratory freezing. After extruding the soil samples into pre-tared 40-ml VOA vials containing reagent-grade extractant water, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The laboratory must receive and immediately freeze the vials to <-7°C within 48 hours of the sample collection time. During the freezing process, the vials should be stored in a 45° angle to prevent water expansion from shattering the vials. The samples may be held at <-7°C for up to 7 days prior to analysis from the sample collection date. The vials should not be frozen below -20°C due to potential problems with the vial seals. This technique applies to samples for low-level and high-level analysis.

Additionally, in order to determine VOC concentrations on a dry weight basis, in the absence of one or more additional sample aliquots of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located to each sample collection point. Sample nomenclature that links this sample to the VOC sample containers that comprise a sample set should be used.

3.2.5 Method Incompatibilities

3.2.4.1 Aromatic Hydrocarbons

Chemicals, such as aromatic hydrocarbons (e.g., benzene), are subject to VOC loss by biodegradation under certain sampling procedures. Accordingly, to obtain aromatic hydrocarbon soil concentrations that are representative of site conditions, only a subset of the available options are available for use. To reduce the biological activity in soil contaminated with aromatic hydrocarbons, soil samples should be preserved with methanol or sodium bisulfate solution in the field, or frozen in the field at <-7°C in non-preserved VOA vials. Under no circumstances should soil samples contaminated with aromatic hydrocarbons be collected in the field with VOA vials containing reagent-grade extractant water. The introduction of unpreserved water to the soil sample may enhance the biodegradation of the aromatic hydrocarbons.

3.2.4.2 Chemical Reactions

Acid preservation of soil by sodium bisulfate solution, whether done in the field or in the stationary laboratory, may cause the chemical breakdown of certain compounds, including vinyl chloride. Some olefins, ketones, esters, ethers, and sulfides may react under low pH conditions, yielding analytical results that are not representative of soil conditions. Hence, precaution should be taken when preserving soil samples with sodium bisulfate solution when these compounds are present. If the degree of potential chemical reaction is unknown, an alternative procedure should be used.

3.2.4.3 Calcareous Soil

Calcareous soil samples may react upon contact with sodium bisulfate solution, causing VOC loss through effervescence and potentially cause failure of the VOA vial septum through pressure buildup. Additionally, when soil samples are highly calcareous in nature, the sodium bisulfate preservative solution may not be strong enough to reduce the pH of the aqueous solution to below 2.0, potentially rendering the preservative useless. If carbon dioxide is generated due to carbonate reaction with the acid, the carbon dioxide in the VOA vial may interfere with the detector of the analytical equipment. Hence, precaution should be taken when preserving soil samples with sodium bisulfate solution when carbonates are present.

3.3 USE OF SUB-CORING DEVICE AND EMPTY VIAL

An alternative to using SCDs with field preservation consists of field extruding the samples into clean VOA vials. Benefits of this method include use of less-expensive SCDs and potentially longer holding times. However, the empty vial method involves more physical handling of the samples in the field, including weighing of the samples, potentially impacting production rates. This method should be used with caution and only after full consideration of the inherent problems in the method.

Soil samples for the empty vial method are collected using a sub-coring device. Approved sub-coring devices include:

- Lock N' Load™ sampling system
- EasyDraw Syringe®
- Terra Core® Sampler

The procedures for the collection of the soil samples using the approved sub-coring devices are provided below. A soil sample typically is comprised of a minimum of 3 empty vials containing 5 grams of soil each.

3.3.1 Lock N' Load™ Sampling System

3.3.1.1 Required Equipment

- Lock N' Load™ soil handle

- Lock N’ Load^{TM} soil syringe
- VOA vials (pre-tared)

3.3.1.2 Sampling Procedure

1. Insert Lock N' Load^{TM} Syringe into Lock N' Load^{TM} Handle at base opening. Turn the locking portion of the syringe into the O gram setting. Remove end cap from the Lock N' Load^{TM} Syringe. Position the Lock N' Load^{TM} Handle to the desired soil sample volume (5 grams in triplicate). To do this, slide the slot portion of the handle down the fitted track, then turn the handle one quarter to the right at the desired setting.
2. Push the syringe into the soil until the plunger portion of the syringe makes contact with the base of the Lock N' Load^{TM} Handle.
3. Transfer the soil from the syringe into a pre-tared empty 40 ml VOA vial by turning the Lock N' Load^{TM} Handle one quarter to the left (back to the fitted track) and pushing down. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.3.2 EasyDraw Syringe® and PowerStop Handle®

3.3.2.1 Required Equipment

- PowerStop Handle®
- EasyDraw Syringe®
- VOA vials (pre-tared)

3.3.2.2 Sampling Procedure

1. Load Sampling Device. Insert the EasyDraw Syringe® into the appropriate slot on the Powerstop Handle® and remove end cap from syringe. For low-level analysis, insert syringe into one of the three positions of the device for collection of 5 gram samples. Use the heavy position for dense clay, the light position for dry sandy soil, and the medium position for all others.
2. Collect Sample. Push the EasyDraw Syringe® into freshly exposed soil. Continue pushing until the soil column inside the syringe has forced the plunger to the stopping point. The soil plug should be flush with the mouth of the sampler. The EasyDraw Syringe® delivers approximately 5, 10 or 13 grams. Actual weight will be determined at the laboratory.
3. Eject Sample Into Vial. Remove the syringe from the Powerstop Handle®. Insert syringe into open end of a pre-tared empty 40-ml VOA vial. Extrude the sample into the vial by pushing on the syringe plunger. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.3.3 Terra Core® Sampler

3.3.3.1 Required Equipment

- Terra Core® Sampler

- VOA vials (pre-tared)

3.3.3.2 Sampling Procedure

1. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.
2. Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.
3. Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative, and quickly place the lid back on the 40ml VOA vial. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.3.4 Additional Analytical Requirements

Using the empty vial method requires specific handling procedures for the samples after collection and by the analytical laboratory. Requirements vary depending on the specific preservation method, so care needs to be taken to follow the specific procedure carefully.

Handling options include the following:

a) Field extraction and analysis within 48 hours. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. Upon receipt of the samples, the laboratory chills the vials to the required temperature and analyzes the samples within 48 hours of the sample collection time. This technique applies to samples for low-level and high-level analysis.

b) Field extraction and laboratory freezing. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The laboratory must receive and immediately freeze the vials to <-7°C within 48 hours of the sample collection time. The samples may be held at <-7°C for up to 14 days prior to analysis from the sample collection date. The vials should not be frozen below -20°C due to potential problems with the vial seals. This technique applies to samples for low-level and high-level analysis.

c) Field extraction and laboratory preservation. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The samples must arrive at the laboratory within 48 hours of the sample collection time. The laboratory then must preserve the sample using methanol. The laboratory must prepare and analyze the samples within 14 days of the sample collection date. This technique applies only to high-level analysis so it should be used only if detection limits of greater than 200 ug/kg are appropriate.

d) Field extraction and field freezing. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are immediately frozen to <-7°C and shipped with adequate dry ice to ensure that <-7°C is maintained during transport to the laboratory. The laboratory must receive and immediately freeze the vials to <-7°C. The samples may be held at <-7°C for up to 14 days prior to analysis from the sample collection date. The vials should not be frozen below -20°C due to potential problems with the vial seals. This technique applies to samples for low-level and high-level analysis.

Additionally, in order to determine VOC concentrations on a dry weight basis, in the absence of one or more additional sample aliquots of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located to each sample collection point. Sample nomenclature that links this sample to the VOC sample containers that comprise a sample set should be used.

3.3.5 Method Incompatibilities

Biologically active samples may result in the rapid loss of aromatic hydrocarbons during the initial 48 hours after sampling, and thus should be immediately chemically preserved or frozen. Thus, the use of field freezing is required when using the empty vial method for biologically active samples suspected of containing aromatic hydrocarbons.

3.4 EQUIPMENT

Specific equipment requirements are discussed in the procedures above. In addition to the materials identified above, many of the procedures require the following:

- Appropriate clean laboratory-provided pre-tared VOA vials with selected preservative
- A scale capable of weighing 100 grams and accurate to ± 0.1 grams.

3.5 QUALITY CONTROL SAMPLES

QC samples are important to measure potential impacts to the accuracy and representativeness of the VOC samples collected. Specific QC samples important to the procedures presented in this SOP include:

- Trip blanks
- Temperature blanks
- MS/MSD samples
- Other recommended QC samples

3.5.1 Trip Blanks

Soil samples can be contaminated by diffusion of VOCs through the septum on VOA vials or through the seal on MFSDs during shipment and storage. Trip blanks are samples that accompany the environmental samples during the sampling operations and transport to the laboratory. The trip blanks may be prepared with laboratory grade methanol, sodium bisulfate solution, or reagent water, dependent on the field methods, and could also consist of laboratory-certified soil, and can be carried through sampling and handling protocols as a check on such contamination.

Generally one trip blank should be used for each field sample cooler, as specified in the QAPP. However, at a minimum, one trip blank should be used per day. The trip blank should remain unopened throughout sampling operations and labeled by date, such as TB022510-01 (for cooler no. 1 trip blank sent on February 25, 2010), or similar nomenclature as specified in the QAPP.

3.5.2 Temperature Blanks

Temperature blanks should be used so that the laboratory can verify the temperature upon receipt of the samples. In the case of field freezing, the temperature blanks should be frozen upon arrival at the laboratory. The temperature of the samples upon arrival should be annotated on the chain-of-custody form and also mentioned in the laboratory narrative that accompanies the analytical results. A temperature blank routinely consists of a vial filled with blank water (deionized water is acceptable).

3.5.3 Matrix Spike and Matrix Spike Duplicate Samples

An important measure of the performance of an analytical method relative to the specific sample matrix of interest is the matrix spike and matrix spike duplicate (MS/MSD). The MS/MSD is an important aspect of an overall quality assurance program for a project. When soil sampling, a MS/MSD sample should be collected for each analytical method at a frequency of five (5) percent of the field samples, unless otherwise specified in the site-specific QAPP. The MS/MSD sample should be prepared in a fashion similar to the other samples. Samples taken for MS/MSD should be labeled as such and specified on the chain-of-custody form. The primary purpose of MS/MSD analyses is to establish the applicability of the overall analytical approach to the specific sample matrix from the site.

Each sample set designated for MS/MSD analysis should be collected in triplicate (e.g., if using En Core® Samplers, then nine 5-gram sample containers would be required).

3.5.4 Other Field Quality Control Samples

Field quality control samples to demonstrate the integrity of the field samples should also be collected as required by the site-specific QAPP. Field duplicates should be collected at a minimum frequency of 10 percent of the samples. Field blanks and equipment rinsate blanks, if required, should be collected each day, or as specified in the site-specific QAPP.

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- GPS or survey coordinates for each sample location
- Chains of Custody
- Sample collection logs, including recorded weights of samples placed in vials.
- Field notes

5.0 ATTACHMENTS

Attachment A. Limitations to VOC Soil Sampling Procedures
Attachment B. Various Options for the Collection of Soil Samples for VOC Analyses

6.0 FORMS

None.

7.0 REFERENCES

California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), 2004. *Guidance Document for the Implementation of USEPA Method 5035: Methodologies for Collection, Preservation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds*. November.

United States Department of Defense (USDoD), 2013. *Quality Systems Manual, Version 5.0* July.

United States Environmental Protection Agency (USEPA), Office of Solid Waste, 1997. *Method 5035, Closed-System Purge-and-Trap Extraction for Volatile Organics in Soil and Waste Samples.* June. Part of methods compendium SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update III* (Method 5035).

USEPA, Office of Solid Waste, 2002. *Method 5035A, Closed-System Purge-and-Trap Extraction for Volatile Organics in Soil and Waste Samples.* July. Part of methods compendium SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update III* (Method 5035).   Updated method.

ATTACHMENT A. LIMITATIONS TO VOC SOIL SAMPLING PROCEDURES

Each of the sampling and preservation procedures has their own set of benefits and limitations. Selection of the appropriate procedure should be based primarily on which procedure best addresses the data quality objectives (DQOs) while considering the limitations imposed by field conditions and sampling requirements. Some of the limitations of the different procedures include:

- Multi-Functional Sampling Devices. When the MFSDs are received by the laboratory, the soil subcores within the MFSDs are extruded into VOA vials for analysis. As the soil subcores pass from the MFSDs to the VOA vials during the extrusion process, the soil subcores are open to ambient air and VOC loss could occur. This VOC loss could yield analytical results that are potentially biased low. Users of MFSDs must recognize this limitation when evaluating the data quality objectives for their project.
- Field Chemical Preservation. Chemical preservation of VOA vials in the field with sodium bisulfate solution (low-level analysis) or methanol (high-level analysis) is considered to yield better representativeness for VOC analysis of soil. The introduction of chemical preservatives in the field inhibits VOC loss by biodegradation. Also, VOC loss due to sample handling at the laboratory is minimized in that the sample aliquot is placed in a VOA vial in the field that contains the required preservative, sodium bisulfate or methanol, and stir stick and therefore each VOA vial does not need to be reopened by the laboratory as syringes may be used through the septum cap. However, field preservation has significant limitations that may ultimately prohibit its use on some sites. One issue is that storage of methanol used in preservation may absorb non-site specific VOCs during storage and transport. When the concentration levels of VOCs are not known to be low or high (above 200 ug/kg), multiple VOCs vials containing sodium bisulfate, methanol, and no preservative, will need to be processed in the field for each sample location.
- Empty Vial Technique. The extractant fluid, whether methanol, sodium bisulfate solution, or reagent water, must be added by the stationary laboratory to the VOA vials after the soil has been sealed into the vials in the field. To do this, the PTFE-lined septum caps must be pierced for the introduction of the extraction fluid into the VOA vials. After the introduction of the extraction fluid, the vials must be stirred or sonicated to promote the partitioning of the VOCs into the extraction fluid. Upon completion of the stirring or sonication, the sample is then analyzed for VOC concentration. During the stirring or sonication, VOCs can escape from the VOA vial through the pierced septum. Hence, the Empty Vial Technique may potentially yield analytical results that are biased low. Users of the Empty Vial Technique must recognize this limitation when evaluating the data quality objectives for their project.

ATTACHMENT B. VARIOUS OPTIONS FOR THE COLLECTION OF SOIL SAMPLES FOR VOC ANALYSES

Option	Sample Collection	Sample Container	Field Preservation	Laboratory Procedure	Holding Time (DTSC/EPA)	Reporting Limt
3.1(a)1	MFSD(1)	MFSD	Cool to 4 ± 2°C	Analyze w/in 48 hrs of sample collection	48 hours	Low/High
3.1(a)2	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into unpreserved VOA and freeze to < 7°C	7 days / 14 days	Low/High
3.1(a)3	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into methanol preserved VOA and cool to 4±2°C	14 days	High
3.1(a)3	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into sodium bisulfate preserved VOA and cool to 4±2°C	14 days	Low/High
3.1(a)3	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into reagent-grade extractant water VOA and cool to 4±2°C	14 days	Low/High
3.1(b)	MFSD	MFSD	Freeze to < 7°C	Use of any of the above laboratory procedures and associated holding times	—(3) / See above	See above
3.2(a)	SCD	VOA	Preserve with methanol and cool to 4 ± 2°C	Cool sample to 4±2°C	14 days	High
3.2(b)	SCD	VOA	Preserve with sodium bisulfate and cool to 4 ± 2°C	Cool sample to 4±2°C	14 days	Low/High
3.2(c)	SCD	VOA	Extract into reagent-grade water and cool to 4 ± 2°C	Analyze w/in 48 hrs of sample collection	48 hours	Low/High
3.2(d)	SCD	VOA	Extract into reagent-grade water and freeze to < 7°C	Freeze sample to < 7°C	7 days / 14 days	Low/High
3.2(e)	SCD	VOA	Extract into reagent-grade water and cool to 4 ± 2°C	Freeze sample w/in 48 hrs to < 7°C	7 days / 14 days	Low/High
3.3(a)	SCD	VOA	Cool to 4 ± 2°C	Cool to 4±2°C	48 hours	Low/High
3.3(b)	SCD	VOA	Cool to 4 ± 2°C	Freeze sample w/in 48 hrs to < 7°C	14 days	Low/High
3.3(c)	SCD	VOA	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into methanol preserved VOA and cool to 4±2°C	14 days	High
3.3(d)	SCD	VOA	Freeze to < 7°C	Freeze to < 7°C	14 days	Low/High

(1) Multi-Function Sampling Device (e.g., EnCore Sampler).
(2) Sub-Coring Device (e.g., Lock N' Load sampling system)
(3) Freezing of MFSDs are not recommended by DTSC due to the potential for damage to their seals.

Gilbane

Standard Operating Procedure

Groundwater: Low-Flow Sampling from Ground Water Monitoring Wells

PR-TC-02.02.02.03 v2.1

Reviewed by: Mark Blaisdell Date: 24 Jan 2014
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Approved by: Jeffrey Hess Date: 24 Jan 2014
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue		08 Apr 2010	NA
1.1	Updated stabilization criteria to add temperature as a "monitored" criteria	Section 3.1, pg. 3 Section 3.2, pg. 6	01 Jul 2010	JH
2.0	Updated procedure and added definitions	All	24 Jan 2014	NA
2.1	Updated organization name. No other changes needed.	All	6 Aug 2014	J Hess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for the collection of representative samples from ground water. It includes samples collected from either temporarily or permanently installed ground water monitoring wells using a low-stress, low-flow purging and sampling technique consistent with accepted EPA procedures outlined in *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540/S-95/504, dated April 1996.

Note: The procedure outlined in this SOP requires the use of: 1) a portable or dedicated pump; and 2) sufficient yield from the well during purging to maintain a relatively constant flow without causing undue stress (significant drawdown) on the groundwater. For wells with very poor yield, or where pumps can't be used, alternate sampling techniques should be employed.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms are defined below.

Low-Flow:	A flow rate on the order of 0.1 to 0.5 liters per minute (L/min) (0.03 to 0.13 gallons per minute [g/min]), resulting in a drawdown of less than 0.1 meters [m] (0.33 feet) during purging.
Drawdown:	The difference between the stable height of water in the well prior to pumping and the height of water in the well during pumping.
DO:	dissolved oxygen
EC:	electrical conductivity
Flow-through cell:	device used with a water quality meter to measure water quality indicator parameters under pumping conditions and without air exposure
FSP:	field sampling plan
mg/L:	milligrams per liter
mv:	millivolt
NTU:	nephelometric turbidity unit
OVM:	organic vapor meter
ORP:	oxidation-reduction potential
PID:	photoionization detector used to measure organic vapor
QA:	quality assurance
QAPP:	quality assurance project plan
QC:	quality control
Redox:	oxidation-reduction
SAP:	sampling and analysis plan
uS/cm:	micro-Siemens per centimeter (equivalent to micromhos per centimeter [umhos/cm])

Turbidity meter:	device used to measure nephelometric turbidity units
VOA:	volatile organic analysis
VOC:	volatile organic compound

3.0 PROCEDURES

The intent of this procedure for the low-flow sampling technique is to collect representative groundwater samples with minimal interference to sample integrity from using a pump. The terms “discharge” and “flow” are used interchangeably in this SOP.

3.1 PURGING AND SAMPLING PROCEDURES – DEDICATED PUMPS

Pre-Sampling Activities

1. Sampling should begin at the monitoring well with the lowest levels of contamination, generally upgradient or at the furthest distance from the site or suspected source. Sampling should then proceed systematically to the monitoring wells with the highest levels of contaminated ground water.
2. Check and record the condition of the monitoring wellhead for damage or evidence of tampering. Lay polyethylene sheeting next to the wellhead to minimize the likelihood of contamination of sampling/purging equipment from the ground surface. Place clean (decontaminated) monitoring, purging and sampling equipment on the sheeting.
3. Unlock wellhead. Record location, time, date and appropriate information in a field notes or on the groundwater purge and sample form (see the attached Low-Flow Groundwater Purge and Sample Log form).
4. Remove well casing cap.
5. Monitor the headspace of the well at the rim of the casing for organic vapors with a photoionization detector (PID), if appropriate for the site, and record measurements in the field notes or on the groundwater purge and sample form.
6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator (see SOP PR-TC-02.03.09.00). If no reference point is found, measure the depth to water relative to the top of north side of the inner well casing, mark that reference point on the outside of the well casing and note that reference point in the field notes. Record information on depth to ground water in the field notes or on the groundwater purge and sample form. Record a second measurement of the depth to water to confirm the initial measurement; measurements should agree to within 0.02 feet or re-measure until the measured depth to groundwater is stable.
7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the measured depth to water and the total depth of the monitoring well to calculate the volume of water in the monitoring well casing. Record the calculated volume of water in the well casing in the field notes or on the groundwater purge and sample form.

Purging and Sampling Activities

8. Refer to the available monitoring well information and record the depth of the pump intake in the field notes or on the low-flow groundwater purge and sample form.

9. If purging and sampling activities are not performed immediately following the pre-sampling activities (i.e., depth to water was measured for multiple wells at one time, followed later by initiation of sampling efforts), then re-measure the water level (water level must be measured to nearest 0.01 feet). Record the depth to water in the well casing on the groundwater-sampling log immediately before purging. Leave the water level indicator probe in the monitoring well during purging and sampling.

10. Connect one end of clean sample tubing to the pump discharge line and the other end to a flow-through cell (used to measure water quality indicator parameters discussed below). A “T” connection may need to be installed in the sample tubing between the pump discharge line and the flow-through cell for the collection of water for turbidity measurements (if the flow-through cell does not include turbidity measurement). The sample tubing from the flow-through cell must be directed into a container to store water during purging and sampling activities.

11. Start pumping the well at a low flow rate of about 0.1 liter per minute [L/min] or about 0.03 gallons per minute [g/min]) and slowly increase the rate. Measure the drawdown continuously during the flow rate increase. Maintain a steady flow rate while maintaining a drawdown of less than 0.1 m or about 0.33 feet. If drawdown is greater than 0.1 m or 0.33 feet, lower the flow rate until drawdown is at or less than 0.1 m or 0.33 feet. It should be noted that this goal may be difficult to achieve under some site conditions, and may require some deviation from the recommended flow rates based on site-specific conditions. If adjustments are made to the degree that acceptable drawdown conditions are met, note the nature of the adjustments that were made in the field notes.

12. Measure the pump discharge rate with a graduated cylinder or similar container of known volume. Measure the water level in the well casing and record pump discharge rate and water level in the field notes or on the groundwater purge and sample form. Continue purging and recording water level and pump discharge rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.

13. During purging, a minimum of one sample tubing and pump discharge line volume (including the volume of water in the pump and flow cell) must be purged prior to recording the initial water-quality indicator parameters (discussed below). When that volume of water has been purged from the well, monitor and record the water-quality indicator parameters every three to five minutes from the flow-through cell. The water-quality indicator field parameters are temperature, pH, electrical conductivity, dissolved oxygen, oxidation-reduction (Redox) potential and turbidity. Oxidation-reduction potential is used for both assessing Redox conditions and as a real-time check of the dissolved oxygen readings. Purging will continue until the discharged water reaches a specified set of stable water-quality indicator parameter measurements. Purged water is considered stable when three successive readings of the water quality indicator parameters have been recorded. The following criteria must be met to establish stabilization:

Parameter	Stabilization Criteria
Temperature	monitored, but not a stabilization criteria
pH(1)	± 0.2 pH units
Electrical conductivity(1) (EC)	± 10% of the reading
Dissolved oxygen(1) (DO)	± 10% of the reading, or ± 0.3 mg/L, whichever is greater
Oxidation-reduction potential (ORP)	monitored, but not a stabilization criteria
Turbidity	<10 NTU if possible, or ± 10% of the reading if ≥ 10 NTU

(1) A minimum of the three indicated parameters should reach stabilization prior to sampling.

14. Once the criteria have been successfully met indicating that the water quality parameters have stabilized, sample collection can take place.

15. If stabilized drawdown in the well cannot be maintained at less than 0.1 m or 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off for a period of at least 15 minutes and allow groundwater in the well to recover. (NOTE: the pump must be equipped with a check valve if the pump is shut off) Under no circumstances should the well be pumped dry. After allowing groundwater in the well casing to recharge, begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again, turn the pump off and follow the recovery process again. If two sample tubing and pump discharge line volumes (including the volume of water in the pump and flow-through cell) have been removed during purging, then sampling can proceed the next time the pump is turned on. This information should be noted in the field notes and groundwater purge and sample form including a recommendation for use of a different purging and sampling procedure for the well.

16. Maintain the same pumping rate or reduce slightly for sampling (0.1 to 0.4 L/min or 0.03 to 0.11 g/min) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump sample tubing prior to passing through the flow-through cell (disconnect the sample tubing from the flow-through-cell prior to sample collection). The sample tubing must be completely full of ground water when collecting samples for dissolved gases or VOCs to prevent aeration as the ground water flows through the discharge line.

17. In the event that ground water is too turbid (greater than 10 NTUs), or as otherwise required in the project-specific SAP or FSP/QAPP for metal sample collection, a filtered metal (dissolved) sample should be collected. Filtered metal samples should be collected using an appropriately sized (typically 0.45 micron) in-line filter fitted to the end of the sample tubing. Filtered samples should be collected directly from the in-line filter discharge line. Laboratory filtering should be avoided due to significant potential changes in sample geochemistry and resulting effects on total and dissolved-phase metals.

18. Disconnect the sample tubing that extends from the wellhead (or cap) and properly dispose after use.

19. Replace the well cap, close and lock the wellhead.

3.2 PURGING AND SAMPLING PROCEDURES – PORTABLE PUMPS

Pre-Sampling Activities

1. Sampling should begin at the monitoring well with the lowest levels of contamination, generally upgradient or at the furthest distance from the site or suspected source. Sampling should then proceed systematically to the monitoring wells with the highest levels of contaminated ground water. The portable pump should be fully decontaminated to site-specific requirements prior to sampling each well.
2. Check and record the condition of the monitoring wellhead for damage or evidence of tampering. Lay polyethylene sheeting next to the wellhead to minimize the likelihood of contamination of sampling/purging equipment from the ground surface. Place clean (decontaminated) monitoring, purging and sampling equipment on the sheeting.
3. Unlock wellhead. Record location, time, date and appropriate information in a field notes or on the groundwater purge and sample form (see the attached Low-Flow Groundwater Purge and Sample Log form).
4. Remove well casing cap.
5. Monitor the headspace of the well at the rim of the casing for organic vapors with a photoionization detector (PID), if appropriate for the site, and record measurements in the field enots or on the groundwater purge and sample form.
6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator (see SOP PR-TC-02.03.09.00). If no reference point is found, measure the depth to water relative to the top of north side of the inner well casing, mark that reference point on the outside of the well casing and note that reference point in the field notes. Record information on depth to ground water in the field notes or on the groundwater purge and sample form. Record a second measurement of the depth to water to confirm the initial measurement; measurements should agree to within 0.02 feet or re-measure until the measured depth to groundwater is stable.
7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the measured depth to water and the total depth of the monitoring well to calculate the volume of water in the monitoring well casing. Record the calculated volume of water in the well casing in the field notes or on the groundwater purge and sample form.

Purging and Sampling Activities

8. Refer to the available monitoring well information to determine the depth and length of the screen interval. Place the pump and support equipment at the wellhead and slowly lower the pump and discharge line down into the monitoring well until the pump intake is set in the middle of the screened interval. Do not touch bottom with the bottom of the pump and measure up as this has the potential to greatly increase initial turbidity. The pump position should be set with a calibrated pump discharge line or a weighted-measuring tape. To reduce the potential for disturbing sediments and other debris that

typically accumulate at the bottom of the well, do not lower the pump to the bottom of the screen/well. Record pump depth in field notes or on the groundwater purge and sample form.

9. Measure the water level (water level must be measured to nearest 0.01 feet) and record information in the field notes or on the groundwater purge and sample form. Leave the water level indicator probe in the monitoring well.
10. Connect one end of clean sample tubing to the pump discharge line and the other end to a flow-through cell (used to measure water quality indicator parameters discussed below). A “T” connection may need to be installed in the sample tubing between the pump discharge line and the flow-through cell for the collection of water for turbidity measurements (if the flow-through cell does not include turbidity measurement). The sample tubing from the flow-through cell must be directed into a container to store water during purging and sampling activities.
11. Start pumping the well at a low flow rate (about 0.1 L/min or 0.03 g/min) and slowly increase the rate. Measure the drawdown continuously during the flow rate increase. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet from the initial static water level obtained in Step 6. (Note that the act of placing the pump will cause a temporary water level rise from displacement. Do not use this new level as the start point for drawdown.) If drawdown is greater than 0.1 m or 0.33 feet, lower the flow rate until drawdown is at or less than 0.1 m or 0.33 feet. It should be noted that this goal may be difficult to achieve under some site conditions, and may require some deviation from the recommended flow rates based on site-specific conditions. If adjustments are made to the degree that acceptable drawdown conditions are met, note the nature of the adjustments that were made in the field notes.
12. Measure the pump discharge rate with a graduated cylinder or similar container of known volume. Measure the water level in the well casing and record pump discharge rate and water level in the field notes or on the groundwater purge and sample form. Continue purging and recording water level and pump discharge rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.
13. During purging, a minimum of one sample tubing and pump discharge line volume (including the volume of water in the pump and flow cell) must be purged prior to recording the initial water-quality indicator parameters (discussed below). When that volume of water has been purged from the well, monitor and record the water-quality indicator parameters every three to five minutes from the flow-through cell. The water-quality indicator field parameters are temperature, pH, electrical conductivity, dissolved oxygen, oxidation-reduction (Redox) potential and turbidity. Oxidation-reduction potential is used for both assessing Redox conditions and as a real-time check of the dissolved oxygen readings. Purging will continue until the discharged water reaches a specified set of stable water-quality indicator parameter measurements. Purged water is considered stable when three successive readings of the water quality indicator parameters have been recorded. The following criteria must be met to establish stabilization:

Parameter	Stabilization Criteria
Temperature	monitored, but not a stabilization criteria
pH(1)	± 0.2 pH units
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Oxidation-reduction potential (ORP)	monitored, but not a stabilization criteria
Turbidity	<10 NTU if possible, or ± 10% of the reading if ≥ 10 NTU

(1) A minimum of the three indicated parameters should reach stabilization prior to sampling.

14. Once the criteria have been successfully met indicating that the water quality parameters have stabilized, sample collection can take place.
15. If stabilized drawdown in the well cannot be maintained at less than 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off for a period of at least15 minutes and allow groundwater in the well to recover. (NOTE: the pump must be equipped with a check valve if the pump is shut off) Under no circumstances should the well be pumped dry. After allowing groundwater in the well casing to recharge, begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again turn the pump off and follow the recovery process again. If two sample tubing and pump discharge line volumes (including the volume of water in the pump and flow-through cell) have been removed during purging, then sampling can proceed the next time the pump is turned on. This information should be noted in the field notes and groundwater purge and sample form including a recommendation for use of a different purging and sampling procedure for the well.
16. Maintain the same pumping rate or reduce slightly for sampling (0.1 to 0.4 L/min or 0.03 to 0.11 g/min) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump sample tubing prior to passing through the flow-through cell (disconnect the sample tubing from the flow-through-cell prior to sample collection). The sample tubing must be completely full of ground water when collecting samples for dissolved gases or VOCs to prevent aeration as the ground water flows through the discharge line.
17. In the event that ground water is too turbid (greater than 10 NTUs), or as otherwise required in the project-specific SAP or FSP/QAPP for sample collection, a filtered metal (dissolved) sample should be collected. Filtered metal samples should be collected using an appropriately sized (typically 0.45 micron) in-line filter fitted to the end of the sample tubing. Filtered samples should be collected directly from the in-line filter discharge line. Laboratory filtering should be avoided due to significant potential changes in sample geochemistry and resulting effects on total and dissolved-phase metals.
18. Disconnect the sample tubing that extends from the wellhead (or cap) and properly dispose after use.
19. Replace the well cap, close and lock the wellhead.

3.3 EQUIPMENT

The following equipment is required for this procedure:

- Electronic depth to water meter (Water level meter)
- Dedicated or portable submersible pump capable of attaining low flow discharge rates (typically bladder or electrical pumps constructed of inert materials [such as stainless steel and Teflon], but can include other types including peristaltic for shallow groundwater conditions)
- Dedicated or disposable sample tubing
- Disposable bladders, as needed.
- Calibrated water quality parameter meter with flow-through cell (YSI 556 or equivalent)
- Turbidity Meter (EXTECH TB400 or equivalent)
- Flow measuring device (typically graduated cylinder)
- Appropriate sample containers
- Lab quality in-line disposable filter, as needed (typically 0.45 micron)
- Container for purge water (typically 55-gallon UN-approved drum)
- Plastic sheeting
- Disposable gloves
- GPS unit (if coordinates for the wells are not already known)
- Notebook and/or appropriate field forms

3.4 SAMPLE COLLECTION

This section discusses specific issues and concerns relating to the physical collection of groundwater samples from the discharge of the low-flow sampling system.

- Sample containers should be filled with minimal turbulence by allowing the ground water to flow from the sample tubing at as low a velocity as possible, down the inside of the container.
- Sample containers should be filled in the following sequence: volatile organics (VOCs, BTEX), semivolatile organics (SVOCs, extractable fuels), and inorganics.
- When filling the VOC sample vials, a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and headspace prior to capping. Once the VOA vial is filled and capped, invert the sample and tap gently on the side of the vial to insure that the vial does not contain entrapped air. If any entrapped air is present, empty the sample in the purge water container, discard the vial and collect a sample in a new VOA vial.
- In the event that total metals samples are scheduled to be collected and the ground water is turbid (greater than 10 NTUs), or as otherwise required in the project-specific SAP or FSP/QAPP, a filtered metal (dissolved) sample also should be collected. Filtered samples

should be collected last, as they require placement of an in-line field filter on the sample tubing. To collect the filtered sample, attach an appropriately sized in-line filter to the end of the sample tubing, and collect the sample from the filter effluent port. Typically, a 0.45-micron filter can be used; however, the filter size may vary depending on project specific conditions. Refer to the site-specific FSP for correct filter selection.

3.5 QC SAMPLING

Quality control (QC) samples must be collected to verify that sample collection and handling procedures were performed appropriately and that they have not compromised the quality of the ground water samples. The applicable EPA program guidance must be consulted in preparing the field QC sample requirements for each site-specific Quality Assurance Project Plan (QAPP). There are five primary areas of concern for quality assurance (QA) in the collection of representative ground-water samples:

1. Obtaining a ground-water sample that is representative of the aquifer or zone of interest in the aquifer. Quality assurance is verified based on field log documentation of the field water-quality parameter stabilization during well purging, prior to sample collection.
2. Ensuring that the purging and sampling equipment are made of materials, and utilized in a manner, which will not interact with or alter the analyses.
3. Ensuring that results generated by these procedures are reproducible; therefore, the sampling scheme should incorporate co-located samples (duplicates).
4. Preventing cross-contamination. Sampling should proceed from wells with the lowest to highest levels of contamination, if known. Field equipment blanks should be incorporated for all sampling and purging equipment that is used on more than one well, and decontamination of such equipment is therefore required.
5. Properly preserving, packaging, and shipping samples.

All field QC samples must be prepared using the same methods as the investigation samples with regard to sample volume, containers, and preservation. The chain of custody procedures for the QC samples must be identical to the investigation ground water samples. Equipment blanks listed below are to be collected from non-dedicated pieces of equipment that require decontamination between wells, such as a non-dedicated bladder pump. The following QC samples must be collected during the sampling event:

Sample Type	Suggested Frequency
Field duplicates	1 per 20 samples
Matrix spike	1 per 20 samples
Matrix spike duplicate	1 per 20 samples
Equipment blank	1 per day per piece of equipment
Trip blank (VOCs)	1 per sample cooler
Temperature blank	1 per sample cooler

4.0 REQUIRED DOCUMENTATION

The following records must be generated and maintained as a result of implementation of this procedure as quality records.

- Low-flow groundwater purges and sample forms.
- Field notes.
- Chains of Custody.

5.0 ATTACHMENTS

None.

6.0 FORMS

Low-Flow Groundwater Purge and Sample Form.

7.0 REFERENCES

ASTM, 2002. *Standard Practice for Low-Flow Purging and Sampling*.

USEPA, 2002. *Ground-Water Sampling Guidelines for Superfund and RCRA Managers*.

U.S. Environmental Protection Agency (USEPA), 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540/S-95/504. April.

USEPA, 1987. *Compendium of Superfund Field Operations*.

Forms

Gilbane

Low-Flow Groundwater Purge and Sample Log

Project Name: ______________________ Project No.: ______________
Well No./ Location ID: ____________ Tested By: __________ Date: ____________

Measuring Point Description: ______________________ Static Water Level (ft.): ________
Total Well Depth (ft.): ________ Screen Interval (ft.): ________ Sample Depth (ft.): ________
Water Level Measurement Method: ______________________________
Purge Method: ________________ Sample Method: ________________
Time Start Purge: ________________ Field Filter (micron): 1.0 / 0.45 / 0.1 / Other:
Time End Purge: ________________ Time Sampled: ________________
Volume Purged (L): ________________ Calculated Flow Rate (L/min): ________________
Sample ID: ______________________________
Comments: ______________________________

Time	Temp. (ºC)	pH	EC (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	DTW (ft.)

Version 012314

Gilbane

Standard Operating Procedure

Groundwater: Measuring Water Levels

PR-TC-02.03.09.00 v1.2

Reviewed by: ______________________ Date: 3 Feb 2010
Jim Schollard, QA Manager

Approved by: Jeffrey Hess ______________________ Date: 16 Feb 2010
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	NA	16 Feb 2010	NA
1.1	Remove reference to decontamination SOP currently under revision.	Pgs 3-4	05 Aug 2010	J Hess
1.2	Updated organization name. No other changes needed.	All	6 Aug 2014	JHess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for measurement of groundwater well water levels and for conducting measurements of light non-aqueous phase liquids (LNAPLs).

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

DTB: Depth to Bottom

DTW: Depth to Water

Electronic sounder: Commercial battery-powered water level measuring device that includes a graduated cable secured to a reel with a probe sensor at the cable terminus that is designed to register a signal when the probe contacts water. The cable must have graduations to 0.01 feet.

Field logbook: Logbooks used at field sites that contain detailed information regarding site activities including dates, times, personnel names, activities conducted, equipment used, weather conditions, etc. Field logbooks are used by a variety of different field personnel and are part of the project file.

Light non-aqueous phase liquid (LNAPL): Free-phase petroleum hydrocarbons in groundwater.

Non-aqueous phase liquid (NAPL): Free-phase liquid in groundwater.

Measuring tape: Steel or plastic tape with graduations to 0.01 feet.

Oil/water interface probe: Commercial probe and cable designed to register a signal when the probe contacts oil and a different signal when the probe contacts water. The cable must have graduations to 0.01 feet.

Pressure Transducer: A commercial batter-powered electronic device to measure changes in pressure of a column of water column. Typically used to measure changes in water level over time.

3.0 PROCEDURES

The intent of this sampling technique is to collect reliable water level depths in monitoring wells and other groundwater monitoring points, and to evaluate the potential presence and thickness of LNAPL.

3.1 MEASURING WATER LEVELS WITH AN ELECTRONIC SOUNDER

The standard equipment for collecting individual water-level measurements will be a battery-powered sounder.

Calibration checks on the electronic sounder will be made annually and the date of calibration recorded on the device. The sounder markings will first be checked for the proper spacing by physically comparing the spacing with a graduated steel tape. These checks will be made annually and after any incident that may alter the measuring capability of the instrument, such as cable stretching, entanglement, or sensor tip replacement.

The following procedure should be used when measuring groundwater levels with an electronic water-level measuring device:

1. Where historic water quality results are available, the monitoring wells should generally be measured in the order of clean to dirty.
2. Check for proper instrument response by inserting the sensor at the end of the cable, the “probe”, in water. Fix or replace the probe or instrument if the instrument operates intermittently or is non-responsive.
3. Unlock the well cover and remove the cap.
4. Locate the reference point on the riser pipe (this is generally either a black line or notch in the casing, and is generally located on the north side of the casing).
5. Don a pair of clean gloves.
6. Slowly lower the probe down the well until the signal indicates that the water has been contacted.
7. Note the reading at the depth corresponding to the reference point on the riser pipe.
8. Withdraw the probe; then repeat steps 5 and 6. [NOTE: If free-phase hydrocarbons are suspected or observed on the probe, measurement of hydrocarbon thickness and water level should be made using an electronic oil/water interface probe. See Section 3.2.] Consecutive measurements should agree within 0.02 feet. If not, continue with measurements until 0.02 feet precision is achieved. Record the reading to the nearest 0.01 feet in the field logbook or on the field form as **Depth to Water** (DTW) and note the measurement is final.
9. To verify the well identification by confirming the total depth of the well, or if groundwater sampling will be conducted, then lower the probe until the bottom of the well is reached, as indicated by slack in the line.

10. Pull slightly to remove the slack, measure at the reference point, and record this value to the nearest 0.01 feet in the field logbook or on the field form as **Depth to Bottom** (DTB).
11. Remove the probe from the well and decontaminate the probe and all portions of the cable that were inserted in the well. Sounders will be maintained in a clean and functional condition.

3.2 MEASURING WATER LEVELS AND LIGHT NON-AQUEOUS PHASE LIQUIDS USING AN OIL/WATER INTERFACE PROBE

Oil or other light non-aqueous phase liquids (LNAPLs) may be floating on the water in some wells. In such instances, the LNAPL level and the water level are measured using an oil/water interface probe, as follows:

1. Check for proper instrument response by inserting the probe in water. Electronic Sounders typically indicate the presence of LNAPLs with a steady indicator light and tone, while the presence of water is indicated by an intermittent light and tone.
2. Unlock the well cover and remove the cap.
3. Locate the reference point on the riser pipe.
4. Don a pair of clean gloves.
5. Slowly lower the oil/water interface probe down the well until the signal indicates that LNAPL has been contacted (typically a steady indicator light and tone).
6. Record the reading at the reference point to the nearest 0.01 feet in the field logbook or on the field form as depth to **non-aqueous phase liquid** (NAPL).
7. Continue lowering the probe until the signal indicates that water has been contacted (typically an intermittent light and tone).
8. Record the reading at the reference point to the nearest 0.01 feet in the field logbook or on the field form as DTW.
9. Withdraw the probe and repeat steps 5 through 8. Duplicate measurements should agree within 0.02 feet. If not, continue with measurements until 0.02 feet precision is achieved. Record the readings to the nearest 0.01 feet in the field logbook or on the field form as final readings.
10. To verify the well identification by confirming the total depth of the well, or if groundwater sampling will be conducted, lower the probe until the bottom of the well is reached, as indicated by slack in the line.
11. Pull slightly to remove the slack, measure at the reference point, and record it as DTB.
12. Remove the probe from the well and decontaminate the probe and all portions of the cable that were inserted in the well. Sounders will be maintained in a clean and functional condition. Special care should be taken to decontaminate the oil/water interface probe.

3.3 MEASURING WATER LEVELS USING A PRESSURE TRANSDUCER

Electronic pressure transducers may be used during aquifer testing, tidal studies, or other studies where frequent or continuous measurement of water levels over time is needed.

Pressure transducers will be operated, calibrated, maintained, and stored in accordance with the manufacturer's specifications and the following guidelines:

1. The depth to water in the well will be measured with an electronic sounder at the time of transducer placement and immediately prior to transducer removal from the well to verify accuracy, and will be recorded in the field logbook or on the appropriate field form(s).
2. The transducer calibration will be checked in the field by lowering it exactly one (1) foot in the water column and noting the change in the meter response. Results of the calibration check and conditions that could affect transducer operation will be noted and recorded in the field logbook.
3. When pressure transducers are used for continuous water-level monitoring over extended periods of time, the calibration of the transducer will be checked periodically by measuring the water level with an electronic sounder.

3.4 EQUIPMENT

The following items are required for this procedure:

- Decontaminated, commercial electronic sounder, such as a *Solinst Model 101 Water Level Meter* or equivalent.
- Oil/water interface probe (if measuring LNAPL), such as *Solinst Model 122 Interface Meter* or equivalent.
- Field logbook or appropriate field form for recording measurements and calibration activities.
- Personal protective equipment (PPE) as specified in the site-specific Health and Safety Plan (SSHSP).

3.5 QC SAMPLING

Redundant measurements are specified for each step in the above procedures, both to ensure accurate readings and to determine the stability of the groundwater level. If consistent stable groundwater levels cannot be achieved, make special note of this in the field documentation, including whether the level is consistently rising, dropping, or fluctuating.

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- Field notes reported in either the field logbook or on the appropriate field forms(s).

5.0 ATTACHMENTS

None.

6.0 FORMS

- Monitoring Well Water Level Measurement Form

7.0 REFERENCES

American Society for Testing and Materials (ASTM), D4750-87 (Reapproved 2001), *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*, West Conshohocken, PA.

U.S. Department of the Interior, 1977 (updated 1984), *National Handbook of Recommended Methods for Water-Data Acquisition*, Chapter 2, Reston, VA.

Forms

Monitoring Well Water Level Measurement Form

Gilbane

Project Name:

Page of

Project No./Task Code:

Date:

Measured By:

Monitoring Well I.D.	Depth to NAPL (feet)	Depth to Water (feet)	Depth to Bottom (feet)	Time	Comments/ Observations

Additional Comments:

Prepared by:

Signature:

Gilbane

Standard Operating Procedure

Sample Handling, Packaging and Shipping

PR-TC-02.04.01.01 v2.1

Prepared by: Kristen A Carlyon
Kristen Carlyon, Program Chemist
Date: 13 June 2013

Reviewed by:
Jim Schollard, Program QA/QC Manager
Date: 13 June 2013

Approved by: Jeffrey Hess
Jeffrey Hess, Director Technical Services
Date: 13 June 2013

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval
1.0	Initial Issue	NA	30 Sep 2009	NA
1.1	Added perchlorate to the Sample Preservation and Storage Requirements Table.	Attachment A	24 Feb 2010	J Hess
1.2	Remove references to SOPs currently under revision for inclusion of CLP procedures.	Pgs 4-5	06 Aug 2010	J Hess
2.0	Added in SW846 Revision 4	Attachment A	13 Jun 2013	NA
2.1	Updated organization name. No other changes needed.	All	6 Aug 2014	J Hess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

Table of Contents

1.0 PURPOSE

The objective of this procedure is to establish a uniform method for the handling of environmental samples. This includes using the appropriate sample containers and preservatives, following correct chain-of-custody procedures, and using appropriate sample shipment methods.

2.0 SCOPE AND APPLICABILITY

This procedure will be used during the collection and handling of all types of environmental media, including but not limited to, groundwater, surface water, soil, sediment, and air samples.

This procedure applies to the shipping and packing of all non-hazardous samples. Non-hazardous samples are those that do not meet any hazard class definitions found in 49 CFR 107-178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances). In general, most soil, air, and aqueous samples do not meet any of DOT's hazardous materials definitions. However, samples for which screening has shown a potential hazard sufficient to meet a DOT definition or that are derived from a source known or suspected to meet a DOT definition must be packaged and shipped in accordance with applicable DOT and/or IATA requirements.

3.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

°C:	degrees Celcius
Bubble wrap:	Plastic sheeting with entrained air bubbles; used for protective packaging purposes.
CFR:	Code of Federal Regulations
CLP:	Contract Laboratory Program
COC:	Chain-of-custody
Cooler:	Any hard-sided insulated container meeting DOT or IATA packaging requirements.
DOT:	U.S. Department of Transportation.
IATA:	International Air Transport Association.
Packing material:	Styrofoam beads ("peanuts"), or equivalent
PPE:	Personal protective equipment.
QAPP:	Quality Assurance Project Plan
Shipping container:	*see* Cooler
VOA vial:	40-mL glass vial used for the collection of samples for volatile organic analysis.

4.0 EQUIPMENT AND MATERIALS

Equipment and materials that may be required to implement this SOP include the following:

- Bubble wrap
- Packing material
- Tape (packing tape, duct tape, or other tear-resistant material)
- Large plastic trash bags
- Ziploc bags (freezer grade, gallon and quart sizes)
- Shipping containers (e.g. coolers)
- Sample container(s) as specified in the approved project plans
- Ice
- Custody seals
- “This Side Up” arrows
- Address labels and/or airbills
- Chain-of-Custody forms
- Sample Collection Forms, Daily Activity Reports, activity-specific sampling forms
- Black waterproof pen (e.g., fine-point Sharpie marker).

5.0 PROCEDURE

5.1 GENERAL

The following method outlines general considerations for sample handling in the field and maintaining sample custody after collection.

Environmental samples are collected in the field in order to evaluate whether conditions in soil gas, soil, surface water, groundwater or atmosphere are hazardous. These samples therefore, should be handled with the utmost care to maintain sample integrity, so that analytical data represent field conditions as closely as possible. In addition, sample care, custody, and control are extremely important for establishing that sample integrity was maintained between field crews and the laboratory.

General considerations for handling during sampling are:

- Always wear proper PPE when handling samples.

- Wrap sample container in a way that is both protective of the sample container and other surrounding sample containers.
- Document all collection procedures thoroughly in sampling forms (e.g. Sample Collection Form) and general field notes in the Daily Activity Report (or field logbook, when applicable). There is never "too much information".

Samples must be stabilized for transport from the field to the laboratory through the use of the proper sample containerization and preservation. This is due to the potential chemical and/or biological degradation that may occur after samples are collected. Typical sample containerization and preservation are presented in Appendix A. Unless otherwise indicated in the site-specific QAPP, sample containers should be cooled immediately after completion of sampling and maintained at a temperature not to exceed the temperature specified in Attachment A until received by the laboratory.

5.2 SAMPLE CONTAINERIZATION AND PRESERVATION

The appropriate sample container types, volumes, preservatives, and holding time requirements for soil and groundwater samples for the most commonly requested analyses are listed in Attachment A, Sample Preservation and Storage Requirements.

Methods of sample preservation are intended to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light.

All sample containers will be properly labeled and monitored for temperature control in the field and during laboratory transport and storage. Temperature blanks will be used in all coolers containing samples requiring preservation at reduced temperature.

5.3 SAMPLE IDENTIFICATION AND LABELS

All samples will be properly labeled to prevent misidentification of samples. Generally, preprinted sample labels are encouraged to enhance legibility and reduce transcription errors at the laboratory. The label will be affixed to the sample container prior to transportation to the laboratory and will generally contain the following information (except when using CLP):

- Project name, number, and location
- Site name
- Name of collector
- Date and time of collection
- Sample identification number
- Preservative, if any
- Requested test methods or analyses.

See the site-specific QAPP for any additional sample identification protocols.

5.4 CHAIN OF CUSTODY

Chain-of-custody (COC) procedures are implemented to ensure that all samples are traceable from the time that they is collected until they, or their derived data, are used. A sample is considered to be "in custody" under the following conditions:

- It is in personal possession.
- It is in personal view after being in personal possession.
- It was in personal possession when it was properly secured.
- It is in a designated secure area.

Sample custody will be documented through the use of COC forms. These forms will be used to track sample custody from the point of sample collection through sample disposal. The security of samples will be ensured by the use of the procedures described below.

5.4.1 Chain-of-Custody Forms

A COC form will be filled out for and will accompany every group of samples sent to the analytical laboratory, to document sample care, custody, and control from the time of collection to sample receipt. See SOP PR-TC-01.04.05.00 for a copy of the latest COC form and on how to properly complete the form.

The following information will be recorded on the COC form:

- COC form number
- Company name, address, and telephone number
- Company contact person
- Laboratory name, address, and telephone number
- Laboratory contact person
- Sample identification
- Date and time of collection
- Sampler's name
- Analytical method(s) requested
- Sample volume (e.g., three 40-milliliter [mL] vials)
- Sample matrix (e.g., soil or groundwater)
- Preservative (e.g., hydrochloric acid [HCl])
- Request for matrix spike analysis or other QC analysis
- Signatures of individuals releasing and accepting samples
- Times of release and acceptance of samples
- Air bill number if shipping by commercial courier

- Any comments to identify special conditions or requests.

5.4.2 Custody Seals

Custody seals will be used when samples are shipped via courier service, and must be placed on the shipping container (cooler) so that the seals have to be broken before the container can be opened. The seal must be signed and dated by the field personnel. Custody seals are not deemed necessary when the samples will be in the continuous possession of project, field, or laboratory personnel.

5.5 PACKAGING FOR SHIPMENT

Samples will be packaged for shipment as follows:

- Use tape to seal off the cooler drain on the inside and outside to prevent leakage.
- Place packing material (bubble wrap) on the bottom of the shipping container (cooler) to provide a soft impact surface.
- Place a 55-gallon or equivalent plastic bag into the cooler (to minimize the possibility of leakage during transit).
- Place each sample bottle or set of volatile organic analysis (VOA) vials in a separate plastic bag and seal the bag. Squeeze air from the bag before sealing.
- Starting with the largest glass containers, wrap each container with sufficient bubble wrap to ensure the best chance to prevent breakage of the container.
- Pack the largest glass containers in bottom of the cooler, placing packing material between the containers to partially cover the sample containers (more than halfway) to avoid breakage from bumping. Cardboard separators may be placed between the containers at the discretion of the shipper.
- Double-bag ice chips or cubes in gallon or quart freezer-grade Ziploc plastic bags and wedge the ice bags between the sample containers.
- Add bagged ice across the tops of the samples.
- Continue filling the shipping container in the same manner (e.g., using bubble-wrap and ice) with smaller sample containers/vials.
- When the container is sufficiently full (or all samples have been packed), seal the inner protective plastic bag (with twist-ties and/or packing tape), and place additional packing material on top of the bag to minimize shifting of containers during shipment.
- Tape a gallon Ziploc bag to the inside of the cooler lid, place one copy of the completed COC document for the shipment inside, and seal the bag shut.
- Tape the shipping container (cooler) shut using packing tape, duct tape, or other tear-resistant adhesive strips. Taping should be sufficient to ensure that the lid will not open during transport.

- In situations where samples will not be in the continuous possession of project, field, or laboratory personnel, place custody seals on two separate portions of the cooler, to provide evidence that the lid has not been opened prior to receipt by the intended recipient.

5.5.1 Labeling

Label the shipping container/cooler as follows:

- Attach a “This Side Up” arrow securely to each side of the cooler. Affix "fragile" or other labels on the cooler as appropriate.
- Attach a label with the name and address of the receiver and the shipper to the top of the cooler.
- If the cooler is to be shipped by overnight carrier, attach a properly completed airbill to the top of the cooler.

6.0 ATTACHMENTS

- Attachment A: Sample Preservation and Storage Requirements

7.0 FORMS

The following forms are attached:

- None

8.0 REFERENCES

ITSI, 2006. *Final Chemical Data Quality Management Plan, 8(a) Remedial Action Contract Number N68711-005-D-6403*. January.

U.S. Department of Transportation Regulations, 49 CFR Parts 108-178.

International Air Transport Association (IATA), Dangerous Goods Regulations, current edition.

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	VOC	Gasoline Range Organics (GRO) 8015B	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis
Water	VOC	Gasoline Range Organics (GRO) 8015C	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis
Water	VOC	Gasoline Range Organics (GRO) 8015D	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis
Water	VOC	GCMS VOCs 8260B	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis (7 days unpreserved)
Water	VOC	GCMS VOCs 8260C	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis (7 days unpreserved)^{a,b}
Water	VOC	GC VOCs 8021B (SW846 Update III)	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis (7 days unpreserved)
Water	VOC	GC VOCs 8021B (SW846 Update IV)	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / ≤ 6 °C	14 days analysis (7 days unpreserved)^{b}
Water	SVOC	Phenols 8041A (SW846 Update III)	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Phenols 8041A (SW846 Update IV)	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organochlorine Pesticides 8081A	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organochlorine Pesticides 8081B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polychlorinated Biphenyls (PCBs) 8082	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polychlorinated Biphenyls (PCBs) 8082A	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	None
Water	SVOC	Organophosphorus Pesticide 8141A	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organophosphorus Pesticide 8141B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	SVOC	Chlorinated Herbicides 8151A (SW846 Update III)	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Chlorinated Herbicides 8151A (SW846 Update IV)	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	GCMS SVOC 8270C	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	GCMS SVOC 8270D	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Dioxins and Furans 8280A; 8290	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C, store in the dark	30 days extraction 45 days analysis (after extraction)
Water	SVOC	Dioxins and Furans 8280B; 8290A	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	None
Water	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW846 Update III) ; 8270CSIM	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW846 Update IV); 8270DSIM	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Nitroaromatics and Nitroamines 8330A; 8330B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015B	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015C	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015D	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	Metals	ICP-AES Metals 6010B; 6010C	1 X 500 mL plastic	HNO_3 to pH < 2	6 months analysis
Water	Metals	ICP-MS Metals 6020; 6020A	1 X 500 mL plastic	HNO_3 to pH < 2	6 months analysis

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Metals	Mercury by CVAA 7470A (SW846 Update III)	1 X 500 mL plastic	HNO_3 to pH < 2; 4 ± 2°C	28 days analysis
Water	Metals	Mercury by CVAA 7470A (SW846 Update IV)	1 X 500 mL plastic	HNO_3 to pH < 2; ≤ 6 °C	28 days analysis
Water	Inorganic	Hexavalent Chromium 7196A; 7199	1 X 250 mL plastic	4 ± 2°C	24 hours analysis
Water	Inorganic	Hexavalent Chromium 7196A; 7199	1 X 250 mL plastic	≤ 6 °C	24 hours analysis
Water	Inorganic	Anions by IC 300.0 / 9056A (S846 Update III)	1 X 250 mL plastic	4 ± 2°C	48 hours for nitrate, nitrite, and orthophosphate analysis 28 days for chloride, sulfate, bromide, and fluoride analysis
Water	Inorganic	Anions by IC 300.0 / 9056A (SW846 Update IV)	1 X 250 mL plastic	≤ 6 °C	48 hours for nitrate, nitrite, and orthophosphate analysis 28 days for chloride, sulfate, bromide, and fluoride analysis
Water	Inorganic	Nitrate and Nitrite as N Total 353.2	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 ± 2°C	28 days analysis
Water	Inorganic	Kjeldahl Nitrogen 351.4 / SM 4500NH3-C	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 ± 2°C	28 days analysis
Water	Inorganic	Chemical Oxygen Demand (COD) 410.4 / SM 5220D	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 ± 2°C	28 days analysis
Water	Inorganic	Alkalinity SM 2320B / 310.1	1 X 250 mL plastic	4 ± 2°C	14 days analysis
Water	Inorganic	Total Dissolved Solids (TDS) SM 2540C / 160.1	1 X 250 mL plastic	4 ± 2°C	7 days analysis
Water	Inorganic	pH SM 4500-H+B	1 X 250 mL plastic	None	15 minutes analysis
Water	Inorganic	pH 150.1	1 X 250 mL plastic	None	24 hour analysis

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Inorganic	Conductivity SM 2510B / 120.1	1 X 250 mL plastic	4 ± 2°C	28 days analysis
Water	Radiochem	Gross Alpha/Gross Beta 900.0	500-mL glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Gamma-Emitting Radionuclides 901.1	2 X 1-liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Radium-226 by Radon Emanation 903.1	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Gamma Radioassay HASL300 GA-01-R	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Radium-228 EPA 904.0	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Strontium-90 905.0	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Tritium 906.0	2 X 1 liter glass or plastic	None	6 months analysis^e
Water	Radiochem	Plutonium 238 and 239/240 HASL 300-Pu-11	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Water	Radiochem	Uranium-234, -235, and -238 HASL 300 U-02-RC	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis^e
Soil	VOC	Gasoline Range Organics (GRO) 8015B	3 X 5g EnCore® or equivalent	4 ± 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	Gasoline Range Organics (GRO) 8015C	3 X 5g EnCore® or equivalent	≤ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	Gasoline Range Organics (GRO) 8015D	3 X 5g EnCore® or equivalent	≤ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	GCMS VOCs 8260B	3 X 5g EnCore® or equivalent	4 ± 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	VOC	GCMS VOCs 8260C	3 X 5g EnCore® or equivalent	≤ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)[a]
Soil	VOC	GC VOCs 8021B (SW846 Update III)	3 X 5g EnCore® or equivalent	4 ± 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	GC VOCs 8021B (SW846 Update IV)	3 X 5g EnCore® or equivalent	≤ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	SVOC	Phenols 8041A (SW846 Update III)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Phenols 8041A (SW846 Update IV)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organochlorine Pesticides 8081A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organochlorine Pesticides 8081B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polychlorinated Biphenyls (PCBs) 8082	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polychlorinated Biphenyls (PCBs) 8082A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	None
Soil	SVOC	Organophosphorus Pesticides 8141A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organophosphorus Pesticides 8141B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Chlorinated Herbicides 8151A (SW846 Update III)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Chlorinated Herbicides 8151A (SW846 Update IV)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	GCMS SVOCs 8270C	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	SVOC	GCMS SVOCs 8270D	Sleeves^c with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Dioxins and Furans 8280A; 8290	Sleeves^c with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C ; store in the dark	extraction - 30 days analysis - 45 days
Soil	SVOC	Dioxins and Furans 8280B; 8290A	Sleeves^c with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	None
Soil	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW386 Update III); 8270CSIM	Sleeves^c with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW386 Update IV); 8270DSIM	Sleeves^c with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Nitroaromatics and Nitramines 8330A	Sleeves^c with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Nitroaromatics and Nitramines 8330B	1.5 grams of soil in specially prepared locking plastic bag	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015B	Sleeves^c with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015C	Sleeves^c with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015D	Sleeves^c with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	Metals	ICP-AES 6010B; 6010C	Sleeves^c with PTFE™ end caps or 4 oz glass jar	None	analysis - 6 months
Soil	Metals	ICP-MS 6020; 6020A	Sleeves^c with PTFE™ end caps or 4 oz glass jar	None	analysis - 6 months
Soil	Metals	Mercury by CVAA 7471A	Sleeves^c with PTFE™ end caps or 4 oz glass jar	4 ± 2 °C	analysis - 28 days
Soil	Metals	Mercury by CVAA 7471B	Sleeves^c with PTFE™ end caps or 4 oz glass jar	≤ 6 °C	analysis - 28 days
Soil	Inorganics	Conductivity 9050A/ 9050A	1 X 4 oz glass jar	4 ± 2 °C	analysis - 28 days

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	Inorganics	Hexavalent Chromium 7196A / 7199 (SW846 Update III)	1 X 4 oz glass jar	4 ± 2 °C	analysis - 24 hours
Soil	Inorganics	Hexavalent Chromium 7196A / 7199 (SW846 Update IV)	1 X 4 oz glass jar	≤ 6 °C	analysis - 24 hours
Soil	Inorganics	pH 9045D	1 X 4 oz glass jar	None	analysis - immediately
Soil	Radiochem	Gamma-Emitting Radionuclides 901.1M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Radium-226 by Radon Emanation 903.1M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Gamma Radioassay HASL300 GA-01-R	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Radium-228 904.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Strontium-90 905.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Tritium 906.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Plutonium 238 and 239/240 HASL 300-Pu-11	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Uranium-234, -235, and -238 HASL 300 U-02-RC	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]

Abbreviations and Notes:

AES = Atomic Emission Spectrometry
°C = degrees centigrade
CVAA = Cold Vapor Atomic Absorption
GC = Gas Chromatography
HCl = Hydrochloric Acid
H2SO4 = Sulfuric Acid
IC = Ion Chromatography
ICP = Inductively Coupled Plasma
mL = milliliters
MS = Mass Spectrometry
oz = ounce
SVOC = Semi-volatile Organic Compounds
VOA = Volatile Organic Analysis
VOC = Volatile Organic Compounds

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Abbreviations and Notes:

[a] If vinyl chloride, sytene, or 2-chloroethyl vinyl ether are analytes of interest, collect a second set of samples without acid preservatives and analyze as soon as possible (7 day hold time).

[b] If carbonaceous materials are present (or if MTBE and other fuel oxygenate ethers are present and a high temperature sample preparative method is to be used), do not acid preserve the sample.

[c] Sleeves may be stainless steel, acetate, brass or PTFE, depending on project needs.

[d] Sample volume and container dependent on required site-specific reporting limits. See the site-specific plan for details or variances such as tuna cans.

[e] Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-B-97-001, March 1997 Criteria and Procedures Quality Assurance

Standard Operating Procedure

Sample Tracking and Electronic Data Management

PR-TC-02.12.02.00 v2.2

Prepared by: Date: 14 June 2013
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Reviewed by: Date: 14 June 2013
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Approved by: Date: 14 June 2013
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Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	–	30 Sep 2009	NA
1.1	Clarification of Project Chemist responsibilities, and corrections to section numbering.	Pages 2-4	30 Sep 2009	J. Hess
2.0	Reorganized procedures and responsibilities	Section 3-4	14 Jun 2013	NA
2.1	Updated definition of ERPIMS	Page 1	16 Jan 2014	J. Hess
2.2	Updated field procedures and flow chart	Pages 3-5, Flow Chart	14 Oct 2016	JHess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for tracking environmental samples in a manner that will provide a systematic means of notifying our electronic data management group (including our chemists, database administrators, data management specialists, and other interested parties) of upcoming sampling events, ensuring the correct samples are collected and correct analyses are requested, tracking the receipt of analytical data from the laboratory for the sampling efforts, facilitate upload of electronic data to the database from the field crew and laboratories, and provide a reference for reconciliation of laboratory invoices.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

COC: chain-of-custody form
CDQMP: Chemical Data Quality Management Plan
DQO: data quality objective
EDD: electronic data deliverable
eDMS: Environmental Data Management System, Gilbane's in-house environmental data management system.
ERPIMS: Environmental Resources Program Information Management System
FSP: Field Sampling Plan
Geotracker: A database and geographic information system (GIS) hosted by the California State Water Resources Control Board (SWRCB) that provides online access to environmental data.
GPS: global positioning system
LIMS: laboratory information management system
NIRIS: Naval Installation Restoration Information Solution
ORP: oxidation-reduction potential
PID: photo-ionization detector
QAPP: Quality Assurance Project Plan
SAP: Sampling and Analysis Plan
SEDD: staged electronic data deliverable
SOP: standard operating procedure
XRF: x-ray fluorescence

3.0 ROLES AND RESPONSIBILITIES

Project Manager. Establishes and communicates the goals and objectives (DQOs) of the sampling event to the team, and provides specifics regarding the number and type of samples, analytical methods, and any special reporting requirements. Authorizes payment of laboratory and validation invoices upon successful submittal of complete EDD.

Field Personnel. Responsible for the proper collection of environmental samples according to the approved SAP or FSP/QAPP. Responsible for accurate, defensible documentation of sample collection per approved project plans and corporate SOPs.

Sample Coordinator. Responsible for tracking the samples from time of collection through laboratory acceptance. Updates the Sample Tracking Log daily. Reconciles coolers contents against COCs prior to transfer to laboratory. Uploads COC and field information, including sample coordinates and field parameters, into eDMS daily. Submit samples to the laboratory. Sends COCs, Sample Collection Logs and other field forms to project team. Resolves completeness issues with laboratory (e.g. broken bottles, missing samples, etc.).

Project Chemist (or designee). Prepares SAP or FSP/QAPP and sample tracking log. Sets up site in eDMS and portal, if necessary. Loads eQAPP and sample schedule into eDMS. Uploads project planning documents to Gilbane project portal. Reviews COC and field information in eDMS. Reviews LIMS login report and resolves analytical issues with laboratory. Facilitates communication between lab and data group in upload of EDDs. Runs completeness test on EDDs against COCs to ensure all data has been received (this can be accomplished with the use of Event Planning reports). Reviews and finalizes results/validation qualifiers, releasing data for use. Updates Sample Tracking Log once samples are in the laboratory and for subsequent activities (e.g., data validation). Notify Project Manager upon successful submittal of completed EDDs.

Data Management Staff. Work with Project Chemist on setting up project and/or site, if new and updating existing projects as they evolve. Identify EDD reporting requirements (ERPIMS, NIRIS, SEDD, etc.) based on Contract and Task Order requirements. Manage any new user accounts needed based on staffing of project team. Work with Project Chemist on designation of sample IDs (and new location IDs, if required).

4.0 PROCEDURES

Systematic sample tracking and efficient data management require that the procedures presented in this SOP be followed by all parties involved in the collection and reporting of environmental data. Figure 1 outlines the generalized flow of sample information and laboratory results from initial sampling through reporting of the validated results. Although not specifically shown in Figure 1, these procedures are applicable to other field or laboratory generated environmental data from field instruments (e.g, chemical, radiological, geotechnical, water quality, and air monitoring), mobile field laboratories, and observations.

Procedures for managing the accurate collection and reporting of the data are discussed below. Roles and specific responsibilities are presented in Sections 3.1-3.3.

- **Kickoff Meeting**. A meeting is held with the project manager or task lead, the project chemist, and a representative of the data management team to communicate the goals and objectives (e.g., DQOs) of the sampling event to the team, and provide specifics regarding the number and type of samples, analytical methods, and any special reporting requirements.
- **Preparation of Sample Guidance Documents.** The SAP or FSP/QAPP is prepared by the project chemist, is reviewed by the project manager or task lead for consistency with the work plan and other project documents, and goes through both the internal and client approval process. The information contained in the approved SAP or FSP/QAPP is used to develop a Planned Sample Table / Sample Tracking Log.
- **Setup of Project Database.** If the site does not already exist in eDMS (Gilbane's web-based environmental data management system), a new database is created. If the site exists, a new project is added to the previously existing database. The quality control (QC) criteria from the SAP or QAPP is entered into eDMS, and (optionally) the information from the Planned Sample Table / Sample Tracking Log is entered into the Event Planning Tool.
    - The use of the Event Planning Tool allows for utilization of database tools such as electronic COCs, pre-printed labels, and completeness and performance reports. These are a requirement of some contracts, so be sure to complete this task if the project is under a contract requiring performance monitoring.
- **Sample Collection and Documentation**. Samples are collected in accordance with the approved site-specific project plans and chain-of-custody is properly documented.
- **Sample Tracking**. Samples are tracked from time of collection through laboratory acceptance. Issues with sample receipt (i.e., bottle breakage) are resolved. The Sample Tracking Log is updated in the field if event planning tool was not used.
- **Sample Entry**. COCs, Sample Collection Logs, and other field forms are submitted from the field team by scanning the field documentation and uploading to eDMS nightly. COC and appropriate field information (e.g., depth to water, water quality parameters) is then entered into eDMS daily, including field parameters and GPS coordinates.
    - Best practice (and required by some clients) is to collect GPS coordinates at time of sample collection even if a subsequent survey is planned later.
- **COC Review**. COC and field information is reviewed in eDMS. Laboratory LIMS login report is reviewed and analytical/login issues resolved with laboratory. The Event Planning Tool in eDMS is updated with required information (e.g., SDG associated with each sample).
- **EDD Upload**. The EDDs are uploaded to the project database. Upon successful upload, the laboratory report is available for review/validation.

- **Release of Data**. Review/validation is reviewed and approved. Sample Tracking Log is updated or if Event Planning was used, completeness reports are run. Once data is approved and shown to be complete, it can be released for use.
- **Review and Publication of Data**. Once data has been released for use, various reports can be run from eDMS to view the data in a variety of formats, and to review the data relative to applicable screening criteria and/or cleanup goals. The data is also available to incorporation into GIS for figure generation.
- **Generation of Deliverable EDDs**. Deliverable EDDs (i.e. NEDDs, ERPIMs, or SEDDs) are generated and uploaded as appropriate. Project Manager is notified of completion.

4.1 FIELD STAFF RESPONSIBILITIES

4.1.1 Notification of Sampling

At the beginning of each project involving the acquisition of environmental data, a preliminary meeting will be held by the project manager, project chemist and members of the electronic data management group to discuss the data quality objectives (DQOs), sampling requirements, and plan out preparation of the SAP or FSP/QAPP (including location and sample IDs). Once fieldwork is scheduled, a meeting between the project manager, project chemist and the field personnel prior to deployment will be conducted to discuss the specific requirements of the project. Specific information regarding the number and type of samples to be collected will be presented, along with recommended field procedures, sequence of work, and identity of the primary and secondary analytical laboratories. Sample naming protocols will be discussed to insure proper sample identification in the field and on Chains-of-Custody (COCs). The electronic data management group will be notified of the start of sampling at this time.

For multi-phase or recurring projects such as quarterly monitoring, both the project chemist and electronic data management group will be notified prior to the beginning of each sampling event, and a copy of the Sample Tracking Log will be provided to all interested parties prior to the initiation of sampling.

4.1.2 Chain-of-Custody

During field sampling activities, a copy of the COC will be uploaded daily by the sample coordinator to eDMS for access by the project chemist and data management staff.

- When the Event Planning tool is used in eDMS (the preferred approach), an electronic COC can replace a hand-written COC. Several fields will be pre-populated based on the sample tracking table and the room for hand-written error is greatly reduced. Internet connectivity is required to use this feature either on site or at a hotel or office before sampling begins. The COCs will be uploaded to the server nightly.
- If paper COCs are used, then COCs with a unique identification number should be used and can be requested through the your project chemist prior to the beginning of sampling. The location and sample IDs and the sample depths (top and bottom) for non-aqueous samples should be written on the copies of the COCs. The COCs will then be uploaded to eDMS nightly. In those cases where there is no internet access available, COCs are to be faxed daily and sent by FedEx at the end of each week.

- If Forms II Lite is used, a copy of the output files should be forwarded electronically to the Project Chemist and electronic data management group, along with a copy of the hard copy COC from the field printer for reference.

The data management group will review and QC COCs daily in eDMS.

4.1.3 Sample Coordinates and Other Field Notes

Along with the COCs, the sample coordinator will either: 1) directly load sample coordinates (from GPS) into eDMS; or 2) forward sample coordinates (from surveys) to be loaded into eDMS for each sample collected, with the exception of waste and some process samples, or recurring sample locations where coordinates already exist (e.g., previously surveyed monitoring wells). Please confirm the existence of valid coordinates for each sample location prior to sampling, otherwise collect GPS coordinates just in case. In addition, all field notes including boring logs, water levels, and field measurements will be uploaded on a daily basis to eDMS or to the data management group for entry into the system.

4.2 PROJECT CHEMIST RESPONSIBILITIES

4.2.1 Development of SAP or FSP/QAPP and Appropriate Location and Sample IDs

The Project Chemist is responsible for preparation of the SAP or QAPP/FSP and development of appropriate location and sample IDs in consultation with the Project Manager or Task Lead. A list of location IDs and their associated sample IDs should be sent to the data manager or their designee for approval before they are incorporated in the sampling plan. The location and sample IDs should conform to the location and sample ID nomenclature requirements listed in SOP PR-TC-01.04.04.00. Once the project plans are approved by the client, the Project Chemist shall upload the eQAPP in eDMS and request that the data manager set up the site in the eDMS. The project chemist shall setup the site in the Gilbane portal and upload the work plan to the portal.

4.2.2 Creation of Sample Tracking Log

The project chemist shall develop a Sample Tracking Log at the inception of the project. The log shall track the following items:

Pre-Sampling Post-Sampling

- Location ID
- Sample ID
- Sample matrix
- Required analyses
- Sample Date
- Date Submitted to Lab
- Laboratory Sample ID
- Status of data packages.
- Method predicted to be used for collecting samples

The project chemist shall submit the Sample Tracking Log to the data management group for use in setting up the Event Planning for each sampling event. This will allow for electronic COC use and electronic tracking of laboratory SDG status.

4.2.2.1 QC of Entry of COCs in eDMS

The project chemist (or designee) will QC the data entry of the COC information entered into eDMS. The sample identifications, analyses requested, sampling methods, matrices, dates and times of sample collections, and proper assignment of quality control samples will all be checked. The Project Chemist will also verify that the Sample Tracking Log has been updated, and will update the log if it has not been updated.

4.2.2.2 Cross-checking of Laboratory Receipt Form

Upon receipt of the samples by the laboratory, a completed chain-of-custody and laboratory receipt form shall be forwarded to the Project Chemist and crosschecked to the Sample Tracking Log (or online data management system) within 48 hours. Transcription errors and any minor differences will be resolved right away and documented through email correspondence. Major problems will be documented through the use of corrective action forms.

4.2.3 Receipt of Data and Data Uploads

As laboratory data packages are prepared and submitted to Gilbane, receipt of these data packages will be recorded on the Sample Tracking Log (or online data management system). The Project Chemist will facilitate communication between the lab and data management group to successfully load and certify EDDs. If not uploaded to eDMS by the lab, the electronic data deliverables (EDDs) in acceptable format (Enhanced ERPIMS unless otherwise approved) will be forwarded to the electronic data management group right away. The completeness of the EDDs will be verified upon receipt by the electronic data management group. eDMS will screen the results against the eQAPP. After errors (if any) are resolved, the EDD is certified by the person who uploaded it.

Validation using eDMS or a third-party validator occurs at this point. The validation codes are applied to eDMS and a validation report is prepared. The Project Chemist reviews and approves the qualifiers and again updates the Sample Tracking Log. At this point the data is approved by the Project Chemist for general use.

Upon completion of the receipt of the last sample for the sampling event (for example, one complete round of groundwater monitoring), a copy of the completed Sample Tracking Log will be forwarded to the electronic data management group for organization purposes

4.2.4 Reconciliation of Invoices

Upon receipt of laboratory invoices, the Project Chemist or his designee will cross-check the invoices against the sample tracking log to verify the receipt by Gilbane of all billed sample analyses, completed final data packages, and EDDs (accepted by the electronic data management group) before notifying the project manager that the invoices should be authorized for payment.

4.3 DATA MANAGEMENT GROUP RESPONSIBILITIES

4.3.1 Upload of Sample Information and Field Data to Database

The data management group will use the information in the sample tracking log and/or Event Planning tool in eDMS and the COCs as they are received in preparation for the upload of the electronic data deliverables (EDDs) directly from the laboratory or from laboratory provided electronic files.

Upon receipt of the sample-tracking log, the data management group will review the log. Any immediate potential problems (for example, the use of the dash '-' instead of an underscore '_' in the laboratory data system) that may follow in the preparation of the EDD will be identified and corrected.

4.3.1.1 Entry of COCs

The data management group will enter the COC information into eDMS. The sample identifications, analyses requested, sampling methods, matrices, sample depths, dates and times of sample collections, and proper assignment of quality control samples will be cross-checked for accuracy. The Sample Tracking Log will be updated as each COC is entered.

4.3.1.2 Entry of Other Field Data

Other data to be entered by the data management group includes water levels, field stability parameters (dissolved oxygen, ORP, turbidity, etc.), and GPS or survey coordinates. Additional data may include results of XRF field sampling, immunoassay test kit sampling, PID measurements, or other information required to be electronically provided to the client (typically any data used to make a regulatory decision), important for data review and analysis.

4.3.2 Creation of Final Data Package

The data management group will consolidate the validated EDDs from the in-house and/or third-party data validation firms with field information needed to complete the required data package. The final data package will then be submitted to the client in the required format (ERPIMS, NIRIS, Geotracker, etc.)

5.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- Completed COCs
- Sample Collection Logs
- GPS coordinates for each sample collected
- Sample Tracking Log (if event planning not performed).
- Field notes

6.0 ATTACHMENTS

None.

7.0 FORMS

- Sample Tracking Log

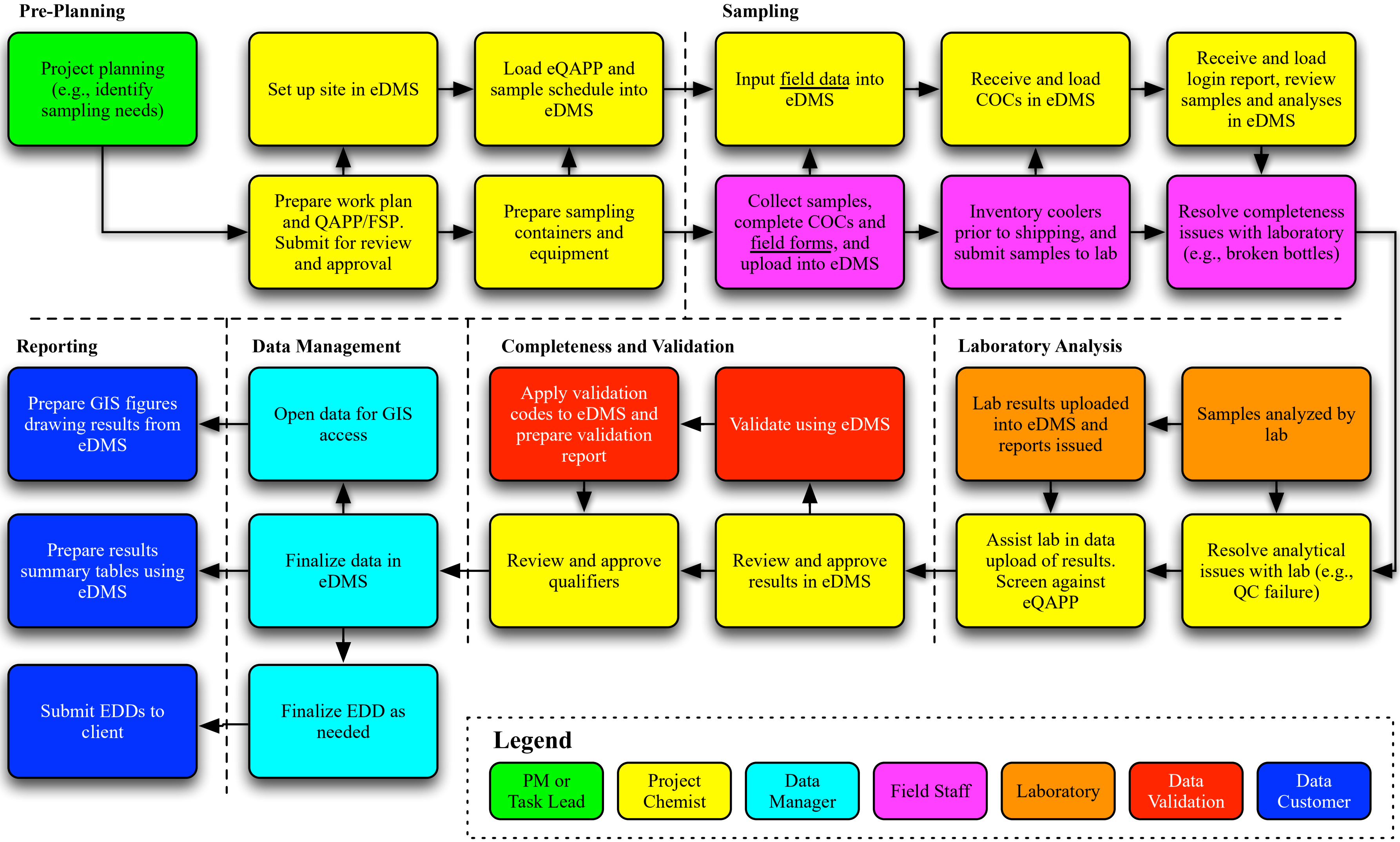
8.0 REFERENCES

None.

Sample Tracking Log

Event	Location ID	Sample Type	Field QC	Date Sampled	Time	Sample ID	Date Shipped	Date Received	Chain of Custody	Laboratory Work Order No.	Laboratory Sample No.	Analyses					Report Received	EDD Received	Data on eDMS	Notes
												TPH-DRO & MO by EPA 8015B	VOCs by EPA 8260	SVOCs by EPA 8270C	Title 22 Metals by 6010/6020/7000	Percent Moisture by ASTM D2216				

Figure 1. Gilbane Data Management Workflow



Field data includes environmental measurements collected during the course of collecting samples, and can include depth to water in a monitoring well, water quality parameters generated during purging, soil types classified during drilling, location information (by GPS), etc.

Field forms consist of the daily paperwork package generated during field events, including daily activity report (DAR), tailgate safety form, sample collection logs (as specified in the applicable SOPs), chain-of-custody forms, contractor production report (CPR), etc.

Gilbane

Standard Operating Procedure

Review, Verification, and Validation of Chemical Data

PR-TC-04.01.00.00 v3

Prepared by: Kristen Carlyon Peyton
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Date: 26 Apr 2018

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	NA	27 Jul 2011	NA
1.1	Changed title to add the term "chemical data"		22 Nov 2013	J Hess
2.0	Revise procedures to document changes to process for updating validation codes.	Sections 4.2 & 4.3	17 Mar 2014	NA
2.1	Update validation checklists in eDMS	Section 6.0 & Attachments	13 Oct 2016	J Hess
3.0	Updated text to reflect updated government requirements and updated ADR procedures.	All	21 Mar 2018	NA

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Attachments

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to describe the requirements and procedures for data review and data validation, using both automated and manual procedures. Use of the procedures outlined in this SOP for procedures other than by an experienced data reviewer should be done with great caution.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

3rd Party: An independent party not involved in the collection or analysis of the samples.

ADR: automated data review; an automated validation of electronic data deliverables against project and contract requirements entered into Gilbane's database, eDMS.

COC: chain-of-custody

DAR: Data Assessment Report

DQAR: Data Quality Assessment Report

% D: percent difference (also termed percent drift)

DV: data validation; the analyte- and sample-specific process that determines the analytical quality of a specific set of data.

EDD: electronic data deliverable; an electronic file containing, in a specific electronic format, laboratory data; an EDD is produces for each sample delivery group, and is used for uploading data to the eDMS. .

eDMS: environmental data management system

GCMS: gas chromatography/mass spectrometry

ID: identification

MS/MSD: matrix spike/matrix spike duplicate

QA: quality assurance

QC: quality control

QAPP: Quality Assurance Project Plan

QRT: qualified results table

RPD: relative percent difference

RSD: relative standard deviation

SDG: sample delivery group; a group of samples that is reported together under one laboratory identification number.

SAP: Sampling and Analysis Plan

SOP: standard operating procedure

3.0 BACKGROUND

There are many competing procedures for the review and validation of chemical data. This SOP attempts to harmonize these differing procedures utilizing the most recent regulatory guidelines and the latest technology. The sections below provide the necessary background information used in developing these harmonized procedures.

3.1 GENERAL REQUIREMENTS

The general requirements for the review and/or validation of chemical data are outlined in the following documents (the relevant guidance will be identified in the SAP):

- *General Data Validation Guidelines* (Department of Defense [DoD], 2018)
- *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (U.S. Environmental Protection Agency [EPA], 2009)

As described in these documents, some or all of following items (as applicable to the analytical method(s) used to generate the data) are considered and evaluated in a routine review of laboratory-generated data:

- Laboratory reports and chain of custody documentation, to check for errors and omissions;
- Laboratory case narratives, to check for anomalies and exceedances of QA/QC requirements;
- Laboratory reports, to check for correct reporting limits and units, and type of sensitivity limits (i.e. reporting limit/method detection limit versus limit of quantitation/limit of detection/detection limit);
- Extraction and analysis holding times;
- Method blank, trip blank, equipment blank, ambient blank, and rinse water blank data (to note any detected analytes and their respective concentrations and to check for frequency of collection);
- Surrogate compounds, the spiking levels, the resulting concentrations, and the percent recoveries;
- Laboratory control samples, the spiking levels, resulting concentrations, and percent recoveries;
- Laboratory duplicate samples, field duplicate samples, and relative percent differences (or replicates and relative standard deviation [RSD]).
- MS/MSD samples, the spiking levels, resulting concentrations, percent recoveries, and relative percent differences between the MS and MSD.

It should be noted that unless otherwise specified in the project-specific plans, as a policy, Gilbane has adopted the holding time decision criteria presented in the *General Data Validation Guidelines* (DoD, 2018).

In addition to the routine review procedure described above, more rigorous data validation will be conducted at a frequency prescribed in the project-specific sampling and analysis plan (SAP) or quality assurance project plan (QAPP). These reviews will evaluate the above items, plus each of the following (as applicable to the subject analytical methodology):

- Instrument initial calibrations, calibration levels, individual compound response factors for each level, and RSD or regression summaries of the response factors;
- Instrument continuing calibrations, calibration levels, individual compound response factors, and the percent difference (%D) or percent drift between the response factor and the response factor in the initial calibration;
- Initial and continuing blank summaries;
- Internal standard area counts and retention times, to compare to method-specified acceptance criteria;
- GC/MS tuning data and instrument performance checks, to compare to method-specified acceptance criteria;
- Data for serial dilution analyses, interference check samples, post-digestion spikes, and any method of standard additions (metals analyses only);
- Confirmation of positive results for second column or detector including percent difference between the two analytical concentrations that are greater than the detection limit;
- Raw data, including chromatograms, to check for correct transcription, interpretation, manual integrations, and compound identification;
- Injection logs for all instruments used for analysis of project sample;
- Preparation logs for all project samples and associated QA/QC samples;
- Date and time of analysis of project samples and associated QA/QC samples.

3.2 REGULATORY BASIS

The general requirements outlined in Section 3.1 were evaluated against guidelines and procedures outlines in the 2009 *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* by the U.S. Environmental Protection Agency (EPA) (EPA, 2009). This guidance document establishes specific terminology for data review and validation efforts. This terminology is being adopted here to facilitate a clear understanding by both the reviewer and the ultimate user of the data regarding the specific level of review and validation to which the data was subjected. This terminology is outlined below.

Table 1. Description of "Stages" Terminology

Stage	Validation Description	Label Codes
–	Not validated	NV
1	Completeness	S1VE, S1VM
2A	Completeness and sample-related QC	S2AVE, S2AVM, S2AVEM
2B	Completeness and both sample-related and instrument-related QC	S2BVE, S2BVM, S2BVEM
3	Completeness, both sample-related and instrument-related QC, and recalculation checks	S3VE, S3VM, S3VEM
4	Completeness, both sample-related and instrument-related QC, recalculation checks and review actual instrument outputs	S4VE, S4VM, S4VEM

The possible label codes are based on a combination of what "Stage" of review and/or validation was performed, and whether the review and/or validation was performed manually (M), electronically (E), or both (EM).

4.0 PROCEDURES

The specific protocols used are outlined below for the review and validation of analytical data consistent with the guidance presented in Section 3.1.

4.1 STAGE 1 VERIFICATION

Stage 1 verification, commonly referred to as a completeness check , of the laboratory analytical data package consists of verification of compliance and sample receipt conditions. The following items are considered and evaluated during Stage 1 verification of the sample delivery group (SDG):

- Chain-of-custody documentation including laboratory receipt information,
- Laboratory case narrative and summary report,
- Laboratory report signed by official laboratory representative,
- Requested samples analyzed,
- Requested analytes, sensitivity limits, sensitivity limit types and units.

Stage 1 can be completed either manually, electronically within eDMS, or a combination of the two.

4.1.1 Manual Stage 1

Specific procedures for manual Stage 1 verification are provided below:

1. Verify the laboratory report clearly identifies the laboratory receiving the samples and performing the analyses and that the laboratory report is signed by an official laboratory representative.
2. Review laboratory case narrative for anomalies and QC issues.

3. Verify the analytical methods specified in the SAP or QAPP were performed, and if substitutions were made, verify written instructions from the Gilbane Project Chemist specifying/allowing the substitution.
4. Review cooler receipts and sample login files for potential issues that may affect the usability of the samples (presence of custody seals, etc.) or validity of the reported results (receiving temperatures, etc.).
5. Verify all the target compounds identified in the SAP or QAPP for each of the analyses were reported by the laboratory.
6. Verify all the analyses for each of the samples listed on the chain-of-custodies were completed, the dates are present when the analyses were performed, the analyses were performed within the specified holding times, the requested reporting limits were obtained, and the results appropriately qualified.
7. Document review with Stage 1 Verification Checklist, included here in the Attachments.

4.1.2 Electronic Stage 1 Using eDMS

Much of a Stage 1 verification is by nature manual. For this reason, no specific procedures for electronic Stage 1 verification incorporating eDMS are provided.

Perform steps 1 through 4 as written above.

From the Gilbane Projects Portal (https://edms.gilbaneco.com), select the project in which you would like to run your report from the drop-down menu.

From the grey menu bar, select “Reports>Data Review Reports>ADR Report”.

A new screen will pop up. In “Status” choose “Loaded and Certified”, and a list of available SDGs should appear. Choose an SDG, and fill in the rest of the fields as appropriate. These are report headers and used for documentation purposes. At a minimum, fill in the data review quality control (QC) S1VEM (per Table 1 in Section 3.2). Select the “Display All” option of the Anomalies Display pull-down menu to generate a list of cases where the reported reporting limit (RL) exceeds that specified in the governing project document.

Use the last four fields as a case narrative for any qualifiers entered in the sample qualification tool that the ADR did not qualify.

Select “View Reports” and the bookmarked ADR Report will generate.

Verify that the total number of analyses presented in the “ADR Summary” match the total number of analyses requested on the COC. If there is a discrepancy, use the detailed “Batch Report” for more in-depth review.

Verify that there were no holding time exceedances by reviewing the “QC Outliers Report.”

Review the “Reporting Anomalies” to verify requested reporting limits were attained.

Document review using Stage 1 Validation Checklist, example presented in the Attachments. File completed checklist in the project library on eDMS and/or on server in project folder in Data Validation subfolder.

4.2 STAGE 2A VALIDATION

Stage 2A validation will evaluate and consider the items listed above for completeness, in addition to following:

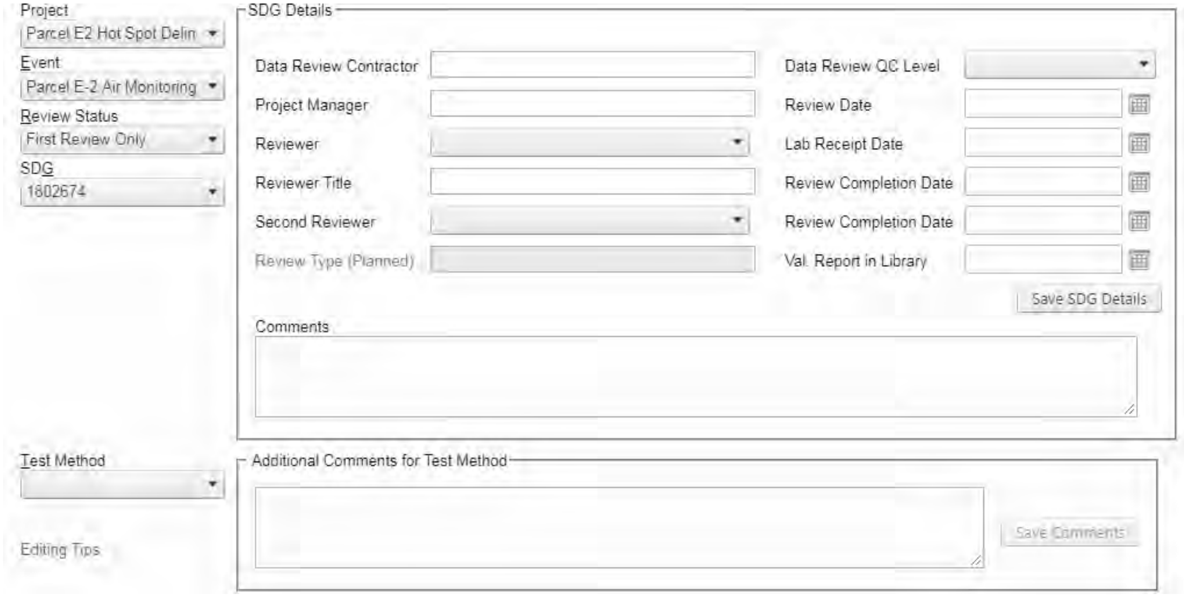
- Extraction and analysis holding times,
- Method blank, trip blank, equipment blank and ambient blank data,
- Surrogates,
- Matrix spikes and matrix spike duplicates,
- Field duplicates,
- Laboratory control samples, and
- Laboratory duplicates.

Stage 2A can be performed manually, but is preferentially performed electronically using eDMS. The following steps apply when performing automated data review (ADR) for Stage 2A within eDMS:

Data Validator (Gilbane or 3rd Party)

1. From the Gilbane Projects Portal (https://edms.gilbaneco.com), select the project in which you would like to run your reports from the drop-down menu.
2. From the grey menu bar, select "Reports>Data Review Reports>ADR LOD Detail"
3. The status pull-down menu will default to the most commonly used status ("Loaded and Certified"). Select the desired SDG, and fill in the balance of the items as desired.
4. Click "View Report" on the left hand side of the screen to generate the report.
5. Review the resulting report for QC Outliers and RL anomalies. (The report can be exported to Excel or PDF for ease of review by clicking on the export icon above the report.
    - On the Batch Report, verify all samples are being reported with the correct IDs. Verify the correct parameters were evaluated.
    - Skip to "QC Outlier Report" and review. Verify that both the correct control limits and correct warning limits were used to qualify the data. Check the outliers against the case narrative and check 10% against the hard copy.

      Note: If incorrect control or warning limits are discovered, send an email to the database manager or specialist with a correction request.
6. Return to the home screen and select Tools>Data – Review Checklist. Select the relevant project and event from left-hand side of the screen. Select whether it is the first or second review, or all if there will be only one.
7. Select the desired SDG from the left-hand side pull-down menu.
8. Select the SAP- or QAPP-specified validation level from the top-right hand Data Review QC Level pull-down menu, populate the balance of the upper fields, and click " Save SDG Details".



Project: Parcel E2 Hot Spot Delin
Event: Parcel E-2 Air Monitoring
Review Status: First Review Only
SDG: 1802674

9. The Test Methods will become available once Save SDG Details has been clicked. Each method has an associated electronic checklist to be populated.
10. After the checklists are populated, edit/add qualifiers as necessary in the database by selecting “Tools>Sample Qualification” in the Gilbane Project Portal.
    a. If there are any necessary changes to “Qualified Results”, notify the project chemist immediately to determine if project setup needs to be adjusted to correct the issues and prevent the issue in the future.
11. Generate a Field Duplicate Report, if applicable, by choosing “Reports>Data Review Reports>Field Duplicate Reports by SDG.” Fill in the desired title of the report, select the project and event from the pull-down menu, select the SDG from the next pull-down menu, and click “View Report. Check that the correct parent and duplicate sample are identified, and that the correct limits are displayed in the RPD columns. If updates are necessary then:
    - Notify the Project Chemist of any changes that need to be made to project setup;
    - Select “Field Duplicate Reports by SDG (user criteria)” from the “Data Review Reports”; enter appropriate information and the RPD values for the inorganic or organic methods. Click “View Report” to verify the report. Export the report in desired format (i.e. pdf, by clicking down arrow next to “Select a format” and then clicking on “Export.” Note if there are any qualified outliers.
12. From the grey menu bar, select “Reports>Data Review Reports>ADR”.
13. The following screen will appear:

Status	Loaded and Certified ▼	SDG	<Select a Value> ▼
2nd Signature on Report	○ True ● False	Second Reviewer Title	
Logo to Display	▼	Report Title	Data Validation Report ▼
Display Modified Qualifications Table	● True ○ False	Display Trace Values Table	○ True ● False

14. The status pull-down menu will default to the most commonly used status ("Loaded and Certified"). Select the desired SDG, and fill in the balance of the items as desired.
15. The "Project" logo choice will provide a Gilbane logo. The "Company" logo defaults to Gilbane as well, but can be customized for those projects using third party validation by contacting the Database Manager at htse@gilbaneco.com and providing a company logo.
16. Click on "View Report" on the left hand side of the screen to generate the ADR.
17. From the "Select a format" pull down menu, select "PDF", and click on export.
18. Combine the final ADR and the Field Duplicate Report into a single PDF and collect all applicable electronic signatures.
19. When reports have been generated and review process is complete select <Finalize Qualifiers> from main screen.

Gilbane Project Chemist

20. Review the data validation report for consistency with project-specific requirements, validation guidelines (e.g., National Functional Guidelines, General DV Guidelines, etc.), and with this SOP. Work directly with the data validator to resolve any questions and any necessary changes. Once the data validation report is approved, the SDGs will be released for use by selecting <Approve SDG>.

4.3 STAGE 2B VALIDATION

For 2B validation, the following additional information will be reviewed:

- Initial and continuing calibration standards,
- Initial and continuing calibration blanks (for inorganic and metals analyses),
- Serial dilutions and post spikes, where applicable,
- Reporting limit verification standard, and
- Instrument tune and performance checks
- Internal standards (if summaries are available)
- Interference check standards

These additional steps apply when performing an ADR for 2B within eDMS:

Data Validator (Gilbane or 3rd Party)

1. Manually review those elements of the Stage 2B not covered by the ADR using the applicable sections of the Stage 2B Validation Checklist, example presented in the Attachments. These items include:
    - Initial and continuing calibration standards
    - Initial and continuing calibration blanks

- Serial dilutions and post spikes, where applicable
- Reporting limit verification standard
- Instrument tune and performance checks
- Internal standards (if summaries are available)

2. Additional qualification of data may result from the manual review. Narration of any additional qualification should be presented in the appropriate checklist and case narrative, if applicable..
3. Edit/add qualifiers as necessary in the database by selecting “Tools>Data - Sample Qualification” in the Gilbane Project Portal.
4. To add QC Outliers to the ADR Report, use either the “Apply Contamination Qualifiers” or “Apply Qualifiers with Outlier” functions in the Data- Sample Qualification Tool, as appropriate.
5. Generate a Field Duplicate Report, if applicable, by choosing “Reports> Data Review Reports>Field Duplicate Report by SDG.” Fill in the desired title of the report, select the event from the pull-down menu, select the SDG from the next pull-down menu, and click “View Report. Check that the correct parent and duplicate sample are identified and that the correct limits are displayed in the RPD columns. If updates are necessary then:
    - Notify the Project Chemist of any changes that need to be made to project setup;
    - Select “Field Duplicate Reports by SDG (user criteria)” from the “Data Review Reports”; enter appropriate information and the RPD values for the inorganic or organic methods. Click “View Report” to verify the report. Export the report in desired format (i.e. pdf, by clicking down arrow next to “Select a format” and then clicking on “Export.”
6. When reports have been generated and review process is complete select <Finalize Qualifiers>.
7. For the final report combine the ADR and Field Duplicate Report into one pdf file.

   Note: Depending on the requirements of the project, the ADR pdf alone may suffice as the final deliverable. Check with the Project Chemist for the specific requirements of each project.

   Gilbane Project Chemist

8. Review the data validation report for consistency with project-specific requirements, validation guidelines (e.g., National Functional Guidelines, General DV Guidelines, etc.), and with this SOP. Work directly with the data validator to resolve any questions and any necessary changes. Once the data validation report is approved, the SDGs will be released for use by selecting <Approve SDG>.

4.4 STAGE 3 AND 4 VALIDATION

Stage 3 validation will evaluate and consider the raw data associated with items reviewed in Stages 2A and 2B, in addition to following:

- Internal standards and retention times

- Manual integration
- Method of standard additions, linear range determinations, instrument detection limits, (metals analyses only)
- Method detection limit studies
- Sequence logs
- Preparation logs
- Raw data suitable for recalculation of results

For a Stage 4 review, add the review of the following instrument outputs:

- Raw data of chromatograms and spectra suitable for qualitative assessment

The following additional steps apply when performing the ADR within eDMS:

Data Validator (Gilbane or 3rd Party)

1. Manually review the raw data for calibrations, internal standards and retention times, tunes, serial dilutions, post-spikes, interference check samples, and MDLs, and perform raw data recalculations, and, if specified, review raw chromatograms and spectra using the Stage 3 and 4 Validation Checklists and Worksheets example presented in the Attachments.
2. Edit and review qualifiers as necessary in the database by following the instructions in Section 4.3 steps 3 and 4.
3. When reports have been generated and review process is complete, select <Finalize Qualifiers> from main screen.
4. For the final report, combine the ADR and Field Duplicate Report into one pdf file.

Gilbane Project Chemist

5. Review the data validation report for consistency with project-specific requirements, validation guidelines (e.g., National Functional Guidelines, General DV Guidelines, etc.), and with this SOP. Work directly with the data validator to resolve any questions and any necessary changes. Once the data validation report is approved, the SDGs will be released for use by selecting <Approve SDG>.

5.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- ADR with checklists attached
- Field Duplicate Report (as applicable)

6.0 ATTACHMENTS

- Example eDMS checklists
- Example Manual Checklists
    - Stage 1 Verification Checklist
    - Stage 2 Validation Checklists
    - Stage 3 & 4 Validation Checklists and Worksheet

7.0 FORMS

None.

8.0 REFERENCES

U.S. Department of Defense (DoD), 2018. *General Data Validation Guidelines*. February.

U.S. Department of the Navy, Southwest Division (NAVFAC-SW), 2001. *Environmental Work Instruction #1, Data Validation Guidelines for Chemical Analysis of Environmental Samples*. 28 November.

U.S. Environmental Protection Agency (USEPA), 2009. EPA 540-R-8-005, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* January.

ATTACHMENTS

- Example eDMS checklists
- Example Manual Checklists
    - Stage 1 Verification Checklist
    - Stage 2 Validation Checklists
    - Stage 3 & 4 Validation Checklists and Worksheet

Example eDMS Checklists

Item No.	Review Questions	Yes/No/NA	Comment
SW6010C – Inductively Coupled Plasma-Atomic Emission Spectrometry			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Samples - Batching?		
11	Stage 2 Review: Samples - Lab qualifiers?		
12	Stage 2 Review: Calibration - ICAL?		
13	Stage 2 Review: Calibration - ICV?		
14	Stage 2 Review: Calibration - CCV?		
15	Stage 2 Review: Blank - Method blank?		
16	Stage 2 Review: Blank - Trip blank?		
17	Stage 2 Review: Blank - Equipment blank?		
18	Stage 2 Review: Precision/Accuracy - MS/MSD?		
19	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
20	Stage 2 Review: Quantitation - PQLs?		
21	Stage 2 Review: Quantitation - Dilution Factor?		
22	Stage 2 Review: Quantitation - Results (i.e. correct analytes)?		
23	Stage 2 Review: Field Duplicates - RPD within limits?		

SW8260B – Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Samples - Batching?		
11	Stage 2 Review: Samples - Surrogate recoveries?		
12	Stage 2 Review: Samples - Lab qualifiers?		
13	Stage 2 Review: Calibration - ICAL?		
14	Stage 2 Review: Calibration - ICV?		
15	Stage 2 Review: Calibration - CCV?		
16	Stage 2 Review: Blank - Method blank?		
17	Stage 2 Review: Blank - Trip blank?		
18	Stage 2 Review: Blank - Equipment blank?		
19	Stage 2 Review: Precision/Accuracy - MS/MSD?		
20	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
21	Stage 2 Review: Quantitation - PQLs?		
22	Stage 2 Review: Quantitation - Dilution Factor?		
23	Stage 2 Review: Quantitation - Results (i.e. correct analytes)?		
24	Stage 2 Review: Field Duplicates - RPD within limits?		

Example Manual Checklists

- Stage 1 Verification Checklist
- Stage 2 Validation Checklists
- Stage 3 & 4 Validation Checklists and Worksheet

Stage 1 Verification Checklist

Project Name:	Project No.:
Laboratory:	SDG #:
Reviewer:	Organization:

CATEGORY		COMMENTS
SAMPLE RECEIPT FORM		
☐	Cooler temperature within control limits	
☐	Samples received intact within holding time	
RECONCILIATION OF CHAIN-OF-CUSTODY TO SDG		
☐	Sample IDs correct	
☐	Requested analysis received	
☐	Sample time and date received correct	
☐	Chain of custody maintained (i.e. signatures and line-outs)	
REVIEW OF SDG		
Review case narrative		
☐	Check for analytical holding times	
Review laboratory package		
☐	Verify analyses requested on COC for each sample were completed	
☐	Verify analytical methods specified in QAPP were performed, else written variance on file.	
☐	Verify all the target compounds identified in the QAPP for each of the analyses were reported by the laboratory.	
☐	Verify requested reporting limits were obtained, and that results were appropriately reported and qualified.	
☐	Check type of package requested (ie Level III, Level IV) was received.	

Stage 2 Review Checklist: Organics

Project Name:
Laboratory:
Reviewer:

Project No.:
SDG #:
Organization:

Category	**Method__________**	**Notes**
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Batching		
Surrogate recoveries		
Lab qualifiers		
Calibration (Stage 2b only)		
ICAL		
ICV		
CCV		
Blank		
Method blank		
Trip blank		
Equipment blank		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Quantitation		
PQLs		
Dilution Factor		
Results (i.e. correct analytes)		
Field Duplicates		
RPD within limits		

Stage 2 Review Checklist: Metals

Project Name: Project No.:
Laboratory: SDG #:
Reviewer: Organization:

Category	**Method___________**	**Notes**
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies (DQFs)		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Batching		
Lab qualifiers		
Blank		
Method blank		
Equipment blank		
Calibration (Stage 2b only)		
ICAL		
ICV		
CCV		
LLCCV		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Quantitation		
PQLs		
Dilution Factor		
Results		
Field Duplicates		
RPD in criteria		

Stage 3 & 4 Review Checklist: Organics

Project Name:	Project No.:
Laboratory:	SDG #:
Reviewer:	Organization:

Category	**Method__________**	**Notes**
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Batching		
Surrogate recoveries		
Internal standard recoveries		
Lab qualifiers		
Blank		
Method blank		
Trip blank		
Equipment blank		
Calibration		
ICAL		
ICV		
CCV		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Instrument		
Tune		
Breakdown Standard		

Stage 3 & 4 Review Checklist: Organics

Project Name: Project No.:
Laboratory: SDG #:
Reviewer: Organization:

Quantitation		
PQLs		
Dilution Factor		
Results (RT, Ions, Rel. Itens.)		
Retention times		
Major ions present		
Relative intensities		
Column/Detector RPD		
Confirmation		
Result Recalculation		
Field Duplicates		
RPD within limits		
Review Chromatograms/Spectra (Stage 4 only)		

Stage 3-4 Organic Checklist 072711.doc

Stage 3 & 4 Review Checklist: Metals

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

Category	**Method___________**	**Notes**
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies (DQFs)		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Internal standard		
Batching		
Lab qualifiers		
Blank		
Method blank		
Calibration blank		
Equipment blank		
Calibration		
ICAL		
ICV		
CCV		
LLCCV		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Post digestion spike		
Serial dilution		
Reporting Limit Std.		
Instrument		
ICSA		
ICSAB		
Tune		

Stage 3 & 4 Review Checklist: Metals

Project Name:
Project No.:
Laboratory:
SDG #:
Reviewer:
Organization:

Quantitation		
PQLs		
Dilution Factor		
Results - Recalc		
Field Duplicates		
RPD in criteria		

Gilbane

Standard Operating Procedure

Review, Verification, and Validation of Radiological Data

PR-TC-04.01.02.00 v1.0a

Reviewed by: Kristen A. Carlyon
Kristen Carlyon Peyton, Senior Chemist
Date: 12 Oct 2016

Reviewed by: Evelyn D
Evelyn Dawson, Senior Chemist
Date: 12 Oct 2016

Approved by: Jeffrey Hess
Jeffrey Hess, PG, CEM, Chief Scientist
Date: 12 Oct 2016

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval[*]
1.0	Initial Issue	NA	12 Oct 2016	NA
1.0a	Reviewed, no update necessary	NA	21 Jun 2018	

[*] Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to describe the requirements and procedures for the review and validation of radiological data using primarily manual procedures. Use of the procedures outlined in this SOP for procedures other than by an experienced data reviewer should be done with great caution.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

ADR: automated data review; an automated validation of electronic data deliverables against project and contract requirements entered into Gilbane's database, eDMS.

ANSI: American National Standards Institute

Carrier: A known mass of a non-radioactive isotope of the analyte (or stable isotope of a chemically similar element) used in analyses to determine chemical yield.

CDQMP: Chemical Data Quality Management Plan

Chemical Yield: A measure for losses that might have occurred during sample processing, separation, and quantification, as measured using a tracer or carrier. Chemical yield is expressed as the percent recovery.

COC: chain-of-custody

CSU: combined standard uncertainty. Standard uncertainty of an output estimate calculated by combining the standard uncertainties (one-sigma uncertainties) of the input estimates. Expanded uncertainty is the combined standard uncertainty multiplied by a "coverage factor" (e.g., 2 or 3) to obtain the two-sigma [95% probability] or three-sigma [99% probability] expanded uncertainty.

critical value (L_c): The minimum measured value (e.g., of the instrument signal or the radionuclide concentration) required to give a specified probability that a positive (non-zero) amount of radioactivity is present in the material being measured. Also known as the critical level, decision level (DL), and decision level concentration (DCL).

DAR: Data Assessment Report

DER: duplicate error ratio. A measure of the reproducibility of results calculated using the primary and duplicate sample results and combined standard uncertainties. Also known as relative error ratio (RER)

DL: decision level (see critical value)

DPM: disintegrations per minute

DQA: data quality assessment

DQAR: Data Quality Assessment Report

DQO: data quality objective

% D: percent difference (also termed percent drift)

DV: data validation; the analyte- and sample-specific process that determines the analytical quality of a specific set of data.

EDD: electronic data deliverable; an electronic file containing, in a specific electronic format, laboratory data; an EDD is produced for each sample delivery group, and is used for uploading data to the eDMS.

eDMS: environmental data management system.

ID: identification

MARLAP: Multi-Agency Radiological Laboratory Analytical Protocols Manual

MARSAME: Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual

MARSSIM: Multi-Agency Radiation Survey and Site Investigation Manual

MB: method blank

MDA: minimum detectable amount. Also known as the minimum detectable activity. The minimum amount or concentration of a radionuclide required within a given confidence that the measurement result would be above the DL (detected). This is typically based on a confidence level of 95%. Correspondingly, the probability of a Type II error (probability of erroneously not concluding a radionuclide is detected in a sample that has the MDA quantity or concentration) is typically set at 0.05. Thus the alpha (Type I) and beta (Type II) probabilities are both typically set at 0.05.

MDC: minimum detectable concentration (see MDA). There are two types of MDC:
(1) the "a priori" MDC calculated using nominal or typical analytical parameter values, typically used to evaluate the relative detection capabilities of specific analytical methods; and
(2) the "a posteriori" sample-specific MDC (ssMDC) calculated for a specific sample and using the sample-specific Lc (ssLc) and parameter values for the individual sample.

MS/MSD: matrix spike/matrix spike duplicate

MQO: measurement quality objective

QA: quality assurance

QC: quality control

QAPP: Quality Assurance Project Plan

QRT: qualified results table

RDL: required detection limit. Also known as the required minimum detectable concentration (RMDC).

RPD: relative percent difference

RSD: relative standard deviation

SDG: sample delivery group; a group of samples that is reported together under one laboratory identification number.

SAP: Sampling and Analysis Plan

SOP: standard operating procedure

TPU: total propagated uncertainty (TPU). See CSU (MARLAP, 2004).

Tracer: A known amount of a radioactive isotope chemically similar to the analyte used in analyses to determine chemical yield.

3.0 BACKGROUND

Historically there have been few formalized procedures for the review and validation of radiological data. This SOP attempts to develop specific procedures that are consistent with the available standards in order to provide for more uniform verification and validation of radiological data by Gilbane personnel and 3rd-party validation firms.

In 2012, the American Nuclear Society (ANS), working with the American National Standards Institute (ANSI), published *Verification And Validation Of Radiological Data For Use In Waste Management And Environmental Remediation* (ANSI/ANS–41.5–2012). This standard complements recommended practices in Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) (NUREG-1576, 2004) for planning radiological testing programs and for the laboratory analyses of radiological samples, and is adopted by Gilbane as the standard for data verification and validation of radiological data.

3.1 GENERAL REQUIREMENTS

3.1.1 Evaluation Criteria

As outlined in ANSI/ANS-41.5, the following items may be evaluated during the verification and validation of laboratory-generated radiological data:

- Sample Specific Parameters
    - Sample Preservation
    - Holding Time
    - Sample-specific Chemical Yield
    - Required Detection Limit (RDL)
    - Nuclide Identification
    - Quantification and Uncertainty
    - Detectability
    - Sample Aliquot Representativeness
- Batch Control Parameters
    - Laboratory Control Sample (LCS) Analysis
    - Matrix Spike (MS) Analysis
    - Duplicate and Matrix Spike Duplicate (MSD) Analysis
    - Batch Method Blank Analysis
- Instrument Parameters
    - Counting Efficiency Calibration
    - Energy Calibration
    - Background Determination

Additional evaluation steps are recommended as part of the laboratory selection and qualification process, and may be included in a laboratory desktop audit performed prior to or during preparation of the project-specific planning documents. See ANS/ANSI-41.5-2012 Sections 3.1 through 3.4.

3.1.2 Qualifying Radiological Data

The verification and validation process for radiological data involves a series of evaluations as outlined in Section 3.1.1, and culminates in a judgment of the quality and reliability of data, both individually and for an entire batch of data. Based on this judgment, appropriate qualifiers are assigned.

Radiological data should not be rejected without adequate cause, generally requiring a pattern of problems with a specific piece of data or batch of data to be rejected. As MARLAP indicates, “rejecting a result is an unconditional statement that it is not useable for the intended purpose. A result should only be rejected when the risks of using it are significant relative to the benefits of using whatever information it carries.” MARLAP provides some general guidance to consider when thinking about rejecting data:

1. Insufficient or only incorrect data are available to make fundamental decisions about data quality. For example, if correctly computed uncertainty estimates are not available, it is not possible to do most of the suggested tests. If the intended use depends on a consistent, high level of validation, it may be proper to reject such data. The missing data should be fundamental. For example, missing certificates for standards are unlikely to be fundamental if laboratory performance on spiked samples is acceptable. In contrast, if no spiked sample data is available, it may be impossible to determine if a method gives even roughly correct results, and rejection may be appropriate.
2. Available data indicate that the assumptions underlying the method are not true. For example, QC samples may demonstrate that the laboratory’s processes are out of control. Method performance data may indicate that the method simply does not work for particular samples. These problems should be so severe that is not possible to make quantitative estimates of their effects.
3. A result is very unusually uncertain. It is difficult to say what degree of uncertainty makes a result unusable. Whenever possible, uncertain data should be rejected based on multiple problems with one result, patterns in related data, and the validator’s judgment, not the outcome of a single test. This requires radiochemistry expertise and knowledge of the intended use.

3.2 REGULATORY BASIS

The requirements outlined in Section 3.1 were evaluated against guidelines and procedures outlines in the 2009 *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* by the U.S. Environmental Protection Agency (EPA) (EPA, 2009). This guidance document establishes specific terminology for data review and validation efforts. This terminology is adopted here to facilitate a clear understanding by both the reviewer and the ultimate user of the data regarding the specific level of review and validation to which the data was subjected. This terminology is outlined below.

Table 1. Description of "Stages" Terminology

Stage	Validation Description	Label Codes
–	Not validated	NV
1	Completeness	S1VE, S1VM
2A	Completeness and sample-related QC	S2AVE, S2AVM, S2AVEM
2B	Completeness and both sample-related and instrument-related QC	S2BVE, S2BVM, S2BVEM
3	Completeness, both sample-related and instrument-related QC, and recalculation checks	S3VE, S3VM, S3VEM
4	Completeness, both sample-related and instrument-related QC, recalculation checks and review actual instrument outputs	S4VE, S4VM, S4VEM

The possible label codes are based on a combination of what "Stage" of review and/or validation was performed, and whether the review and/or validation was performed manually (M), electronically (E), or both (EM).

3.3 SPECIFIC CLIENT REQUIREMENTS

Based on a review of various client requirements (e.g. Department of Defense data item descriptions, NAVFAC-SW Environmental Work Instruction #1, *Chemical Data Validation* (NAVFAC-SW, 2001), EM 200-1-10, etc.) and their governing CDQMPs, the following table outlines the general guidelines for the review and/or validation of chemical data for various clients:

Table 2. Cross-Walk of Validation Requirements

Client	Target Validation Level	Equivalent Stage
Department of Defense		
Air Force/AFCEC	Level III	2A
	Expanded Level III	2B
	Level IV	3
Army/USACE	Level III	2A
	Expanded Level III	2B
	Level IV	3
Navy	Level III	2B (3rd party)
	Level IV	3 (3rd party)
Other Federal Agencies		
EPA	Tier 1A	1
	Tier 1B	2A or 2B
	Tier 2	4 (on subset of results)
	Tier 3	4

There may be specific contracts that require components of SEDD 2B as part of their Level III validation specifications; **ALWAYS** check the master contract language when specifying DV services under this SOP. As contract-specific requirements are identified, please send them to j.hess@gilbaneco.com so they may be incorporated into this SOP in a future update.

4.0 PROCEDURES

The specific protocols used are outlined below for the review and validation of analytical data consistent with our CDQMP and the EPA "Stage" approach.

4.1 STAGE 1 VERIFICATION

Stage 1 verification, commonly referred to as a completeness check (or level II verification), of the laboratory analytical data package consists of verification of compliance and sample receipt conditions. The following items are considered and evaluated during Stage 1 verification of the sample delivery group (SDG):

- Laboratory report signed by official laboratory representative
- Chain-of-custody documentation including laboratory receipt information
- Laboratory case narrative and summary report
- Requested samples analyzed
- Requested analytes reported
- Results include:
  - requested analyte results and associated uncertainty (and type of uncertainty)
  - laboratory data qualifiers and definitions
  - reporting limits

  - sample-specific critical value and sample-specific minimum detectable value, activity or concentration for results at or below the critical value
  - chemical yield (if applicable to method), reference date and time
  - units (both for results and associated uncertainty)
  - sampling dates

At this time, Stage 1 is performed manually, until such time as Gilbane's environmental data management system (eDMS) supports electronic review of radiological data.

4.1.1 Manual Stage 1

Specific procedures for manual Stage 1 verification are provided below:

1. Verify the laboratory report clearly identifies the laboratory receiving the samples and performing the analyses and that the laboratory report is signed by an official laboratory representative.
2. Review chain-of-custodies for proper custody, and cooler receipts and sample login files for potential issues that may affect the usability of the samples (presence of custody seals, etc.) or validity of the reported results (receiving temperatures, sample condition, etc.).
3. Review laboratory case narrative for anomalies and QC issues.
4. Verify the analytical methods specified in the project plan were performed, and if substitutions were made, verify written instructions were received from the Gilbane Project Chemist specifying/allowing the substitution.
5. Verify all the target compounds identified in the project plan for each of the analyses were reported by the laboratory.
6. Verify all the analyses for each of the samples listed on the chain-of-custodies were completed. Verify the requested reporting limits were obtained.
7. For each analysis, verify the following information is provided:
   - the dates when the samples were collected and when analyses were performed
   - the requested analyte results and associated uncertainty (and type of uncertainty)
   - laboratory data qualifiers and definitions
   - sample-specific critical value and sample-specific minimum detectable value, activity or concentration for results at or below the critical value
   - chemical yield (if applicable to method)
   - units (both for results and associated uncertainty)
8. Document review with Stage 1 Verification Checklist, included in Attachment A. Upload completed checklist to eDMS.

4.1.2 Electronic Stage 1 Using eDMS

Currently performing Stage 1 electronically is not supported in eDMS. However, if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized.

4.2 STAGE 2A VALIDATION

Stage 2A validation (which can include some or all of the components of level III validation, depending on client) will evaluate and consider the items listed above for completeness, in addition to the following:

- Sample Specific Parameters
    - Sample Preservation
    - Holding Time
    - Sample Specific Chemical Yield
    - Required Detection Limit (RDL)
    - Nuclide Identification
    - Quantification and Uncertainty
    - Detectability
    - Sample Aliquot Representativeness
- Batch Control Parameters
    - Laboratory Control Sample (LCS) Analysis
    - Matrix Spike Sample (MSS) Analysis
    - Duplicate and Matrix Spike Duplicate (MSD) Sample Analysis
    - Batch Method Blank Analysis

Stage 2A is performed manually, until such time as Gilbane's eDMS supports electronic review of radiological data. Document review with Stage 2A Verification Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized. Data qualifiers generated during the validation process are entered into eDMS, as eDMS is the definitive source of data for generation of tables and figures for reporting purposes. Attachment B provides guidance for entering in qualifiers into eDMS.

4.2.1 Sample Specific Parameters

Perform the following activities, using either the provided checklists or equivalent.

1. Verify required **sample preservation** was performed per the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code or reject ("R") based on professional judgment those results for samples improperly preserved

2. Verify analyses were performed within the required **holding times** as stipulated in the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results that exceeded holding times.

3. Verify **sample-specific chemical yield** was performed consistent with the approved project plan or method requirements (or laboratory SOP) if not specified. Qualify as estimated ("J/UJ") with the appropriate reason code those results with sample-specific chemical yield varied from acceptable method requirements.

4. Verify the MDA meets the **required detection limit** (RDL) for all analytes of interest as stipulated in the approved project plans. Qualify as estimated ("J/UJ") with the appropriate reason code those results for samples with the MDA not meeting the RDL.
5. Evaluate **detectability** by verifying results for all detected analytes of interest are greater than or equal to ("≥") their Lc, and that those analytes of interest with results below their Lc are appropriately qualified as non-detect ("U").

4.2.2 Batch Control Parameters

Verify QC parameters are within requirements stipulated in the approved project plans (or laboratory SOP if not specified in the project plans).

1. Verify the number of LCS analyses performed and the limits stipulated in the approved SAP (or laboratory SOP) were met.
    - Compare LCS analytical results to the bias and precision measurement quality objectives (MQOs) identified in the approved project plans. In general, individual LCS results should be compared with the least restrictive of the bias or precision MQO or overall measurement uncertainty MQO. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with LCS results outside specified control limits.
2. Verify the number of MS analyses performed and the limits stipulated in the approved project plans (or laboratory SOP if not specified in the project plans) were met.
    - Compare MS analytical results to the bias and precision measurement quality objectives (MQOs) identified in the approved project plans. In general, individual MS results should be compared with the least restrictive of the bias or precision MQO or overall measurement uncertainty MQO. Qualify as estimated ("J") with the appropriate reason code those results associated with a batch with MS results outside specified control limits.
3. Verify the number of duplicate and MSD analyses performed stipulated in the approved project plans (or laboratory SOP if not specified in the project plans) were met.
    - Compare relative percent difference (RPD) results for both duplicate and MSD analyses with the precision MQO stipulated in the approved project plans. If RPD is higher than stipulated in the approved project plans, evaluate duplicate results considering measurement uncertainty using a duplicate error ratio (DER) calculation against appropriate precision requirement. Use a DER limit of 2 (equivalent to 95% [2-sigma] confidence) if not otherwise stipulated in the approved SAP. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with RSD results greater than specified in the approved project plans.
4. Verify the number of Method blanks (MBs) performed stipulated in the approved project plans (or laboratory SOP if not specified in the project plans) was met. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with RSD results greater than specified in the approved project plans.

4.3 STAGE 2B VALIDATION

Most of Stage 2B is performed manually, until such time as Gilbane's eDMS supports electronic review of radiological data and associated QC. Document review with Stage 2B Verification Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized. Data qualifiers generated during the validation process are entered into eDMS, as eDMS is the definitive source of data for generation of tables and figures for reporting purposes. Attachment B provides guidance for entering in qualifiers into eDMS.

Stage 2B validation (which includes all of the components of level III validation, regardless of client) will evaluate and consider the items listed above for completeness and Stage 2A validation, in addition to the following:

- Instrument Parameters
  - Counting Efficiency Calibration
  - Energy Calibration
  - Background Determination

4.3.1 Counting Efficiency Calibration

Use the appropriate checklist provided in this SOP or checklist in Data Review/Checklist module in eDMS, or equivalent checklist (for 3rd party data validation) for verification of the following:

1. Verify instrument's efficiency calibrations are present and were performed within frequency required in approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with less than required efficiency calibration.
2. Verify daily efficiency performance checks were performed. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing efficiency performance checks.
3. Verify check source counting statistics are present. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing check source counting statistics.
4. Verify efficiency performance checks were performed daily prior to counting samples. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing performance checks.

4.3.2 Energy Calibration

Use the appropriate checklist provided in this SOP, or equivalent checklist (for 3rd party data validation) for verification of the following:

1. Verify instrument's energy calibrations performed within frequency required in approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing energy calibration.

2. Verify energy performance checks performed daily prior to counting samples. Qualify as estimated (“J”) with the appropriate reason code those results associated with a batch with missing energy performance checks.

4.3.3 Background Determination

Verify the following:

1. Verify background performance checks were performed at the required frequency identified in the approved project plans (or laboratory SOW if not specified in the project plans). Qualify as estimated (“J/UJ”) with the appropriate reason code those results associated with a batch with missing background performance checks.

4.4 STAGE 3 VALIDATION

Stage 3 validation builds upon the validation conducted in Stages 2A and 2B, and involves the verification by calculation of instrument and sample results from the laboratory instrument responses, and comparison of recalculated results to laboratory reported results. Document review with Stage 3 Validation Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the validation checklist present in eDMS can be utilized.

4.4.1 Sample Specific Parameters

1. Verify chemical yield is within required limits. If greater than 110%, qualify the sample result as estimated (J) or unusable (R) based on the amount of bias allowed by the MQOs.
2. For sample results at or below the Lc (non-detect), verify by calculation each analyte’s detectability. Estimate the Lc by multiplying the CSU by 1.65 (corresponding to 95% [2-sigma] probability). Qualify as estimated (“UJ”) with the appropriate reason code those results with Lc < 1.65 times CSU. When appropriate background data (detector or blanks) is available, a more comprehensive evaluation of the Lc should be performed for those results qualified by the above calculation (see Section 4.7.2, ANSI/ANS-41.5-2012).
3. For sample results at or below the Lc (non-detect), determine whether the RDL has been met. Verify by calculation the CSU times 3.5 (corresponding to a 95% [2-sigma] probability) is less than or equal to (“≤”) the RDL, or as otherwise stipulated in the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated (“UJ”) with the appropriate reason code those results when 3.5 times CSU > RDL or as otherwise stipulated.
4. For sample results that are negative, evaluate results for excessive negative bias. Verify by calculation the absolute value of the negative result is less than (“<”) 2 times the CSU, or as otherwise stipulated in the approved project plans (or laboratory SOP if not specified in the project plans). If absolute value of result is equal to or greater than 2 times CSU, qualify those results as estimated (“UJ”) with the appropriate reason code.

4.4.2 Batch Control Parameters

1. For a subset of the LCS analyses (10% or as otherwise stipulated in the approved SAP), verify recoveries are calculated correctly (see Section 5.1.1, ANSI/ANS-41.5-2013):

$$\%D = \frac{\left|LCS_M - LCS_E\right|}{LCS_E} \times 100$$

where:

LCS_M = measured concentration of each analyte in the LCS
LCS_E = expected concentration of each analyte in the LCS

If the LCS is calculated incorrectly, contact the laboratory for corrected results.

2. For a subset of the MS analyses (10% or as otherwise stipulated in the approved SAP), verify recoveries are calculated correctly (see Section 5.2.1, ANSI/ANS-41.5-2013):

$$\%D = \frac{\left|SSR - SR - SA\right|}{SA} \times 100$$

where:

SSR = spiked sample result
SR = sample result
SA = amount of spike added.

If the MS is calculated incorrectly, contact the laboratory for corrected results.

3. For a subset of the duplicate and MSD results (10% or as otherwise stipulated in the approved SAP), verify calculations for RPD and DER (see Section 5.3.1, ANSI/ANS-41.5-2013).

$$RPD = \frac{\left|S - D\right|}{\left[\left(S + D\right)/2\right]} \times 100$$

and

$$DER = \frac{\left|S - D\right|}{\sqrt{(CSU_S)^2 + (CSU_D)^2}}$$

where:

RPD = relative present difference
DER = duplicate error ratio
S = first sample value
D = second sample value
CSU_S = first sample CSU
CSU_D = second sample CSU

If the RPD or DER is calculated incorrectly, contact the laboratory for corrected results.

4. For a subset of the MB analyses (10% or as otherwise stipulated in the approved project plans), verify by calculation the MB is less than 1.65 x CSU and/or within control limits.

Qualify as estimated (“J/UJ”) with the appropriate reason code those results with MB exceeding required limits.

4.4.3 Instrument Parameters

1. Evaluate whether the daily performance check results are within established tolerances [identified in the approved project plans (or laboratory SOP if not specified in the project plans)]. Qualify as estimated (“J/UJ”) with the appropriate reason code those results associated with a batch with efficiency checks are outside accepted tolerances.
2. Evaluate whether the reported counting uncertainty was less than or equal to 1/5 of the MQO [identified in the approved project plans]. Qualify as estimated (“J/UJ”) with the appropriate reason code those results associated with a batch with counting uncertainty outside acceptable criteria.
3. Verify the daily peak centroid or calculated energy for each peak in the performance check source or tolerance charts are within established tolerances identified in the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated (“J/UJ”) with the appropriate reason code those results associated with a batch with energy calibration outside acceptable criteria.

4.4.4 Background Determination

Use the appropriate checklist provided in this SOP or in eDMS, or equivalent checklist (for 3rd party data validation) for verification of the following:

- Verify instrument’s background was determined each time there was significant operational change and performed within frequency required in SAP (or laboratory SOW).
- Verify background performance check count-rate results are within established tolerances [identified in the SAP (or laboratory SOW)].
- Verify background performance check counting time was equal to or longer than sample counting time.

Qualify as estimated (“J”) with the appropriate reason code those results associated with a batch with one or more of the above issues related to instrument background determination.

4.4.5 Quantitation and CSU

1. Verify raw data and calculations used in developing the results, MDA, and CSU were included in the results.
2. Verify procedures and equations used are consistent with method requirements (or laboratory SOP).
3. Verify dates and time intervals used in calculations are correct.
4. Review by calculation a subset of the quantitation calculations (10% of target analytes or as otherwise stipulated in the approved project plans).

4.5 STAGE 4 VALIDATION

Stage 4 validation builds upon the validation conducted in Stage 3. Stage 4 validation of the laboratory analytical data package consists of the Stage 3 validation plus the evaluation of instrument outputs. Document review with Stage 4 Validation Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized.

4.5.1 Nuclide Identification

1. Verify the raw spectral data and/or peak search and identification reports were included in the results.
2. Review raw spectral data for potential errors, including but not limited to: misidentification of peaks, nonlinear energy response or skewed spectral peak positions, and unresolved overlapping peak interference.
3. Review the resolution and centroid position of peak associated with radio tracer (alpha spectroscopy).
4. Verify by calculation detector resolution and energy calibration parameters of spectrometry systems and peak centroid energy.

5.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- Narrative summary
- QRT
- DAR or DQAR (as required)
- Validation and Verification Checklists

6.0 ATTACHMENTS

A. Verification and Validation Checklists and Worksheets
B. Entering Qualifiers into eDMS

7.0 FORMS

None.

8.0 REFERENCES

American Nuclear Society (ANS), 2012. *Verification and Validation of Radiological Data for Use in Waste Management and Environmental Remediation*, ANS/ANSI-41.5-2012, Approved by the American National Standards Institute, Inc. (ANSI). February.

Innovative Technical Solutions, Inc. (ITSI), 2010. *Chemical Data Quality Management Plan (CDQMP)*, March.

U.S. Department of the Navy, Southwest Divsion (NAVFAC-SW), 2001. *Environmental Work Instruction #1, Data Validation Guidelines for Chemical Analysis of Environmental Samples*. 28 November.

U.S. Army Corps of Engineers (USACE), 2005. EM 200-1-10, *Guidance for Evaluating Performance-Based Chemical Data*. 30 June.

U.S. Environmental Protection Agency (USEPA), 2009. EPA 540-R-8-005, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* January.

Attachments

Attachment A

Verification and Validation Checklists and Worksheets

Item No.	Review Questions	Yes/No/NA	Comment
E901.1 – Gamma Emitting Radionuclides in Drinking Water			
Stage 2B VEM			
1	Sampling/Login: COC - Custody Trail?		
2	Sampling/Login: COC - Temperature/Condition?		
3	Sampling/Login: COC - Receipt anomalies?		
4	Sampling/Login: COC - Sample/Methods checked?		
6	Sampling/Login: Samples - Collection date?		
7	ICAL: Calibration - Verification source when calculated with the new efficiency must be +- 10% of known value?		
8	ICAL: Full Width at the Half Maximum (FWHM) < +- 2 sigma or FWHM <= 3.0 keV at 1332 KeV or reference manufactures specifications?		
9	ICAL: Peak Shape - FWHM difference < 0.5 keV for selected peaks – one low end (ie: 241Am), one middle (ie: 60Co) and one high (ie: 137Cs)		
10	ICAL: Background - Monthly - Long count and Daily - Short count +- 3 sigma of measured population.		
11	ICAL: Background counting time was equal to or longer than sample counting time?		
12	CCV: Daily Verification - Verification +- 3 sigma?		
13	Analysis: Samples - Extraction date?		
14	Analysis: Samples - Analysis date?		
15	Analysis: Samples - Holding time?		
16	Analysis: Samples - Batching?		
17	Analysis: Samples - Lab qualifiers?		
18	Analysis: Blank - Method blank <MDA?		
19	Analysis: Blank - Equipment blank <MDA?		
20	Analysis: Precision/Accuracy - MS/MSD?		
21	Analysis: Precision/Accuracy - LCS/LCSD (75-125%)?		
22	Analysis: Precision/Accuracy - Laboratory Duplicates (Act. < 5*MDC then RPD < 100%, Act. > 5*MDC then < 20%RPD)?		
23	Analysis: Quantitation - PQLs (Lab RL < Project RL)?		
24	Analysis: Quantitation - MDA < required detection limit (RDL). Formula 3.5 * CSU <= RDL? If this is not true then: If the result is less than Lc and the result plus 1.65 times its uncertainty is greater than the action level,it shall be qualified as (J/UJ).		
25	Analysis: Quantitation - Sample Uncertainty (Negative results less than 2X TPU flagged "U", >2X TPU flagged "UJ"?		
26	Analysis: Quantitation - Dilution Factor?		
27	Analysis: Field Duplicates - RPD in criteria?		
E905.0 – Radioactive Strontium			
Stage 2B VEM			
1	Sampling/Login: COC - Custody Trail?		
2	Sampling/Login: COC - Temperature/Condition?		
3	Sampling/Login: COC - Receipt anomalies?		
4	Sampling/Login: COC - Sample/Methods checked?		
5	Sampling/Login: Case Narratives - Anomalies (DQFs)?		
6	Sampling/Login: Samples - Collection date?		
7	ICAL: Calibration - Verfication source when calculated with the new efficiency		

	must be +- 25% of known value?		
8	ICAL: Background frequency performed at required interval?		
9	ICAL: Daily (short count) Weekly (long count) Verification - Background Check +- 3 sigma		
10	ICAL: Background updated upon instrument/operational change?		
11	ICAL: Background counting time was equal to or longer than sample counting time?		
12	CCV: Daily Verification - Efficiency Check +- 3 sigma		
13	Analysis: Samples - Extraction date?		
14	Analysis: Samples - Analysis date?		
15	Analysis: Samples - Holding time?		
16	Analysis: Samples - Batching?		
17	Analysis: Samples - Lab qualifiers?		
18	Analysis: Blank - Method blank <MDA?		
19	Analysis: Blank - Equipment blank <MDA?		
20	Analysis: Precision/Accuracy - MS/MSD?		
21	Analysis: Precision/Accuracy - LCS/LCSD (75-125%)?		
22	Analysis: Precision/Accuracy - Tracers/Carriers (25-125%)?		
23	Analysis: Precision/Accuracy - Laboratory Duplicates (Act. < 5*MDC then RPD < 100%, Act. > 5*MDC then < 20%RPD or RER <= 3)?		
24	Analysis: Quantitation - PQLs (Lab RL < Project RL)?		
26	Analysis: Quantitation - Sample Uncertainty (Negative results less than 2X TPU flagged "U", >2X TPU flagged "UJ"?		
27	Analysis: Quantitation - Dilution Factor?		
28	Analysis: Field Duplicates - RPD in criteria?		
HASL 300 – Alpha, Beta or Gamma Radioassay			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Calibration - ICAL?		
11	Stage 2 Review: Calibration - ICV?		
12	Stage 2 Review: Calibration - CCV?		
13	Stage 2 Review: Blank - Method blank?		
14	Stage 2 Review: Blank - Trip blank?		
15	Stage 2 Review: Blank - Equipment blank?		
16	Stage 2 Review: Tracer/Carrier recoveries within limits?		
17	Stage 2 Review: Precision/Accuracy - MS/MSD?		
18	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
19	Stage 2 Review: Precision - Duplicate RPD Acceptable?		
20	Stage 2 Review: Reporting Limits Acceptable?		
21	Stage 2 Review: System Performance Acceptable?		
22	Stage 2 Review: Analysis: Quantitation - Sample Uncertainty (Negative results less than 2X TPU flagged "U", >2X TPU flagged "UJ"?		
23	Stage 2 Review: Overall Assessment of data in SDG?		
E903 – Total Alpha-Emitting Radium Isotopes			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		

2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Calibration - ICAL?		
11	Stage 2 Review: Calibration - ICV?		
12	Stage 2 Review: Calibration - CCV?		
13	Stage 2 Review: Blank - Method blank?		
14	Stage 2 Review: Blank - Equipment blank?		
15	Stage 2 Review: Tracer/Carrier recoveries within limits?		
16	Stage 2 Review: Precision/Accuracy - MS/MSD?		
17	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
18	Stage 2 Review: Precision - Duplicate RPD Acceptable?		
19	Stage 2 Review: Reporting Limits Acceptable?		
20	Stage 2 Review: System Performance Acceptable?		
21	Stage 2 Review: Sample Uncertainty Review (Between 2 and 3 Sigma J/UJ over 3 Sigma R/R)?		
22	Stage 2 Review: Overall Assessment of data in SDG?		
E904 – Radium 228			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Calibration - ICAL?		
11	Stage 2 Review: Calibration - ICV?		
12	Stage 2 Review: Calibration - CCV?		
13	Stage 2 Review: Blank - Method blank?		
14	Stage 2 Review: Blank - Equipment blank?		
15	Stage 2 Review: Tracer/Carrier recoveries within limits?		
16	Stage 2 Review: Precision/Accuracy - MS/MSD?		
17	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
18	Stage 2 Review: Precision - Duplicate RPD Acceptable?		
19	Stage 2 Review: Reporting Limits Acceptable?		
20	Stage 2 Review: System Performance Acceptable?		
21	Stage 2 Review: Sample Uncertainty Review (Between 2 and 3 Sigma J/UJ over 3 Sigma R/R)?		
22	Stage 2 Review: Overall Assessment of data in SDG?		

Gilbane

Work Instruction

Calculating Toxic Equivalence (TEQ) for Dioxins, Furans and Dioxin-Like Compounds

Reviewed by: Kristen A Carlyon Date: 27 Oct 2011
Kristen Carlyon, Senior Chemist

Approved by: Jeffrey Hess Date: 27 Oct 2011
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Review/ Revision Date	Approval*
1.0	Initial release		27 Oct 2011	NA
1.1	Add references to updated EPA National Functional Guidelines for dioxins and furans	Pages 2 and 4	27 June 2012	JHess
1.2	Updated new company information. No other changes made.	All	04 Mar 2015	JHess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the work instruction require review and approval by the signatures to the work instruction.

1.0 PURPOSE AND SCOPE

The purpose of this work instruction is to describe the standard methodology for calculating the 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalency (TEQ). This methodology uses toxicity equivalence factors (TEFs) established for polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and dioxin-like compounds (DLCs) by the World Health Organization (WHO) in 2005, and is consistent with U.S. Environmental Protection Agency (EPA) recommended practice.

There are several alternative methodologies for calculating the TEQ, some of which will be briefly discussed in this document. However, care should be taken in calculating TEQ using any of these alternative methodologies, and use of alternative methodologies should be clearly documented, including the rationale for use of the alternative methodology.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

DLC: dioxin-like compound
EMPC: estimated maximum possible concentration
EDL: estimated detection limit
EQL: estimated quantitation limit
TCDD: 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF: toxicity equivalence factor
TEQ: toxic equivalency
PCDD: polychlorinated dibenzo-p-dioxin
PCDF: polychlorinated dibenzofuran
USEPA: U.S. Environmental Protection Agency
WHO: World Health Organization

3.0 BASIS OF CALCULATION

TEFs are published for seven 2,3,7,8-substituted isomers of PCDD's and ten 2,3,7,8-substituted isomers of PCDF's, and 12 polychlorinated biphenyls (PCBs) considered DLCs by WHO (2005) and recommended for use in human health risk assessment by EPA in *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8- Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* (2010). For PCDDs/PCDFs, the TEF's are used to convert concentrations of the specific isomers to "equivalent" concentrations of TCDD, the sum of which represents the samples TEQ.

As noted in EPA Method 8280B (revision 2) for *PCDDs and PCDFs by High-Resolution Gas Chromatography/ Low-Resolution Mass Spectrometry (HRGC/LRMS)*, when calculating TEQ for a sample:

> …include only those 2,3,7,8-substituted isomers that were detected in the sample and met all of the qualitative identification criteria in Section 11.14.5. Do not include EMPC or EQL values in the TEQ calculation.

Section 11.14.5 of the method identifies a series of identification criteria that must be met for a peak to be "unambiguously identified" as a PCDD or PCDF. The criteria include: 1) retention times; 2) peak identification; 3) signal to noise ratio; 4) ion abundance ratios; and 5) other steps to minimize interference if the previous 4 steps are not met.

Further, as indicated in the *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (EPA, 2005):

> When calculating the 2,3,7,8-TCDD TEF-adjusted concentration of a sample, the laboratory must include only those 2,3,7,8-substituted isomers that were detected in the sample and that met all of the qualitative identification criteria. The laboratory does not include Estimated Maximum Possible Concentration (EMPC) or Estimated Detection Limit (EDL) values in the TEF calculations.

The updated *National Functional Guidelines for CDDs and CDFs Data Review* (EPA, 2011) reaffirmed EPA's position on the above methodology, but added in the option of considering EMPCs or EDLs in the calculation of TEQ as surrogates for non-detect results, depending on regional policies. The methodology specified in this work instruction is consistent with the methodology specified for the analytical laboratories and as identified in XII (C)(1)(a) of the National Functional Guidelines (EPA, 2011).

The published TEFs as established by the WHO in 2005 are provided below. These are for mammals, there are separate TEFs for fish and birds, so make sure the correct TEFs are used when performing ecological risk assessments.

PCDDs

Compound	TEF
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003

PCDFs

Compound	TEF
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0003

Non-*ortho*-substituted PCBs

Compound	TEF
3,3',4,4'-TCB (77)	0.0001
3,4,4',5-TCB (81)	0.0003
3,3',4,4',5-PeCB (126)	0.1
3,3',4,4',5,5'-HxCB (169)	0.03

Mono-*ortho*-substituted PCBs

Compound	TEF
2,3,3',4,4'-PeCB (105)	0.00003
2,3,4,4',5-PeCB (114)	0.00003
2,3',4,4',5-PeCB (118)	0.00003
2',3,4,4',5-PeCB (123)	0.00003
2,3,3',4,4',5-HXCB (156)	0.00003
2,3,3',4,4',5'-HxCB (157)	0.00003
2,3',4,4',5,5'-HxCB (167)	0.00003
2,3,3',4,4',5,5'-HpCB (189)	0.00003

4.0 CALCULATION METHOD

The TEQ is calculated by multiplying the reported value of the 2,3,7,8-substituted isomer by the corresponding TEF shown above, and then summing the resulting values. As noted above, the TEF should only be calculated for isomers that were detected and met all of the identification criteria identified in the analytical method; EMPC or EDL values should not be included in the calculation of TEQ.

An example calculation is shown below, with the shaded portion typical of the information the laboratory will provide:

Isomer	Result	EMPC	Qualifier	DL	LOQ	TEF	Isomer-specific TEQ
2,3,7,8-TCDD	ND		U	0.176	0.539	1	–
1,2,3,7,8-PeCDD	ND		U	0.367	2.69	1	–
1,2,3,4,7,8-HxCDD	0.500		J	0.420	2.69	0.1	0.05
1,2,3,6,7,8-HxCDD	3.76			0.445	2.69	0.1	0.376
1,2,3,7,8,9-HxCDD	1.87		J	0.438	2.69	0.1	0.187
1,2,3,4,6,7,8-HpCDD	133			1.13	2.69	0.01	1.33
OCDD	734			1.83	5.39	0.0003	0.2202
2,3,7,8-TCDF		0.511	J	0.240	0.539	0.1	–
1,2,3,7,8-PeCDF	ND		U	0.205	2.69	0.03	–
2,3,4,7,8-PeCDF	ND		U	0.199	2.69	0.3	–
1,2,3,4,7,8-HxCDF		0.433	J	0.259	2.69	0.1	–
1,2,3,6,7,8-HxCDF	ND		U	0.243	2.69	0.1	–
1,2,3,7,8,9-HxCDF		0.435	J	0.260	2.69	0.1	–
2,3,4,6,7,8-HxCDF	ND		U	0.296	2.69	0.1	–
1,2,3,4,6,7,8-HpCDF	3.17			0.274	2.69	0.01	0.0317
1,2,3,4,7,8,9-HpCDF	ND		U	0.354	2.69	0.01	–
OCDF	4.01		J	1.00	5.39	0.0003	0.001203
						Total TEQ:	2.20

PCDD and PCDF results are typically reported in pg/g, equivalent to parts per trillion (ppt).

5.0 DISCUSSION

Inclusion of non-detect and estimated results in TEQ calculations varies by regulatory agency and ultimate use of the results. While the above methodology is consistent with:

- EPA National Functional Guidelines (EPA, 2005)(EPA, 2011)
- EPA Region II Data Validation SOP (EPA, 2006)
- EPA Method 8280B (EPA, 2007)
- Bay Area Clean Water Agencies (BACWA) Guidance (BACWA, 2010)

Other jurisdictions (including EPA Region 4 [EPA, 2008]) include both estimated and non-detect values, with the EDLs being used for non-detect values. Additionally, the State of Florida methodology for calculating TEQ (Florida Department of Environmental Protection [FDEP], 2005) uses older 1997 WHO TEF values and ½ the method detection limit for non-detect values (based on FDEP's excel-based *Dioxin Conversion Table* at http://www.dep.state.fl.us/waste/quick_topics/publications/wc/DioxinConversionTable.xls).

6.0 REFERENCES

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EPA, 2010. *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8- Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds*, EPA/100/R 10/005, December.

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Van den Berg, et al, 2006. *The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds*. Toxicological Sciences Volume 93, Issue 2, pp. 223-241, October.

ATTACHMENT B
DoD QSM Laboratory Limits

Attachment B. DoD QSM Laboratory Limits
Sampling and Analysis Plan
IR Site 12 Remedial Design/Remedial Action
Former Naval Station Treasure Island
San Francisco, California

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Dioxins and Furans (HRGC/HRMS)	8290A_DOD5	2,3,7,8-TCDD	1746-01-6	1.00	0.150	0.400	pg/g	70	128	20	70	128	20		
		2,3,7,8-TCDF	51207-31-9	1.00	0.110	0.400	pg/g	75	135	20	75	135	20		
		1,2,3,7,8-PeCDD	40321-76-4	5.00	0.300	0.750	pg/g	74	125	20	74	125	20		
		1,2,3,7,8-PeCDF	57117-41-6	5.00	0.270	0.750	pg/g	77	131	20	77	131	20		
		2,3,4,7,8-PeCDF	57117-31-4	5.00	0.290	0.750	pg/g	75	128	20	75	128	20		
		1,2,3,4,7,8-HxCDD	39227-28-6	5.00	0.710	2.00	pg/g	72	131	20	72	131	20		
		1,2,3,6,7,8-HxCDD	57653-85-7	5.00	0.580	2.00	pg/g	74	134	20	74	134	20		
		1,2,3,7,8,9-HxCDD	19408-74-3	5.00	0.580	2.00	pg/g	71	138	20	71	138	20		
		1,2,3,4,7,8-HxCDF	70648-26-9	5.00	0.300	0.750	pg/g	77	130	20	77	130	20		
		1,2,3,6,7,8-HxCDF	57117-44-9	5.00	0.380	1.00	pg/g	73	134	20	73	134	20		
		1,2,3,7,8,9-HxCDF	72918-21-9	5.00	0.430	1.00	pg/g	74	135	20	74	135	20		
		2,3,4,6,7,8-HxCDF	60851-34-5	5.00	0.300	0.750	pg/g	74	133	20	74	133	20		
		1,2,3,4,6,7,8-HpCDD	35822-46-9	5.00	0.460	1.00	pg/g	76	125	20	76	125	20		
		1,2,3,4,6,7,8-HpCDF	67562-39-4	5.00	0.380	1.00	pg/g	73	135	20	73	135	20		
		1,2,3,4,7,8,9-HpCDF	55673-89-7	5.00	0.650	2.00	pg/g	72	131	20	72	131	20		
		OCDD	3268-87-9	10.0	1.50	4.00	pg/g	73	135	20	73	135	20		
		OCDF	39001-02-0	10.0	1.20	4.00	pg/g	66	144	20	66	144	20		
		13C-2,3,7,8-TCDD	76523-40-5	200		100	pg/g								
		13C-2,3,7,8-TCDF	89059-46-1	200		100	pg/g								
		13C-1,2,3,7,8-PeCDD	109719-79-1	200		100	pg/g								
		13C-1,2,3,7,8-PeCDF	109719-77-9	200		100	pg/g								
		13C-1,2,3,6,7,8-HxCDD	109719-81-5	200		100	pg/g								
		13C-1,2,3,4,7,8-HxCDF	114423-98-2	200		100	pg/g								
		13C-1,2,3,4,6,7,8-HpCDD	109719-83-7	200		100	pg/g								
		13C-1,2,3,4,6,7,8-HpCDF	109719-84-8	200		100	pg/g								
		13C-OCDD	114423-97-1	400		200	pg/g								
Metals (ICP)	6010C_DOD5	Lead	7439-92-1	1.00	0.250	0.750	mg/Kg	81	112	20	81	112	20		
Metals (ICP)	6010C_DOD5	Chromium	7440-47-3	1.00	0.250	0.750	mg/Kg	85	113	20	85	113	20		
Percent Moisture	Moisture	Percent Moisture	STL00177	0.100		0.100	%								
		Percent Solids	STL00234	0.100		0.100	%								
Radium-226 & Other Gamma Emitters (GS)	GA_01_R_Ra	Actinium-227	14952-40-0				pCi/g								
		Actinium 228	14331-83-0				pCi/g								
		Americium-241	14596-10-2				pCi/g	87	116	40					
		Bismuth-212	14913-49-6				pCi/g								
		Bismuth-214	14733-03-0				pCi/g								
		Cesium-137	10045-97-3				pCi/g	87	120	40					

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Cobalt-60	10198-40-0				pCi/g	87	115	40					
		Lead-210	14255-04-0				pCi/g								
		Lead-212	15092-94-1				pCi/g								
		Lead-214	15067-28-4				pCi/g								
		Potassium-40	13966-00-2				pCi/g								
		Protactinium-231	14331-85-2				pCi/g								
		Radium-226	13982-63-3	1.00			pCi/g								
		Radium-228	15262-20-1				pCi/g								
		Thallium-208	14913-50-9				pCi/g								
		Thorium-232	7440-29-1				pCi/g								
		Th-234	15065-10-8				pCi/g								
		Uranium-235	15117-96-1				pCi/g								
		Uranium-238	7440-61-1				pCi/g								
		Thorium 228	14274-82-9				pCi/g								
Semivolatile Organic Compounds (GC/MS SIM)	8270D_SIM_DOD5	Acenaphthene	83-32-9	0.00500	0.000470	0.00100	mg/Kg	44	111	20	44	111	20		
		Anthracene	120-12-7	0.00500	0.000395	0.00100	mg/Kg	50	114	20	50	114	20		
		Benzo[a]anthracene	56-55-3	0.00500	0.000303	0.00100	mg/Kg	54	122	20	54	122	20		
		Benzo[a]pyrene	50-32-8	0.00500	0.000399	0.00100	mg/Kg	50	125	20	50	125	20		
		Benzo[b]fluoranthene	205-99-2	0.00500	0.000505	0.00200	mg/Kg	53	128	20	53	128	20		
		Benzo[g,h,i]perylene	191-24-2	0.00500	0.00100	0.00300	mg/Kg	49	127	20	49	127	20		
		Benzo[k]fluoranthene	207-08-9	0.00500	0.000760	0.00200	mg/Kg	56	123	20	56	123	20		
		Chrysene	218-01-9	0.00500	0.000347	0.00100	mg/Kg	57	118	20	57	118	20		
		Dibenz(a,h)anthracene	53-70-3	0.00500	0.00120	0.00300	mg/Kg	50	129	20	50	129	20		
		Fluoranthene	206-44-0	0.00500	0.000293	0.00100	mg/Kg	55	119	20	55	119	20		
		Fluorene	86-73-7	0.00500	0.000490	0.00100	mg/Kg	47	114	20	47	114	20		
		Indeno[1,2,3-cd]pyrene	193-39-5	0.00500	0.000479	0.00100	mg/Kg	49	130	20	49	130	20		
		Naphthalene	91-20-3	0.00500	0.000307	0.00100	mg/Kg	38	111	20	38	111	20		
		Pyrene	129-00-0	0.00500	0.000350	0.00100	mg/Kg	55	117	20	55	117	20		
		2-Fluorobiphenyl (Surr)	321-60-8	0.00500	0.000250	0.00100	mg/Kg							46	115
		Nitrobenzene-d5	4165-60-0	0.00500	0.000250	0.00100	mg/Kg							44	125
		Terphenyl-d14	1718-51-0	0.00500	0.000250	0.00100	mg/Kg							58	133
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082A_DOD5	Aroclor 1016	12674-11-2	0.0330	0.00340	0.0100	mg/Kg	47	134	30	47	134	30		
		Aroclor 1221	11104-28-2	0.0330	0.00520	0.0150	mg/Kg								
		Aroclor 1232	11141-16-5	0.0330	0.00640	0.0200	mg/Kg								
		Aroclor 1242	53469-21-9	0.0330	0.00740	0.0200	mg/Kg								
		Aroclor 1248	12672-29-6	0.0330	0.00570	0.0150	mg/Kg								
		Aroclor 1254	11097-69-1	0.0330	0.00270	0.0100	mg/Kg								
		Aroclor 1260	11096-82-5	0.0330	0.00290	0.0100	mg/Kg	53	140	30	53	140	30		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		DCB Decachlorobiphenyl	2051-24-3	0.00500	0.00167	0.00500	mg/Kg							60	125
Organochlorine Pesticides (GC)	8081B_DOD5	alpha-BHC	319-84-6	0.00170	0.000220	0.000500	mg/Kg	45	137	30	45	137	30		
		4,4'-DDD	72-54-8	0.00170	0.000260	0.000500	mg/Kg	56	139	30	56	139	30		
		DCB Decachlorobiphenyl	2051-24-3	0.00170	0.000500	0.00170	mg/Kg	49	119	30	49	119		49	119
		Tetrachloro-m-xylene	877-09-8	0.00170	0.000500	0.00170	mg/Kg	42	129	30	42	129	30	42	129
Metals (ICP)	6020A_DOD5	Antimony	7440-36-0	0.5	0.2	0.4	mg/Kg	72	124	20	72	124	20		
		Arsenic	7440-38-2	1	0.4	0.8	mg/Kg	82	118	20	82	118	20		
		Barium	7440-39-3	2	0.5	1	mg/Kg	86	116	20	86	116	20		
		Beryllium	7440-41-7	0.1	0.04	0.08	mg/Kg	80	120	20	80	120	20		
		Cadmium	7440-43-9	0.05	0.024	0.048	mg/Kg	84	116	20	84	116	20		
		Chromium	7440-47-3	1	0.45	0.9	mg/Kg	83	119	20	83	119	20		
		Cobalt	7440-48-4	0.2	0.075	0.15	mg/Kg	84	115	20	84	115	20		
		Copper	7440-50-8	1	0.4	0.8	mg/Kg	84	119	20	84	119	20		
		Lead	7439-92-1	0.3	0.125	0.25	mg/Kg	84	118	20	84	118	20		
		Molybdenum	7439-98-7	0.5	0.2	0.4	mg/Kg	83	114	20	83	114	20		
		Nickel	7440-02-0	0.5	0.2	0.4	mg/Kg	84	119	20	84	119	20		
		Selenium	7782-49-2	0.5	0.32	0.4	mg/Kg	80	119	20	80	119	20		
		Silver	7440-22-4	0.2	0.075	0.15	mg/Kg	83	118	20	83	118	20		
		Thallium	7440-28-0	0.5	0.2	0.4	mg/Kg	83	118	20	83	118	20		
		Vanadium	7440-62-2	1	0.4	0.8	mg/Kg	82	116	20	82	116	20		
		Zinc	7440-66-6	5	2	4	mg/Kg	82	119	20	82	119	20		
Mercury (CVAA)	7471B_DOD5	Mercury	7439-97-6	0.0330	0.0110	0.0300	mg/Kg	80	124	20	80	124	30		
Percent Moisture	Moisture	Percent Moisture	STL00177	0.100		0.100	%								
		Percent Solids	STL00234	0.100		0.100	%								
pH	9045D	pH adj. to 25 deg C	STL00204	0.100		0.100	SU	98	102	10					
Volatile Organic Compounds (GC/MS)	8260C_DOD5	1,1,1,2-Tetrachloroethane	630-20-6	0.00500	0.000410	0.00100	mg/Kg	78	125	20	78	125	20		
		1,1,1-Trichloroethane	71-55-6	0.00500	0.000360	0.00100	mg/Kg	73	130	20	73	130	20		
		1,1,2,2-Tetrachloroethane	79-34-5	0.00500	0.000680	0.00200	mg/Kg	70	124	20	70	124	20		
		1,1,2-Trichloroethane	79-00-5	0.00500	0.000440	0.00100	mg/Kg	78	121	20	78	121	20		
		1,1-Dichloroethane	75-34-3	0.00500	0.000290	0.00100	mg/Kg	76	125	20	76	125	20		
		1,1-Dichloroethene	75-35-4	0.00500	0.000260	0.00100	mg/Kg	70	131	20	70	131	20		
		1,2,3-Trichlorobenzene	87-61-6	0.00500	0.000750	0.00200	mg/Kg	66	130	20	66	130	20		
		1,2,4-Trichlorobenzene	120-82-1	0.00500	0.000750	0.00200	mg/Kg	67	129	20	67	129	20		
		1,2,4-Trimethylbenzene	95-63-6	0.00500	0.000510	0.00200	mg/Kg	75	123	20	75	123	20		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		1,2-Dibromo-3-Chloropropa	96-12-8	0.0100	0.000880	0.00200	mg/Kg	61	132	20	61	132	20		
		1,2-Dibromoethane (EDB)	106-93-4	0.0100	0.000270	0.00100	mg/Kg	78	122	20	78	122	20		
		1,2-Dichlorobenzene	95-50-1	0.00500	0.000640	0.00200	mg/Kg	78	121	20	78	121	20		
		1,2-Dichloroethane	107-06-2	0.00500	0.000730	0.00200	mg/Kg	73	128	20	73	128	20		
		1,2-Dichloropropane	78-87-5	0.00500	0.000600	0.00200	mg/Kg	76	123	20	76	123	20		
		1,3,5-Trimethylbenzene	108-67-8	0.00500	0.000350	0.00100	mg/Kg	73	124	20	73	124	20		
		1,3-Dichlorobenzene	541-73-1	0.00500	0.000300	0.00100	mg/Kg	77	121	20	77	121	20		
		1,3-Dichloropropane	142-28-9	0.00500	0.000570	0.00200	mg/Kg	77	121	20	77	121	20		
		1,4-Dichlorobenzene	106-46-7	0.00500	0.000780	0.00200	mg/Kg	75	120	20	75	120	20		
		2-Butanone	78-93-3	0.0100	0.00140	0.00500	mg/Kg	51	148	20	51	148	20		
		2-Chlorotoluene	95-49-8	0.00500	0.000620	0.00200	mg/Kg	75	122	20	75	122	20		
		2-Hexanone	591-78-6	0.0100	0.000740	0.00200	mg/Kg	53	145	20	53	145	20		
		4-Chlorotoluene	106-43-4	0.00500	0.000860	0.00200	mg/Kg	72	124	20	72	124	20		
		4-Methyl-2-pentanone	108-10-1	0.0100	0.000920	0.00200	mg/Kg	65	135	20	65	135	20		
		Acetone	67-64-1	0.0200	0.00140	0.00500	mg/Kg	36	164	20	36	164	20		
		Benzene	71-43-2	0.00500	0.000260	0.00100	mg/Kg	77	121	20	77	121	20		
		Bromobenzene	108-86-1	0.00500	0.000520	0.00200	mg/Kg	78	121	20	78	121	20		
		Bromochloromethane	74-97-5	0.00500	0.000940	0.00200	mg/Kg	78	125	20	78	125	20		
		Bromodichloromethane	75-27-4	0.00500	0.000530	0.00200	mg/Kg	75	127	20	75	127	20		
		Bromoform	75-25-2	0.00500	0.000400	0.00100	mg/Kg	67	132	20	67	132	20		
		Bromomethane	74-83-9	0.00500	0.000860	0.00200	mg/Kg	53	143	20	53	143	20		
		Carbon disulfide	75-15-0	0.0100	0.000490	0.00100	mg/Kg	63	132	20	63	132	20		
		Carbon tetrachloride	56-23-5	0.00500	0.000530	0.00200	mg/Kg	70	135	20	70	135	20		
		Chlorobenzene	108-90-7	0.00500	0.000290	0.00100	mg/Kg	79	120	20	79	120	20		
		Chloroform	67-66-3	0.00500	0.000260	0.00100	mg/Kg	78	123	20	78	123	20		
		Chloromethane	74-87-3	0.00500	0.000500	0.00100	mg/Kg	50	136	20	50	136	20		
		cis-1,2-Dichloroethene	156-59-2	0.00500	0.000890	0.00200	mg/Kg	77	123	20	77	123	20		
		cis-1,3-Dichloropropene	10061-01-5	0.00500	0.000640	0.00200	mg/Kg	74	126	20	74	126	20		
		Dibromochloromethane	124-48-1	0.00500	0.000260	0.00100	mg/Kg	74	126	20	74	126	20		
		Dibromomethane	74-95-3	0.00500	0.000580	0.00200	mg/Kg	78	125	20	78	125	20		
		Dichlorodifluoromethane	75-71-8	0.00500	0.000890	0.00200	mg/Kg	29	149	20	29	149	20		
		Ethylbenzene	100-41-4	0.00500	0.000340	0.00100	mg/Kg	76	122	20	76	122	20		
		Hexachlorobutadiene	87-68-3	0.00500	0.000330	0.00100	mg/Kg	61	135	20	61	135	20		
		m,p-Xylenes	179601-23-1	0.00500	0.000810	0.00200	mg/Kg	77	124	20	77	124	20		
		Methylene Chloride	75-09-2	0.00500	0.000840	0.00200	mg/Kg	70	128	20	70	128	20		
		Methyl-tert-butyl Ether (MTE	1634-04-4	0.00500	0.000600	0.00200	mg/Kg	73	125	20	73	125	20		
		o-Xylene	95-47-6	0.00500	0.000330	0.00100	mg/Kg	77	123	20	77	123	20		
		Styrene	100-42-5	0.00500	0.000310	0.00100	mg/Kg	76	124	20	76	124	20		
		Tetrachloroethene	127-18-4	0.00500	0.000610	0.00200	mg/Kg	73	128	20	73	128	20		
		Toluene	108-88-3	0.00500	0.000610	0.00200	mg/Kg	77	121	20	77	121	20		
		trans-1,2-Dichloroethene	156-60-5	0.00500	0.000380	0.00100	mg/Kg	74	125	20	74	125	20		
		Trichloroethene	79-01-6	0.00500	0.000600	0.00200	mg/Kg	77	123	20	77	123	20		
		Trichlorofluoromethane	75-69-4	0.00500	0.000340	0.00100	mg/Kg	62	140	20	62	140	20		
		Vinyl chloride	75-01-4	0.00500	0.000360	0.00100	mg/Kg	56	135	20	56	135	20		
		Xylenes, Total	1330-20-7	0.00500	0.000810	0.00150	mg/Kg	78	124	20	78	124	20		
		1,2-Dichloroethane-d4 (Surr	17060-07-0	0.00500	0.00100	0.00500	mg/Kg	71	136	20	71	136	20	71	136
		4-Bromofluorobenzene (Sur	460-00-4	0.00500	0.00100	0.00500	mg/Kg	79	119	20	79	119	20	79	119

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Dibromofluoromethane (Sur	1868-53-7	0.00500	0.00100	0.00500	mg/Kg	78	119	20	78	119	20	78	119
		Toluene-d8 (Surr)	2037-26-5	0.00500	0.00100	0.00500	mg/Kg	85	116	20	85	116	20	85	116
Semivolatile Organic Compounds (GC/MS SIM)	8270D_SIM_DOD5	Acenaphthene	83-32-9	0.00500	0.000470	0.00100	mg/Kg	44	111	20	44	111	20		
		Anthracene	120-12-7	0.00500	0.000395	0.00100	mg/Kg	50	114	20	50	114	20		
		Benzo[a]anthracene	56-55-3	0.00500	0.000303	0.00100	mg/Kg	54	122	20	54	122	20		
		Benzo[a]pyrene	50-32-8	0.00500	0.000399	0.00100	mg/Kg	50	125	20	50	125	20		
		Benzo[b]fluoranthene	205-99-2	0.00500	0.000505	0.00200	mg/Kg	53	128	20	53	128	20		
		Benzo[g,h,i]perylene	191-24-2	0.00500	0.00100	0.00300	mg/Kg	49	127	20	49	127	20		
		Benzo[k]fluoranthene	207-08-9	0.00500	0.000760	0.00200	mg/Kg	56	123	20	56	123	20		
		Chrysene	218-01-9	0.00500	0.000347	0.00100	mg/Kg	57	118	20	57	118	20		
		Dibenz(a,h)anthracene	53-70-3	0.00500	0.00120	0.00300	mg/Kg	50	129	20	50	129	20		
		Fluoranthene	206-44-0	0.00500	0.000293	0.00100	mg/Kg	55	119	20	55	119	20		
		Fluorene	86-73-7	0.00500	0.000490	0.00100	mg/Kg	47	114	20	47	114	20		
		Indeno[1,2,3-cd]pyrene	193-39-5	0.00500	0.000479	0.00100	mg/Kg	49	130	20	49	130	20		
		Naphthalene	91-20-3	0.00500	0.000307	0.00100	mg/Kg	38	111	20	38	111	20		
		Phenanthrene	85-01-8	0.00500	0.000350	0.00100	mg/Kg	49	113	20	49	113	20		
		Pyrene	129-00-0	0.00500	0.000350	0.00100	mg/Kg	55	117	20	55	117	20		
		2-Fluorobiphenyl (Surr)	321-60-8	0.00500	0.000250	0.00100	mg/Kg							46	115
		Nitrobenzene-d5	4165-60-0	0.00500	0.000250	0.00100	mg/Kg							44	125
		Terphenyl-d14	1718-51-0	0.00500	0.000250	0.00100	mg/Kg							58	133
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082A_DOD5	Aroclor 1016	12674-11-2	0.0330	0.00340	0.0100	mg/Kg	47	134	30	47	134	30		
		Aroclor 1221	11104-28-2	0.0330	0.00520	0.0150	mg/Kg								
		Aroclor 1232	11141-16-5	0.0330	0.00640	0.0200	mg/Kg								
		Aroclor 1242	53469-21-9	0.0330	0.00740	0.0200	mg/Kg								
		Aroclor 1248	12672-29-6	0.0330	0.00570	0.0150	mg/Kg								
		Aroclor 1254	11097-69-1	0.0330	0.00270	0.0100	mg/Kg								
		Aroclor 1260	11096-82-5	0.0330	0.00290	0.0100	mg/Kg	53	140	30	53	140	30		
		DCB Decachlorobiphenyl	2051-24-3	0.00500	0.00167	0.00500	mg/Kg							60	125
Organochlorine Pesticides (GC)	8081B_DOD5	4,4'-DDD	72-54-8	0.00170	0.000260	0.000500	mg/Kg	56	139	30	56	139	30		
		4,4'-DDE	72-55-9	0.00170	0.000220	0.000500	mg/Kg	56	134	30	56	134	30		
		4,4'-DDT	50-29-3	0.00170	0.000400	0.00100	mg/Kg	50	141	30	50	141	30		
		Aldrin	309-00-2	0.00170	0.000210	0.000500	mg/Kg	45	136	30	45	136	30		
		alpha-BHC	319-84-6	0.00170	0.000220	0.000500	mg/Kg	45	137	30	45	137	30		
		beta-BHC	319-85-7	0.00170	0.000330	0.00100	mg/Kg	50	136	30	50	136	30		
		Chlordane (technical)	12789-03-6	0.0250	0.00850	0.0200	mg/Kg	43	149	30	43	149	30		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Dieldrin	60-57-1	0.00170	0.0000910	0.000270	mg/Kg	56	136	30	56	136	30		
		Endosulfan I	959-98-8	0.00170	0.000100	0.000270	mg/Kg	53	132	30	53	132	30		
		Endosulfan II	33213-65-9	0.00170	0.000100	0.000270	mg/Kg	53	134	30	53	134	30		
		Endrin	72-20-8	0.00170	0.000110	0.000270	mg/Kg	57	140	30	57	140	30		
		.gamma.-BHC	58-89-9	0.00170	0.000170	0.000500	mg/Kg	49	135	30	49	135	30		
		Heptachlor	76-44-8	0.00170	0.000190	0.000500	mg/Kg	47	136	30	47	136	30		
		Heptachlor epoxide	1024-57-3	0.00170	0.000120	0.000270	mg/Kg	52	136	30	52	136	30		
		Methoxychlor	72-43-5	0.00340	0.00130	0.00300	mg/Kg	52	143	30	52	143	30		
		Toxaphene	8001-35-2	0.0670	0.0200	0.0500	mg/Kg	33	141	30	33	141	30		
		DCB Decachlorobiphenyl	2051-24-3	0.00170	0.000500	0.00170	mg/Kg	49	119	30	49	119		49	119
		Tetrachloro-m-xylene	877-09-8	0.00170	0.000500	0.00170	mg/Kg	42	129	30	42	129	30	42	129

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Diesel Range Organics (DRO) (GC)	8015B_DRO_ DOD5	Diesel Range Organics (C1	STL00096	2.00	0.500	1.00	mg/Kg	38	132	30	38	132	30		
		Motor Oil Range Organics (	STL00158	20.0	3.77	10.0	mg/Kg								
		o-Terphenyl (Surr)	84-15-1				mg/Kg							45	130

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Volatile Organic Compounds by GC/MS	8260_CALUFT _DOD	Gasoline Range Organics (	STL00061	0.500	0.0500	0.200	mg/Kg	79	123	30	79	123	30		
		4-Bromofluorobenzene (Su	460-00-4				mg/Kg							70	131

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Semivolatile Organic Compounds (GC/MS)	8270D_DOD5	2,4,5-Trichlorophenol	95-95-4	0.330	0.0830	0.167	mg/Kg	41	124	20	41	124	20		
		2,4,6-Trichlorophenol	88-06-2	0.330	0.0840	0.167	mg/Kg	39	126	20	39	126	20		
		2,4-Dichlorophenol	120-83-2	0.330	0.0890	0.167	mg/Kg	40	122	20	40	122	20		
		2,4-Dimethylphenol	105-67-9	0.500	0.167	0.333	mg/Kg								
		2,4-Dinitrophenol	51-28-5	2.00	0.214	0.333	mg/Kg	10	60	20	10	60	20		
		2,4-Dinitrotoluene	121-14-2	0.330	0.0890	0.167	mg/Kg	48	126	20	48	126	20		
		2,6-Dinitrotoluene	606-20-2	0.330	0.0990	0.167	mg/Kg	46	124	20	46	124	20		
		2-Chloronaphthalene	91-58-7	0.330	0.0810	0.167	mg/Kg	41	114	20	41	114	20		
		2-Chlorophenol	95-57-8	0.330	0.0880	0.167	mg/Kg	34	121	20	34	121	20		
		2-Methylnaphthalene	91-57-6	0.330	0.0850	0.167	mg/Kg	38	122	20	38	122	20		
		2-Methylphenol	95-48-7	0.330	0.0580	0.167	mg/Kg	32	122	20	32	122	20		
		2-Nitroaniline	88-74-4	1.60	0.0840	0.333	mg/Kg	44	127	20	44	127	20		
		3/4-Methylphenol	15831-10-4	1.00	0.330	0.660	mg/Kg	34	119	20	34	119	20		
		3,3'-Dichlorobenzidine	91-94-1	1.60	0.0940	0.167	mg/Kg	22	121	20	22	121	20		
		4-Chloroaniline	106-47-8	0.330	0.0580	0.167	mg/Kg	17	106	20	17	106	20		
		4-Nitroaniline	100-01-6	1.60	0.0880	0.167	mg/Kg	63	109	20	63	109	20		
		Benzoic acid	65-85-0	1.60	0.289	0.660	mg/Kg	10	97	20	10	97	20		
		Benzyl alcohol	100-51-6	0.510	0.170	0.367	mg/Kg	29	122	20	29	122	20		
		Bis(2-chloroethoxy)methane	111-91-1	0.330	0.0880	0.167	mg/Kg	36	121	20	36	121	20		
		Bis(2-chloroethyl)ether	111-44-4	0.330	0.0810	0.167	mg/Kg	31	120	20	31	120	20		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Bis(2-ethylhexyl) phthalate	117-81-7	0.330	0.0980	0.167	mg/Kg	51	133	20	51	133	20		
		Dibenzofuran	132-64-9	0.330	0.0860	0.167	mg/Kg	44	120	20	44	120	20		
		Diethylphthalate	84-66-2	0.330	0.0900	0.167	mg/Kg	50	124	20	50	124	20		
		Dimethylphthalate	131-11-3	0.330	0.0870	0.167	mg/Kg	48	124	20	48	124	20		
		Di-n-butyl phthalate	84-74-2	0.330	0.0970	0.167	mg/Kg	51	128	20	51	128	20		
		Di-n-octyl phthalate	117-84-0	0.330	0.0970	0.167	mg/Kg	45	140	20	45	140	20		
		Hexachlorobenzene	118-74-1	0.330	0.0890	0.167	mg/Kg	45	122	20	45	122	20		
		Hexachlorobutadiene	87-68-3	0.330	0.0820	0.167	mg/Kg	32	123	20	32	123	20		
		Hexachloroethane	67-72-1	0.330	0.0810	0.167	mg/Kg	28	117	20	28	117	20		
		Isophorone	78-59-1	0.330	0.0930	0.167	mg/Kg	30	122	20	30	122	20		
		Nitrobenzene	98-95-3	0.330	0.0760	0.167	mg/Kg	34	122	20	34	122	20		
		N-Nitrosodimethylamine	62-75-9	0.330	0.0960	0.167	mg/Kg	23	120	20	23	120	20		
		Pentachlorophenol	87-86-5	1.60	0.0510	0.167	mg/Kg	25	133	20	25	133	20		
		Phenol	108-95-2	0.330	0.0830	0.167	mg/Kg	34	121	20	34	121	20		
		2,4,6-Tribromophenol (Surr)	118-79-6	3.30	0.100	3.30	mg/Kg	39	132					39	132
		2-Fluorobiphenyl (Surr)	321-60-8	3.30	0.100	3.30	mg/Kg	44	115					44	115
		2-Fluorophenol (Surr)	367-12-4	3.30	0.100	3.30	mg/Kg	35	115					35	115
		Nitrobenzene-d5 (Surr)	4165-60-0	3.30	0.100	3.30	mg/Kg	37	122					37	122
		Phenol-d5 (Surr)	4165-62-2	3.30	0.100	3.30	mg/Kg	33	122					33	122
		Terphenyl-d14 (Surr)	1718-51-0	3.30	0.100	3.30	mg/Kg	54	127					54	127
Metals (ICP/MS)	6020A_DOD5	Aluminum	7429-90-5	50.0	20.0	40.0	ug/L	84	117	20	84	117	20		
		Antimony	7440-36-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Arsenic	7440-38-2	10.0	4.00	8.00	ug/L	84	116	20	84	116	20		
		Barium	7440-39-3	2.00	0.900	1.80	ug/L	86	114	20	86	114	20		
		Beryllium	7440-41-7	0.500	0.200	0.400	ug/L	83	121	20	83	121	20		
		Cadmium	7440-43-9	0.500	0.200	0.400	ug/L	87	115	20	87	115	20		
		Calcium	7440-70-2	100	45.0	90.0	ug/L	87	118	20	87	118	20		
		Chromium	7440-47-3	10.0	4.00	8.00	ug/L	85	116	20	85	116	20		
		Cobalt	7440-48-4	2.00	0.900	1.80	ug/L	86	115	20	86	115	20		
		Copper	7440-50-8	3.00	1.90	2.50	ug/L	85	118	20	85	118	20		
		Iron	7439-89-6	50.0	20.0	40.0	ug/L	87	118	20	87	118	20		
		Lead	7439-92-1	3.00	1.00	2.00	ug/L	88	115	20	88	115	20		
		Magnesium	7439-95-4	50.0	20.0	40.0	ug/L	83	118	20	83	118	20		
		Manganese	7439-96-5	2.00	0.900	1.80	ug/L	87	115	20	87	115	20		
		Molybdenum	7439-98-7	5.00	2.00	4.00	ug/L	83	115	20	83	115	20		
		Nickel	7440-02-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Potassium	7440-09-7	100	45.0	90.0	ug/L	87	115	20	87	115	20		
		Selenium	7782-49-2	5.00	2.00	4.00	ug/L	80	120	20	80	120	20		
		Silver	7440-22-4	2.00	0.900	1.80	ug/L	85	116	20	85	116	20		
		Sodium	7440-23-5	100	45.0	90.0	ug/L	85	117	20	85	117	20		
		Thallium	7440-28-0	2.00	0.900	1.80	ug/L	82	116	20	82	116	20		
		Vanadium	7440-62-2	10.0	4.00	8.00	ug/L	86	115	20	86	115	20		
		Zinc	7440-66-6	20.0	7.50	15.0	ug/L	83	119	20	83	119	20		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Mercury (CVAA)	7470A_DOD5	Mercury	7439-97-6	0.200	0.0600	0.150	ug/L	82	119	20	82	119	20		
Metals (ICP/MS)	6020A_DOD5	Aluminum	7429-90-5	50.0	20.0	40.0	ug/L	84	117	20	84	117	20		
		Antimony	7440-36-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Arsenic	7440-38-2	10.0	4.00	8.00	ug/L	84	116	20	84	116	20		
		Barium	7440-39-3	2.00	0.900	1.80	ug/L	86	114	20	86	114	20		
		Beryllium	7440-41-7	0.500	0.200	0.400	ug/L	83	121	20	83	121	20		
		Cadmium	7440-43-9	0.500	0.200	0.400	ug/L	87	115	20	87	115	20		
		Calcium	7440-70-2	100	45.0	90.0	ug/L	87	118	20	87	118	20		
		Chromium	7440-47-3	10.0	4.00	8.00	ug/L	85	116	20	85	116	20		
		Cobalt	7440-48-4	2.00	0.900	1.80	ug/L	86	115	20	86	115	20		
		Copper	7440-50-8	3.00	1.90	2.50	ug/L	85	118	20	85	118	20		
		Iron	7439-89-6	50.0	20.0	40.0	ug/L	87	118	20	87	118	20		
		Lead	7439-92-1	3.00	1.00	2.00	ug/L	88	115	20	88	115	20		
		Magnesium	7439-95-4	50.0	20.0	40.0	ug/L	83	118	20	83	118	20		
		Manganese	7439-96-5	2.00	0.900	1.80	ug/L	87	115	20	87	115	20		
		Molybdenum	7439-98-7	5.00	2.00	4.00	ug/L	83	115	20	83	115	20		
		Nickel	7440-02-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Potassium	7440-09-7	100	45.0	90.0	ug/L	87	115	20	87	115	20		
		Selenium	7782-49-2	5.00	2.00	4.00	ug/L	80	120	20	80	120	20		
		Silver	7440-22-4	2.00	0.900	1.80	ug/L	85	116	20	85	116	20		
		Sodium	7440-23-5	100	45.0	90.0	ug/L	85	117	20	85	117	20		
		Thallium	7440-28-0	2.00	0.900	1.80	ug/L	82	116	20	82	116	20		
		Vanadium	7440-62-2	10.0	4.00	8.00	ug/L	86	115	20	86	115	20		
		Zinc	7440-66-6	20.0	7.50	15.0	ug/L	83	119	20	83	119	20		
Mercury (CVAA)	7470A_DOD5	Mercury	7439-97-6	0.200	0.0600	0.150	ug/L	82	119	20	82	119	20		
Radium-226 (GFPC)	903.0	Radium-226	13982-63-3	1.00			pCi/L	68	137	40	75	138	40		
		Ba Carrier	7440-39-3				g							40	110
Solids, Total Dissolved (TDS)	2540C_Calcd	Total Dissolved Solids	STL00242	10.0	5.40	10.0	mg/L	80	120	20	85	115	20		
Solids, Total Suspended (TSS)	2540D	Total Suspended Solids	STL00161	5.00	5.00	5.00	mg/L	85	115	20					
Anions, Ion Chromatography	300_ORGFM_28D	Sulfate	14808-79-8	1.00	0.0490	0.150	mg/L	90	110	10	90	110	10		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Volatile Organic Compounds by GC/MS	8260_CALUFT_DOD	Gasoline Range Organics (	STL00061	0.0500	0.0150	0.0300	mg/L	78	118	23	78	118	23		
		4-Bromofluorobenzene (Su	460-00-4				mg/L							73	115

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Diesel Range Organics (DRO) (GC)	8015B_DRO_DOD5	Diesel Range Organics (C1	STL00096	0.0500	0.0160	0.0400	mg/L	36	132	30	36	132	30		
		Motor Oil Range Organics (	STL00158	0.500	0.166	0.400	mg/L								
		o-Terphenyl (Surr)	84-15-1				mg/L							56	125

ATTACHMENT C
Laboratory Standard Operating Procedures

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Title: ANALYSIS OF METALS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY
[SW-846 6020; SW-846 6020A; SW-846 6020B; EPA 200.8]

Approvals (Signature/Date):

6/6/17
Cory Buffington — Date
Metals Manager

T. Romanko — 6/7/17
FOR Michael Ridenhower — Date
Health & Safety Manager / Coordinator

6/9/17
Kristen Ely — Date
Quality Assurance Manager

Elaine Wild — 6/7/17
Elaine Wild — Date
Laboratory Director

This SOP was previously identified as SOP No. ST-MT-0001 Rev. 25

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ATTACHMENT D
Laboratory DoD ELAP Certificates

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TestAmerica Laboratories

St. Louis Facility
13715 Rider Trail North
Earth City, Missouri 63045

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

and DoD Quality Systems Manual for Environmental Laboratories (DoD QSM V 5.1)

while demonstrating technical competence in the fields of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations and/or tests to which this accreditation applies.

L2305
Certificate Number

ANAB Approval

Certificate Valid: 03/21/2018-04/06/2019
Version No. 001 Issued: 03/21/2018

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 AND DOD QUALITY SYSTEMS MAUAL FOR ENVIRONMENTAL LABORATORIES (DOD QSM V5.1)

TestAmerica Laboratories
St. Louis Facility
13715 Rider Trail North
Earth City, Missouri 63045
Marti Ward
314-298-8566

TESTING

Valid to: **April 6, 2019** Certificate Number: **L2305**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Aluminum
ICP-AES	EPA 6010B/6010C/6010D	Antimony
ICP-AES	EPA 6010B/6010C/6010D	Arsenic
ICP-AES	EPA 6010B/6010C/6010D	Barium
ICP-AES	EPA 6010B/6010C/6010D	Beryllium
ICP-AES	EPA 6010B/6010C/6010D	Bismuth
ICP-AES	EPA 6010B/6010C/6010D	Boron
ICP-AES	EPA 6010B/6010C/6010D	Cadmium
ICP-AES	EPA 6010B/6010C/6010D	Calcium
ICP-AES	EPA 6010B/6010C/6010D	Chromium
ICP-AES	EPA 6010B/6010C/6010D	Cobalt
ICP-AES	EPA 6010B/6010C/6010D	Copper
ICP-AES	EPA 6010B/6010C/6010D	Iron
ICP-AES	EPA 6010B/6010C/6010D	Lead
ICP-AES	EPA 6010B/6010C/6010D	Lithium
ICP-AES	EPA 6010B/6010C/6010D	Magnesium

Non-Potable Water

Technology	Method	Analyte
ICP-AES	EPA 6010B/6010C/6010D	Manganese
ICP-AES	EPA 6010B/6010C/6010D	Molybdenum
ICP-AES	EPA 6010B/6010C/6010D	Nickel
ICP-AES	EPA 6010B/6010C/6010D	Phosphorus
ICP-AES	EPA 6010B/6010C/6010D	Potassium
ICP-AES	EPA 6010B/6010C/6010D	Selenium
ICP-AES	EPA 6010B/6010C/6010D	Silicon
ICP-AES	EPA 6010B/6010C/6010D	Silver
ICP-AES	EPA 6010B/6010C/6010D	Sodium
ICP-AES	EPA 6010B/6010C/6010D	Strontium
ICP-AES	EPA 6010B/6010C/6010D	Sulfur
ICP-AES	EPA 6010B/6010C/6010D	Thallium
ICP-AES	EPA 6010B/6010C/6010D	Thorium
ICP-AES	EPA 6010B/6010C/6010D	Tin
ICP-AES	EPA 6010B/6010C/6010D	Titanium
ICP-AES	EPA 6010B/6010C/6010D	Vanadium
ICP-AES	EPA 6010B/6010C/6010D	Zinc
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Acetonitrile
GC/MS	EPA 8260B/8260C	Acrolein
GC/MS	EPA 8260B/8260C	Acrylonitrile
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Benzyl chloride
GC/MS	EPA 8260B/8260C	Bromobenzene
GC/MS	EPA 8260B/8260C	Bromochloromethane
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	n-Butanol
GC/MS	EPA 8260B/8260C	2-Butanone
GC/MS	EPA 8260B/8260C	n-Butylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Carbon disulfide
GC/MS	EPA 8260B/8260C	Carbon tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	2-Chloro-1,3-butadiene
GC/MS	EPA 8260B/8260C	Chlorodibromomethane
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	Allyl chloride
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Cyclohexanone
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethene (total)
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 8260B/8260C	Dimethyl disulfide
GC/MS	EPA 8260B/8260C	1,4-Dioxane
GC/MS	EPA 8260B/8260C	Ethyl acetate
GC/MS	EPA 8260B/8260C	Ethylbenzene
GC/MS	EPA 8260B/8260C	Ethyl ether
GC/MS	EPA 8260B/8260C	Diethyl ether
GC/MS	EPA 8260B/8260C	Ethyl methacrylate
GC/MS	EPA 8260B/8260C	Freon 113
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	n-Hexane
GC/MS	EPA 8260B/8260C	2-Hexanone
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	p-Isopropyltoluene
GC/MS	EPA 8260B/8260C	Methacrylonitrile
GC/MS	EPA 8260B/8260C	Methyl acetate
GC/MS	EPA 8260B/8260C	Methylcyclohexane
GC/MS	EPA 8260B/8260C	Methylene chloride
GC/MS	EPA 8260B/8260C	Methyl methacrylate
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone
GC/MS	EPA 8260B/8260C	MTBE
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	2-Nitropropane
GC/MS	EPA 8260B/8260C	Nonanal

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Pentachloroethane
GC/MS	EPA 8260B/8260C	Propionitrile
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Tetrahydrofuran
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	Trichlorotrifluoroethane
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	Vinyl acetate
GC/MS	EPA 8260B/8260C	Vinyl chloride
GC/MS	EPA 8260B/8260C	m-Xylene & p-Xylene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	Xylenes (total)
GC/MS	EPA 8260B/8260C SIM	1,4-Dioxane
GC/MS	EPA 624	Acetone
GC/MS	EPA 624	Acetonitrile
GC/MS	EPA 624	Acrolein
GC/MS	EPA 624	Acrylonitrile

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 624	Benzene
GC/MS	EPA 624	Benzyl chloride
GC/MS	EPA 624	Bromobenzene
GC/MS	EPA 624	Bromochloromethane
GC/MS	EPA 624	Bromodichloromethane
GC/MS	EPA 624	Bromoform
GC/MS	EPA 624	Bromomethane
GC/MS	EPA 624	n-Butanol
GC/MS	EPA 624	2-Butanone
GC/MS	EPA 624	n-Butylbenzene
GC/MS	EPA 624	sec-Butylbenzene
GC/MS	EPA 624	tert-Butylbenzene
GC/MS	EPA 624	Carbon disulfide
GC/MS	EPA 624	Carbon tetrachloride
GC/MS	EPA 624	Chlorobenzene
GC/MS	EPA 624	2-Chloro-1,3-butadiene
GC/MS	EPA 624	Chlorodibromomethane
GC/MS	EPA 624	Chloroethane
GC/MS	EPA 624	2-Chloroethyl vinyl ether
GC/MS	EPA 624	Chloroform
GC/MS	EPA 624	Chloromethane
GC/MS	EPA 624	Allyl chloride
GC/MS	EPA 624	2-Chlorotoluene
GC/MS	EPA 624	4-Chlorotoluene
GC/MS	EPA 624	Cyclohexane
GC/MS	EPA 624	Cyclohexanone
GC/MS	EPA 624	1,2-Dibromo-3-chloropropane
GC/MS	EPA 624	1,2-Dibromoethane
GC/MS	EPA 624	Dibromomethane
GC/MS	EPA 624	1,2-Dichlorobenzene
GC/MS	EPA 624	1,3-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624	1,4-Dichlorobenzene
GC/MS	EPA 624	trans-1,4-Dichloro-2-butene
GC/MS	EPA 624	Dichlorodifluoromethane
GC/MS	EPA 624	1,1-Dichloroethane
GC/MS	EPA 624	1,2-Dichloroethane
GC/MS	EPA 624	cis-1,2-Dichloroethene
GC/MS	EPA 624	trans-1,2-Dichloroethene
GC/MS	EPA 624	1,1-Dichloroethene
GC/MS	EPA 624	1,2-Dichloroethene (total)
GC/MS	EPA 624	1,2-Dichloropropane
GC/MS	EPA 624	1,3-Dichloropropane
GC/MS	EPA 624	2,2-Dichloropropane
GC/MS	EPA 624	cis-1,3-Dichloropropene
GC/MS	EPA 624	trans-1,3-Dichloropropene
GC/MS	EPA 624	1,1-Dichloropropene
GC/MS	EPA 624	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 624	Dimethyl disulfide
GC/MS	EPA 624	1,4-Dioxane
GC/MS	EPA 624	Ethyl acetate
GC/MS	EPA 624	Ethylbenzene
GC/MS	EPA 624	Ethyl ether
GC/MS	EPA 624	Diethyl ether
GC/MS	EPA 624	Ethyl methacrylate
GC/MS	EPA 624	Freon 113
GC/MS	EPA 624	Hexachlorobutadiene
GC/MS	EPA 624	n-Hexane
GC/MS	EPA 624	2-Hexanone
GC/MS	EPA 624	Iodomethane
GC/MS	EPA 624	Isobutanol
GC/MS	EPA 624	Isopropylbenzene
GC/MS	EPA 624	p-Isopropyltoluene

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 624	Methacrylonitrile
GC/MS	EPA 624	Methyl acetate
GC/MS	EPA 624	Methylcyclohexane
GC/MS	EPA 624	Methylene chloride
GC/MS	EPA 624	Methyl methacrylate
GC/MS	EPA 624	4-Methyl-2-pentanone
GC/MS	EPA 624	MTBE
GC/MS	EPA 624	Naphthalene
GC/MS	EPA 624	2-Nitropropane
GC/MS	EPA 624	Nonanal
GC/MS	EPA 624	Pentachloroethane
GC/MS	EPA 624	Propionitrile
GC/MS	EPA 624	n-Propylbenzene
GC/MS	EPA 624	Styrene
GC/MS	EPA 624	1,1,1,2-Tetrachloroethane
GC/MS	EPA 624	1,1,2,2-Tetrachloroethane
GC/MS	EPA 624	Tetrachloroethene
GC/MS	EPA 624	Tetrahydrofuran
GC/MS	EPA 624	Toluene
GC/MS	EPA 624	1,3,5-Trichlorobenzene
GC/MS	EPA 624	1,2,3-Trichlorobenzene
GC/MS	EPA 624	1,2,4-Trichlorobenzene
GC/MS	EPA 624	1,1,1-Trichloroethane
GC/MS	EPA 624	1,1,2-Trichloroethane
GC/MS	EPA 624	Trichloroethene
GC/MS	EPA 624	Trichlorofluoromethane
GC/MS	EPA 624	1,2,3-Trichloropropane
GC/MS	EPA 624	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 624	Trichlorotrifluoroethane
GC/MS	EPA 624	1,2,4-Trimethylbenzene
GC/MS	EPA 624	1,3,5-Trimethylbenzene

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 624	Vinyl acetate
GC/MS	EPA 624	Vinyl chloride
GC/MS	EPA 624	m-Xylene & p-Xylene
GC/MS	EPA 624	o-Xylene
GC/MS	EPA 624	Xylenes (total)
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene
GC/MS	EPA 8270C/8270D	Acetophenone
GC/MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC/MS	EPA 8270C/8270D	4-Aminobiphenyl
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Aramite (total)
GC/MS	EPA 8270C/8270D	Atrazine
GC/MS	EPA 8270C/8270D	Azobenzene
GC/MS	EPA 8270C/8270D	Benzaldehyde
GC/MS	EPA 8270C/8270D	Benzidine
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic acid
GC/MS	EPA 8270C/8270D	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzyl alcohol
GC/MS	EPA 8270C/8270D	1,1'-Biphenyl
GC/MS	EPA 8270C/8270D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/8270D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Chloroisopropyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Ethylhexyl) phthalate
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	n-Butylbenzenesulfonamide
GC/MS	EPA 8270C/8270D	Butyl benzyl phthalate

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	Caprolactam
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	Chlorobenzilate
GC/MS	EPA 8270C/8270D	p-Chlorobenzilate
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Cresols (total)
GC/MS	EPA 8270C/8270D	Cyclohexanol
GC/MS	EPA 8270C/8270D	Diallate
GC/MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	Diethyl phthalate
GC/MS	EPA 8270C/8270D	O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate
GC/MS	EPA 8270C/8270D	Dimethoate
GC/MS	EPA 8270C/8270D	p-Dimethylaminoazobenzene
GC/MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/8270D	3,3'-Dimethylbenzidine
GC/MS	EPA 8270C/8270D	Dimethylformamide
GC/MS	EPA 8270C/8270D	alpha,alpha-Dimethylphenethylamine
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	Dimethyl phthalate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dinitrobenzene
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2-sec-Butyl-4,6-dinitrophenol
GC/MS	EPA 8270C/8270D	Dinoseb
GC/MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC/MS	EPA 8270C/8270D	1,4-Dioxane
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	Disulfoton
GC/MS	EPA 8270C/8270D	Ethyl methacrylate
GC/MS	EPA 8270C/8270D	Ethyl methanesulfonate
GC/MS	EPA 8270C/8270D	Famphur
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Hexachlorophene
GC/MS	EPA 8270C/8270D	Hexachloropropene
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D	Isodrin
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Isosafrole
GC/MS	EPA 8270C/8270D	Kepone
GC/MS	EPA 8270C/8270D	Methapyrilene
GC/MS	EPA 8270C/8270D	2-Methylbenzenamine
GC/MS	EPA 8270C/8270D	3-Methylcholanthrene
GC/MS	EPA 8270C/8270D	4,4'-Methylenebis(2-chloroaniline)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Methyl methacrylate
GC/MS	EPA 8270C/8270D	Methyl methanesulfonate
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	Methyl parathion
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	3-Methylphenol & 4-Methylphenol
GC/MS	EPA 8270C/8270D	2-Methylphenol, 3-methylphenol and 4-methylphenol
GC/MS	EPA 8270C/8270D	Methylphenols (total)
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	1,4-Naphthoquinone
GC/MS	EPA 8270C/8270D	1-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-butylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomethylethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomorpholine
GC/MS	EPA 8270C/8270D	N-Nitrosopiperidine
GC/MS	EPA 8270C/8270D	N-Nitrosopyrrolidine
GC/MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC/MS	EPA 8270C/8270D	2,2'-oxybis(1-Chloropropane)
GC/MS	EPA 8270C/8270D	Parathion
GC/MS	EPA 8270C/8270D	Pentachlorobenzene

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	Pentachloroethane
GC/MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenacetin
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol
GC/MS	EPA 8270C/8270D	p-Phenylene diamine
GC/MS	EPA 8270C/8270D	Phorate
GC/MS	EPA 8270C/8270D	2-Picoline
GC/MS	EPA 8270C/8270D	Pronamide
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS	EPA 8270C/8270D	Safrole
GC/MS	EPA 8270C/8270D	Sulfotepp
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	Tetraethyldithiopyrophosphate (Sulfotepp)
GC/MS	EPA 8270C/8270D	Thionazin
GC/MS	EPA 8270C/8270D	o-Toluidine
GC/MS	EPA 8270C/8270D	Tributyl phosphate
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC/MS	EPA 8270C/8270D	Tris(2-chloroethyl)phosphate
GC/MS	EPA 8270C/8270D	1-Methyl naphthalene
GC/MS	EPA 625	Acenaphthene
GC/MS	EPA 625	Acenaphthylene
GC/MS	EPA 625	Acetophenone
GC/MS	EPA 625	2-Acetylaminofluorene
GC/MS	EPA 625	4-Aminobiphenyl

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 625	Aniline
GC/MS	EPA 625	Anthracene
GC/MS	EPA 625	Aramite (total)
GC/MS	EPA 625	Atrazine
GC/MS	EPA 625	Azobenzene
GC/MS	EPA 625	Benzaldehyde
GC/MS	EPA 625	Benzidine
GC/MS	EPA 625	Benzo(a)anthracene
GC/MS	EPA 625	Benzo(b)fluoranthene
GC/MS	EPA 625	Benzo(k)fluoranthene
GC/MS	EPA 625	Benzoic acid
GC/MS	EPA 625	Benzo(ghi)perylene
GC/MS	EPA 625	Benzo(a)pyrene
GC/MS	EPA 625	Benzyl alcohol
GC/MS	EPA 625	1,1'-Biphenyl
GC/MS	EPA 625	bis(2-Chloroethoxy)methane
GC/MS	EPA 625	bis(2-Chloroethyl) ether
GC/MS	EPA 625	bis(2-Chloroisopropyl) ether
GC/MS	EPA 625	bis(2-Ethylhexyl) phthalate
GC/MS	EPA 625	4-Bromophenyl phenyl ether
GC/MS	EPA 625	n-Butylbenzenesulfonamide
GC/MS	EPA 625	Butyl benzyl phthalate
GC/MS	EPA 625	Caprolactam
GC/MS	EPA 625	Carbazole
GC/MS	EPA 625	4-Chloroaniline
GC/MS	EPA 625	Chlorobenzilate
GC/MS	EPA 625	p-Chlorobenzilate
GC/MS	EPA 625	4-Chloro-3-methylphenol
GC/MS	EPA 625	2-Chloronaphthalene
GC/MS	EPA 625	2-Chlorophenol
GC/MS	EPA 625	4-Chlorophenyl phenyl ether
GC/MS	EPA 625	Chrysene
GC/MS	EPA 625	Cresols (total)
GC/MS	EPA 625	Cyclohexanol

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 625	Diallate
GC/MS	EPA 625	Dibenzo(a,h)anthracene
GC/MS	EPA 625	Dibenzofuran
GC/MS	EPA 625	Di-n-butyl phthalate
GC/MS	EPA 625	1,2-Dichlorobenzene
GC/MS	EPA 625	1,3-Dichlorobenzene
GC/MS	EPA 625	1,4-Dichlorobenzene
GC/MS	EPA 625	3,3'-Dichlorobenzidine
GC/MS	EPA 625	2,4-Dichlorophenol
GC/MS	EPA 625	2,6-Dichlorophenol
GC/MS	EPA 625	Diethyl phthalate
GC/MS	EPA 625	O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate
GC/MS	EPA 625	Dimethoate
GC/MS	EPA 625	p-Dimethylaminoazobenzene
GC/MS	EPA 625	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 625	3,3'-Dimethylbenzidine
GC/MS	EPA 625	Dimethylformamide
GC/MS	EPA 625	alpha,alpha-Dimethylphenethylamine
GC/MS	EPA 625	2,4-Dimethylphenol
GC/MS	EPA 625	Dimethyl phthalate
GC/MS	EPA 625	1,3-Dinitrobenzene
GC/MS	EPA 625	1,4-Dinitrobenzene
GC/MS	EPA 625	4,6-Dinitro-2-methylphenol
GC/MS	EPA 625	2,4-Dinitrophenol
GC/MS	EPA 625	2,4-Dinitrotoluene
GC/MS	EPA 625	2,6-Dinitrotoluene
GC/MS	EPA 625	2-sec-Butyl-4,6-dinitrophenol
GC/MS	EPA 625	Dinoseb
GC/MS	EPA 625	Di-n-octyl phthalate
GC/MS	EPA 625	1,4-Dioxane
GC/MS	EPA 625	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 625	Disulfoton
GC/MS	EPA 625	Ethyl methacrylate
GC/MS	EPA 625	Ethyl methanesulfonate

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 625	Famphur
GC/MS	EPA 625	Fluoranthene
GC/MS	EPA 625	Fluorene
GC/MS	EPA 625	Hexachlorobenzene
GC/MS	EPA 625	Hexachlorobutadiene
GC/MS	EPA 625	Hexachlorocyclopentadiene
GC/MS	EPA 625	Hexachloroethane
GC/MS	EPA 625	Hexachlorophene
GC/MS	EPA 625	Hexachloropropene
GC/MS	EPA 625	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 625	Isodrin
GC/MS	EPA 625	Isophorone
GC/MS	EPA 625	Isosafrole
GC/MS	EPA 625	Kepone
GC/MS	EPA 625	Methapyrilene
GC/MS	EPA 625	2-Methylbenzenamine
GC/MS	EPA 625	3-Methylcholanthrene
GC/MS	EPA 625	4,4'-Methylenebis(2-chloroaniline)
GC/MS	EPA 625	Methyl methacrylate
GC/MS	EPA 625	Methyl methanesulfonate
GC/MS	EPA 625	2-Methylnaphthalene
GC/MS	EPA 625	Methyl parathion
GC/MS	EPA 625	2-Methylphenol
GC/MS	EPA 625	3-Methylphenol & 4-Methylphenol
GC/MS	EPA 625	2-Methylphenol, 3-methylphenol and 4-methylphenol
GC/MS	EPA 625	Methylphenols (total)
GC/MS	EPA 625	Naphthalene
GC/MS	EPA 625	1,4-Naphthoquinone
GC/MS	EPA 625	1-Naphthylamine
GC/MS	EPA 625	2-Naphthylamine
GC/MS	EPA 625	2-Nitroaniline
GC/MS	EPA 625	3-Nitroaniline
GC/MS	EPA 625	4-Nitroaniline

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625	Nitrobenzene
GC/MS	EPA 625	2-Nitrophenol
GC/MS	EPA 625	4-Nitrophenol
GC/MS	EPA 625	4-Nitroquinoline-1-oxide
GC/MS	EPA 625	N-Nitrosodi-n-butylamine
GC/MS	EPA 625	N-Nitrosodiethylamine
GC/MS	EPA 625	N-Nitrosodimethylamine
GC/MS	EPA 625	N-Nitrosodiphenylamine
GC/MS	EPA 625	N-Nitrosodi-n-propylamine
GC/MS	EPA 625	N-Nitrosomethylethylamine
GC/MS	EPA 625	N-Nitrosomorpholine
GC/MS	EPA 625	N-Nitrosopiperidine
GC/MS	EPA 625	N-Nitrosopyrrolidine
GC/MS	EPA 625	5-Nitro-o-toluidine
GC/MS	EPA 625	2,2'-oxybis(1-Chloropropane)
GC/MS	EPA 625	Parathion
GC/MS	EPA 625	Pentachlorobenzene
GC/MS	EPA 625	Pentachloroethane
GC/MS	EPA 625	Pentachloronitrobenzene
GC/MS	EPA 625	Pentachlorophenol
GC/MS	EPA 625	Phenacetin
GC/MS	EPA 625	Phenanthrene
GC/MS	EPA 625	Phenol
GC/MS	EPA 625	p-Phenylene diamine
GC/MS	EPA 625	Phorate
GC/MS	EPA 625	2-Picoline
GC/MS	EPA 625	Pronamide
GC/MS	EPA 625	Pyrene
GC/MS	EPA 625	Pyridine
GC/MS	EPA 625	Safrole
GC/MS	EPA 625	Sulfotepp
GC/MS	EPA 625	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 625	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 625	Tetraethyldithiopyrophosphate (Sulfotepp)

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 625	Thionazin
GC/MS	EPA 625	o-Toluidine
GC/MS	EPA 625	Tributyl phosphate
GC/MS	EPA 625	1,2,4-Trichlorobenzene
GC/MS	EPA 625	2,4,5-Trichlorophenol
GC/MS	EPA 625	2,4,6-Trichlorophenol
GC/MS	EPA 625	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 625	1,3,5-Trinitrobenzene
GC/MS	EPA 625	Tris(2-chloroethyl)phosphate
GC/MS	EPA 625	1-Methyl naphthalene
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	alpha-BHC
GC-ECD	EPA 8081A/8081B	beta-BHC
GC-ECD	EPA 8081A/8081B	delta-BHC
GC-ECD	EPA 8081A/8081B	gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	alpha-Chlordane
GC-ECD	EPA 8081A/8081B	gamma-Chlordane
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	2,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	2,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	2,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor

Non-Potable Water

Technology	Method	Analyte
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 608	Aldrin
GC-ECD	EPA 608	alpha-BHC
GC-ECD	EPA 608	beta-BHC
GC-ECD	EPA 608	delta-BHC
GC-ECD	EPA 608	gamma-BHC (Lindane)
GC-ECD	EPA 608	alpha-Chlordane
GC-ECD	EPA 608	gamma-Chlordane
GC-ECD	EPA 608	Chlordane (technical)
GC-ECD	EPA 608	4,4'-DDD
GC-ECD	EPA 608	2,4'-DDD
GC-ECD	EPA 608	4,4'-DDE
GC-ECD	EPA 608	2,4'-DDE
GC-ECD	EPA 608	4,4'-DDT
GC-ECD	EPA 608	2,4'-DDT
GC-ECD	EPA 608	Dieldrin
GC-ECD	EPA 608	Endosulfan I
GC-ECD	EPA 608	Endosulfan II
GC-ECD	EPA 608	Endosulfan sulfate
GC-ECD	EPA 608	Endrin
GC-ECD	EPA 608	Endrin aldehyde
GC-ECD	EPA 608	Endrin ketone
GC-ECD	EPA 608	Heptachlor
GC-ECD	EPA 608	Heptachlor epoxide
GC-ECD	EPA 608	Methoxychlor
GC-ECD	EPA 608	Toxaphene
GC-ECD	EPA 608	Aroclor 1016
GC-ECD	EPA 608	Aroclor 1221
GC-ECD	EPA 608	Aroclor 1232
GC-ECD	EPA 608	Aroclor 1242
GC-ECD	EPA 608	Aroclor 1248
GC-ECD	EPA 608	Aroclor 1254

Non-Potable Water

Technology	Method	Analyte
GC-ECD	EPA 608	Aroclor 1260
GC-ECD	EPA 608	Aroclor 1262
GC-ECD	EPA 608	Aroclor 1268
GC-ECD	EPA 8082A/8082	Aroclor 1016
GC-ECD	EPA 8082A/8082	Aroclor 1221
GC-ECD	EPA 8082A/8082	Aroclor 1232
GC-ECD	EPA 8082A/8082	Aroclor 1242
GC-ECD	EPA 8082A/8082	Aroclor 1248
GC-ECD	EPA 8082A/8082	Aroclor 1254
GC-ECD	EPA 8082A/8082	Aroclor 1260
GC-ECD	EPA 8082A/8082	Aroclor 1262
GC-ECD	EPA 8082A/8082	Aroclor 1268
GC-FID	EPA 8015B	Ethanol
GC-FID	EPA 8015B	Methanol
GC-FID	EPA 8015B	Ethylene glycol
GC-FID	EPA 8015B	Propylene glycol
GC-FID	EPA 8015B	Diesel Range Organics
GC-FID	EPA 8015B	Motor Oil Range Organics
GC-FID	EPA 8015B	Gasoline Range Organics
HPLC	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC	EPA 8330A/8330B	2,4-Dinitrotoluene
HPLC	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC	EPA 8330A/8330B	HMX
HPLC	EPA 8330A/8330B	HNAB
HPLC	EPA 8330A/8330B	HNS
HPLC	EPA 8330A/8330B	Nitrobenzene
HPLC	EPA 8330A/8330B	Nitroglycerin
HPLC	EPA 8330A/8330B	2-Nitrotoluene
HPLC	EPA 8330A/8330B	3-Nitrotoluene
HPLC	EPA 8330A/8330B	4-Nitrotoluene

Non-Potable Water

Technology	Method	Analyte
HPLC	EPA 8330A/8330B	PETN
HPLC	EPA 8330A/8330B	RDX
HPLC	EPA 8330A/8330B	TATB
HPLC	EPA 8330A/8330B	Tetryl
HPLC	EPA 8330A/8330B	MNX
HPLC	EPA 8330A/8330B	DNX
HPLC	EPA 8330A/8330B	TNX
HPLC	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC	EPA 8330A/8330B	2,4,6-Trinitrotoluene
GC/MS	EPA 8270C/8270D SIM	Acenaphthene
GC/MS	EPA 8270C/8270D SIM	Acenaphthylene
GC/MS	EPA 8270C/8270D SIM	Anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D SIM	Chrysene
GC/MS	EPA 8270C/8270D SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D SIM	Fluoranthene
GC/MS	EPA 8270C/8270D SIM	Fluorene
GC/MS	EPA 8270C/8270D SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D SIM	Naphthalene
GC/MS	EPA 8270C/8270D SIM	Phenanthrene
GC/MS	EPA 8270C/8270D SIM	Pyrene
ICP-MS	EPA 6020/6020A/6020B	Aluminum
ICP-MS	EPA 6020/6020A/6020B	Antimony
ICP-MS	EPA 6020/6020A/6020B	Arsenic
ICP-MS	EPA 6020/6020A/6020B	Barium
ICP-MS	EPA 6020/6020A/6020B	Beryllium
ICP-MS	EPA 6020/6020A/6020B	Bismuth
ICP-MS	EPA 6020/6020A/6020B	Boron

Non-Potable Water

Technology	Method	Analyte
ICP-MS	EPA 6020/6020A/6020B	Cadmium
ICP-MS	EPA 6020/6020A/6020B	Calcium
ICP-MS	EPA 6020/6020A/6020B	Cerium
ICP-MS	EPA 6020/6020A/6020B	Cesium
ICP-MS	EPA 6020/6020A/6020B	Chromium
ICP-MS	EPA 6020/6020A/6020B	Cobalt
ICP-MS	EPA 6020/6020A/6020B	Copper
ICP-MS	EPA 6020/6020A/6020B	Gold
ICP-MS	EPA 6020/6020A/6020B	Hafnium
ICP-MS	EPA 6020/6020A/6020B	Iron
ICP-MS	EPA 6020/6020A/6020B	Lanthanum
ICP-MS	EPA 6020/6020A/6020B	Lead
ICP-MS	EPA 6020/6020A/6020B	Lithium
ICP-MS	EPA 6020/6020A/6020B	Magnesium
ICP-MS	EPA 6020/6020A/6020B	Manganese
ICP-MS	EPA 6020/6020A/6020B	Molybdenum
ICP-MS	EPA 6020/6020A/6020B	Neodymium
ICP-MS	EPA 6020/6020A/6020B	Nickel
ICP-MS	EPA 6020/6020A/6020B	Niobium
ICP-MS	EPA 6020/6020A/6020B	Palladium
ICP-MS	EPA 6020/6020A/6020B	Phosphorus
ICP-MS	EPA 6020/6020A/6020B	Platinum
ICP-MS	EPA 6020/6020A/6020B	Potassium
ICP-MS	EPA 6020/6020A/6020B	Praseodymium
ICP-MS	EPA 6020/6020A/6020B	Rhenium
ICP-MS	EPA 6020/6020A/6020B	Rhodium
ICP-MS	EPA 6020/6020A/6020B	Ruthenium
ICP-MS	EPA 6020/6020A/6020B	Samarium
ICP-MS	EPA 6020/6020A/6020B	Selenium
ICP-MS	EPA 6020/6020A/6020B	Silicon
ICP-MS	EPA 6020/6020A/6020B	Silver
ICP-MS	EPA 6020/6020A/6020B	Sodium

Non-Potable Water

Technology	Method	Analyte
ICP-MS	EPA 6020/6020A/6020B	Strontium
ICP-MS	EPA 6020/6020A/6020B	Tantalum
ICP-MS	EPA 6020/6020A/6020B	Tellurium
ICP-MS	EPA 6020/6020A/6020B	Thallium
ICP-MS	EPA 6020/6020A/6020B	Thorium
ICP-MS	EPA 6020/6020A/6020B	Tin
ICP-MS	EPA 6020/6020A/6020B	Titanium
ICP-MS	EPA 6020/6020A/6020B	Tungsten
ICP-MS	EPA 6020/6020A/6020B	Uranium
ICP-MS	EPA 6020/6020A/6020B	Uranium 233
ICP-MS	EPA 6020/6020A/6020B	Uranium 234
ICP-MS	EPA 6020/6020A/6020B	Uranium 235
ICP-MS	EPA 6020/6020A/6020B	Uranium 236
ICP-MS	EPA 6020/6020A/6020B	Uranium 238
ICP-MS	EPA 6020/6020A/6020B	Vanadium
ICP-MS	EPA 6020/6020A/6020B	Yttrium
ICP-MS	EPA 6020/6020A/6020B	Zinc
ICP-MS	EPA 6020/6020A/6020B	Zirconium
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic
ICP-MS	EPA 200.8	Barium
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Bismuth
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Cerium
ICP-MS	EPA 200.8	Cesium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper

Non-Potable Water

Technology	Method	Analyte
ICP-MS	EPA 200.8	Gold
ICP-MS	EPA 200.8	Hafnium
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lanthanum
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Neodymium
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Niobium
ICP-MS	EPA 200.8	Palladium
ICP-MS	EPA 200.8	Phosphorus
ICP-MS	EPA 200.8	Platinum
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Praseodymium
ICP-MS	EPA 200.8	Rhenium
ICP-MS	EPA 200.8	Rhodium
ICP-MS	EPA 200.8	Ruthenium
ICP-MS	EPA 200.8	Samarium
ICP-MS	EPA 200.8	Selenium
ICP-MS	EPA 200.8	Silicon
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Tantalum
ICP-MS	EPA 200.8	Tellurium
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Thorium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Tungsten
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium
ICP-MS	EPA 200.8	Yttrium
ICP-MS	EPA 200.8	Zinc
ICP-MS	EPA 200.8	Zirconium
ICP-AES	EPA 200.7	Aluminum
ICP-AES	EPA 200.7	Antimony
ICP-AES	EPA 200.7	Arsenic
ICP-AES	EPA 200.7	Barium
ICP-AES	EPA 200.7	Beryllium
ICP-AES	EPA 200.7	Bismuth
ICP-AES	EPA 200.7	Boron
ICP-AES	EPA 200.7	Cadmium
ICP-AES	EPA 200.7	Calcium
ICP-AES	EPA 200.7	Chromium
ICP-AES	EPA 200.7	Cobalt
ICP-AES	EPA 200.7	Copper
ICP-AES	EPA 200.7	Iron
ICP-AES	EPA 200.7	Lead
ICP-AES	EPA 200.7	Lithium
ICP-AES	EPA 200.7	Magnesium
ICP-AES	EPA 200.7	Manganese
ICP-AES	EPA 200.7	Molybdenum
ICP-AES	EPA 200.7	Nickel
ICP-AES	EPA 200.7	Phosphorus
ICP-AES	EPA 200.7	Potassium
ICP-AES	EPA 200.7	Selenium
ICP-AES	EPA 200.7	Silicon
ICP-AES	EPA 200.7	Silver
ICP-AES	EPA 200.7	Sodium
ICP-AES	EPA 200.7	Strontium

Non-Potable Water

Technology	Method	Analyte
ICP-AES	EPA 200.7	Sulfur
ICP-AES	EPA 200.7	Thallium
ICP-AES	EPA 200.7	Thorium
ICP-AES	EPA 200.7	Tin
ICP-AES	EPA 200.7	Titanium
ICP-AES	EPA 200.7	Vanadium
ICP-AES	EPA 200.7	Zinc
CVAA	EPA 7470A	Mercury
Colorimetric	EPA 9010C EPA 9012A/9012B	Cyanide
Ion Chromatrography	EPA 300.0/9056/9056A	Bromide
Ion Chromatrography	EPA 300.0/9056/9056A	Chloride
Ion Chromatrography	EPA 300.0/9056/9056A	Fluoride
Ion Chromatrography	EPA 300.0/9056/9056A	Nitrate
Ion Chromatrography	EPA 300.0/9056/9056A	Nitrite
Ion Chromatrography	EPA 300.0/9056/9056A	Sulfate
Ion Chromatrography	EPA 300.0/9056/9056A	Ortho-phosphate
Ion Chromatrography	EPA 300.0/9056/9056A	Iodide
Ion Chromatrography	EPA 314.0	Perchlorate
Gravimetric	SM 2540B SM 2540C SM 2540D	Solids
Probe	EPA 9040B/C EPA 150.1	pH
Titration	SM 2320B EPA 310.1	Alkalinity
Titration	EPA 9030B EPA 9034/9034A	Sulfide
Penske-Martin	EPA 1010/1010A	Ignitability
Colormetric	EPA 353.1	nitrate/Nitrite
Colormetric	EPA 350.1	Ammonia
Colorimetric	EPA 410.4	COD
Colorimetric	EPA 365.2	Total Phosphorus

Non-Potable Water		
Technology	**Method**	**Analyte**
TOC Analyzer	EPA 9060A	TOC
Tritrmetric	EPA 9020B	TOX
Colormetric	EPA 7196A	Hex Chromium
Gravimetric	EPA 1664A	Oil & Grease
Gravimetric	EPA 1664A	TPH
Probe	EPA 9050A	Conductivity
Gas Flow Proportional Counter	EPA 900.0 EPA 9310 SM 7110C	gross alpha/beta
Gas Flow Proportional Counter	ST-RC-0036 ST-RD-0403	Chlorine-36
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	total radium
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02 DOE HASL 300 Sr-03	Strontium-90
Liquid Scintillation Counter	EPA 906.0	Tritium
Liquid Scintillation Counter	Eichrom Technologies TCW01/TCS01	Tecnetium-99
Liquid Scintillation Counter	EERF C-01-C14	Carbon-14
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125

Non-Potable Water

Technology	Method	Analyte
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium-137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Calcium-45
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese-56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 83
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230

Non-Potable Water

Technology	Method	Analyte
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95
Alpha Spectroscopy	DOE HASL 300 A-01-R	Alpha spec analysis:
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Uranium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Thorium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Americium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Plutonium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Neptunium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Curium
Liquid Scintillation Counter	Eichrom Technologies OTW01, OTS01	Lead-210
Alpha Spectroscopy	Laboratory SOP ST-RC-0210	Polonium-210
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55

Non-Potable Water		
Technology	**Method**	**Analyte**
Liquid Scintillation Counter	DOE RP-300	Nickel 59/63
Liquid Scintillation Counter	SM 7500-IB	Iodine-129
Preparation	**Method**	**Type**
Organic Extraction & Sample Prep	EPA 3500C	Organic Extraction & Sample Prep
Volatile Prep	EPA 5000	Sample Preparation for Volatile Organic Compounds
Organic prep/analysis	EPA 8000C	Determinative Chromatographic Separations
Acid Digestion (Aqueous samples)	EPA 3010A	Acid Digestion for Metals (Aqueous samples)
Purge & Trap	EPA 5030C	Purge & Trap for Aqueous Volatile
Sep Funnel Liquid-Liquid Extraction	EPA 3510C	Sep Funnel Liquid-Liquid Extraction
Organic Cleanup	EPA 3600A	Cleanup for Organic extracts
Florisil Cleanup	EPA 3620C	Florisil Cleanup
Sulfur Cleanup	EPA 3660B	Sulfur Cleanup
Acid Clean Up	EPA 3665A	Acid Clean Up for PCBs
TCLP Extraction	EPA 1311	TCLP Extraction
SPLP Extraction	EPA 1312	SPLP Extraction
CWET Extraction	CA Title 22	CWET Extraction
Solid Phase Extraction	EPA 3535A	Solid Phase Extraction

Drinking Water		
Technology	**Method**	**Analyte**
Gas Flow Proportional Counter	EPA 900.0 EPA 9310	gross alpha/beta
Gas Flow Proportional Counter	ST-RC-0036 ST-RD-0403	Chlorine-36
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02	Strontium-90
Liquid Scintillation Counter	EPA 906.0	Tritium
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium-137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Calcium-45
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese-56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 83
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Aluminum
ICP-AES	EPA 6010B/6010C/6010D	Antimony
ICP-AES	EPA 6010B/6010C/6010D	Arsenic
ICP-AES	EPA 6010B/6010C/6010D	Barium
ICP-AES	EPA 6010B/6010C/6010D	Beryllium
ICP-AES	EPA 6010B/6010C/6010D	Bismuth
ICP-AES	EPA 6010B/6010C/6010D	Boron
ICP-AES	EPA 6010B/6010C/6010D	Cadmium
ICP-AES	EPA 6010B/6010C/6010D	Calcium

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	EPA 6010B/6010C/6010D	Chromium
ICP-AES	EPA 6010B/6010C/6010D	Cobalt
ICP-AES	EPA 6010B/6010C/6010D	Copper
ICP-AES	EPA 6010B/6010C/6010D	Iron
ICP-AES	EPA 6010B/6010C/6010D	Lead
ICP-AES	EPA 6010B/6010C/6010D	Lithium
ICP-AES	EPA 6010B/6010C/6010D	Magnesium
ICP-AES	EPA 6010B/6010C/6010D	Manganese
ICP-AES	EPA 6010B/6010C/6010D	Molybdenum
ICP-AES	EPA 6010B/6010C/6010D	Nickel
ICP-AES	EPA 6010B/6010C/6010D	Phosphorus
ICP-AES	EPA 6010B/6010C/6010D	Potassium
ICP-AES	EPA 6010B/6010C/6010D	Selenium
ICP-AES	EPA 6010B/6010C/6010D	Silicon
ICP-AES	EPA 6010B/6010C/6010D	Silver
ICP-AES	EPA 6010B/6010C/6010D	Sodium
ICP-AES	EPA 6010B/6010C/6010D	Strontium
ICP-AES	EPA 6010B/6010C/6010D	Sulfur
ICP-AES	EPA 6010B/6010C/6010D	Thallium
ICP-AES	EPA 6010B/6010C/6010D	Thorium
ICP-AES	EPA 6010B/6010C/6010D	Tin
ICP-AES	EPA 6010B/6010C/6010D	Titanium
ICP-AES	EPA 6010B/6010C/6010D	Vanadium
ICP-AES	EPA 6010B/6010C/6010D	Zinc
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Acetonitrile
GC/MS	EPA 8260B/8260C	Acrolein
GC/MS	EPA 8260B/8260C	Acrylonitrile
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Benzyl chloride
GC/MS	EPA 8260B/8260C	Bromobenzene
GC/MS	EPA 8260B/8260C	Bromochloromethane

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	n-Butanol
GC/MS	EPA 8260B/8260C	2-Butanone
GC/MS	EPA 8260B/8260C	n-Butylbenzene
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Carbon disulfide
GC/MS	EPA 8260B/8260C	Carbon tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	2-Chloro-1,3-butadiene
GC/MS	EPA 8260B/8260C	Chlorodibromomethane
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	Allyl chloride
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Cyclohexanone
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethene (total)
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 8260B/8260C	Dimethyl disulfide
GC/MS	EPA 8260B/8260C	1,4-Dioxane
GC/MS	EPA 8260B/8260C	Ethyl acetate
GC/MS	EPA 8260B/8260C	Ethylbenzene
GC/MS	EPA 8260B/8260C	Ethyl ether
GC/MS	EPA 8260B/8260C	Diethyl ether
GC/MS	EPA 8260B/8260C	Ethyl methacrylate
GC/MS	EPA 8260B/8260C	Freon 113
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	n-Hexane
GC/MS	EPA 8260B/8260C	2-Hexanone
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	p-Isopropyltoluene
GC/MS	EPA 8260B/8260C	Methacrylonitrile
GC/MS	EPA 8260B/8260C	Methyl acetate
GC/MS	EPA 8260B/8260C	Methylcyclohexane
GC/MS	EPA 8260B/8260C	Methylene chloride
GC/MS	EPA 8260B/8260C	Methyl methacrylate
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8260B/8260C	MTBE
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	2-Nitropropane
GC/MS	EPA 8260B/8260C	Nonanal
GC/MS	EPA 8260B/8260C	Pentachloroethane
GC/MS	EPA 8260B/8260C	Propionitrile
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Tetrahydrofuran
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	Trichlorotrifluoroethane
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	Vinyl acetate
GC/MS	EPA 8260B/8260C	Vinyl chloride
GC/MS	EPA 8260B/8260C	m-Xylene & p-Xylene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	Xylenes (total)
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Acetophenone
GC/MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC/MS	EPA 8270C/8270D	4-Aminobiphenyl
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Aramite (total)
GC/MS	EPA 8270C/8270D	Atrazine
GC/MS	EPA 8270C/8270D	Azobenzene
GC/MS	EPA 8270C/8270D	Benzaldehyde
GC/MS	EPA 8270C/8270D	Benzidine
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic acid
GC/MS	EPA 8270C/8270D	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzyl alcohol
GC/MS	EPA 8270C/8270D	1,1'-Biphenyl
GC/MS	EPA 8270C/8270D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/8270D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Chloroisopropyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Ethylhexyl) phthalate
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	n-Butylbenzenesulfonamide
GC/MS	EPA 8270C/8270D	Butyl benzyl phthalate
GC/MS	EPA 8270C/8270D	Caprolactam
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	Chlorobenzilate
GC/MS	EPA 8270C/8270D	p-Chlorobenzilate
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Cresols (total)
GC/MS	EPA 8270C/8270D	Cyclohexanol
GC/MS	EPA 8270C/8270D	Diallate
GC/MS	EPA 8270C/8270D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	Diethyl phthalate
GC/MS	EPA 8270C/8270D	O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate
GC/MS	EPA 8270C/8270D	Dimethoate
GC/MS	EPA 8270C/8270D	p-Dimethylaminoazobenzene
GC/MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/8270D	3,3'-Dimethylbenzidine
GC/MS	EPA 8270C/8270D	Dimethylformamide
GC/MS	EPA 8270C/8270D	alpha,alpha-Dimethylphenethylamine
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	Dimethyl phthalate
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dinitrobenzene
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	2-sec-Butyl-4,6-dinitrophenol
GC/MS	EPA 8270C/8270D	Dinoseb
GC/MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC/MS	EPA 8270C/8270D	1,4-Dioxane
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	Disulfoton
GC/MS	EPA 8270C/8270D	Ethyl methacrylate
GC/MS	EPA 8270C/8270D	Ethyl methanesulfonate
GC/MS	EPA 8270C/8270D	Famphur
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Hexachlorophene
GC/MS	EPA 8270C/8270D	Hexachloropropene
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D	Isodrin
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Isosafrole
GC/MS	EPA 8270C/8270D	Kepone
GC/MS	EPA 8270C/8270D	Methapyrilene
GC/MS	EPA 8270C/8270D	2-Methylbenzenamine
GC/MS	EPA 8270C/8270D	3-Methylcholanthrene
GC/MS	EPA 8270C/8270D	4,4'-Methylenebis(2-chloroaniline)
GC/MS	EPA 8270C/8270D	Methyl methacrylate
GC/MS	EPA 8270C/8270D	Methyl methanesulfonate
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	Methyl parathion
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	3-Methylphenol & 4-Methylphenol

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	2-Methylphenol, 3-methylphenol and 4-methylphenol
GC/MS	EPA 8270C/8270D	Methylphenols (total)
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	1,4-Naphthoquinone
GC/MS	EPA 8270C/8270D	1-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-butylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomethylethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomorpholine
GC/MS	EPA 8270C/8270D	N-Nitrosopiperidine
GC/MS	EPA 8270C/8270D	N-Nitrosopyrrolidine
GC/MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC/MS	EPA 8270C/8270D	2,2'-oxybis(1-Chloropropane)
GC/MS	EPA 8270C/8270D	Parathion
GC/MS	EPA 8270C/8270D	Pentachlorobenzene
GC/MS	EPA 8270C/8270D	Pentachloroethane
GC/MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenacetin
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	p-Phenylene diamine
GC/MS	EPA 8270C/8270D	Phorate
GC/MS	EPA 8270C/8270D	2-Picoline
GC/MS	EPA 8270C/8270D	Pronamide
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS	EPA 8270C/8270D	Safrole
GC/MS	EPA 8270C/8270D	Sulfotepp
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	Tetraethyldithiopyrophosphate (Sulfotepp)
GC/MS	EPA 8270C/8270D	Thionazin
GC/MS	EPA 8270C/8270D	o-Toluidine
GC/MS	EPA 8270C/8270D	Tributyl phosphate
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC/MS	EPA 8270C/8270D	Tris(2-chloroethyl)phosphate
GC/MS	EPA 8270C/8270D	1-Methyl naphthalene
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	alpha-BHC
GC-ECD	EPA 8081A/8081B	beta-BHC
GC-ECD	EPA 8081A/8081B	delta-BHC
GC-ECD	EPA 8081A/8081B	gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	alpha-Chlordane
GC-ECD	EPA 8081A/8081B	gamma-Chlordane
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	2,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE

Solid and Chemical Materials

Technology	Method	Analyte
GC-ECD	EPA 8081A/8081B	2,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	2,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8082/8082A	Aroclor 1016
GC-ECD	EPA 8082/8082A	Aroclor 1221
GC-ECD	EPA 8082/8082A	Aroclor 1232
GC-ECD	EPA 8082/8082A	Aroclor 1242
GC-ECD	EPA 8082/8082A	Aroclor 1248
GC-ECD	EPA 8082/8082A	Aroclor 1254
GC-ECD	EPA 8082/8082A	Aroclor 1260
GC-ECD	EPA 8082/8082A	Aroclor 1262
GC-ECD	EPA 8082/8082A	Aroclor 1268
HPLC	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC	EPA 8330A/8330B	2,4-Dinitrotoluene
HPLC	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC	EPA 8330A/8330B	HMX
HPLC	EPA 8330A/8330B	HNAB
HPLC	EPA 8330A/8330B	HNS
HPLC	EPA 8330A/8330B	Nitrobenzene

Solid and Chemical Materials

Technology	Method	Analyte
HPLC	EPA 8330A/8330B	Nitroglycerin
HPLC	EPA 8330A/8330B	2-Nitrotoluene
HPLC	EPA 8330A/8330B	3-Nitrotoluene
HPLC	EPA 8330A/8330B	4-Nitrotoluene
HPLC	EPA 8330A/8330B	PETN
HPLC	EPA 8330A/8330B	RDX
HPLC	EPA 8330A/8330B	TATB
HPLC	EPA 8330A/8330B	Tetryl
HPLC	EPA 8330A/8330B	MNX
HPLC	EPA 8330A/8330B	DNX
HPLC	EPA 8330A/8330B	TNX
HPLC	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC	EPA 8330A/8330B	2,4,6-Trinitrotoluene
GC/MS	EPA 8270C/8270D SIM	Acenaphthene
GC/MS	EPA 8270C/8270D SIM	Acenaphthylene
GC/MS	EPA 8270C/8270D SIM	Anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D SIM	Chrysene
GC/MS	EPA 8270C/8270D SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D SIM	Fluoranthene
GC/MS	EPA 8270C/8270D SIM	Fluorene
GC/MS	EPA 8270C/8270D SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D SIM	Naphthalene
GC/MS	EPA 8270C/8270D SIM	Phenanthrene
GC/MS	EPA 8270C/8270D SIM	Pyrene
GC-FID	EPA 8015B	Diesel Range Organics
GC-FID	EPA 8015B	Motor Oil Range Organics
GC-FID	EPA 8015B	Gasoline Range Organics

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-FID	EPA 8015B	Ethanol
GC-FID	EPA 8015B	Methanol
GC-FID	EPA 8015B	Ethylene glycol
GC-FID	EPA 8015B	Propylene glycol
ICP-MS	EPA 6020/6020A/6020B	Aluminum
ICP-MS	EPA 6020/6020A/6020B	Antimony
ICP-MS	EPA 6020/6020A/6020B	Arsenic
ICP-MS	EPA 6020/6020A/6020B	Barium
ICP-MS	EPA 6020/6020A/6020B	Beryllium
ICP-MS	EPA 6020/6020A/6020B	Bismuth
ICP-MS	EPA 6020/6020A/6020B	Boron
ICP-MS	EPA 6020/6020A/6020B	Cadmium
ICP-MS	EPA 6020/6020A/6020B	Calcium
ICP-MS	EPA 6020/6020A/6020B	Cerium
ICP-MS	EPA 6020/6020A/6020B	Cesium
ICP-MS	EPA 6020/6020A/6020B	Chromium
ICP-MS	EPA 6020/6020A/6020B	Cobalt
ICP-MS	EPA 6020/6020A/6020B	Copper
ICP-MS	EPA 6020/6020A/6020B	Gold
ICP-MS	EPA 6020/6020A/6020B	Hafnium
ICP-MS	EPA 6020/6020A/6020B	Iron
ICP-MS	EPA 6020/6020A/6020B	Lanthanum
ICP-MS	EPA 6020/6020A/6020B	Lead
ICP-MS	EPA 6020/6020A/6020B	Lithium
ICP-MS	EPA 6020/6020A/6020B	Magnesium
ICP-MS	EPA 6020/6020A/6020B	Manganese
ICP-MS	EPA 6020/6020A/6020B	Molybdenum
ICP-MS	EPA 6020/6020A/6020B	Neodymium
ICP-MS	EPA 6020/6020A/6020B	Nickel
ICP-MS	EPA 6020/6020A/6020B	Niobium
ICP-MS	EPA 6020/6020A/6020B	Palladium
ICP-MS	EPA 6020/6020A/6020B	Phosphorus

Solid and Chemical Materials

Technology	Method	Analyte
ICP-MS	EPA 6020/6020A/6020B	Platinum
ICP-MS	EPA 6020/6020A/6020B	Potassium
ICP-MS	EPA 6020/6020A/6020B	Praseodymium
ICP-MS	EPA 6020/6020A/6020B	Rhenium
ICP-MS	EPA 6020/6020A/6020B	Rhodium
ICP-MS	EPA 6020/6020A/6020B	Ruthenium
ICP-MS	EPA 6020/6020A/6020B	Samarium
ICP-MS	EPA 6020/6020A/6020B	Selenium
ICP-MS	EPA 6020/6020A/6020B	Silicon
ICP-MS	EPA 6020/6020A/6020B	Silver
ICP-MS	EPA 6020/6020A/6020B	Sodium
ICP-MS	EPA 6020/6020A/6020B	Strontium
ICP-MS	EPA 6020/6020A/6020B	Tantalum
ICP-MS	EPA 6020/6020A/6020B	Technetium-99
ICP-MS	EPA 6020/6020A/6020B	Tellurium
ICP-MS	EPA 6020/6020A/6020B	Thallium
ICP-MS	EPA 6020/6020A/6020B	Thorium
ICP-MS	EPA 6020/6020A/6020B	Tin
ICP-MS	EPA 6020/6020A/6020B	Titanium
ICP-MS	EPA 6020/6020A/6020B	Tungsten
ICP-MS	EPA 6020/6020A/6020B	Uranium
ICP-MS	EPA 6020/6020A/6020B	Uranium 233
ICP-MS	EPA 6020/6020A/6020B	Uranium 234
ICP-MS	EPA 6020/6020A/6020B	Uranium 235
ICP-MS	EPA 6020/6020A/6020B	Uranium 236
ICP-MS	EPA 6020/6020A/6020B	Uranium 238
ICP-MS	EPA 6020/6020A/6020B	Vanadium
ICP-MS	EPA 6020/6020A/6020B	Yttrium
ICP-MS	EPA 6020/6020A/6020B	Zinc
ICP-MS	EPA 6020/6020A/6020B	Zirconium
CVAA	EPA 7471A/7471B	Mercury
Colormetric	EPA 9010C EPA 9012A/9012B	Cyanide

Solid and Chemical Materials

Technology	Method	Analyte
Ion Chromatography	EPA 300.0 EPA 9056/9056A	Bromide
Ion Chromatography	EPA 300.0	Chloride
Ion Chromatography	EPA 9056/9056A	Fluoride
Ion Chromatography	EPA 300.0	Nitrate
Ion Chromatography	EPA 9056/9056A	Nitrite
Ion Chromatography	EPA 300.0	Sulfate
Ion Chromatography	EPA 9056/9056A	Ortho-phosph
Ion Chromatography	EPA 300.0	Iodide
Ion Chromatography	EPA 314.0	Perchlorate
Probe	EPA 9045C/D	pH
Titration	SM 2320B EPA 310.1	Alkalinity
Titration	EPA 9030B EPA 9034/9034A	Sulfide
Penske-Martin	EPA 1010/1010A	Ignitability
Colormetric	EPA 353.1	nitrate/Nitrite
Colormetric	EPA 350.1	Ammonia
TOC Analyzer	EPA 9060A	TOC
Colormetric	EPA 7196A	Hex Chromium
Gravimetric	EPA 1664A	Oil & Grease
Gravimetric	EPA 1664A	TPH
Probe	EPA 9050A	Conductivity
Gas Flow Proportional Counter	EPA 900.0 EPA 9310	gross alpha/beta
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	total radium
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02 DOE HASL 300 Sr-03	Strontium-90
Liquid Scintillation Counter	EPA 906.0	Tritium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Liquid Scintillation Counter	Eichrom Technologies TCW01/TCS01	Tecnetium-99
Liquid Scintillation Counter	EERF C-01-C14	Carbon-14
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium-137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Calcium-45
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141

Solid and Chemical Materials

Technology	Method	Analyte
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese-56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 83
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95
Alpha Spectroscopy	DOE HASL 300 A-01-R	Alpha spec analysis:
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Uranium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Thorium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Americium

Solid and Chemical Materials

Technology	Method	Analyte
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Plutonium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Neptunium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Curium
Liquid Scintillation Counter	Eichrom Technologies OTW01, OTS01	Lead-210
Alpha Spectroscopy	Laboratory SOP ST-RC-0210	Polonium-210
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55
Liquid Scintillation Counter	DOE RP-300	Nickel 59/63
Liquid Scintillation Counter	SM 7500-IB	Iodine-129
Preparation	**Method**	**Type**
Organic Extraction & Sample Prep	EPA 3500C	Organic Extraction & Sample Prep
Volatile Prep	EPA 5000	Sample Preparation for Volatile Organic Compounds
Organic Cleanup	EPA 3600A	Cleanup for Organic extracts
Organic prep/analysis	EPA 8000C	Determinative Chromatographic Separations
Acid Digestion (Aqueous samples)	EPA 3010A	Acid Digestion for Metals (Aqueous samples)
Acid Digestion (solids)	EPA 3050B	Acid Digestion for Metals of Sedimtent/Soils
Purge & Trap	EPA 5030C	Purge & Trap for Aqueous Volatile Samples
Closed System Purge & Trap and Extraction for Volatiles	EPA 5035A	Closed System Purge & Trap and Extraction for Volatiles
Sep Funnel Liquid-Liquid Extraction	EPA 3510C	Sep Funnel Liquid-Liquid Extraction
Ultrasonic Extraction	EPA 3550C	Ultrasonic Extraction Organic Soils
Solid Phase Extraction	EPA 3535A	Solid Phase Extraction
Acid Clean-up	EPA 3665A	Acid Clean Up for PCBs
Florisil Cleanup	EPA 3620C	Florisil Cleanup
Sulfur Cleanup	EPA 3660B	Sulfur Cleanup
Waste Dilution	EPA 3585	Waste Dilution Volatile Organics
Waste Dilution	EPA 3580A	Waste Dilution SemiVolatile Organics
TCLP Extraction	EPA 1311	TCLP Extraction
SPLP Extraction	EPA 1312	SPLP Extraction

Solid and Chemical Materials

Technology	Method	Analyte
CWET Extraction	CA Title 22	CWET Extraction
Alkaline Digestion	EPA 3060A	Alkaline Digestion for Hexavalent Chromium
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2305

R.D

Vice President

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

TestAmerica St. Louis

13715 Rider Trail North
Earth City, MO 63045

Scope of the certificate is limited to the "Fields of Testing" which accompany this Certificate.

Continued accredited status depends on successful completion of on-site inspection, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2886**
Expiration Date: **6/30/2019**
Effective Date: **7/1/2018**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

TestAmerica St. Louis

13715 Rider Trail North
Earth City, MO 63045
Phone: (314) 298-8566

Certificate No. **2886**
Expiration Date **6/30/2019**

Field of Testing: 106 - Radiochemistry of Drinking Water

106.010	001	Gross Alpha	EPA 900.0
106.010	002	Gross Beta	EPA 900.0
106.030	001	Radioactive Cesium	EPA 901.1
106.030	003	Gamma Emitters	EPA 901.1
106.050	001	Total Alpha Radium	EPA 903.0
106.050	002	Radium-226 (estimate)	EPA 903.0
106.060	001	Radium-228	EPA 904.0
106.070	003	Strontium-90	EPA 905.0
106.080	001	Tritium	EPA 906.0
106.220	001	Strontium-89, 90	DOE Sr-01
106.230	001	Isotopic Uranium	DOE U-02
106.270	001	Gross Alpha by Coprecipitation	SM7110 C

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	001	Boron	EPA 200.8
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.120	012	Nitrate (as N)	EPA 300.0
108.120	014	Nitrite (as N)	EPA 300.0
108.120	015	Phosphate, Ortho (as P)	EPA 300.0
108.183	001	Cyanide, Total	EPA 335.4
108.209	001	Ammonia (as N)	EPA 350.1
108.211	002	Kjeldahl Nitrogen, Total (as N)	EPA 351.2
108.323	001	Chemical Oxygen Demand	EPA 410.4
108.381	001	Oil and Grease	EPA 1664A
108.440	001	Residue, Total	SM2540B-1997
108.441	001	Residue, Filterable TDS	SM2540C-1997

108.442	001	Residue, Non-filterable TSS	SM2540D-1997
108.490	001	Hydrogen Ion (pH)	SM4500-H+ B-2000
Field of Testing: 109 - Toxic Chemical Elements of Wastewater			
109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	006	Boron	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	025	Titanium	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	008	Cobalt	EPA 200.8
109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	015	Silver	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	021	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.190	001	Mercury	EPA 245.1

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	000	Purgeable Organic Compounds	EPA 624

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.100	000	Base/Neutral & Acid Organics	EPA 625
111.170	000	Organochlorine Pesticides and PCBs	EPA 608

Field of Testing: 112 - Radiochemistry of Wastewater

112.010	001	Gross Alpha	EPA 900.0
112.010	002	Gross Beta	EPA 900.0
112.020	001	Total Alpha Radium	EPA 903.0
112.140	001	Cesium	EPA 901.1
112.140	002	Gamma	EPA 901.1
112.160	001	Radium-228	EPA 904.0
112.170	001	Strontium	EPA 905.0
112.180	001	Tritium	EPA 906.0
112.510	001	Strontium	DOE Sr-02
112.520	001	Isotopic Uranium	DOE U-02

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.020	001	Antimony	EPA 6020
114.020	002	Arsenic	EPA 6020
114.020	003	Barium	EPA 6020
114.020	004	Beryllium	EPA 6020
114.020	005	Cadmium	EPA 6020
114.020	006	Chromium	EPA 6020
114.020	007	Cobalt	EPA 6020
114.020	008	Copper	EPA 6020
114.020	009	Lead	EPA 6020
114.020	010	Molybdenum	EPA 6020
114.020	011	Nickel	EPA 6020
114.020	012	Selenium	EPA 6020
114.020	013	Silver	EPA 6020

114.020	014	Thallium	EPA 6020	
114.020	015	Vanadium	EPA 6020	
114.020	016	Zinc	EPA 6020	
114.103	001	Chromium (VI)	EPA 7196A	
114.140	001	Mercury	EPA 7470A	Aqueous Only
114.141	001	Mercury	EPA 7471A	
114.221	001	Cyanide, Total	EPA 9012A	
114.240	001	Corrosivity - pH Determination	EPA 9040B	
114.241	001	Corrosivity - pH Determination	EPA 9045C	
114.250	001	Fluoride	EPA 9056	
Field of Testing: 115 - Extraction Test of Hazardous Waste				
115.020	001	Toxicity Characteristic Leaching Procedure (TC	EPA 1311 (TCLP)	
115.021	001	TCLP Inorganics	EPA 1311 (TCLP)	
115.022	001	TCLP Extractables	EPA 1311 (TCLP)	
115.023	001	TCLP Volatiles	EPA 1311 (TCLP)	
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II	
115.040	001	Synthetic Precipitation Leaching Procedure (S	EPA 1312 (SPLP)	
Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste				
116.030	001	Gasoline-range Organics	EPA 8015B	
116.080	000	Volatile Organic Compounds	EPA 8260B	
Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste				
117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B	
117.110	000	Extractable Organics	EPA 8270C	
117.171	000	Nitroaromatics and Nitramines	EPA 8330A	
117.210	000	Organochlorine Pesticides	EPA 8081A	
117.220	000	PCBs	EPA 8082	
Field of Testing: 118 - Radiochemistry of Hazardous Waste				
118.010	001	Gross Alpha	EPA 9310	
118.010	002	Gross Beta	EPA 9310	
118.020	001	Radium, Total	EPA 9315	
118.030	001	Radium-228	EPA 9320	
118.271	001	Strontium	DOE Sr-02	
Field of Testing: 120 - Physical Properties of Hazardous Waste				
120.010	001	Ignitability	EPA 1010	
120.040	001	Reactive Cyanide	Section 7.3 SW-846	
120.050	001	Reactive Sulfide	Section 7.3 SW-846	
120.070	001	Corrosivity - pH Determination	EPA 9040B	
120.080	001	Corrosivity - pH Determination	EPA 9045C	

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

and DoD Quality Systems Manual for Environmental Laboratories (DoD QSM V 5.1)

while demonstrating technical competence in the fields of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations and/or tests to which this accreditation applies.

L2468
Certificate Number

ANAB Approval

Certificate Valid: 03/22/2018-01/20/2021
Version No. 003 Issued: 03/22/2018

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 AND DOD QUALITY SYSTEMS MAUAL FOR ENVIRONMENTAL LABORATORIES (DOD QSM V5.1)

TestAmerica Sacramento

880 Riverside Parkway
West Sacramento, CA 95605
Ms. Lisa Stafford
916-373-5600

TESTING

Valid to: **January 20, 2021** Certificate Number: **L2468**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium
ICP-AES	EPA 6010B/6010C	Boron
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium (Total)
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
ICP-AES	EPA 6010B/6010C	Molybdenum
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium
ICP-AES	EPA 6010B/6010C	Silica

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C	Silicon
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium
ICP-AES	EPA 6010B/6010C	Tin
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium (Total)
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Phosphorus
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Strontium
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Tin
ICP-MS	EPA 6020/6020A	Titanium
ICP-MS	EPA 6020/6020A	Uranium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc

Non-Potable Water		
Technology	**Method**	**Analyte**
CVAAS	EPA 7470A	Mercury
Colorimetric	EPA 353.2	Nitrate
Colorimetric	EPA 353.2	Nitrate-nitrite
Colorimetric	EPA 353.2	Nitrite
Colorimetric	EPA 410.4	Chemical Oxygen Demand (COD)
LC/MS/MS	EPA 6850	Perchlorate
Colorimetric	EPA 7196A	Chromium (Hexavalent)
Probe	EPA 9040B/9040C	pH
Ion Chromatography	EPA 9056A/300.0	Bromide
Ion Chromatography	EPA 9056A/300.0	Chloride
Ion Chromatography	EPA 9056A/300.0	Fluoride
Ion Chromatography	EPA 9056A/300.0	Nitrate
Ion Chromatography	EPA 9056A/300.0	Nitrite
Ion Chromatography	EPA 9056A/300.0	Orthophosphate
Ion Chromatography	EPA 9056A/300.0	Sulfate
Titration	SM 2320B	Alkalinity
Gravimetric	SM 2540B	Solids, Total
Gravimetric	SM 2540C	Solids, Total Dissolved
Gravimetric	SM 2540D	Solids, Total Suspended
Colorimetric/Hydrolysis	EPA 353.2 Modified / WS-WC-0050	Nitrocellulose
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1-Chlorohexane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	2-Butanone (MEK)
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	2-Hexanone (MBK)
GC/MS	EPA 8260B/8260C	2-Methyl-2-propanol (tert- Butyl Alcohol, TBA)
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Isopropyltoluene
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Allyl Chloride
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Bromobenzene
GC/MS	EPA 8260B/8260C	Bromochloromethane
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	Carbon Disulfide
GC/MS	EPA 8260B/8260C	Carbon Tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Dibromochloromethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	Diisopropyl Ether (DIPE)
GC/MS	EPA 8260B/8260C	Ethylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Ethylmethacrylate
GC/MS	EPA 8260B/8260C	Ethyl tert-butyl Ether (ETBE)
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	Hexane
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol (2-Methyl-1-propanol)
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	m & p Xylene
GC/MS	EPA 8260B/8260C	Methyl tert-butyl Ether (MTBE)
GC/MS	EPA 8260B/8260C	Methylene Chloride
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	n-Butylbenzene
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	t-Amyl methyl Ether (TAME)
GC/MS	EPA 8260B/8260C	t-1,4-Dichloro-2-Butene
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	Vinyl Acetate
GC/MS	EPA 8260B/8260C	Vinyl Chloride
GC/MS	EPA 8260B/8260C	Xylenes, Total
GC/MS	EPA 8260B/AK101MS	Gasoline (GRO)
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	1-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	3&4-Methylphenol
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic Acid

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Benzyl Alcohol
GC/MS	EPA 8270C/8270D	Benzyl butyl Phthalate
GC/MS	EPA 8270C/8270D	Biphenyl
GC/MS	EPA 8270C/8270D	Bis(2-chloroethoxy) Methane
GC/MS	EPA 8270C/8270D	Bis(2-chloroethyl) Ether
GC/MS	EPA 8270C/8270D	Bis(2-chloroisopropyl) Ether
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Bis (2-ethylhexyl) Phthalate
GC/MS	EPA 8270C/8270D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Diethyl Phthalate
GC/MS	EPA 8270C/8270D	Dimethyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-butyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-octyl Phthalate
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-c,d) Pyrene
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS SIM	EPA 8260C-SIM	1,1,2-Trichloroethane
GC/MS SIM	EPA 8260C-SIM	1,1,2,2-Tetrachloroethane
GC/MS SIM	EPA 8260C-SIM	1,2,3-Trichloropropane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA 8260C-SIM	1,2-Dibromoethane
GC/MS SIM	EPA 8260C-SIM	1,2-Dichloroethane
GC/MS SIM	EPA 8260C-SIM	1,3-Butadiene
GC/MS SIM	EPA 8260C-SIM	1,4-Dichlorobenzene
GC/MS SIM	EPA 8260C-SIM	Benzene
GC/MS SIM	EPA 8260C-SIM	Bromodichloromethane
GC/MS SIM	EPA 8260C-SIM	Bromoform
GC/MS SIM	EPA 8260C-SIM	Bromomethane
GC/MS SIM	EPA 8260C-SIM	Chloroform
GC/MS SIM	EPA 8260C-SIM	Dibromochloromethane
GC/MS SIM	EPA 8260C-SIM	Hexachlorobutadiene
GC/MS SIM	EPA 8260C-SIM	Naphthalene
GC/MS SIM	EPA 8260C-SIM	Tetrachloroethene
GC/MS SIM	EPA 8260C-SIM	Trichloroethene
GC/MS SIM	EPA 8260C-SIM	Vinyl Chloride
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	1-Methylnaphthalene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	2-Methylnaphthalene
GC/MS SIM	EPA 8270D-SIM	3,3'-Dichlorobenzidine
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(b)fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(g,h,i)perylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(k)fluoranthene
GC/MS SIM	EPA 8270D-SIM	Bis(2-chloroethyl) Ether
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Chrysene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Dibenz(a,h)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluorene
GC/MS SIM	EPA 8270D-SIM	Hexachlorobenzene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Indeno(1,2,3-c,d) Pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Naphthalene
GC/MS SIM	EPA 8270D-SIM	n-Nitrosodimethylamine
GC/MS SIM	EPA 8270D-SIM	n-Nitrosodi-n-propylamine
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Phenanthrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Pyrene
GC/MS SIM	EPA 8270C-SIM Modified / WS-MS-0011	1,4-Dioxane
GC-IT/MS	EPA 521 Modified / WS-MS-0012	N-Nitrosodimethyl amine (NDMA)
GC-FID	EPA 8015B/8015C/8015D AK102	Diesel Range Organics (DRO)
GC-FID	AK103	Residual Range Organics
GC-FID	EPA 8015B/8015C/8015D	Motor Oil Range Organics (MRO)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	a-BHC
GC-ECD	EPA 8081A/8081B	b-BHC
GC-ECD	EPA 8081A/8081B	d-BHC
GC-ECD	EPA 8081A/8081B	g-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	a-Chlordane
GC-ECD	EPA 8081A/8081B	g-Chlordane
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate

Non-Potable Water

Technology	Method	Analyte
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin Aldehyde
GC-ECD	EPA 8081A/8081B	Endrin Ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor Epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8082/8082A	PCB-1016
GC-ECD	EPA 8082/8082A	PCB-1221
GC-ECD	EPA 8082/8082A	PCB-1232
GC-ECD	EPA 8082/8082A	PCB-1242
GC-ECD	EPA 8082/8082A	PCB-1248
GC-ECD	EPA 8082/8082A	PCB-1254
GC-ECD	EPA 8082/8082A	PCB-1260
GC-ECD	EPA 8082/8082A	PCB-1262
GC-ECD	EPA 8082/8082A	PCB-1268
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDD
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDD
GC/MS	EPA 8280A/8280B	OCDD
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDF
GC/MS	EPA 8280A/8280B	2,3,4,7,8-PeCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDF
GC/MS	EPA 8280A/8280B	2,3,4,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8,9-HpCDF
GC/MS	EPA 8280A/8280B	OCDF
GC/MS	EPA 8280A/8280B	Total TCDD
GC/MS	EPA 8280A/8280B	Total PeCDD

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8280A/8280B	Total HxCDD
GC/MS	EPA 8280A/8280B	Total HeptaCDD
GC/MS	EPA 8280A/8280B	Total TCDF
GC/MS	EPA 8280A/8280B	Total PeCDF
GC/MS	EPA 8280A/8280B	Total HxCDF
GC/MS	EPA 8280A/8280B	Total HpCDF
GC/HRMS	EPA 8290/8290A/1613B	2,3,7,8-TeCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8-PeCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,7,8-HxCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,6,7,8-HxCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8,9-HxCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,6,7,8-HpCDD
GC/HRMS	EPA 8290/8290A/1613B	OCDD
GC/HRMS	EPA 8290/8290A/1613B	2,3,7,8-TeCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8-PeCDF
GC/HRMS	EPA 8290/8290A/1613B	2,3,4,7,8-PeCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,7,8-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,6,7,8-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8,9-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	2,3,4,6,7,8-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,6,7,8-HpCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,7,8,9-HpCDF
GC/HRMS	EPA 8290/8290A/1613B	OCDF
GC/HRMS	EPA 8290/8290A/1613B	Total TCDD
GC/HRMS	EPA 8290/8290A/1613B	Total PeCDD
GC/HRMS	EPA 8290/8290A/1613B	Total HxCDD
GC/HRMS	EPA 8290/8290A/1613B	Total HpCDD
GC/HRMS	EPA 8290/8290A/1613B	Total TCDF
GC/HRMS	EPA 8290/8290A/1613B	Total PeCDF
GC/HRMS	EPA 8290/8290A/1613B	Total HxCDF
GC/HRMS	EPA 8290/8290A/1613B	Total HpCDF
HPLC/UV	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4-Dinitrotoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	Glycerol trinitrate (Nitroglycerin)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitro- 1,3,5-triazine (Hexogen)
HPLC/UV	EPA 8330A/8330B	Methyl-2,4,6- trinitrophenylnitramine
HPLC/UV	EPA 8330A/8330B	Nitrobenzene
HPLC/UV	EPA 8330A/8330B	2-Nitrotoluene (o-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	3-Nitrotoluene (m-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	4-Nitrotoluene (p-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	Octahydro-1,3,5,7- tetranitro1,3,5,7-tetracine (Octogen)
HPLC/UV	EPA 8330A/8330B	Picric acid
HPLC/UV	EPA 8330A/8330B	Pentaerythritol Tetranitrate
HPLC/UV	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4,6-Trinitrotoluene
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3-dinitroso-5- nitro-1,3,5,triazine (DNX)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitroso- 1,3,5-triazine (TNX)
HPLC/UV	EPA 8330A/8330B	1-Nitroso-3,5-dinitro-1,3,5- triazacyclohexane (MNX)
HPLC/UV	EPA 8330A Modified /WS-LC-0010	Nitroguanidine
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	6:2 Fluorotelomer sulfonate (6:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	8:2 Fluorotelomer sulfonate (8:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Ethyl perfluorooctanesulfon amidacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Methyl perfluorooctanesulfon amidoacetic acid (MeFOSAA)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctanoic acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctane Sulfonic Acid (PFOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutyric acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoropentanoic acid (PFPA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorononanoic acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecanoic acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroundecanoic acid (PFUDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorododecanoic acid (PFDoDA)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotridecanoic acid (PFTriA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotetradecanoic acid (PDTeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutane Sulfonic Acid (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexane Sulfonic Acid (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptane Sulfonic Acid (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecane Sulfonic Acid (PFDS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroocatane Sulfonamide (FOSA)
GC/HRMS	EPA 1668A/1668C	PCB 1
GC/HRMS	EPA 1668A/1668C	PCB 2
GC/HRMS	EPA 1668A/1668C	PCB 3
GC/HRMS	EPA 1668A/1668C	PCB 4
GC/HRMS	EPA 1668A/1668C	PCB 5
GC/HRMS	EPA 1668A/1668C	PCB 6
GC/HRMS	EPA 1668A/1668C	PCB 7
GC/HRMS	EPA 1668A/1668C	PCB 8
GC/HRMS	EPA 1668A/1668C	PCB 9
GC/HRMS	EPA 1668A/1668C	PCB 10
GC/HRMS	EPA 1668A/1668C	PCB 11
GC/HRMS	EPA 1668A/1668C	PCB 12

Non-Potable Water

Technology	Method	Analyte
GC/HRMS	EPA 1668A/1668C	PCB 13
GC/HRMS	EPA 1668A/1668C	PCB 14
GC/HRMS	EPA 1668A/1668C	PCB 15
GC/HRMS	EPA 1668A/1668C	PCB 16
GC/HRMS	EPA 1668A/1668C	PCB 17
GC/HRMS	EPA 1668A/1668C	PCB 18
GC/HRMS	EPA 1668A/1668C	PCB 19
GC/HRMS	EPA 1668A/1668C	PCB 20
GC/HRMS	EPA 1668A/1668C	PCB 21
GC/HRMS	EPA 1668A/1668C	PCB 22
GC/HRMS	EPA 1668A/1668C	PCB 23
GC/HRMS	EPA 1668A/1668C	PCB 24
GC/HRMS	EPA 1668A/1668C	PCB 25
GC/HRMS	EPA 1668A/1668C	PCB 26
GC/HRMS	EPA 1668A/1668C	PCB 27
GC/HRMS	EPA 1668A/1668C	PCB 28
GC/HRMS	EPA 1668A/1668C	PCB 29
GC/HRMS	EPA 1668A/1668C	PCB 30
GC/HRMS	EPA 1668A/1668C	PCB 32
GC/HRMS	EPA 1668A/1668C	PCB 31
GC/HRMS	EPA 1668A/1668C	PCB 33
GC/HRMS	EPA 1668A/1668C	PCB 34
GC/HRMS	EPA 1668A/1668C	PCB 35
GC/HRMS	EPA 1668A/1668C	PCB 36
GC/HRMS	EPA 1668A/1668C	PCB 37
GC/HRMS	EPA 1668A/1668C	PCB 38
GC/HRMS	EPA 1668A/1668C	PCB 39
GC/HRMS	EPA 1668A/1668C	PCB 40
GC/HRMS	EPA 1668A/1668C	PCB 41
GC/HRMS	EPA 1668A/1668C	PCB 42
GC/HRMS	EPA 1668A/1668C	PCB 43
GC/HRMS	EPA 1668A/1668C	PCB 44
GC/HRMS	EPA 1668A/1668C	PCB 45
GC/HRMS	EPA 1668A/1668C	PCB 46
GC/HRMS	EPA 1668A/1668C	PCB 47
GC/HRMS	EPA 1668A/1668C	PCB 48

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 49
GC/HRMS	EPA 1668A/1668C	PCB 50
GC/HRMS	EPA 1668A/1668C	PCB 51
GC/HRMS	EPA 1668A/1668C	PCB 52
GC/HRMS	EPA 1668A/1668C	PCB 53
GC/HRMS	EPA 1668A/1668C	PCB 54
GC/HRMS	EPA 1668A/1668C	PCB 55
GC/HRMS	EPA 1668A/1668C	PCB 56
GC/HRMS	EPA 1668A/1668C	PCB 57
GC/HRMS	EPA 1668A/1668C	PCB 58
GC/HRMS	EPA 1668A/1668C	PCB 59
GC/HRMS	EPA 1668A/1668C	PCB 60
GC/HRMS	EPA 1668A/1668C	PCB 61
GC/HRMS	EPA 1668A/1668C	PCB 62
GC/HRMS	EPA 1668A/1668C	PCB 63
GC/HRMS	EPA 1668A/1668C	PCB 64
GC/HRMS	EPA 1668A/1668C	PCB 65
GC/HRMS	EPA 1668A/1668C	PCB 66
GC/HRMS	EPA 1668A/1668C	PCB 67
GC/HRMS	EPA 1668A/1668C	PCB 68
GC/HRMS	EPA 1668A/1668C	PCB 69
GC/HRMS	EPA 1668A/1668C	PCB 70
GC/HRMS	EPA 1668A/1668C	PCB 71
GC/HRMS	EPA 1668A/1668C	PCB 72
GC/HRMS	EPA 1668A/1668C	PCB 73
GC/HRMS	EPA 1668A/1668C	PCB 74
GC/HRMS	EPA 1668A/1668C	PCB 75
GC/HRMS	EPA 1668A/1668C	PCB 76
GC/HRMS	EPA 1668A/1668C	PCB 77
GC/HRMS	EPA 1668A/1668C	PCB 78
GC/HRMS	EPA 1668A/1668C	PCB 79
GC/HRMS	EPA 1668A/1668C	PCB 80
GC/HRMS	EPA 1668A/1668C	PCB 81
GC/HRMS	EPA 1668A/1668C	PCB 82
GC/HRMS	EPA 1668A/1668C	PCB 83
GC/HRMS	EPA 1668A/1668C	PCB 84

Non-Potable Water

Technology	Method	Analyte
GC/HRMS	EPA 1668A/1668C	PCB 85
GC/HRMS	EPA 1668A/1668C	PCB 86
GC/HRMS	EPA 1668A/1668C	PCB 87
GC/HRMS	EPA 1668A/1668C	PCB 88
GC/HRMS	EPA 1668A/1668C	PCB 89
GC/HRMS	EPA 1668A/1668C	PCB 90
GC/HRMS	EPA 1668A/1668C	PCB 91
GC/HRMS	EPA 1668A/1668C	PCB 92
GC/HRMS	EPA 1668A/1668C	PCB 93
GC/HRMS	EPA 1668A/1668C	PCB 94
GC/HRMS	EPA 1668A/1668C	PCB 95
GC/HRMS	EPA 1668A/1668C	PCB 96
GC/HRMS	EPA 1668A/1668C	PCB 97
GC/HRMS	EPA 1668A/1668C	PCB 98
GC/HRMS	EPA 1668A/1668C	PCB 99
GC/HRMS	EPA 1668A/1668C	PCB 100
GC/HRMS	EPA 1668A/1668C	PCB 101
GC/HRMS	EPA 1668A/1668C	PCB 102
GC/HRMS	EPA 1668A/1668C	PCB 103
GC/HRMS	EPA 1668A/1668C	PCB 104
GC/HRMS	EPA 1668A/1668C	PCB 105
GC/HRMS	EPA 1668A/1668C	PCB 106
GC/HRMS	EPA 1668A/1668C	PCB 107
GC/HRMS	EPA 1668A/1668C	PCB 108
GC/HRMS	EPA 1668A/1668C	PCB 109
GC/HRMS	EPA 1668A/1668C	PCB 110
GC/HRMS	EPA 1668A/1668C	PCB 111
GC/HRMS	EPA 1668A/1668C	PCB 112
GC/HRMS	EPA 1668A/1668C	PCB 113
GC/HRMS	EPA 1668A/1668C	PCB 114
GC/HRMS	EPA 1668A/1668C	PCB 115
GC/HRMS	EPA 1668A/1668C	PCB 116
GC/HRMS	EPA 1668A/1668C	PCB 117
GC/HRMS	EPA 1668A/1668C	PCB 118
GC/HRMS	EPA 1668A/1668C	PCB 119
GC/HRMS	EPA 1668A/1668C	PCB 120

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 121
GC/HRMS	EPA 1668A/1668C	PCB 122
GC/HRMS	EPA 1668A/1668C	PCB 123
GC/HRMS	EPA 1668A/1668C	PCB 124
GC/HRMS	EPA 1668A/1668C	PCB 125
GC/HRMS	EPA 1668A/1668C	PCB 126
GC/HRMS	EPA 1668A/1668C	PCB 127
GC/HRMS	EPA 1668A/1668C	PCB 128
GC/HRMS	EPA 1668A/1668C	PCB 129
GC/HRMS	EPA 1668A/1668C	PCB 130
GC/HRMS	EPA 1668A/1668C	PCB 131
GC/HRMS	EPA 1668A/1668C	PCB 132
GC/HRMS	EPA 1668A/1668C	PCB 133
GC/HRMS	EPA 1668A/1668C	PCB 134
GC/HRMS	EPA 1668A/1668C	PCB 135
GC/HRMS	EPA 1668A/1668C	PCB 136
GC/HRMS	EPA 1668A/1668C	PCB 137
GC/HRMS	EPA 1668A/1668C	PCB 138
GC/HRMS	EPA 1668A/1668C	PCB 139
GC/HRMS	EPA 1668A/1668C	PCB 140
GC/HRMS	EPA 1668A/1668C	PCB 141
GC/HRMS	EPA 1668A/1668C	PCB 142
GC/HRMS	EPA 1668A/1668C	PCB 143
GC/HRMS	EPA 1668A/1668C	PCB 144
GC/HRMS	EPA 1668A/1668C	PCB 145
GC/HRMS	EPA 1668A/1668C	PCB 146
GC/HRMS	EPA 1668A/1668C	PCB 147
GC/HRMS	EPA 1668A/1668C	PCB 148
GC/HRMS	EPA 1668A/1668C	PCB 149
GC/HRMS	EPA 1668A/1668C	PCB 150
GC/HRMS	EPA 1668A/1668C	PCB 151
GC/HRMS	EPA 1668A/1668C	PCB 152
GC/HRMS	EPA 1668A/1668C	PCB 153
GC/HRMS	EPA 1668A/1668C	PCB 154
GC/HRMS	EPA 1668A/1668C	PCB 155
GC/HRMS	EPA 1668A/1668C	PCB 156

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 157
GC/HRMS	EPA 1668A/1668C	PCB 158
GC/HRMS	EPA 1668A/1668C	PCB 159
GC/HRMS	EPA 1668A/1668C	PCB 160
GC/HRMS	EPA 1668A/1668C	PCB 161
GC/HRMS	EPA 1668A/1668C	PCB 162
GC/HRMS	EPA 1668A/1668C	PCB 163
GC/HRMS	EPA 1668A/1668C	PCB 164
GC/HRMS	EPA 1668A/1668C	PCB 165
GC/HRMS	EPA 1668A/1668C	PCB 166
GC/HRMS	EPA 1668A/1668C	PCB 167
GC/HRMS	EPA 1668A/1668C	PCB 168
GC/HRMS	EPA 1668A/1668C	PCB 169
GC/HRMS	EPA 1668A/1668C	PCB 170
GC/HRMS	EPA 1668A/1668C	PCB 171
GC/HRMS	EPA 1668A/1668C	PCB 172
GC/HRMS	EPA 1668A/1668C	PCB 173
GC/HRMS	EPA 1668A/1668C	PCB 174
GC/HRMS	EPA 1668A/1668C	PCB 175
GC/HRMS	EPA 1668A/1668C	PCB 176
GC/HRMS	EPA 1668A/1668C	PCB 177
GC/HRMS	EPA 1668A/1668C	PCB 178
GC/HRMS	EPA 1668A/1668C	PCB 179
GC/HRMS	EPA 1668A/1668C	PCB 180
GC/HRMS	EPA 1668A/1668C	PCB 181
GC/HRMS	EPA 1668A/1668C	PCB 182
GC/HRMS	EPA 1668A/1668C	PCB 183
GC/HRMS	EPA 1668A/1668C	PCB 184
GC/HRMS	EPA 1668A/1668C	PCB 185
GC/HRMS	EPA 1668A/1668C	PCB 186
GC/HRMS	EPA 1668A/1668C	PCB 187
GC/HRMS	EPA 1668A/1668C	PCB 188
GC/HRMS	EPA 1668A/1668C	PCB 189
GC/HRMS	EPA 1668A/1668C	PCB 190
GC/HRMS	EPA 1668A/1668C	PCB 191
GC/HRMS	EPA 1668A/1668C	PCB 192

Non-Potable Water

Technology	Method	Analyte
GC/HRMS	EPA 1668A/1668C	PCB 193
GC/HRMS	EPA 1668A/1668C	PCB 194
GC/HRMS	EPA 1668A/1668C	PCB 195
GC/HRMS	EPA 1668A/1668C	PCB 196
GC/HRMS	EPA 1668A/1668C	PCB 197
GC/HRMS	EPA 1668A/1668C	PCB 198
GC/HRMS	EPA 1668A/1668C	PCB 199
GC/HRMS	EPA 1668A/1668C	PCB 200
GC/HRMS	EPA 1668A/1668C	PCB 201
GC/HRMS	EPA 1668A/1668C	PCB 202
GC/HRMS	EPA 1668A/1668C	PCB 203
GC/HRMS	EPA 1668A/1668C	PCB 204
GC/HRMS	EPA 1668A/1668C	PCB 205
GC/HRMS	EPA 1668A/1668C	PCB 206
GC/HRMS	EPA 1668A/1668C	PCB 207
GC/HRMS	EPA 1668A/1668C	PCB 208
GC/HRMS	EPA 1668A/1668C	PCB 209
Preparation	**Method**	**Type**
Acid Digestion (Aqueous)	EPA 3005A/3010A	Inorganics
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	Semivolatile and Non-Volatile Organics
Solid Phase Extraction	EPA 3535A	Semivolatile and Non-Volatile Organics
Purge and Trap	EPA 5030B/5030C	Volatile Organic Compounds
Florisil Cleanup	EPA 3620B/3620C	Cleanup of pesticide residues and other chlorinated hydrocarbons
Sulfur Cleanup	EPA 3660A	Sulfur Cleanup
Sulfuric Acid Cleanup	EPA 3665A	Sulfuric Acid Cleanup for PCBs
Silica Gel Cleanup	EPA 3630C	Column Cleanup

Drinking Water

Technology	Method	Analyte
LC/MS/MS	EPA 537	Perfluorobutane Sulfonic Acid (PFBS)
LC/MS/MS	EPA 537	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	EPA 537	Perfluorohexane Sulfonic Acid (PFHxS)
LC/MS/MS	EPA 537	Perfluorononanoic acid (PFNA)

LC/MS/MS	EPA 537	Perfluorooctanoic acid (PFOA)
LC/MS/MS	EPA 537	Perfluorooctane Sulfonic Acid(PFOS)
Preparation	**Method**	**Type**
Solid Phase Extraction	EPA 537	Perfluoro compounds in Drinking Water

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium
ICP-AES	EPA 6010B/6010C	Boron
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium (Total)
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
ICP-AES	EPA 6010B/6010C	Molybdenum
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium
ICP-AES	EPA 6010B/6010C	Tin
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium (Total)
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Phosphorus
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Strontium
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Tin
ICP-MS	EPA 6020/6020A	Titanium
ICP-MS	EPA 6020/6020A	Uranium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
CVAAS	EPA 7471A/7471B	Mercury
Colorimetric	EPA 353.2	Nitrate
Colorimetric	EPA 353.2	Nitrate-nitrite
Colorimetric	EPA 353.2	Nitrite
Colorimetric/Hydrolysis	EPA 353.2 Modified /WS-WC-0050	Nitrocellulose
LC/MS/MS	EPA 6850	Perchlorate
Probe	EPA 9045C/9045D	pH
Ion Chromatography	EPA 9056A/300.0	Bromide
Ion Chromatography	EPA 9056A/300.0	Chloride
Ion Chromatography	EPA 9056A/300.0	Fluoride
Ion Chromatography	EPA 9056A/300.0	Sulfate
Ion Chromatography	EPA 9056A/300.0	Nitrate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Ion Chromatography	EPA 9056A/300.0	Nitrite
Gravimetric	ASTM D2216	%Moisture
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1-Chlorohexane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	2-Butanone (MEK)
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	2-Hexanone (MBK)
GC/MS	EPA 8260B/8260C	2-Methyl-2-propanol (tert- Butyl Alcohol, TBA)
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Isopropyltoluene
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Allyl Chloride
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Bromobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Bromochloromethane
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	Carbon Disulfide
GC/MS	EPA 8260B/8260C	Carbon Tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Dibromochloromethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	Diisopropyl Ether (DIPE)
GC/MS	EPA 8260B/8260C	Ethylbenzene
GC/MS	EPA 8260B/8260C	Ethylmethacrylate
GC/MS	EPA 8260B/8260C	Ethyl tert-butyl Ether (ETBE)
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	Hexane
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol (2-Methyl-1-propanol)
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	m & p Xylene
GC/MS	EPA 8260B/8260C	Methyl tert-butyl Ether (MTBE)
GC/MS	EPA 8260B/8260C	Methylene Chloride
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	n-Butylbenzene
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	t-Amyl methyl Ether (TAME)
GC/MS	EPA 8260B/8260C	t-1,4-Dichloro-2-Butene

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	Vinyl Acetate
GC/MS	EPA 8260B/8260C	Vinyl Chloride
GC/MS	EPA 8260B/8260C	Xylenes, Total
GC/MS	EPA 8260B/AK101MS	Gasoline Range Organics (GRO)
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	3&4-Methylphenol
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic Acid
GC/MS	EPA 8270C/8270D	Benzyl Alcohol
GC/MS	EPA 8270C/8270D	Benzyl butyl Phthalate
GC/MS	EPA 8270C/8270D	Biphenyl
GC/MS	EPA 8270C/8270D	Bis(2-chloroethoxy) Methane
GC/MS	EPA 8270C/8270D	Bis(2-chloroethyl) Ether
GC/MS	EPA 8270C/8270D	Bis(2-chloroisopropyl) Ether
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Bis (2-ethylhexyl) Phthalate
GC/MS	EPA 8270C/8270D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Diethyl Phthalate
GC/MS	EPA 8270C/8270D	Dimethyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-butyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-octyl Phthalate
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-c,d) Pyrene
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS SIM	EPA 8260C-SIM	1,1,2-Trichloroethane
GC/MS SIM	EPA 8260C-SIM	1,1,2,2-Tetrachloroethane
GC/MS SIM	EPA 8260C-SIM	1,2,3-Trichloropropane
GC/MS SIM	EPA 8260C-SIM	1,2-Dibromoethane
GC/MS SIM	EPA 8260C-SIM	1,2-Dichloroethane
GC/MS SIM	EPA 8260C-SIM	1,3-Butadiene
GC/MS SIM	EPA 8260C-SIM	1,4-Dichlorobenzene
GC/MS SIM	EPA 8260C-SIM	Benzene
GC/MS SIM	EPA 8260C-SIM	Bromodichloromethane
GC/MS SIM	EPA 8260C-SIM	Bromoform
GC/MS SIM	EPA 8260C-SIM	Bromomethane
GC/MS SIM	EPA 8260C-SIM	Chloroform
GC/MS SIM	EPA 8260C-SIM	Dibromochloromethane
GC/MS SIM	EPA 8260C-SIM	Dibromomethane
GC/MS SIM	EPA 8260C-SIM	Hexachlorobutadiene
GC/MS SIM	EPA 8260C-SIM	Naphthalene
GC/MS SIM	EPA 8260C-SIM	Tetrachloroethene
GC/MS SIM	EPA 8260C-SIM	Trichloroethene
GC/MS SIM	EPA 8260C-SIM	Vinyl Chloride
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	1-Methylnaphthalene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	2-Methylnaphthalene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(b)fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(g,h,i)perylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(k)fluoranthene
GC/MS SIM	EPA 8270D-SIM	Bis(2-chloroethyl) Ether
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Chrysene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Dibenz(a,h)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluorene
GC/MS SIM	EPA 8270D-SIM	Hexachlorobenzene
GC/MS SIM	EPA 8270D-SIM	Hexachlorocyclopentadiene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Indeno(1,2,3-c,d) Pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Naphthalene
GC/MS SIM	EPA 8270D-SIM	n-Nitrosodi-n-propylamine
GC/MS SIM	EPA 8270D-SIM	Pentachlorophenol
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Phenanthrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Pyrene
GC/MS SIM	EPA 521 Modified / WS-MS-0012	N-Nitrosodimethyl amine (NDMA)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-FID	EPA 8015B/8015C/8015D AK102	Diesel Range Organics (DRO)
GC-FID	AK103	Residual Range Organics
GC-FID	EPA 8015B/8015C/8015D	Motor Oil Range Organics (MRO)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	a-BHC
GC-ECD	EPA 8081A/8081B	b-BHC
GC-ECD	EPA 8081A/8081B	d-BHC
GC-ECD	EPA 8081A/8081B	g-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	a-Chlordane
GC-ECD	EPA 8081A/8081B	g-Chlordane
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin Aldehyde
GC-ECD	EPA 8081A/8081B	Endrin Ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor Epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8082/8082A	PCB-1016
GC-ECD	EPA 8082/8082A	PCB-1221
GC-ECD	EPA 8082/8082A	PCB-1232
GC-ECD	EPA 8082/8082A	PCB-1242
GC-ECD	EPA 8082/8082A	PCB-1248
GC-ECD	EPA 8082/8082A	PCB-1254
GC-ECD	EPA 8082/8082A	PCB-1260
GC-ECD	EPA 8082/8082A	PCB-1262
GC-ECD	EPA 8082/8082A	PCB-1268
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDD

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDD
GC/MS	EPA 8280A/8280B	OCDD
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDF
GC/MS	EPA 8280A/8280B	2,3,4,7,8-PeCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDF
GC/MS	EPA 8280A/8280B	2,3,4,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8,9-HpCDF
GC/MS	EPA 8280A/8280B	OCDF
GC/MS	EPA 8280A/8280B	Total TCDD
GC/MS	EPA 8280A/8280B	Total PeCDD
GC/MS	EPA 8280A/8280B	Total HxCDD
GC/MS	EPA 8280A/8280B	Total HeptaCDD
GC/MS	EPA 8280A/8280B	Total TCDF
GC/MS	EPA 8280A/8280B	Total PeCDF
GC/MS	EPA 8280A/8280B	Total HxCDF
GC/MS	EPA 8280A/8280B	Total HpCDF
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,7,8-TeCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8-PeCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,7,8-HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,6,7,8-HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8,9-HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,6,7,8-HpCDD
GC/HRMS	EPA 8290/ 8290A/1613B	OCDD
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,7,8-TeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8-PeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,4,7,8-PeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,7,8-HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,6,7,8-HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8,9-HxCDF

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,4,6,7,8-HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,6,7,8-HpCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,7,8,9-HpCDF
GC/HRMS	EPA 8290/ 8290A/1613B	OCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total TCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total PeCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total HpCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total TCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total PeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total HpCDF
HPLC/UV	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	Glycerol trinitrate (Nitroglycerin)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitro- 1,3,5-triazine (Hexogen)
HPLC/UV	EPA 8330A/8330B	Methyl-2,4,6- trinitrophenylnitramine
HPLC/UV	EPA 8330A/8330B	Nitrobenzene
HPLC/UV	EPA 8330A/8330B	2-Nitrotoluene (o-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	3-Nitrotoluene (m-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	4-Nitrotoluene (p-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	Octahydro-1,3,5,7- tetranitro1,3,5,7-tetracine (Octogen)
HPLC/UV	EPA 8330A/8330B	Picric acid
HPLC/UV	EPA 8330A/8330B	Pentaerythritol Tetranitrate
HPLC/UV	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4,6-Trinitrotoluene
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3-dinitroso-5- nitro-1,3,5,triazine (DNX)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitroso- 1,3,5-triazine (TNX)
HPLC/UV	EPA 8330A/8330B	1-Nitroso-3,5-dinitro-1,3,5- triazacyclohexane (MNX)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A Modified / WS-LC-0010	Nitroguanidine
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	6:2 Fluorotelomer sulfonate (6:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	8:2 Fluorotelomer sulfonate (8:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Ethyl perfluorooctanesulfon amidacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Methyl perfluorooctanesulfon amidoacetic acide (MeFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctanoic acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctane Sulfonic Acid (PFOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutyric acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoropentanoic acid (PFPA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptanoic acid (PFHpA)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorononanoic acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecanoic acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroundecanoic acid (PFUDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorododecanoic acid (PFDoDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotridecanoic acid (PFTriA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotetradecanoic acid (PDTeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutane Sulfonic Acid (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexane Sulfonic Acid (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptane Sulfonic Acid (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecane Sulfonic Acid (PFDS)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroocatane Sulfonamide (FOSA)
GC/HRMS	EPA 1668A/1668C	PCB 1
GC/HRMS	EPA 1668A/1668C	PCB 2
GC/HRMS	EPA 1668A/1668C	PCB 3
GC/HRMS	EPA 1668A/1668C	PCB 4
GC/HRMS	EPA 1668A/1668C	PCB 5
GC/HRMS	EPA 1668A/1668C	PCB 6
GC/HRMS	EPA 1668A/1668C	PCB 7
GC/HRMS	EPA 1668A/1668C	PCB 8
GC/HRMS	EPA 1668A/1668C	PCB 9
GC/HRMS	EPA 1668A/1668C	PCB 10
GC/HRMS	EPA 1668A/1668C	PCB 11
GC/HRMS	EPA 1668A/1668C	PCB 12
GC/HRMS	EPA 1668A/1668C	PCB 13
GC/HRMS	EPA 1668A/1668C	PCB 14
GC/HRMS	EPA 1668A/1668C	PCB 15
GC/HRMS	EPA 1668A/1668C	PCB 16
GC/HRMS	EPA 1668A/1668C	PCB 17
GC/HRMS	EPA 1668A/1668C	PCB 18
GC/HRMS	EPA 1668A/1668C	PCB 19
GC/HRMS	EPA 1668A/1668C	PCB 20
GC/HRMS	EPA 1668A/1668C	PCB 21
GC/HRMS	EPA 1668A/1668C	PCB 22
GC/HRMS	EPA 1668A/1668C	PCB 23
GC/HRMS	EPA 1668A/1668C	PCB 24
GC/HRMS	EPA 1668A/1668C	PCB 25
GC/HRMS	EPA 1668A/1668C	PCB 26
GC/HRMS	EPA 1668A/1668C	PCB 27
GC/HRMS	EPA 1668A/1668C	PCB 28
GC/HRMS	EPA 1668A/1668C	PCB 29
GC/HRMS	EPA 1668A/1668C	PCB 30
GC/HRMS	EPA 1668A/1668C	PCB 32
GC/HRMS	EPA 1668A/1668C	PCB 31
GC/HRMS	EPA 1668A/1668C	PCB 33

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 34
GC/HRMS	EPA 1668A/1668C	PCB 35
GC/HRMS	EPA 1668A/1668C	PCB 36
GC/HRMS	EPA 1668A/1668C	PCB 37
GC/HRMS	EPA 1668A/1668C	PCB 38
GC/HRMS	EPA 1668A/1668C	PCB 39
GC/HRMS	EPA 1668A/1668C	PCB 40
GC/HRMS	EPA 1668A/1668C	PCB 41
GC/HRMS	EPA 1668A/1668C	PCB 42
GC/HRMS	EPA 1668A/1668C	PCB 43
GC/HRMS	EPA 1668A/1668C	PCB 44
GC/HRMS	EPA 1668A/1668C	PCB 45
GC/HRMS	EPA 1668A/1668C	PCB 46
GC/HRMS	EPA 1668A/1668C	PCB 47
GC/HRMS	EPA 1668A/1668C	PCB 48
GC/HRMS	EPA 1668A/1668C	PCB 49
GC/HRMS	EPA 1668A/1668C	PCB 50
GC/HRMS	EPA 1668A/1668C	PCB 51
GC/HRMS	EPA 1668A/1668C	PCB 52
GC/HRMS	EPA 1668A/1668C	PCB 53
GC/HRMS	EPA 1668A/1668C	PCB 54
GC/HRMS	EPA 1668A/1668C	PCB 55
GC/HRMS	EPA 1668A/1668C	PCB 56
GC/HRMS	EPA 1668A/1668C	PCB 57
GC/HRMS	EPA 1668A/1668C	PCB 58
GC/HRMS	EPA 1668A/1668C	PCB 59
GC/HRMS	EPA 1668A/1668C	PCB 60
GC/HRMS	EPA 1668A/1668C	PCB 61
GC/HRMS	EPA 1668A/1668C	PCB 62
GC/HRMS	EPA 1668A/1668C	PCB 63
GC/HRMS	EPA 1668A/1668C	PCB 64
GC/HRMS	EPA 1668A/1668C	PCB 65
GC/HRMS	EPA 1668A/1668C	PCB 66
GC/HRMS	EPA 1668A/1668C	PCB 67
GC/HRMS	EPA 1668A/1668C	PCB 68
GC/HRMS	EPA 1668A/1668C	PCB 69

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 70
GC/HRMS	EPA 1668A/1668C	PCB 71
GC/HRMS	EPA 1668A/1668C	PCB 72
GC/HRMS	EPA 1668A/1668C	PCB 73
GC/HRMS	EPA 1668A/1668C	PCB 74
GC/HRMS	EPA 1668A/1668C	PCB 75
GC/HRMS	EPA 1668A/1668C	PCB 76
GC/HRMS	EPA 1668A/1668C	PCB 77
GC/HRMS	EPA 1668A/1668C	PCB 78
GC/HRMS	EPA 1668A/1668C	PCB 79
GC/HRMS	EPA 1668A/1668C	PCB 80
GC/HRMS	EPA 1668A/1668C	PCB 81
GC/HRMS	EPA 1668A/1668C	PCB 82
GC/HRMS	EPA 1668A/1668C	PCB 83
GC/HRMS	EPA 1668A/1668C	PCB 84
GC/HRMS	EPA 1668A/1668C	PCB 85
GC/HRMS	EPA 1668A/1668C	PCB 86
GC/HRMS	EPA 1668A/1668C	PCB 87
GC/HRMS	EPA 1668A/1668C	PCB 88
GC/HRMS	EPA 1668A/1668C	PCB 89
GC/HRMS	EPA 1668A/1668C	PCB 90
GC/HRMS	EPA 1668A/1668C	PCB 91
GC/HRMS	EPA 1668A/1668C	PCB 92
GC/HRMS	EPA 1668A/1668C	PCB 93
GC/HRMS	EPA 1668A/1668C	PCB 94
GC/HRMS	EPA 1668A/1668C	PCB 95
GC/HRMS	EPA 1668A/1668C	PCB 96
GC/HRMS	EPA 1668A/1668C	PCB 97
GC/HRMS	EPA 1668A/1668C	PCB 98
GC/HRMS	EPA 1668A/1668C	PCB 99
GC/HRMS	EPA 1668A/1668C	PCB 100
GC/HRMS	EPA 1668A/1668C	PCB 101
GC/HRMS	EPA 1668A/1668C	PCB 102
GC/HRMS	EPA 1668A/1668C	PCB 103
GC/HRMS	EPA 1668A/1668C	PCB 104
GC/HRMS	EPA 1668A/1668C	PCB 105

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 106
GC/HRMS	EPA 1668A/1668C	PCB 107
GC/HRMS	EPA 1668A/1668C	PCB 108
GC/HRMS	EPA 1668A/1668C	PCB 109
GC/HRMS	EPA 1668A/1668C	PCB 110
GC/HRMS	EPA 1668A/1668C	PCB 111
GC/HRMS	EPA 1668A/1668C	PCB 112
GC/HRMS	EPA 1668A/1668C	PCB 113
GC/HRMS	EPA 1668A/1668C	PCB 114
GC/HRMS	EPA 1668A/1668C	PCB 115
GC/HRMS	EPA 1668A/1668C	PCB 116
GC/HRMS	EPA 1668A/1668C	PCB 117
GC/HRMS	EPA 1668A/1668C	PCB 118
GC/HRMS	EPA 1668A/1668C	PCB 119
GC/HRMS	EPA 1668A/1668C	PCB 120
GC/HRMS	EPA 1668A/1668C	PCB 121
GC/HRMS	EPA 1668A/1668C	PCB 122
GC/HRMS	EPA 1668A/1668C	PCB 123
GC/HRMS	EPA 1668A/1668C	PCB 124
GC/HRMS	EPA 1668A/1668C	PCB 125
GC/HRMS	EPA 1668A/1668C	PCB 126
GC/HRMS	EPA 1668A/1668C	PCB 127
GC/HRMS	EPA 1668A/1668C	PCB 128
GC/HRMS	EPA 1668A/1668C	PCB 129
GC/HRMS	EPA 1668A/1668C	PCB 130
GC/HRMS	EPA 1668A/1668C	PCB 131
GC/HRMS	EPA 1668A/1668C	PCB 132
GC/HRMS	EPA 1668A/1668C	PCB 133
GC/HRMS	EPA 1668A/1668C	PCB 134
GC/HRMS	EPA 1668A/1668C	PCB 135
GC/HRMS	EPA 1668A/1668C	PCB 136
GC/HRMS	EPA 1668A/1668C	PCB 137
GC/HRMS	EPA 1668A/1668C	PCB 138
GC/HRMS	EPA 1668A/1668C	PCB 139
GC/HRMS	EPA 1668A/1668C	PCB 140
GC/HRMS	EPA 1668A/1668C	PCB 141

Solid and Chemical Materials

Technology	Method	Analyte
GC/HRMS	EPA 1668A/1668C	PCB 142
GC/HRMS	EPA 1668A/1668C	PCB 143
GC/HRMS	EPA 1668A/1668C	PCB 144
GC/HRMS	EPA 1668A/1668C	PCB 145
GC/HRMS	EPA 1668A/1668C	PCB 146
GC/HRMS	EPA 1668A/1668C	PCB 147
GC/HRMS	EPA 1668A/1668C	PCB 148
GC/HRMS	EPA 1668A/1668C	PCB 149
GC/HRMS	EPA 1668A/1668C	PCB 150
GC/HRMS	EPA 1668A/1668C	PCB 151
GC/HRMS	EPA 1668A/1668C	PCB 152
GC/HRMS	EPA 1668A/1668C	PCB 153
GC/HRMS	EPA 1668A/1668C	PCB 154
GC/HRMS	EPA 1668A/1668C	PCB 155
GC/HRMS	EPA 1668A/1668C	PCB 156
GC/HRMS	EPA 1668A/1668C	PCB 157
GC/HRMS	EPA 1668A/1668C	PCB 158
GC/HRMS	EPA 1668A/1668C	PCB 159
GC/HRMS	EPA 1668A/1668C	PCB 160
GC/HRMS	EPA 1668A/1668C	PCB 161
GC/HRMS	EPA 1668A/1668C	PCB 162
GC/HRMS	EPA 1668A/1668C	PCB 163
GC/HRMS	EPA 1668A/1668C	PCB 164
GC/HRMS	EPA 1668A/1668C	PCB 165
GC/HRMS	EPA 1668A/1668C	PCB 166
GC/HRMS	EPA 1668A/1668C	PCB 167
GC/HRMS	EPA 1668A/1668C	PCB 168
GC/HRMS	EPA 1668A/1668C	PCB 169
GC/HRMS	EPA 1668A/1668C	PCB 170
GC/HRMS	EPA 1668A/1668C	PCB 171
GC/HRMS	EPA 1668A/1668C	PCB 172
GC/HRMS	EPA 1668A/1668C	PCB 173
GC/HRMS	EPA 1668A/1668C	PCB 174
GC/HRMS	EPA 1668A/1668C	PCB 175
GC/HRMS	EPA 1668A/1668C	PCB 176
GC/HRMS	EPA 1668A/1668C	PCB 177

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 178
GC/HRMS	EPA 1668A/1668C	PCB 179
GC/HRMS	EPA 1668A/1668C	PCB 180
GC/HRMS	EPA 1668A/1668C	PCB 181
GC/HRMS	EPA 1668A/1668C	PCB 182
GC/HRMS	EPA 1668A/1668C	PCB 183
GC/HRMS	EPA 1668A/1668C	PCB 184
GC/HRMS	EPA 1668A/1668C	PCB 185
GC/HRMS	EPA 1668A/1668C	PCB 186
GC/HRMS	EPA 1668A/1668C	PCB 187
GC/HRMS	EPA 1668A/1668C	PCB 188
GC/HRMS	EPA 1668A/1668C	PCB 189
GC/HRMS	EPA 1668A/1668C	PCB 190
GC/HRMS	EPA 1668A/1668C	PCB 191
GC/HRMS	EPA 1668A/1668C	PCB 192
GC/HRMS	EPA 1668A/1668C	PCB 193
GC/HRMS	EPA 1668A/1668C	PCB 194
GC/HRMS	EPA 1668A/1668C	PCB 195
GC/HRMS	EPA 1668A/1668C	PCB 196
GC/HRMS	EPA 1668A/1668C	PCB 197
GC/HRMS	EPA 1668A/1668C	PCB 198
GC/HRMS	EPA 1668A/1668C	PCB 199
GC/HRMS	EPA 1668A/1668C	PCB 200
GC/HRMS	EPA 1668A/1668C	PCB 201
GC/HRMS	EPA 1668A/1668C	PCB 202
GC/HRMS	EPA 1668A/1668C	PCB 203
GC/HRMS	EPA 1668A/1668C	PCB 204
GC/HRMS	EPA 1668A/1668C	PCB 205
GC/HRMS	EPA 1668A/1668C	PCB 206
GC/HRMS	EPA 1668A/1668C	PCB 207
GC/HRMS	EPA 1668A/1668C	PCB 208
GC/HRMS	EPA 1668A/1668C	PCB 209
Preparation	**Method**	**Type**
Acid Digestion (Aqueous)	EPA 3005A/3010A	Inorganics
Acid Digestion (Solid)	EPA 3050B	Inorganics
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	Semivolatile and Non-Volatile Organics

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Ultrasonic Extraction	EPA 3550B/3550C	Semivolatile and Non-Volatile Organics
Solvent Dilution	EPA 3580A	Semivolatile and Non-Volatile Organics
Purge and Trap	EPA 5030B	Volatile Organic Compounds
Purge and Trap	EPA 5035/5035A	Volatile Organic Compounds
Microwave Extraction	EPA 3546	Semivolatile and Non-Volatile Organics
Florisil Cleanup	EPA 3620B/3620C	Cleanup of pesticide residues and other chlorinated hydrocarbons
Sulfur Cleanup	EPA 3660A	Sulfur Cleanup
Sulfuric Acid Cleanup	EPA 3665A	Sulfuric Acid Cleanup for PCBs
Silica Gel Cleanup	EPA 3630C	Column Cleanup
TCLP Extraction	EPA 1311	Toxicity Characteristic Leaching Procedure

Air and Emissions		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium (Total)
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Thallium

Air and Emissions

Technology	Method	Analyte
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
Gravimetric	40CFR Part 50 App B	TSP (Total Suspended Particulate)
Gravimetric	40CFR Part 50 App J	PM10
GC/MS	EPA TO-14A/TO-15	1,1,1-Trichloroethane
GC/MS	EPA TO-14A/TO-15	1,1,2,2-Tetrachloroethane
GC/MS	EPA TO-14A/TO-15	1,1,2-Trichloroethane
GC/MS	EPA TO-14A/TO-15	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA TO-14A/TO-15	1,1-Dichloroethane
GC/MS	EPA TO-14A/TO-15	1,1-Dichloroethene
GC/MS	EPA TO-14A/TO-15	1,2,3-Trichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,2,3-Trichloropropane
GC/MS	EPA TO-14A/TO-15	1,2,4-Trichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,2,4-Trimethylbenzene
GC/MS	EPA TO-14A/TO-15	1,2-Dibromoethane
GC/MS	EPA TO-14A/TO-15	1,2-Dichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,2-Dichloroethane
GC/MS	EPA TO-14A/TO-15	1,2-Dichloropropane
GC/MS	EPA TO-14A/TO-15	1,3,5-Trimethylbenzene
GC/MS	EPA TO-14A/TO-15	1,3-Dichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,4-Dichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,4-Dioxane
GC/MS	EPA TO-14A/TO-15	2-Butanone (MEK)
GC/MS	EPA TO-14A/TO-15	2-Chlorotoluene
GC/MS	EPA TO-14A/TO-15	2-Hexanone (MBK)
GC/MS	EPA TO-14A/TO-15	2-Methyl-2-propanol (tert- Butyl Alcohol, TBA)
GC/MS	EPA TO-14A/TO-15	4-Ethyltoluene
GC/MS	EPA TO-14A/TO-15	4-Isopropyltoluene
GC/MS	EPA TO-14A/TO-15	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA TO-14A/TO-15	Acetone
GC/MS	EPA TO-14A/TO-15	Acrolein
GC/MS	EPA TO-14A/TO-15	Allyl Chloride
GC/MS	EPA TO-14A/TO-15	Alpha Methyl Styrene
GC/MS	EPA TO-14A/TO-15	Benzene
GC/MS	EPA TO-14A/TO-15	Benzyl Chloride
GC/MS	EPA TO-14A/TO-15	Bromodichloromethane

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-14A/TO-15	Bromoform
GC/MS	EPA TO-14A/TO-15	Bromomethane
GC/MS	EPA TO-14A/TO-15	Butadiene (1,3-Butadiene)
GC/MS	EPA TO-14A/TO-15	Butane
GC/MS	EPA TO-14A/TO-15	Carbon Disulfide
GC/MS	EPA TO-14A/TO-15	Carbon Tetrachloride
GC/MS	EPA TO-14A/TO-15	Chlorobenzene
GC/MS	EPA TO-14A/TO-15	Chlorodifluoromethane
GC/MS	EPA TO-14A/TO-15	Chloroethane
GC/MS	EPA TO-14A/TO-15	Chloroform
GC/MS	EPA TO-14A/TO-15	Chloromethane
GC/MS	EPA TO-14A/TO-15	cis-1,2-Dichloroethene
GC/MS	EPA TO-14A/TO-15	cis-1,3-Dichloropropene
GC/MS	EPA TO-14A/TO-15	Cyclohexane
GC/MS	EPA TO-14A/TO-15	Dibromochloromethane
GC/MS	EPA TO-14A/TO-15	Dibromomethane
GC/MS	EPA TO-14A/TO-15	Dichlorodifluoromethane
GC/MS	EPA TO-14A/TO-15	Ethyl Acetate
GC/MS	EPA TO-14A/TO-15	Ethylbenzene
GC/MS	EPA TO-14A/TO-15	Hexachlorobutadiene
GC/MS	EPA TO-14A/TO-15	Hexane
GC/MS	EPA TO-14A/TO-15	Isooctane (2,2,4- Trimethylpentane)
GC/MS	EPA TO-14A/TO-15	Isopropyl Alcohol
GC/MS	EPA TO-14A/TO-15	Isopropylbenzene
GC/MS	EPA TO-14A/TO-15	m & p Xylene
GC/MS	EPA TO-14A/TO-15	Methyl tert-butyl Ether (MTBE)
GC/MS	EPA TO-14A/TO-15	Methylene Chloride
GC/MS	EPA TO-14A/TO-15	Naphthalene
GC/MS	EPA TO-14A/TO-15	n-Butanol
GC/MS	EPA TO-14A/TO-15	n-Butylbenzene
GC/MS	EPA TO-14A/TO-15	n-Heptane
GC/MS	EPA TO-14A/TO-15	n-Nonane
GC/MS	EPA TO-14A/TO-15	n-Octane
GC/MS	EPA TO-14A/TO-15	n-Propylbenzene
GC/MS	EPA TO-14A/TO-15	o-Xylene
GC/MS	EPA TO-14A/TO-15	Pentane

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-14A/TO-15	Propene
GC/MS	EPA TO-14A/TO-15	sec-Butylbenzene
GC/MS	EPA TO-14A/TO-15	Styrene
GC/MS	EPA TO-14A/TO-15	tert-Butylbenzene
GC/MS	EPA TO-14A/TO-15	Tetrachloroethene
GC/MS	EPA TO-14A/TO-15	Tetrahydrofuran
GC/MS	EPA TO-14A/TO-15	Toluene
GC/MS	EPA TO-14A/TO-15	trans-1,2-Dichloroethene
GC/MS	EPA TO-14A/TO-15	trans-1,3-Dichloropropene
GC/MS	EPA TO-14A/TO-15	Trichloroethene
GC/MS	EPA TO-14A/TO-15	Trichlorofluoromethane
GC/MS	EPA TO-14A/TO-15	Vinyl Acetate
GC/MS	EPA TO-14A/TO-15	Vinyl Bromide
GC/MS	EPA TO-14A/TO-15	Vinyl Chloride
GC/MS	EPA TO-14A/TO-15	Xylenes, Total
GC-FID/TCD	ASTM1946D / EPA 3C	Carbon Dioxide
GC-FID/TCD	ASTM1946D / EPA 3C	Nitrogen
GC-FID/TCD	ASTM1946D / EPA 3C	Oxygen
GC-FID/TCD	ASTM1946D / EPA 3C	Helium
GC-FID/TCD	ASTM1946D / EPA 3C	Hydrogen
GC-FID/TCD	ASTM1946D / EPA 3C	Methane
GC-FID/TCD	ASTM1946D / EPA 3C	Carbon Monoxide
GC/MS	EPA TO-14A/TO-15	Gasoline Range Organics (GRO)
GC/MS	EPA TO-14A/TO-15	TPH as Gasoline
GC/MS SIM	EPA TO-15 SIM	1,1,1-Trichloroethane
GC/MS SIM	EPA TO-15 SIM	1,1,2,2-Tetrachloroethane
GC/MS SIM	EPA TO-15 SIM	1,1,2-Trichloroethane
GC/MS SIM	EPA TO-15 SIM	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS SIM	EPA TO-15 SIM	1,1-Dichloroethane
GC/MS SIM	EPA TO-15 SIM	1,1-Dichloroethene
GC/MS SIM	EPA TO-15 SIM	1,2,3-Trichloropropane
GC/MS SIM	EPA TO-15 SIM	1,2,4-Trichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,2-Dibromoethane
GC/MS SIM	EPA TO-15 SIM	1,2-Dichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,2-Dichloroethane
GC/MS SIM	EPA TO-15 SIM	1,2-Dichloropropane

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA TO-15 SIM	1,3-Dichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,4-Dichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,4-Dioxane
GC/MS SIM	EPA TO-15 SIM	Acrolein
GC/MS SIM	EPA TO-15 SIM	Benzene
GC/MS SIM	EPA TO-15 SIM	Benzyl Chloride
GC/MS SIM	EPA TO-15 SIM	Bromodichloromethane
GC/MS SIM	EPA TO-15 SIM	Butadiene (1,3-Butadiene)
GC/MS SIM	EPA TO-15 SIM	Carbon Tetrachloride
GC/MS SIM	EPA TO-15 SIM	Chlorobenzene
GC/MS SIM	EPA TO-15 SIM	Chloroethane
GC/MS SIM	EPA TO-15 SIM	Chloroform
GC/MS SIM	EPA TO-15 SIM	Chloromethane
GC/MS SIM	EPA TO-15 SIM	cis-1,2-Dichloroethene
GC/MS SIM	EPA TO-15 SIM	cis-1,3-Dichloropropene
GC/MS SIM	EPA TO-15 SIM	Dibromochloromethane
GC/MS SIM	EPA TO-15 SIM	Dichlorodifluoromethane
GC/MS SIM	EPA TO-15 SIM	Ethylbenzene
GC/MS SIM	EPA TO-15 SIM	Hexachlorobutadiene
GC/MS SIM	EPA TO-15 SIM	m & p Xylene
GC/MS SIM	EPA TO-15 SIM	Methyl tert-butyl Ether (MTBE)
GC/MS SIM	EPA TO-15 SIM	Methylene Chloride
GC/MS SIM	EPA TO-15 SIM	Naphthalene
GC/MS SIM	EPA TO-15 SIM	o-Xylene
GC/MS SIM	EPA TO-15 SIM	Styrene
GC/MS SIM	EPA TO-15 SIM	Tetrachloroethene
GC/MS SIM	EPA TO-15 SIM	Toluene
GC/MS SIM	EPA TO-15 SIM	trans-1,2-Dichloroethene
GC/MS SIM	EPA TO-15 SIM	trans-1,3-Dichloropropene
GC/MS SIM	EPA TO-15 SIM	Trichloroethene
GC/MS SIM	EPA TO-15 SIM	Trichlorofluoromethane
GC/MS SIM	EPA TO-15 SIM	Vinyl Chloride
GC/MS SIM	EPA TO-15 SIM	Xylenes, Total
GC/MS	EPA TO-13A	1,2,4-Trichlorobenzene
GC/MS	EPA TO-13A	1,2-Dichlorobenzene
GC/MS	EPA TO-13A	1,3-Dichlorobenzene

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-13A	1,3-Dinitrobenzene
GC/MS	EPA TO-13A	1,4-Dichlorobenzene
GC/MS	EPA TO-13A	1-Methylnaphthalene
GC/MS	EPA TO-13A	2,3,4,6-Tetrachlorophenol
GC/MS	EPA TO-13A	2,4,5-Trichlorophenol
GC/MS	EPA TO-13A	2,4,6-Trichlorophenol
GC/MS	EPA TO-13A	2,4-Dichlorophenol
GC/MS	EPA TO-13A	2,4-Dimethylphenol
GC/MS	EPA TO-13A	2,4-Dinitrophenol
GC/MS	EPA TO-13A	2,4-Dinitrotoluene
GC/MS	EPA TO-13A	2,6-Dichlorophenol
GC/MS	EPA TO-13A	2,6-Dinitrotoluene
GC/MS	EPA TO-13A	2-Chloronaphthalene
GC/MS	EPA TO-13A	2-Chlorophenol
GC/MS	EPA TO-13A	2-Methylnaphthalene
GC/MS	EPA TO-13A	2-Methylphenol
GC/MS	EPA TO-13A	2-Nitroaniline
GC/MS	EPA TO-13A	2-Nitrophenol
GC/MS	EPA TO-13A	3&4-Methylphenol
GC/MS	EPA TO-13A	3,3'-Dichlorobenzidine
GC/MS	EPA TO-13A	3-Nitroaniline
GC/MS	EPA TO-13A	4,6-Dinitro-2-methylphenol
GC/MS	EPA TO-13A	4-Bromophenyl phenyl ether
GC/MS	EPA TO-13A	4-Chloro-3-methylphenol
GC/MS	EPA TO-13A	4-Chloroaniline
GC/MS	EPA TO-13A	4-Chlorophenyl phenyl ether
GC/MS	EPA TO-13A	4-Nitroaniline
GC/MS	EPA TO-13A	4-Nitrophenol
GC/MS	EPA TO-13A	Acenaphthene
GC/MS	EPA TO-13A	Acenaphthylene
GC/MS	EPA TO-13A	Aniline
GC/MS	EPA TO-13A	Anthracene
GC/MS	EPA TO-13A	Benzo(a)anthracene
GC/MS	EPA TO-13A	Benzo(a)pyrene
GC/MS	EPA TO-13A	Benzo(b)fluoranthene
GC/MS	EPA TO-13A	Benzo(g,h,i)perylene

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-13A	Benzo(k)fluoranthene
GC/MS	EPA TO-13A	Benzoic Acid
GC/MS	EPA TO-13A	Benzyl Alcohol
GC/MS	EPA TO-13A	Benzyl butyl Phthalate
GC/MS	EPA TO-13A	Biphenyl
GC/MS	EPA TO-13A	Bis(2-chloroethoxy) Methane
GC/MS	EPA TO-13A	Bis(2-chloroethyl) Ether
GC/MS	EPA TO-13A	Bis(2-chloroisopropyl) Ether
GC/MS	EPA TO-13A	Carbazole
GC/MS	EPA TO-13A	Chrysene
GC/MS	EPA TO-13A	Bis (2-ethylhexyl) Phthalate
GC/MS	EPA TO-13A	Dibenz(a,h)anthracene
GC/MS	EPA TO-13A	Dibenzofuran
GC/MS	EPA TO-13A	Diethyl Phthalate
GC/MS	EPA TO-13A	Dimethyl Phthalate
GC/MS	EPA TO-13A	Di-n-butyl Phthalate
GC/MS	EPA TO-13A	Di-n-octyl Phthalate
GC/MS	EPA TO-13A	Fluoranthene
GC/MS	EPA TO-13A	Fluorene
GC/MS	EPA TO-13A	Hexachlorobenzene
GC/MS	EPA TO-13A	Hexachlorobutadiene
GC/MS	EPA TO-13A	Hexachlorocyclopentadiene
GC/MS	EPA TO-13A	Hexachloroethane
GC/MS	EPA TO-13A	Indeno(1,2,3-c,d) Pyrene
GC/MS	EPA TO-13A	Isophorone
GC/MS	EPA TO-13A	Naphthalene
GC/MS	EPA TO-13A	Nitrobenzene
GC/MS	EPA TO-13A	n-Nitrosodimethylamine
GC/MS	EPA TO-13A	n-Nitrosodi-n-propylamine
GC/MS	EPA TO-13A	n-Nitrosodiphenylamine
GC/MS	EPA TO-13A	Pentachlorophenol
GC/MS	EPA TO-13A	Phenanthrene
GC/MS	EPA TO-13A	Phenol
GC/MS	EPA TO-13A	Pyrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	1-Methylnaphthalene

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	2-Methylnaphthalene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Acenaphthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Acenaphthylene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Anthracene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(a)anthracene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(a)pyrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(b)fluoranthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(g,h,i)perylene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(k)fluoranthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Chrysene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Fluoranthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Fluorene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Indeno(1,2,3-c,d) Pyrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Naphthalene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Phenanthrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Pyrene
GC-ECD	EPA TO-4A/TO-10A	PCB-1016
GC-ECD	EPA TO-4A/TO-10A	PCB-1221
GC-ECD	EPA TO-4A/TO-10A	PCB-1232
GC-ECD	EPA TO-4A/TO-10A	PCB-1242
GC-ECD	EPA TO-4A/TO-10A	PCB-1248
GC-ECD	EPA TO-4A/TO-10A	PCB-1254
GC-ECD	EPA TO-4A/TO-10A	PCB-1260

Air and Emissions		
Technology	**Method**	**Analyte**
GC-ECD	EPA TO-4A/TO-10A	PCB-1262
GC-ECD	EPA TO-4A/TO-10A	PCB-1268
Preparation	**Method**	**Type**
Acid Digestion (Filters, Solid)	EPA 3050B	Inorganics
Soxhlet extraction of PUF	TO-4A/TO-10A	PCBs in Air
Soxhlet extraction of PUF/XAD	TO-13	Semivolatiles in Air
Florisil Cleanup	EPA 3620B/3620C	Cleanup of pesticide residues and other chlorinated hydrocarbons
Sulfur Cleanup	EPA 3660A	Sulfur Cleanup
Sulfuric Acid Cleanup	EPA 3665A	Sulfuric Acid Cleanup for PCBs

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2468

Vice President

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Interim

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

TestAmerica Sacramento

TestAmerica Laboratories, Inc.

880 Riverside Parkway

West Sacramento, CA 95605

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site inspection, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2897**
Expiration Date: **1/31/2019**
Effective Date: **2/1/2018**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

January 10, 2018

Crystal Pollock
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Dear Crystal Pollock: Certificate No. 2897

This is to advise you that the laboratory named above has been granted an interim certificate pursuant to California Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100850(d).

The Fields of Testing for which this laboratory has been granted interim certification is shown in the enclosed "Fields of Testing". The Interim certificate shall remain in effect until **January 31, 2019** or until a certificate pursuant to HSC 100825(a) is issued.

Your laboratory is required to participate in the appropriate performance evaluation studies and to perform acceptably in such studies as stated in HSC 100870 and Title 22 of the California Code of Regulations Section 64809. Continued compliance with the Environmental Laboratory Accreditation Program statutes and regulations is required for maintaining the interim certification status.

Any changes in laboratory location or structural alterations, which may adversely affect the quality of analysis in the fields of testing for which the laboratory has been granted certification, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC 100845(b) and (d)).

Contact our office at (916) 323-3431 or elapca@waterboards.ca.gov for questions.

Sincerely,

Christine Sotelo

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

Enclosure

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

TestAmerica Sacramento
TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
Phone: (916) 373-5600

Certificate No. **2897**
Expiration Date **1/31/2019**
INTERIM

Field of Testing: 102 - Inorganic Chemistry of Drinking Water

102.045	001	Perchlorate	EPA 314.0	
102.047	001	Perchlorate	EPA 331.0	

Field of Testing: 105 - Semi-volatile Organic Chemistry of Drinking Water

105.230	000	Dioxins	EPA 1613B	Interim
105.230	001	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	EPA 1613B	

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.112	001	Boron	EPA 200.7	
108.112	002	Calcium	EPA 200.7	
108.112	003	Hardness (calculation)	EPA 200.7	
108.112	004	Magnesium	EPA 200.7	
108.112	005	Potassium	EPA 200.7	
108.112	007	Sodium	EPA 200.7	
108.113	002	Calcium	EPA 200.8	
108.113	003	Magnesium	EPA 200.8	
108.113	004	Potassium	EPA 200.8	
108.120	001	Bromide	EPA 300.0	
108.120	002	Chloride	EPA 300.0	
108.120	003	Fluoride	EPA 300.0	
108.120	008	Sulfate	EPA 300.0	
108.120	012	Nitrate (as N)	EPA 300.0	
108.120	012	Nitrate (as N)	EPA 300.0	
108.120	014	Nitrite (as N)	EPA 300.0	
108.120	014	Nitrite (as N)	EPA 300.0	
108.120	015	Phosphate, Ortho (as P)	EPA 300.0	
108.232	003	Nitrate-Nitrite (as N)	EPA 353.2	
108.232	004	Nitrite (as N)	EPA 353.2	
108.232	004	Nitrite (as N)	EPA 353.2	Interim
108.323	001	Chemical Oxygen Demand	EPA 410.4	
108.410	001	Alkalinity	SM2320B-1997	
108.420	001	Hardness (calculation)	SM2340B-1997	Interim
108.430	001	Conductivity	SM2510B-1997	
108.430	001	Conductivity	SM2510B-1997	Interim
108.490	001	Hydrogen Ion (pH)	SM4500-H+ B-2000	Interim
108.528	003	Nitrate (as N) (Calculation)	SM4500-NO3- E-2000	Interim

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7	
109.010	002	Antimony	EPA 200.7	

As of 1/10/2018 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

109.010	003	Arsenic	EPA 200.7	
109.010	004	Barium	EPA 200.7	
109.010	005	Beryllium	EPA 200.7	
109.010	006	Boron	EPA 200.7	
109.010	007	Cadmium	EPA 200.7	
109.010	009	Chromium	EPA 200.7	
109.010	010	Cobalt	EPA 200.7	
109.010	011	Copper	EPA 200.7	
109.010	012	Iron	EPA 200.7	
109.010	013	Lead	EPA 200.7	
109.010	015	Manganese	EPA 200.7	
109.010	016	Molybdenum	EPA 200.7	
109.010	017	Nickel	EPA 200.7	
109.010	019	Selenium	EPA 200.7	
109.010	021	Silver	EPA 200.7	
109.010	023	Thallium	EPA 200.7	
109.010	024	Tin	EPA 200.7	
109.010	025	Titanium	EPA 200.7	
109.010	026	Vanadium	EPA 200.7	
109.010	027	Zinc	EPA 200.7	
109.020	001	Aluminum	EPA 200.8	
109.020	002	Antimony	EPA 200.8	
109.020	003	Arsenic	EPA 200.8	
109.020	004	Barium	EPA 200.8	
109.020	005	Beryllium	EPA 200.8	
109.020	006	Cadmium	EPA 200.8	
109.020	007	Chromium	EPA 200.8	
109.020	008	Cobalt	EPA 200.8	
109.020	009	Copper	EPA 200.8	
109.020	010	Lead	EPA 200.8	
109.020	011	Manganese	EPA 200.8	
109.020	012	Molybdenum	EPA 200.8	
109.020	013	Nickel	EPA 200.8	
109.020	014	Selenium	EPA 200.8	
109.020	015	Silver	EPA 200.8	
109.020	016	Thallium	EPA 200.8	
109.020	017	Vanadium	EPA 200.8	
109.020	018	Zinc	EPA 200.8	
109.020	021	Iron	EPA 200.8	
109.020	022	Tin	EPA 200.8	
109.020	023	Titanium	EPA 200.8	

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	000	Purgeable Organic Compounds	EPA 624	

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.111	000	Dioxins and Dibenzofurans	EPA 1613B	
111.170	000	Organochlorine Pesticides and PCBs	EPA 608	Interim

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B	
114.010	002	Arsenic	EPA 6010B	
114.010	003	Barium	EPA 6010B	
114.010	004	Beryllium	EPA 6010B	
114.010	005	Cadmium	EPA 6010B	
114.010	006	Chromium	EPA 6010B	
114.010	007	Cobalt	EPA 6010B	
114.010	008	Copper	EPA 6010B	
114.010	009	Lead	EPA 6010B	
114.010	010	Molybdenum	EPA 6010B	
114.010	011	Nickel	EPA 6010B	
114.010	012	Selenium	EPA 6010B	
114.010	013	Silver	EPA 6010B	
114.010	014	Thallium	EPA 6010B	
114.010	015	Vanadium	EPA 6010B	
114.010	016	Zinc	EPA 6010B	
114.020	001	Antimony	EPA 6020	
114.020	002	Arsenic	EPA 6020	
114.020	003	Barium	EPA 6020	
114.020	004	Beryllium	EPA 6020	
114.020	005	Cadmium	EPA 6020	
114.020	006	Chromium	EPA 6020	
114.020	007	Cobalt	EPA 6020	
114.020	008	Copper	EPA 6020	
114.020	009	Lead	EPA 6020	
114.020	010	Molybdenum	EPA 6020	
114.020	011	Nickel	EPA 6020	
114.020	012	Selenium	EPA 6020	
114.020	013	Silver	EPA 6020	
114.020	014	Thallium	EPA 6020	
114.020	015	Vanadium	EPA 6020	
114.020	016	Zinc	EPA 6020	
114.103	001	Chromium (VI)	EPA 7196A	
114.140	001	Mercury	EPA 7470A	
114.141	001	Mercury	EPA 7471A	
114.240	001	Corrosivity - pH Determination	EPA 9040B	
114.241	001	Corrosivity - pH Determination	EPA 9045C	
114.250	001	Fluoride	EPA 9056	

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	Interim
115.021	001	TCLP Inorganics	EPA 1311	
115.022	001	TCLP Extractables	EPA 1311	
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II	
115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	

Field of Testing: 116 - Volatiie Organic Chemistry of Hazardous Waste

116.080	000	Volatile Organic Compounds	EPA 8260B	
116.080	120	Oxygenates	EPA 8260B	
116.100	001	Total Petroleum Hydrocarbons - Gasoline	LUFT GC/MS	
116.100	010	BTEX and MTBE	LUFT GC/MS	

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B	
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT	
117.110	000	Extractable Organics	EPA 8270C	
117.120	000	Dioxins and Dibenzofurans	EPA 8280A	
117.130	000	Dioxins and Dibenzofurans	EPA 8290	
117.170	000	Nitroaromatics and Nitramines	EPA 8330	
117.171	000	Nitroaromatics and Nitramines	EPA 8330A	
117.210	000	Organochlorine Pesticides	EPA 8081A	Interim
117.220	000	PCBs	EPA 8082	