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FINAL REMEDIAL INVESTIGATION SAMPLING AND ANALYSIS PLAN YOUTH POND WILLIAMSBURG FISC VA

10/1/2012

CH2M HILL

NAVFAC
Naval Facilities Engineering Command

Final

Remedial Investigation Sampling and Analysis Plan Youth Pond

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

October 2012

Contract No. N62470-11-D-8012 | CTO-WE04

prepared by CH2MHILL.

SAP Worksheet #1—Title Page

Final

Remedial Investigation
Sampling and Analysis Plan
Youth Pond

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

Contract Task Order WE04

October 2012

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

NAVFAC CLEAN 8012 Program
Contract N62470-11-D-8012

Prepared by

CH2MHILL.

Virginia Beach, Virginia

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VDEQ Remedial Project Manager / Date

*Pre-draft digitally signed by Jan Nielsen, June 5, 2012

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Executive Summary

This Sampling and Analysis Plan (SAP) has been prepared to support field sampling activities for the Remedial Investigation (RI) at Youth Pond, located at Naval Weapons Station Yorktown Cheatham Annex (CAX) in Williamsburg, Virginia (**Figure 1**). Youth Pond is a freshwater surface water body approximately 2.5 acres in size located between D Street and the York River, east (and downgradient) of Site 4 (**Figure 2**). The historical use of the pond is unknown; however, the pond is currently used for recreational activities.

During a March 2000 CAX Pond Study, surface water and sediment sampling was conducted at four man-made surface water bodies located within CAX, including Youth Pond (Baker, 2001). Two co-located surface water and surface sediment samples from Youth Pond were analyzed for Target Compound List (TCL) organic constituents, Target Analyte List (TAL) inorganic constituents, and explosive compounds.

The following were detected in the sediment of Youth Pond at concentrations that exceeded ecological and/or human health screening values (Baker, 2001):

- Polychlorinated biphenyls (PCBs)—Aroclor-1260
- Metals—aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel and zinc.
- VOCs - 2-Butanone, acetone, toluene
- Semivolatile organic compounds (SVOCs)— fluoranthene
- Pesticides— dieldrin, endrin, endrin ketone, 4,4'-DDE, alpha-chlordane, gamma chlordane, endosulfan sulfate and heptachlor epoxide.
- Explosive Compounds - 1,3,5-trinitrobenzene and 2,4,6-trinitrotoluene.

Several contaminants were detected in the surface water samples collected from Youth Pond; however, none of the concentrations exceeded ecological and/or human health screening values (Baker, 2001).

As a result of the PCB detections in sediment, and as a conservative measure[1], a catch-and-release fishing restriction was implemented for the pond, and further investigations were recommended into the potential source of PCBs and other contaminants to evaluate potential risks to human health and the environment.

A site visit was conducted on October 25, 2011 to identify potential sources of the VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in surface water and sediment samples collected as part of the March 2000 Pond Study. During the visit, several surface features were identified as potential contributors to contamination in Youth Pond or as potential transport conduits (**Figure 3**)..

Surface features, to be investigated as part of this SAP, include:

- Outfall of the culvert from Site 4 (and Upstream Pond) into Youth Pond (note: Site 4 it is not being investigated as part of this RI, as a separate RI is already being conducted at the site.)
- *Outfall 34* – Outfall 34 (Feature #2 on **Figure 3**) lies northwest of Youth Pond and appears to collect stormwater runoff from at least three points:
  - A storm water drain located between CAD Buildings 12 and 13 (Feature #4 on Figure 3)
  - A storm water drain located at the corner of CAD Building 12 and D street (Feature #6 on Figure 3)

[1] The restriction was implemented without biota sampling or a human health risk assessment.

  - A possible storm water drain located inside the fenced area of CAD Building 12 (not field-verified) (Feature #5, the white PVC pipe exposed at surface, on Figure 3)

- Outfall 34 discharges into a drainage channel that eventually runs into Youth Pond.
- *Drainage Channel* – A drainage channel (Feature #1 on Figure 3) runs into Youth Pond on the northwest side. The channel runs parallel to D Street and appears to originate from Outfall 34.
- *Culvert* - A culvert between Outfall 34 and Youth Pond (Feature #3 on Figure 3) also discharges into the drainage channel. The culvert was caved in and appeared to be blocked; however, it is possible that historically, surface runoff through this culvert ran into the drainage channel which drains into Youth Pond.

Following the site visit, the CAX Partnering Team agreed that an RI should be conducted to determine the source of contamination in Youth Pond. The investigation will include surface water and sediment samples at the outfall of the culvert that connects Site 4 to Youth Pond, soil samples at Outfall 34, several storm water drains, and the unnamed culvert, sediment samples along the drainage channel, and surface water and sediment samples at select locations within Youth Pond.

The objectives of the RI are to:

- Determine the source of VOCs, SVOCs, pesticides, PCBs, and metals detected in the surface water and sediment samples collected as part of the March 2000 Pond Study, through the collection of surface soil, sediment, and surface water samples from the surface features discussed above.
- Characterize the nature and extent of contamination in the surface water and sediment within Youth Pond.
- Conduct a biological survey to characterize aquatic receptors and collect fish/frog tissue samples for analysis.
- Assess potential human health and ecological risks associated with fish/frog tissue, surface water, sediment, and soil.

The sampling efforts presented in this SAP include sediment and surface water sampling within Youth Pond and within potential migration pathways, as well as surface soil and surface sediment sampling at several storm water drains, Outfall 34, and a drainage channel leading into Youth Pond. Fish and frog tissue samples will also be collected following a biological survey to determine the presence and type of aquatic communities (fish, amphibians, invertebrates) that exist within Youth Pond. A total of six surface soil samples, fifteen surface sediment samples, thirteen subsurface sediment and six surface water samples (co-located with 6 of the 15 surface sediment samples), six fish tissue, and three frog tissue samples will be collected. The surface soil, sediment, and surface water samples will be analyzed for the full suite of parameters, specifically TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, explosives and TAL total and TAL dissolved (surface water) metals plus cyanide. Because limited information is available for Youth Pond and potential source areas, analyzing for the full suite of parameters will provide the data required to characterize the nature and extent of contamination. Surface soil and sediment samples will also be analyzed for total organic carbon (TOC), pH, sieve grain size and AVS/SEM (sediment only). Standard water quality parameters, including hardness, pH, dissolved oxygen (DO), conductivity, salinity, ORP, turbidity, and temperature, will be measured for surface water, as will water depth and (if applicable) flow rate.

Six fish and three frog tissue samples will be collected. Three of the fish samples and the frog samples will be analyzed for Ecological Risk Assessment (ERA) parameters and analyzed whole-body for TAL metals and select PCB congeners to include the 12 dioxin-like congeners and PCB homologues. Three samples will be analyzed for Human Health Risk Assessment (HHRA) parameters; they will be filleted and analyzed for TAL metals, TCL PCBs, and select PCB congeners to include the 12 dioxin-like congeners. Both sets of fish tissue samples, and the frog samples, will also be analyzed for percent lipids and percent moisture. The exact fish species to be sampled will be determined in the field following the biological survey.

This SAP was prepared under the Comprehensive Long-term Environmental Action—Navy (CLEAN) Contract N62470-11-D-8012, Contract Task Order WE04, for submittal to the Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division, United States Environmental Protection Agency (USEPA) Region 3, and Virginia Department of Environmental Quality (VDEQ). NAVFAC, USEPA, and VDEQ work jointly as the CAX Tier I Partnering Team.

This SAP includes 37 worksheets that detail various aspects of the environmental investigation process and serves as a guideline for the field activities and data assessment. This SAP was developed in general accordance with two guidance documents:

- *Guidance for Quality Assurance Project Plans* (EPA QA/G-5, QAMS) (USEPA, 2002)
- *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (IDQTF, 2005).

This SAP will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and are suitable for the intended uses (i.e., environmental characterization, HHRA and ERA, and path forward determination). The laboratory information cited in this SAP is for ENCO Laboratories (ENCO), Grand Rapids, Michigan, and subcontractor laboratories Columbia Analytical Services (CAS), Rochester, New York; Gel Laboratories, Charleston, South Carolina; and Kemron Environmental Services (KES), Atlanta, Georgia. All three laboratories will provide various surface soil, surface and subsurface sediment and surface water analytical services for this investigation. Fish tissue analytical services will be provided by Katahdin Analytical Services (KAS), Scarborough, Maine, along with subcontractor Test America, Inc., West Sacramento, California. Data validation (DV) services will be provided by CH2M HILL. Data, results, and recommendations will be documented in an RI Report.

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SAP Worksheets

SAP Worksheet #1—Title Page 1
SAP Worksheet #2—SAP Identifying Information 17
SAP Worksheet #3—Distribution List 19
SAP Worksheet #4—Project Personnel Sign-Off Sheet 21
SAP Worksheet #5—Project Organizational Chart 23
SAP Worksheet #6—Communication Pathways 25
SAP Worksheet #7—Personnel Responsibilities and Qualifications Table 29
SAP Worksheet #8—Special Personnel Training Requirements Table 31
SAP Worksheet #9a—Project Scoping Session Participants Sheet 33
SAP Worksheet #9b—Project Scoping Session Participants Sheet 35
SAP Worksheet #10—Problem Definition 39
SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements 47
SAP Worksheet #12-1—Measurement Performance Criteria Table for Field QC Samples 55
SAP Worksheet #12-2—Measurement Performance Criteria Table for Field QC Samples 56
SAP Worksheet #12-3—Measurement Performance Criteria Table for Field QC Samples 57
SAP Worksheet #12-4—Measurement Performance Criteria Table for Field QC Samples 58
SAP Worksheet #12-5—Measurement Performance Criteria Table for Field QC Samples 59
SAP Worksheet #13—Secondary Data Criteria and Limitations Table 61
SAP Worksheet #14—Summary of Project Tasks 63
SAP Worksheet #15-1—Reference Limits and Evaluation Table 69
SAP Worksheet #15-2—Reference Limits and Evaluation Table 71
SAP Worksheet #15-3—Reference Limits and Evaluation Table 73
SAP Worksheet #15-4—Reference Limits and Evaluation Table 74
SAP Worksheet #15-5—Reference Limits and Evaluation Table 75
SAP Worksheet #15-6—Reference Limits and Evaluation Table 76
SAP Worksheet #15-7—Reference Limits and Evaluation Table 77
SAP Worksheet #15-8—Reference Limits and Evaluation Table 78
SAP Worksheet #15-9—Reference Limits and Evaluation Table 79
SAP Worksheet #15-10—Reference Limits and Evaluation Table 81
SAP Worksheet #15-11—Reference Limits and Evaluation Table 83
SAP Worksheet #15-12—Reference Limits and Evaluation Table 85
SAP Worksheet #15-13—Reference Limits and Evaluation Table 86
SAP Worksheet #15-14—Reference Limits and Evaluation Table 87
SAP Worksheet #15-15—Reference Limits and Evaluation Table 88
SAP Worksheet #15-16—Reference Limits and Evaluation Table 89
SAP Worksheet #15-17—Reference Limits and Evaluation Table 90
SAP Worksheet #15-18—Reference Limits and Evaluation Table 91

SAP Worksheet #15-19—Reference Limits and Evaluation Table 92
SAP Worksheet #16—Project Schedule/Timeline Table 93
SAP Worksheet #17—Sampling Design and Rationale 95
SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table 99
SAP Worksheet #19—Analytical SOP Requirements Table 105
SAP Worksheet #20—Field Quality Control Sample Summary Table 107
SAP Worksheet #21—Project Sampling SOP References Table 111
SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table 113
SAP Worksheet #23-1—ENCO Labs Analytical SOP References Table 115
SAP Worksheet #23-2—GEL Laboratories Analytical SOP References Table 117
SAP Worksheet #23-3—CAS-Rochester Analytical SOP References Table 118
SAP Worksheet #23-4—Katahdin Analytical SOP References Table 119
SAP Worksheet #23-5—TestAmerica Analytical SOP References Table 120
SAP Worksheet #24—Analytical Instrument Calibration Table 121
SAP Worksheet #25-1—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table 125
SAP Worksheet #26-1—Sample Handling System for Non-tissue Samples 127
SAP Worksheet #26-2—Sample Handling System for Tissue Samples 128
SAP Worksheet #27—Sample Custody Requirements Table 129
SAP Worksheet #28-1—Laboratory QC Samples 131
SAP Worksheet #28-2—Laboratory QC Samples 132
SAP Worksheet #28-3—Laboratory QC Samples 133
SAP Worksheet #28-4—Laboratory QC Samples 134
SAP Worksheet #28-5—Laboratory QC Samples 135
SAP Worksheet #28-6—Laboratory QC Samples 136
SAP Worksheet #28-7—Laboratory QC Samples 138
SAP Worksheet #28-8—Laboratory QC Samples 139
SAP Worksheet #28-9—Laboratory QC Samples 140
SAP Worksheet #28-10—Laboratory QC Samples 141
SAP Worksheet #28-11—Laboratory QC Samples 142
SAP Worksheet #28-12—Laboratory QC Samples 143
SAP Worksheet #28-13—Laboratory QC Samples 144
SAP Worksheet #28-14—Laboratory QC Samples 145
SAP Worksheet #28-15—Laboratory QC Samples 146
SAP Worksheet #28-16—Laboratory QC Samples 147
SAP Worksheet #28-17—Laboratory QC Samples 148
SAP Worksheet #28-18—Laboratory QC Samples 149
SAP Worksheet #28-19—Laboratory QC Samples 151
SAP Worksheet #28-20—Laboratory QC Samples Table 152
SAP Worksheet #29—Project Documents and Records Table 153

SAP Worksheet #30—Analytical Services Table 155
SAP Worksheet #31—Planned Project Assessments Table 157
SAP Worksheet #31-1—Laboratory Corrective Action Form 159
SAP Worksheet #31-2—Field Performance Audit Checklist 161
SAP Worksheet #31-3—Safe Work Observation Form 163
SAP Worksheet #32—Assessment Findings and Corrective Action Responses 165
SAP Worksheet #33—QA Management Reports Table 167
SAP Worksheets #34-36—Data Verification and Validation (Steps I and IIa/IIb) Process Table 169
SAP Worksheet #37—Usability Assessment 171

Appendices

A Field Standard Operating Procedures
B Navy CLEAN Data Management Plan
C Laboratory DoD ELAP Certificates
D Ecological Screening Values

Tables

1 Historical Surface Sediment Data
2 Historical Surface Water Data

Figures

1 Site Location Map
2 Site Layout Map
3 Proposed and Previous Sampling Locations
4 Surface Features Locations
5 Conceptual Site Model
6 Surface Features Decision Tree
7 Sediment and Surface Water Decision Tree

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Abbreviations and Acronyms

AM	Activity Manager
amsl	above mean sea level
AQM	Activity Quality Manager
ASTM	American Society for Standards and Materials
bgs	below ground surface
bss	below sediment surface
°C	degrees Celsius
CA	corrective action
CAS	Columbia Analytical Services
CAX	Naval Weapons Station Yorktown Cheatham Annex
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CLP	Contract Laboratory Program
COD	coefficient of determination
COPC	constituent of potential concern
COC	constituent of concern
CSM	conceptual site model
CTO	Contract Task Order
DDE	
DO	dissolved oxygen
DQI	data quality indicator
DV	data validation
ECD	electron capture detector
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
ENCO	ENCO Labs
ER	environmental restoration
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ESV	ecological screening value
FD	field duplicate
ft^2/day	square feet per day
FTL	Field Team Leader
GC	gas chromatography
GPS	global positioning system
H&S	health and safety
HHRA	Human Health Risk Assessment
HMW	high molecular weight
HPLC	High Pressure Liquid Chromatography
HSM	Health and Safety Manager

HSO	Health and Safety Officer
HSP	Health and Safety Plan
ICAL	initial calibration
ICS	interference check solution
ICV	initial calibration verification
IDW	investigation-derived waste
IS	internal standard
KAS	Katahdin Analytical Services, Inc.
KES	Kemron Environmental Services (
LCS	laboratory control sample
LIMS	Laboratory Information Management Systems
LMW	low molecular weight
LOQ	limit of quantitation
µg/kg	micrograms per kilogram
µg/L	micrograms per Liter
umol/g	micromole per gram
MDL	method detection limit
mg/kg	milligrams per kilogram
MPC	measurement performance criteria
MS/MSD	matrix spike/matrix spike duplicate
MSA	method of standard addition
MTBE	methyl-tert-butyl ether
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
NIRIS	Naval Installation Restoration Information Solution
NPL	National Priorities List
PAL	project action limit
PC	Project Chemist
PCB	polychlorinated biphenyl
PDS	post-digestion spike
PDM	Project Data Manager
pg/g	picograms per gram
PID	Photoionization Detector
PM	Project Manager
POC	point of contact
PS	post spike
PSLP	Penniman Shell Loading Plan
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plans
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual

RA	Risk Assessor
RBC	risk-based concentration
RF	response factor
RI	Remedial Investigation
RPD	relative percent difference
RPM	Remedial Project Manager
RRT	relative retention time
RSD	relative standard deviation
RSL	risk screening level
SAP	Sampling and Analysis Plan
SI	Site Inspection
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
SSC	Site Safety Coordinator
STC	Senior Technical Consultant
SVOA	semivolatile organic analyte
SVOC	semivolatile organic compound
SWO	safe work observation
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TEF	toxicity equivalency factor
TOC	total organic carbon
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UTLs	Upper Tolerance Limits
VDEQ	Virginia Department of Environmental Quality
VOA	volatile organic analyte

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SAP Worksheet #2—SAP Identifying Information

Site Name/Number: Youth Pond
Operable Unit: Not applicable (N/A)
Contractor Name: CH2M HILL
Contract Number: N62470-11-D-8012 Contract Task Order (CTO) WE04
Contract Title: Comprehensive Long-term Environmental Action—Navy (CLEAN) 8012

1. This Sampling Analysis Plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans* (USEPA, 2005) and *EPA Guidance for Quality Assurance Project Plans* (EPA QA/G-5, QAMS) (USEPA, 2002).

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

- This SAP is a project-specific SAP.

- **List dates of scoping sessions that were held**:

Scoping Session	Date
CAX Scoping Session	12/21/11
CAX Scoping Session	02/01/12
CAX Scoping Session	8/21/12

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

   Final Master Field Sampling and Analysis Plan Naval Weapons Station Yorktown, Yorktown, Virginia and Cheatham Annex, Williamsburg, Virginia (Baker, 2005)

6. **List organizational partners (stakeholders) and connection with lead organization**:
   - **Lead Organization—**Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic Division
   - **Lead Regulatory Agency—**United States Environmental Protection Agency (USEPA) Region 3
   - **State Regulatory Stakeholder—**Virginia Department of Environmental Quality (VDEQ)

7. **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**:

- All SAP Elements required for this project are described herein on the 37 Uniform Federal Policy (UFP)-SAP Worksheets. Therefore, the crosswalk table is not necessary for this project.

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SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	D	DF	F
Scott Park	Remedial Project Manager (RPM) for CAX	NAVFAC Mid-Atlantic	(757) 341-0481	scott.park@navy.mil	A	CL	A
Sue Haug	RPM	USEPA Region 3	(215) 814-3394	Haug.Susanne@epamail.epa.gov	A	CL	A
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.Smith@deq.virginia.gov	A	CL	A
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785	Bonnie.Capito@navy.mil			A
Marlene Ivester	Activity Manager (AM) for CAX	CH2M HILL	(757) 873-1442, x41634	Marlene.Ivester@ch2m.com			A
Stephanie Sawyer	Deputy AM for CAX and Project Manager (PM)		(757) 671-6273	Stephanie.Sawyer@ch2m.com	A	A	A
Toby Stewart	Field Team Leader (FTL)		(757) 419-0430	Toby.Stewart@ch2m.com			A
Doug Bitterman	Senior Technical Consultant (STC) and Activity Quality Manager (AQM)		(757) 671-6209	Doug.Bitterman@ch2m.com			A
Marcia Colon	Laboratory PM	ENCO Labs (ENCO)	(407) 826-5314	mcolon@encolabs.com			HC
Jennifer Obrin	Laboratory PM	Katahdin Analytical Services, Inc. (KAS)	(207) 874-2400	jorbin@katahdinlab.com			HC
Herb Kelly	Validator	CH2M HILL	(352) 384-7100	herb.kelly@ch2m.com			CD

Notes:

A = All, CD = Compact Disc, CL = Cover Letter, D = Draft, DF = Draft Final, HC = Hard Copy, F = Final;

Document Control Number: An administrative record number will be assigned when the final document is being prepared.

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SAP Worksheet #4—Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number	Signature/email Receipt	SAP Section Reviewed	Date SAP Read
Marlene Ivester	CH2M HILL/CAX AM	(757) 873-1442, x41634			
Stephanie Sawyer	CH2M HILL/CAX Deputy AM and PM	(757) 671-6273			
Anita Dodson	CH2M HILL/Navy CLEAN Program Chemist	(757) 671-6218			
Doug Bitterman	CH2M HILL/Senior Technical Consultant (STC) and AQM	(757) 671-6209			
Brett Doerr	CH2M HILL/Program SAP Reviewer	(757) 671-6219			
Clairette Campbell	CH2M HILL/Project Chemist (PC)	(757) 671-6335			
Mark Orman	CH2M HILL/Health and Safety Manager (HSM)	(414) 847-0597			
Toby Stewart	CH2M HILL/FTL	(757) 419-0430			
Hillary Ott	CH2M HILL/Project Data Manager (PDM)	(703) 376-5165			
Roni Warren	CH2M HILL/Human Health Risk Assessor	(814) 364-2454			
Bill Kappleman	CH2M HILL/ Ecological Risk Assessor	(703) 376-5152			
Marcia Colon	ENCO Labs (ENCO)	(407) 826-5314			
Jennifer Obrin	Katahdin Analytical Services, Inc. (KAS)	(207) 874-2400			
Herb Kelly	CH2M HILL / Data Validator (DV)	(352) 384-7100			

Signed versions of **Worksheet #4** will be kept on file at CH2M HILL along with other project documents.

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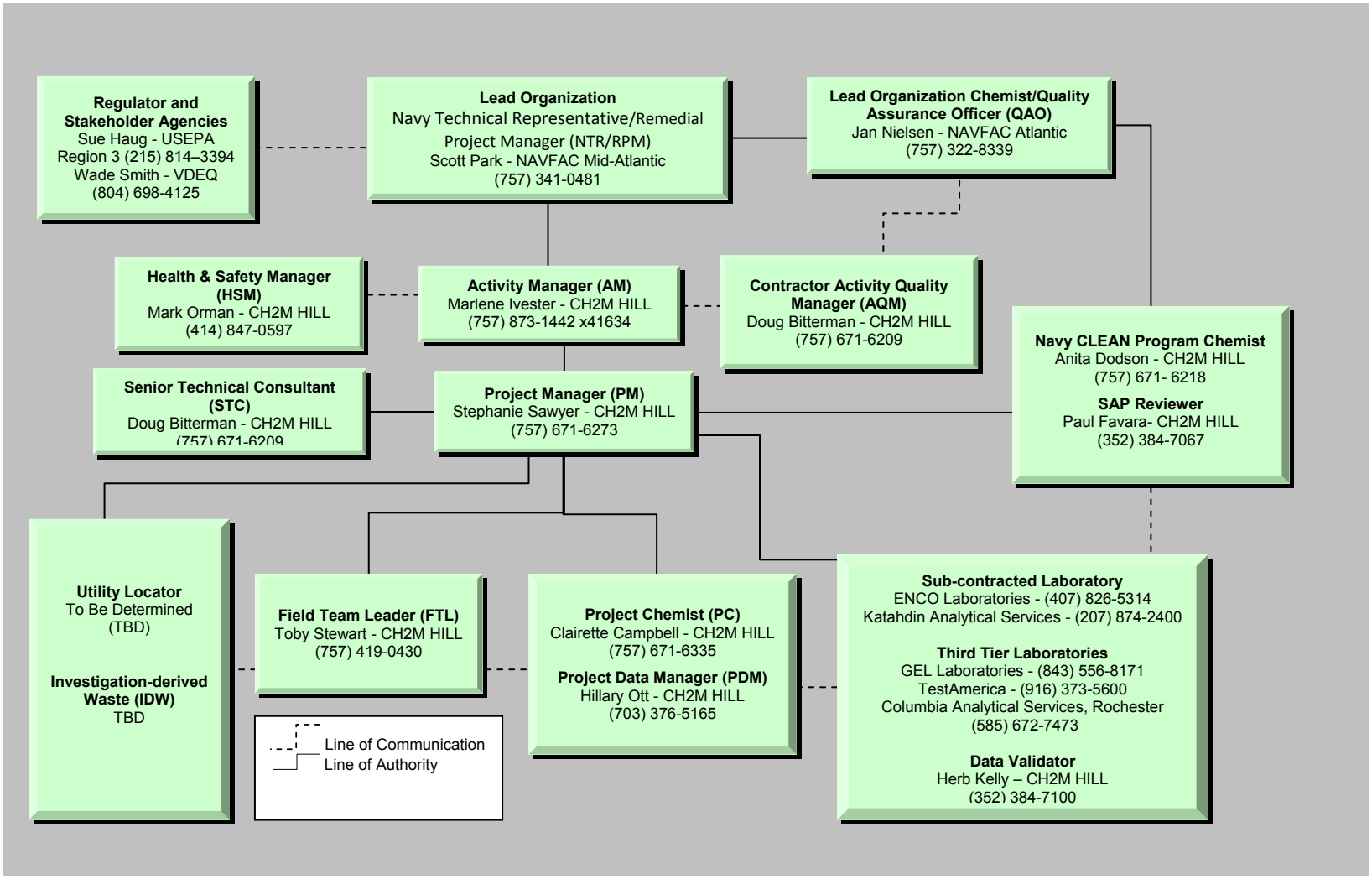
SAP Worksheet #5—Project Organizational Chart



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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Communication with Navy (lead agency)	Navy RPM	Scott Park	(757) 341-0481	Primary point of contact (POC) for Navy; can delegate communication to other internal or external POCs. Any issues that may impact project work are to be reported to Scott immediately. RPM will notify the United States Environmental Protection Agency (USEPA) and VDEQ via email or telephone within 24 hours of field changes affecting the scope or implementation of the work. Navy will have 30 days for SAP review.
Communication with VDEQ	VDEQ RPM	Wade Smith	(804) 698-4125	Primary POC for VDEQ; can delegate communication to other internal or external POCs. Upon notification of field changes, VDEQ will have 24 hours to approve or comment on the field changes. Responses will be communicated via email or phone.
Communication with USEPA	USEPA RPM	Sue Haug	(215) 814-3394	Primary POC for USEPA; can delegate communication to other internal or external POCs. Upon notification of field changes, USEPA will have 24 hours to approve or comment on the field changes. Responses will be communicated via email or phone.
Navy Quality Assurance (QA)/Quality Control (QC) input	Navy Chemist	Jan Nielsen	(757) 322-8339	Provides review comments to Navy contractor on Pre-draft SAP via e-mail through Navy RPM. Provides overall Navy guidance via direct communication with Navy contractor chemist, as warranted.
Communication to/from Navy contractor (e.g., submission of SAP for review; receipt of regulatory comments, updates on project progress, communication of stakeholder expectations, etc.)	CH2M HILL STC and AQM	Doug Bitterman	(757) 671-6209	Team members will contact the STC regarding questions/issues encountered in the field, input on data interpretation, etc., as needed. The STC will have 24 hours to respond to technical field questions as necessary. Responses will be communicated to the PM via email or phone. In addition, the STC/AQM will review data and deliverables as necessary prior to Cheatham Annex (CAX) Partnering Team discussion or distribution.
Communication regarding overall project status and implementation and primary POC with Navy RPM, USEPA, and VDEQ	CH2M HILL CAX AM	Marlene Ivester	(757) 873-1442, x41634	Primary POC for stakeholder and agency managers; can delegate agency communication to other contract staff as appropriate. Oversees project and will be informed of project status by the PM. If field changes occur, the AM will work with the Navy RPM to communicate field changes to the USEPA and VDEQ via email within 24 hours.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Communicates with AM and AQM. Manages all project phases	CH2M HILL Deputy AM; PM	Stephanie Sawyer	(757) 671-6273	Primary modes of communication are phone, email, letter, document submittal; timing dependent on nature of communication and predefined schedule as applicable and as requested by stakeholder agencies. The PM will have 24 hours to respond to the request for field corrective actions (CAs). Responses will be communicated to the FTL via phone. All information and materials about the project will be forwarded to the AM on a daily basis.
Health and safety (H&S) expectations and procedures	CH2M HILL Health and Safety Officer (HSO)	Mark Orman	(414) 847-0597 (414) 712-4138 (cell)	Review of Health and Safety Plan (HSP). Direct communication (via e-mail, telephone, hardcopy, or in person, will be notified within 24 hours of incident) to/from Navy contractor project staff to ensure implementation of appropriate H&S procedures.
Implementation of sampling activities; SAP changes in the field; field CAs; daily field progress reports.	CH2M HILL FTL	Toby Stewart	(757) 419-0430	Documentation of deviations from Work Plan made in field logbooks and rationale for deviations, made within 24 hours of deviation; assistance in material procurement and delivery; injection oversight and implementation; deviations made only with approval from contractor PM and/or Environmental Manager. See **Worksheet #32** Assessment Findings and CA Responses and **Worksheet #32-1** CA Form. FTL will e-mail or fax daily field progress reports to contractor PMs weekly; telephone communication with PMs on as-needed basis.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Ensure staff H&S in the field	CH2M HILL Site Safety Coordinator (SSC)	Toby Stewart	(757) 419-0430	Daily safety tailgates; daily observations; real-time discussions of observations and changes to be implemented with field staff.
Data tracking from collection through upload to database	CH2M HILL PDM	Hillary Ott	(703) 376-5165	PDM will track data from sample collection through upload to database, ensuring SAP requirements are met by laboratory and field staff. The CH2M HILL AM and PM are informed within 24 hours to pass on communications to Navy and regulators as required.
Reporting Laboratory Data Quality Issues	Laboratory PM/ENCO Laboratory PM/GEL Laboratory PM/ Katahdin Laboratory PM/ Test America	Marcia Colon Ann Skradski Jennifer Obrin Karen Sellers	(407) 826-5314 (843) 556-8171 (207) 874-2400 (916) 373-5600	All QA/QC issues with project field samples will be reported by the laboratory to the PDM and/or PC within 1 business day. The second-tier subcontracted laboratory will report all data quality issues to the primary subcontracted laboratory PM.
Field and Analytical CAs	CH2M HILL PC and FTL	Clairette Campbell Toby Stewart	(757) 671-6335 (757) 419-0430	The need for CA for field and analytical issues will be determined by the FTL and/or Contractor Chemist. Should analytical laboratory issues affect data usability by rendering a significant amount of rejected or unusable data such that the project completeness goal cannot be obtained, the project chemist will notify the project team including the Navy RPM and Navy Quality Assurance Officer (QAO).
Reporting data quality issues	Data Validator	Herb Kelly	(352) 384-7100	The Data Validator reviews and qualifies analytical data as necessary. The data along with a validation narrative are returned to the PDM within 14 calendar days.
Technical Support and Reporting	CH2M HILL Human Health Risk Assessment (HHRA) Lead, CH2M HILL Ecological Risk Assessment (ERA) Lead	Roni Warren Bill Kappleman	(814) 364-2454 (703) 376-5152	Risk assessment leads will oversee the preparation of the HHRAs and ERAs.

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SAP Worksheet #7—Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Scott Park	RPM	NAVFAC	Coordinates all environmental activities at CAX.
Jan Nielson	Chemist	NAVFAC	Navy Review of SAP and QA input.
Marlene Ivester	AM	CH2M HILL	Responsible for Environmental Restoration Program (ERP) at CAX.
Doug Bitterman	AQM, STC, and Technical Support Manager		Provides technical support, senior technical oversight, directs and oversees staff, and provides program level review of the UFP-SAP.
Anita Dodson	Navy CLEAN Program Chemist		Provides guidance during preparation of UFP-SAP. Provides program level review of UFP-SAP.
Stephanie Sawyer	Deputy AM and PM		Project administration; coordinates staffing; monitors project performance; directs and oversees project staff.
Clairette Campbell	PC		Preparation of chemistry specific UFP-SAP worksheets. Ensure proper data tracking, reporting, and maintaining communication with PDM. Responsible for coordination of laboratory deliverables.
Toby Stewart	FTL		Supervises and coordinates all field activities and responsible for overseeing subcontractors.
Toby Stewart	SSC		Oversees and ensures safety of onsite personnel; responsible for use and completion of all field work related H&S paperwork.
Bill Kappleman	Senior Ecological Risk Assessor		Conducts ERA to identify possible impacts to ecological receptors.
Roni Warren	Senior Human Health Risk Assessor		Conducts HHRA to identify possible impacts to human receptors.
Mark Orman	HSO		Oversees H&S for field activities.
Hillary Ott	PDM		Manages sample tracking and data management, coordinates with laboratory and DV.
Marcia Colon Ann Skradski Jennifer Obrin Karen Sellers	Laboratory PMs	ENCO GEL Katahdin TestAmerica	Manages analytical projects from initiation to completion.
Herb Kelly	DV	CH2M HILL	Responsible for validation of environmental data.
To Be Determined (TBD)	TBD	Investigation-derived Waste (IDW) Subcontractor	

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SAP Worksheet #8—Special Personnel Training Requirements Table

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
Boat Operations	Qualified Small Boat Operator Training	Internal to CH2M HILL	Project-specific	At least one field crew member	TBD/CH2M HILL	Document in personal HSP File

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SAP Worksheet #9a—Project Scoping Session Participants Sheet

Project Name: Youth Pond RI **Projected Date(s) of Sampling:** September 2012 **PM:** Stephanie Sawyer	**Site Name:** Youth Pond **Site Location:** CAX, Williamsburg, VA
Date of Session: December 21, 2011 (via conference call) **Scoping Session Purpose:** Team discussion and agreement on the sample locations, analytic parameters, and objectives for the Youth Pond RI.	

Name	Title	Affiliation	Phone #	E-mail Address
Krista Parra	RPM	Navy	(757) 341-0395	Krista.Parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 873-1442, x41634	Marlene.Ivester@ch2m.com
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.smith@deq.virginia.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	Stephanie.Sawyer@ch2m.com
Ngozi Ibe	Site Manager	CH2M HILL	(703) 376-5017	Ngozi.Ibe@ch2m.com
John Burchette	RPM	USEPA Region 3	(215) 814-3378	Burchette.John@epamail.epa.gov

Comments/Decisions

The Team held a Partnering conference call and discussed the path forward for the Youth Pond Remedial Investigation (RI). The Team agreed on the objectives of the RI, sample media, number and locations of samples, analytical parameters, and environmental questions that needed to be answered by the RI.

It was agreed that 6 surface soil samples (0-6 inches) and 14 surface sediment samples (0-4 inches) would be collected from select locations and analyzed for volatile organic compounds (VOCs), SVOCs, PCBs, pesticides, metals plus cyanide, and explosives. Subsurface sediment (4-8 inches) and surface water samples would also be collected at 5 of the 14 surface sediment sample locations and analyzed for VOCs, SVOCs, PCBs, pesticides, metals plus cyanide, and explosives.

The team also agreed that 3 fish tissue samples would be collected and analyzed for PCBs and metals. There was some discussion regarding analyzing fish tissue samples for PCB congeners as well; however, the team decided to look into this further before making a final decision.

If results of the agreed upon sampling were sufficient to adequately characterize the nature and extent of contamination, then an RI report would be prepared. If results warranted further action, then a SAP addendum proposing additional work would be submitted under a separate cover.

Action Items

1. Krista will look into what storm event data are available and will report back to the Team. *Krista informed the team on 12/29/11 that regulated outfalls (002, 017, and 033, none of which discharge to or from Youth Pond) are sampled monthly and visually inspected quarterly*.
2. Wade will check with his risk assessor to verify if PCB congener analysis is preferred and make sure it doesn't conflict with EPA requirements. *The team held a conference call to discuss the PCB congener analysis as described in **Worksheet #9b***.
3. SAP Worksheet #9a—Project Scoping Session Participants Sheet
4. SAP Worksheet #9a—Project Scoping Session Participants Sheet
5. SAP Worksheet #9a—Project Scoping Session Participants Sheet

SAP Worksheet #9a—Project Scoping Session Participants Sheet (continued)

Consensus Decisions

The team agreed to:

- The collection of 6 surface soil samples (0-6 inches) and 14 surface sediment samples (0-4 inches) for volatile organic compounds (VOCs), SVOCs, PCBs, pesticides, metals plus cyanide, and explosives analysis.
- The collection of 5 subsurface sediment (4-8 inches) and surface water samples for VOCs, SVOCs, PCBs, pesticides, metals plus cyanide, and explosives analysis.
- The collection of 3 fish tissue samples for PCBs and metals analysis.

SAP Worksheet #9b—Project Scoping Session Participants Sheet

Project Name: Youth Pond RI **Projected Date(s) of Sampling**: September 2012 **PM:** Stephanie Sawyer	**Site Name:** Youth Pond **Site Location:** CAX, Williamsburg, VA

Date of Session: February 1, 2012 (via conference call)

Scoping Session Purpose: Discuss and agree on path forward for PCB Congener Analysis

Name	Title	Affiliation	Phone #	E-mail Address
John Burchette	RPM	USEPA Region 3	(215) 814-3378	burchette.john@epa.gov
Wade Smith	RPM	VDEQ	(804) 698-4125	wade.smith@deq.virginia.gov
Krista Parra	RPM	NAVFAC Mid-Atlantic	(757)-341-0395	krista.parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 671-1634	marlene.ivester@ch2m.com
Stephanie Sawyer	Deputy AM/PM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com
Jennifer Corrack	Human Health Risk Assessor (RA)	Navy Marine Corps Health Center	(757) 953-0950	Jennifer.Corack@med.navy.mil
Jennifer Wright	Ecological RA	NAVFAC Atlantic	(757) 322-8428	jennifer.h.wright@navy.mil
Dave Barclift	Ecological RA	NAVFAC Atlantic	(215) 897-4913	david.barclift@navy.mil
John McCloskey	Ecological RA	USEPA Region 3	(804) 693-6694 X116	John_McCloskey@fws.gov
Dawn Ioven	Toxicologist	USEPA Region 3	(215) 814-3320	ioven.dawn@epa.gov
Kyle Newman	RA	VDEQ	(804) 698-4452	kyle.newman@deq.virginia.gov
William Kappleman	Ecological RA	CH2M HILL	(703) 376-5152	William.kappleman@ch2m.com
Roni Warren	Human Health RA	CH2M HILL	(814) 364-2454	Roni.warren@ch2m.com
Anita Dodson	Chemist	CH2M HILL	(757) 671-6218	Anita.dodson@ch2m.com

Comments/Decisions

The team held a conference call to discuss whether PCB congener analysis should be added to the fish tissue samples being collected at Youth Pond (and additional sites at CAX). John Burchette asked the EPA ecological and human health risk assessors whether they would be comfortable making decisions on PCBs using only Aroclor data, especially for human health assessment. Dawn Ioven replied that dioxin-like congener data would be good to have to conduct risk; however, the tests are expensive. She recommended analyzing a percentage of samples for dioxin-like congeners.

The team discussed the sampling parameters further and agreed that sediment samples would be analyzed for Aroclors only. Human health risk animal tissue samples would be analyzed for the 12 dioxin-like congeners and Aroclors, and ecological risk tissue samples would be analyzed for the 12 dioxin-like congeners and homologues (unless the cost to do this was greater than or equal to full congener analysis, in which case analysis for the full 209 congeners would be performed). This would apply to all tissue samples, not a select percentage of samples as previously recommended by Dawn Ioven. In addition, if necessary, the team agreed that tissue samples could be frozen for potential later analysis for up to one year.

SAP Worksheet #9b—Project Scoping Session Participants Sheet (continued)

Action Items

The Navy and CH will internally discuss the cost of conducting the 12 dioxin-like PCBs and homologue analyses versus the cost to conduct the full congener list. (The Navy and CH2M HILL discussed the cost and agreed with conducting the sampling protocol as outlined in the team decision below.)

Consensus Decisions

1. Aroclor analysis only for sediment, soil, and water.
2. Human health tissue data (fillets) - Aroclor and 12 dioxin-like PCB analyses.
3. Ecological tissue data (whole body) - 12 dioxin-like PCBs and homologue analyses. No Aroclor data.
4. Freezing tissue to analyze later is fine (within one year).
5. For Penniman Lake:
   a) Sample all major ecological food sources present, such as frogs and small fish.
   b) It is assumed at this time that large fish from the open lake (for fillets; HHRA and ERA), and frogs and small fish (whole body; for ERA) from coves with high PCB concentrations will be sampled. The type and number of samples will be determined after the biosurvey is conducted. A call may be necessary to agree upon the type and number of samples to collect after the biosurvey is complete. Contingencies will be written into the SAP.
   c) Adult frogs are preferred over tadpoles.
   d) Composite samples are preferred for whole-body samples.
   e) Conduct aroclor (HHRA), 12 dioxin-like PCBs (HHRA and ERA), and homologue (ERA) analyses for all the tissue samples.

SAP Worksheet #9c—Project Scoping Session Participants Sheet

Project Name: Youth Pond RI **Projected Date(s) of Sampling:** October 2012 **PM:** Stephanie Sawyer	**Site Name:** Youth Pond **Site Location:** CAX, Williamsburg, VA

Date of Session: August 21, 2012 (via conference call)

Scoping Session Purpose: Team discussion and agreement on the sample locations, analytic parameters, and objectives for the Youth Pond RI.

Name	Title	Affiliation	Phone #	E-mail Address
Scott Park	RPM	Navy	(757) 341-0481	Scott.park@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 873-1442, x41634	Marlene.Ivester@ch2m.com
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.smith@deq.virginia.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	Stephanie.Sawyer@ch2m.com
Sue Haug	RPM	USEPA Region 3	(215) 814-3394	Haug.Susanne@epamail.epa.gov
Jennifer Corrack	Human Health Risk Assessor (RA)	Navy Marine Corps Health Center	(757) 953-0950	Jennifer.Corack@med.navy.mil
Jennifer Wright	Ecological RA	NAVFAC Atlantic	(757) 322-8428	jennifer.h.wright@navy.mil
Doug Bitterman	AQM	CH2M HILL	(757) 671-6209	Doug.bitterman@ch2m.com
John McCloskey	Ecological RA	USEPA Region 3	(804) 693-6694 X116	John_McCloskey@fws.gov
Dawn Ioven	Toxicologist	USEPA Region 3	(215) 814-3320	ioven.dawn@epa.gov
William Kappleman	Ecological RA	CH2M HILL	(703) 376-5152	William.kappleman@ch2m.com
Anita Dodson	Chemist	CH2M HILL	(757) 671-6218	Anita.dodson@ch2m.com

Comments/Decisions

The team held a conference call to discuss the EPA's comments on the Youth Pond SAP. As a result of these comments, the team discussed the addition of subsurface sediment, surface water and frog tissue samples to the Youth Pond sampling plan. In addition, the team discussed the deferment of the one surface (0-4") and subsurface (4-8") sediment sample proposed in the Site 4 SAP (submitted under separate cover) to this investigation.

Action Items

None

SAP Worksheet #9c—Project Scoping Session Participants Sheet (continued)

Consensus Decisions

The team agreed to:

- defer the collection of the one surface (0-4”) and subsurface (4-8inches) sediment sample proposed in the Site 4 SAP (submitted under separate cover) to this investigation.
- the collection 13 subsurface sediment samples (4-8 inches) for VOCs, SVOCs, PCBs, pesticides, metals plus cyanide, and explosives analysis. Subsurface sediment samples are to be collocated with surface sediment samples already being collected from within Youth Pond.
- the collection of 6 surface water samples for VOCs, SVOCs, PCBs, pesticides, metals plus cyanide, and explosives analysis.
- the collection of 3 frog tissue samples to be analyzed for the same analytes as those proposed for the whole-body fish tissue samples (metals, the 12 dioxin-like congeners, and PCB homologues).

SAP Worksheet #10—Problem Definition

Introduction

This worksheet provides a summary of the site background and history, the key elements of the conceptual site model (CSM) of Youth Pond, the project statement and objectives, and a narrative description of the questions to be addressed during the RI sampling activities.

Site Background

CAX encompasses 2,300 acres east of Williamsburg, Virginia, between Interstate 64 and the York River on the York-James Peninsula (**Figure 1**). CAX is located on the site of the former DuPont Company Penniman Shell Loading Plan (PSLP) facility that was used as a powder and shell loading plant during World War I and was closed in 1918. CAX's current mission is to supply Atlantic Fleet ships and provide recreational opportunities to military and civilian personnel.

Youth Pond is a freshwater, surface water body approximately two and one-half acres in size located in the northeast portion of CAX (**Figure 2**). Several drainage pathways from the surrounding area combine into two separate drainages which ultimately discharge into Youth Pond. One drainage pathway flows under D Street and connects Site 4 (including Upstream Pond) to Youth Pond and the other pathway receives combined drainage from storm water drains located within the CAD area, Outfall 34, and an unnamed drainage channel (**Figure 3**). Surface water within Youth Pond itself then discharges through a culvert into the York River. The historical use of Youth Pond is unknown; however, it is currently used by military personnel and their families for recreational activities, though it is not open to the general public. Following identification of PCBs within pond sediment during the 2000 Pond Study, as a conservative measure[2], catch-and-release fishing restrictions were implemented for the pond in 2000.

Investigation History

In January 2001, CAX was placed on the National Priorities List (NPL) that required all subsequent activities for Navy ER sites be conducted under CERCLA procedures.

Previous investigations that helped characterize potential contamination and contaminant sources at Youth Pond include the 2000 Pond Study (Baker, 2001), the 2009 Sites 4, 9 AOC 3 Site Inspection (SI) (CH2M HILL, 2011), and a 2011 site visit. Previous sample locations are shown in **Figure 4**.

2000 Pond Study

In 2000, a Pond Study was conducted to provide analytical data for ecological and human health risk screenings, as well as to determine if bioaccumulative constituents of potential concern (COPCs) were present in the sediment and surface water at Youth Pond. Investigation activities included the collection of two co-located surface water and surface sediment samples from Youth Pond for analysis for Target Compound List (TCL) organic constituents (VOCs, SVOCs, pesticides, and PCBs), Target Analyte List (TAL) inorganic constituents, and explosive compounds. Several VOCs, SVOCs, pesticides, PCBs, explosives, and metals were detected in both sediment samples at concentrations above the ecological screening values (ESVs) and EPA Region 3 soil risk-based concentrations (RBCs) (USEPA, 2000) available at the time of the study. However, there were no exceedances of screening levels of these values in surface water samples, with the exception of total thallium, which was selected

[2] The restriction was implemented without biota sampling or a human health risk assessment.

SAP Worksheet #10—Problem Definition (continued)

as a COPC. **Tables 1** and **2** compare the analytical results of the historical sampling event to historic EPA Region 3 RBCs and ESVs as well as current risk screening levels (RSLs) and ESVs.

Based on the Aroclor-1260 concentrations detected in sediment, as a conservative measure, a catch-and-release fishing restriction was implemented and further investigation was recommended to determine the source of contamination within Youth Pond and to quantify potential risks to human health and the environment.

2009 Sites 4, 9, and AOC 3 Site Inspection

In 2009, an SI was conducted to determine if a CERCLA-related release occurred at Site 4 (which encompasses the former AOC 3 study area), located directly southwest of Youth Pond. The Site 4 study area includes a surface water body, Upstream Pond, which is connected to Youth Pond by a culvert that runs underneath D Street (**Figure 3**). Based on the results of the SI, it is likely that Site 4 (including Upstream Pond) is a potential source of contamination to Youth Pond.

October 25, 2011 Site Visit

On October 25, 2011, CH2M HILL personnel conducted a site visit to identify potential sources of the VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in surface water and sediment samples collected during the March 2000 Pond Study (**Figure 4**). As indicated by the Sites 4, 9, and AOC 3 SI Report, Site 4 (which encompasses the former AOC 3 study area) was identified as a potential source of contamination in Youth Pond; however, Site 4 will not be evaluated as part of this investigation, as a separate RI is already being conducted at the Site. In addition, other surface features and drainage patterns were identified during the site visit.

Surface water from the surrounding area enters Youth Pond from either Upstream Pond (from the drainage culvert that flows under D Street) or a drainage channel that runs parallel to D Street from Outfall 34 (**Figure 3**). The surface water runoff from the drainage channel parallel to D Street originates from several storm water drains; one located between CAD Buildings 12 and 13 (Feature #4), one at the corner of CAD Building 12 and D Street (Feature #6), and one possibly from a storm water drain located inside the fenced area of CAD Building 12 (Feature #5, although this storm water drain could not be field-verified). Surface water from these drains flows to Outfall 34 (Feature #2), which ultimately discharges to Youth Pond (Feature #1) through a culvert (Feature #3) between Outfall 34 and Youth Pond. Surface water then discharges through a culvert into the York River.

Conceptual Site Model

The Conceptual Site Model (CSM) for Youth Pond is based on the historical data summarized above and interprets the physical setting, distribution of contamination, release history, potential migration pathways, and the potential exposure and receptor pathways. The CSM figure for Youth Pond is provided as **Figure 5**.

Physical Characteristics

Youth Pond is directly adjacent to the York River. The area surrounding Youth Pond is vegetated with shrubs and trees and slopes northeast towards the York River. CAD buildings 12 and 13 are located to the northwest, across D Street, which runs along the western banks of Youth Pond. The topography of Youth Pond is about 5 feet above mean sea level (amsl) with surface water in Youth Pond flowing to the northeast. When surface water reaches a certain height, it flows into a flood control structure within Youth Pond and ultimately discharges down the slope and into the York River.

Shallow groundwater in the Yorktown-Eastover aquifer likely discharges to Youth Pond, as the depth to groundwater is likely shallow enough in the vicinity of the site due to its proximity to the York River. This aquifer extends across all of CAX and ranges from 60 to 100 feet thick. Transmissivity of the Yorktown-Eastover aquifer ranges from 0.5 to 40 square feet per day (ft^2/day), with groundwater flow generally directed from west-to-east.

SAP Worksheet #10—Problem Definition (continued)

Available Historical Analytical Data

VOCs, SVOCs, pesticides, PCBs, explosives, and metals were detected in surface water and/or sediment samples collected during the 2000 Pond Study. All surface water constituents were detected at concentrations below applicable human health and ecological screening values; however, several constituents in sediment samples were detected at concentrations exceeding applicable human health and ecological screening values used in the Pond Study (**Table 1;** Baker, 2001).

Release History

Site 4 has been identified as a potential source of contamination to Youth Pond; however, based on the October 2011 site visit, other potential sources of contamination may exist. The outfall of the drainage culvert that flows from Site 4, under D Street to the southern corner of Youth Pond and the storm water drains and drainage channel leading into the northwest corner of Youth Pond, identified during the October 2011 site visit, will be investigated during this RI to determine if they contribute to the VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in Youth Pond. Site 4 (including Upstream Pond) will not be investigated as part of this RI, as an RI is already being conducted at this site. However, Site 4 data may be included in the Youth Pond RI, as appropriate.

Potential Migration Pathways

Contaminated material (e.g., surface soils) from the CAD building and roadways may have entered storm water drains through surface runoff and then flowed through culverts and outfalls into the pond. Other potential migration pathways from the terrestrial areas into the pond, such as by wind dispersion and infiltration, are not expected to be significant because the area is heavily vegetated. As noted previously, there is also the potential for transport from Site 4 (Upstream Pond) through the connecting culvert into Youth Pond.

Receptors

Potential human receptors at Youth Pond are:

- **Adult recreational users** - ingestion of and dermal contact with surface water and sediment in Youth Pond and/or the soil and sediment from ditches that drain to the pond, ingestion of fish caught in Youth Pond
- **Child recreational users** - ingestion of and dermal contact with surface water and sediment in Youth Pond and/or the soil and sediment from ditches that drain to the pond, ingestion of fish caught in Youth Pond
- **Current on-base workers (maintenance workers)** - ingestion of and dermal contact with surface water and sediment in Youth Pond as well as soil and sediment in the drainage ditches that drain to Youth Pond
- **Future construction workers** - ingestion of and dermal contact with surface water as well as sediment and soil in the drainage ditches that drain into Youth Pond

Recreational users and workers may be exposed to contaminants through ingestion of and dermal contact with surface water and sediment within Youth Pond, as well as sediment and soil within the drainage ditches that drain into Youth Pond. Recreational users may also be exposed to contaminants through ingestion of fish. While catch-and-release fishing restrictions are in place for Youth Pond, there is no way to guarantee that all of the fish caught are released, and the most conservative approach is to assume that there is a potential for some fish ingestion.

SAP Worksheet #10—Problem Definition (continued)

Potential ecological receptors exposed to surface water and/or sediment at Youth Pond include:

- Aquatic/Wetland Plants
- Benthic/Aquatic Invertebrates
- Fish
- Amphibians
- Reptiles
- Mammals
- Birds

Aquatic and wetland plants may be exposed to chemical constituents through direct contact with surface water and sediment or through root uptake from the sediment. Fish, amphibians, reptiles, and benthic/aquatic invertebrates may be exposed through direct contact with surface water and sediment. Upper trophic level receptors (birds, mammals, reptiles, and amphibians) may be exposed via food webs through the ingestion of aquatic/wetland plants, benthic/aquatic invertebrates, fish, and amphibians.

Project Statement and Objectives

All potential sources of contamination to Youth Pond have not been identified. The objective of the RI is to determine the source of VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in the surface water and sediment samples during the 2000 Pond Study; characterize the nature and extent of contamination in the surface water and sediment within Youth Pond; and evaluate potential human health and ecological risks by conducting an HHRA and ERA (through Step 3a). Due to the limited amount of existing data, this investigation will focus on investigating contamination within Youth Pond and associated drainage ditches. If the data collected to fulfill the objectives of this RI indicate that additional sampling (i.e., subsurface soil, additional tissue and/or York River surface water/sediment samples) or evaluation (i.e., completion of a baseline ERA [through Step 7]) is needed, a SAP addendum to collect and evaluate the additional data will be submitted under a separate cover.

Field activities will include collecting soil and sediment samples (from drainage ditches) to determine the source of VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in Youth Pond, collecting surface water and sediment samples to adequately characterize the nature and extent of contamination in Youth Pond, and collecting fish and frog tissue samples to support the HHRA and ERA. While Site 4 has been identified as a source of contamination into Youth Pond, it will not be investigated as part of this RI, as an RI is already being conducted at this site. However, background (reference) samples (surface water, sediment, and fish/frog tissue) will be collected in conjunction with other environmental restoration (ER) site investigations at CAX (i.e., Site 4 and Penniman Lake) and the relevant data will be used for the Youth Pond evaluation. The specific number and type of reference tissue samples that will be collected and used for the Youth Pond evaluation will depend upon the results of the biological survey since reference tissue samples will be collected to as closely match the type of tissue samples that will be collected in Youth Pond (e.g., type of organism, species, etc.). For planning purposes, three reference samples will be collected from each of the following media: surface water, surface sediment, subsurface sediment, fish tissue (whole-body and fillet), and frog tissue.

The proposed reference area is Cheatham Pond. The Navy proposes that the suitability of Cheatham Pond as a reference area be evaluated as follows: (1) the site reconnaissance surveys at Youth Pond, as well as at Site 4 (Upstream Pond) and Penniman Lake, will be conducted at the beginning of the sampling field event to characterize the physical characteristics of each water body; (2) a reconnaissance survey of Cheatham Pond will then be conducted to find specific areas that match, as closely as possible, the physical properties of each site

SAP Worksheet #10—Problem Definition (continued)

water body (e.g., water depth, substrate type); (3) surface water and sediment (surface and subsurface) samples (up to three samples of each medium as related to Youth Pond; additional reference samples will be included in the Site 4 and Penniman Lake SAPs) will then be collected at the identified areas within Cheatham Pond and submitted for chemical analysis on a quick-turn basis; (4) while media and biological sampling of site water bodies is occurring, the unvalidated surface water and sediment data from Cheatham Pond will be reviewed (following a qualitative evaluation by a CH2M HILL chemist for critical quality issues) to determine if the sampling results preclude any of the specific areas in Cheatham Pond from being used as reference; the Pond Study data will also be considered during this process, which will be coordinated with the partnering team and technical support; and (5) biological data (tissue, invertebrates, and/or toxicity test samples) will be collected from the identified areas within Cheatham Pond that are deemed suitable.

Environmental Questions to be Answered by the Remedial Investigation

To achieve the objectives stated above, the following environmental questions will be answered via implementation of this SAP:

1. What is the source of contamination in Youth Pond?

Site 4 is located directly upgradient of Youth Pond and has been identified as a potential source of contamination to Youth Pond. Additional storm water drains and a drainage channel, leading into the northwest corner of Youth Pond, could be contributing to the contamination in Youth Pond. Sediment and surface water data from the outfall of the culvert that flows from Site 4, under D Street to the southern corner of Youth Pond and soil and sediment data are needed to determine if discharges from these areas contribute to the contamination in Youth Pond.

The following work is proposed to answer this question:

One surface (0-4 inches) and subsurface (4-8 inches) sediment and one surface water sample will be collected from within Youth Pond where the culvert that flows from Site 4, under D Street discharges to the southern corner of Youth Pond. In addition, a minimum of six surface (0-6 inches) soil and two surface sediment (0-4 inches) samples will be collected from various points to the drainage channel near potential source areas and along the drainage channel leading into Youth Pond (**Figure 4**). Since they were detected in surface sediment during the 2000 Pond Study, these samples will be analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals, plus cyanide, to help identify the source of contamination by determining whether constituent concentrations similar to those in Youth Pond are found at any of these locations. The surface soil samples and sediment samples also will be analyzed for TOC, pH, sieve grain size and AVS/SEM (sediment only) to assist in completing the ERA.

2. What is the nature and extent of contamination in Youth Pond?

There are two existing surface sediment (0-4 inches) and surface water samples that were previously collected and evaluated in the 2000 Pond Study. Additional surface sediment (0-4 inches), subsurface sediment (4-8 inches) and surface water samples are necessary to represent current pond conditions and adequately characterize these media.

SAP Worksheet #10—Problem Definition (continued)

The following work is proposed to answer this question:

Thirteen surface sediment (0-4 inches), thirteen subsurface sediment (4-8 inches) and six surface water samples will be collected from within Youth Pond (**Figure 4**). The subsurface sediment and surface water sample locations will be co-located with corresponding surface sediment sample locations. One of the proposed surface water/sediment sample will be collected from within Youth Pond, just prior to the York River discharge point (Figure 4; SD13) and one proposed sediment sample will be collected between from the depositional area of the discharge point, between Youth Pond and the York River (SD14). Since they were detected in surface water during the 2000 Pond Study, these samples will be analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals (total and dissolved), plus cyanide. In addition, the thirteen surface sediment and thirteen subsurface sediment samples will be analyzed for pH, TOC, sieve grain size, and AVS/SEM, and the six surface water samples will be analyzed for hardness to assist in completing the ERA. In addition, dissolved metals will be collected because the dissolved fraction for many of the metals is considered to be the bioavailable fraction for corresponding ecological exposure pathways.

Two of the five co-located surface and subsurface sediment/surface water locations (SD/SW-09 and SD/SW-11) will be collected at the approximate locations of the 2000 Pond Study samples (00-Pond-SD/SW08 and 00-Pond-SD/SW09). These samples will be used to qualitatively compare current constituent concentrations with historical concentrations at these approximate locations as part of the nature and extent evaluation. The analytical results from the two samples collected during the 2000 Pond Study will not be quantitatively evaluated in the HHRA/ERA because they are not considered representative of current pond conditions. In addition, no samples will be collected outside Youth Pond or its discharge culvert (i.e., within the York River) at this time. If the data collected as part of this UFP-SAP indicate that additional sampling is needed, a SAP addendum to collect the additional data will be submitted under a separate cover.

3. Do site media pose a potentially unacceptable risk to human health?

Currently, there is not enough existing data to conduct a HHRA. Analytical results from the proposed soil, sediment and surface water sampling dataset are necessary to adequately assess the potential risk to human health due to exposure to these media.

Although there is a catch-and-release policy for fishing on Youth Pond implemented as a conservative measure based on the 2000 Pond Study, fish tissue samples are needed to adequately assess the potential risk to human health due to the possible ingestion of fish.

The following work is proposed to answer this question:

Following a biological survey, three fish tissue samples, of the most appropriate species for human exposures, will be collected for HHRA. The human health fish tissue samples will be filleted and analyzed for metals, PCBs (Aroclors), and the 12 dioxin-like PCB congeners. All fish tissue samples will also be analyzed for percent lipids and percent moisture.

A baseline HHRA will be completed to determine if site contaminants pose an unacceptable risk to human health. The data collected as part of this RI (six surface soil samples [0-6 inches], 15 surface sediment [0-4 inches], 13 subsurface sediment [4-8 inches], six surface water samples, and three fish tissue samples) will be evaluated in the HHRA.

SAP Worksheet #10—Problem Definition (continued)

4. Is there any additional data that can be collected to refine the HHRA?

When performing an HHRA, it is typically assumed that all detected chromium concentrations in site media are in the hexavalent form, which is unlikely since chromium is generally found in natural conditions in the trivalent form, unless activities at the site have resulted in the release or formation of hexavalent chromium. Therefore, surface soil chromium speciation data are needed to adequately assess the potential risk to human health due to exposure to soil.

The following work is proposed to answer this question:

Three surface soil samples (0-6 inches) will be collected and analyzed for hexavalent chromium to generate an estimated proportion of chromium in trivalent versus hexavalent form that is representative of site data in order to refine the HHRA. These sample locations will be field-determined.

5. Do site media pose a potentially unacceptable risk to ecological receptors?

Currently, there are not enough existing data to conduct an ERA (through Step 3a). Analytical results from the proposed soil, sediment and surface water sampling dataset are necessary to adequately assess the potential risk to ecological receptors due to exposure to these media. Fish and frog tissue samples (whole-body) are needed to directly evaluate potential exposures to fish communities (tissue residues) and to evaluate exposures to piscivorous wildlife receptors from exposures via food webs.

The following work is proposed to answer this question:

Following a biological survey, three composite fish tissue samples (the species determined based upon the results of the biological survey) and three composite frog tissue samples will be collected. Proposed whole-body fish sampling (for metals, the 12 dioxin-like PCB congeners and PCB homologues) will be used to evaluate bioaccumulative chemicals and their potential effects on the environment. Fish and frog tissue samples will also be analyzed for percent moisture (to allow wet weight to dry weight conversions) and percent lipids (to allow lipid normalization of PCB data for comparisons among samples and to background samples).

An ERA (through Step 3a) will be completed to determine if detected constituents pose an unacceptable risk to ecological receptors. The data collected as part of this RI (six surface soil samples, 15 surface sediment [0-4 inches], 13 subsurface sediment [4-8 inches], six surface water samples, three fish tissue samples, and three frog tissue samples) will be evaluated in the ERA.

6. Is further action (i.e., further investigation, removal, or remediation) warranted at this site, based on the results of this study?

Further action recommendations will be based on the nature and extent of contamination, findings of the HHRA and ERA, and the expected future use of the site. If further action or investigation is warranted, the specific details regarding the further action will be submitted under a separate cover.

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

Who will use the data?

The data will be used by the Navy, USEPA, and VDEQ to determine if the project objectives have been met and if further investigation is warranted.

What are the Project Action Limits? (Detailed in Worksheet #15)

The detected surface soil, surface water, surface and subsurface sediment, and fish tissue data will be compared to the following PALs to identify COPCs:

1. Surface Soil: USEPA Adjusted Residential Soil RSLs (adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted) and literature-based ecological screening values for plants and soil invertebrates (**Appendix D**).
2. Sediment: USEPA Adjusted Residential Soil RSLs (adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted) multiplied by 10 to adjust soil RSLs for sediment exposure and literature-based freshwater ecological screening values (**Appendix D**).
3. Subsurface Sediment: USEPA Adjusted Residential Soil RSLs (adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted) multiplied by 10 to adjust soil RSLs for sediment exposure and literature-based freshwater ecological screening values (**Appendix D**).
4. Surface Water: USEPA Adjusted Tap Water RSLs (adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted) multiplied by 10 (to account for direct human health exposure to surface water as a result of fishing in the pond) and literature-based freshwater ecological screening values (**Appendix D**).
5. Tissue: Mean and maximum site concentrations (for bioaccumulative chemicals) will be entered into the food web models used in the Site 4 SI. Tissue RSLs will be calculated using the RSL calculator tool. The PALs provided in this SAP for whole-body tissue are targets for the laboratory to meet and are based upon back-calculated food web model values (using the Site 4 SI models, an HQ of 1, and the most conservative receptors and input parameters); PALs also consider literature-based tissue effect levels (e.g., Jarvinen and Ankley [1999; *linkage of effects to tissue residues: development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals*] and the Army Corp of Engineers *Residue-Effects Database*). These latter values will be compared with the resulting whole-body fish tissue data. Site concentrations for fish and frog tissue will also be compared with concentrations from reference areas.

   Site concentrations for surface water, sediment, and tissue will also be compared with reference concentrations. The purpose of the reference site samples are to provide background concentrations for naturally occurring constituents (such as metals) and widely occurring anthropogenic constituents with a multitude of sources (e.g., PAHs and certain pesticides), and to provide comparative data for biological surveys. Significant detections of constituents such as PCBs and explosives would preclude the use of an area as a suitable reference site. However, the reference pond sediment samples will not be formally compared to the PALs listed above. A quantitative HHRA and ERA (through Step 3a) will be conducted to identify the constituents of potential concern (COPCs) for each medium.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

The COPC concentrations will be compared to the background 95 percent upper tolerance limits (UTLs) (CH2M HILL, 2011b), where available and applicable, to determine if the detected concentrations are consistent with the base background concentrations. If the COPC concentrations exceed the background 95 percent UTL, further evaluation will be conducted to consider whether the COPC concentrations may be attributed to a release or may be associated with background conditions (such as comparing site data to the maximum base background concentrations). If the results of this evaluation potentially indicate that site concentrations are not consistent with background conditions, then the COPC concentrations may be attributed to a release and the COPC should be considered a site-related COPC.

PALs will be compared to laboratory-specific reporting limits in the Reference Limits and Evaluation Tables (**Worksheet #15**). Grain size, pH, AVS/SEM, and TOC have no associated screening criteria; these will be analyzed to assess the bioavailability of certain constituents in various media.

For what will the data be used?

Data will be used to answer the environmental questions discussed at the end of **Worksheet #10**. Proposed sample locations are identified on **Figure 4**.

What types of data are needed (matrix, target analytes, analytical groups, field screening, onsite analytical or offsite laboratory techniques, sampling techniques)?

- Six surface water samples will be collected using a decontaminated collection sampler such as an unpreserved laboratory jar. Samples will be collected just below the water surface, however, if the water depth exceeds 4 feet, the sample will be collected at mid-depth. The collected surface water will then be decanted into the sample containers and shipped to an offsite laboratory (ENCO) for analysis of VOCs, SVOCs, PCBs, pesticides, explosives, and metals (total and dissolved) plus cyanide since these contaminant groups were detected during the 2000 Pond Study. Hardness will also be measured as a physical parameter to assist in completing the ERA.
- Fifteen surface sediment samples will be collected at a depth of 0–4 inches below sediment surface (bss) using a stainless steel Ponar (or similar) dredge or sediment core and shipped to an offsite laboratory (ENCO) for analysis of VOCs, SVOCs, PCBs, pesticides, explosives, and metals plus cyanide since these contaminant groups were detected during the 2000 Pond Study and pH, TOC, sieve grain size, and AVS/SEM to assist in completing the ERA.
- Thirteen subsurface sediment samples will be collected at a depth of 4-8 inches bss using a stainless steel Ponar (or similar) dredge or sediment core and shipped to an offsite laboratory (ENCO) for analysis of VOCs, SVOCs, PCBs, pesticides, explosives, and metals plus cyanide since these contaminant groups were detected during the 2000 Pond Study and pH, TOC, sieve grain size, and AVS/SEM to assist in completing the ERA.
- Six surface soil samples will be collected at a depth of 0–6 inches below ground surface (bgs) using a stainless steel hand auger and shipped to an offsite laboratory (ENCO) for analysis of VOCs, SVOCs, PCBs, pesticides, explosives, and metals plus cyanide since these contaminant groups were detected during the 2000 Pond Study. pH, TOC, and sieve grain size will also be measured as physical parameters to assist in completing the ERA.
- Water quality parameters (pH, dissolved oxygen [DO], temperature, conductivity, salinity, ORP, and turbidity) will be measured at all locations with sufficient water. Water depth will be measured and flow rate (if applicable) will be estimated. If the water depth exceeds 4 feet, water quality measurements will be taken at the top and bottom of the water column. If the water depth exceeds 10 feet, these parameters will be measured at the top, middle, and bottom of the water column.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

- Six fish tissue and three frog tissue samples will be collected using a combination of electro-shocking techniques, seines, or traps, depending upon the site conditions (e.g., water depth) and shipped to an offsite laboratory (Katahdin) for analysis. Three fish and three frog tissue samples will be collected and analyzed for ERA parameters (6 whole-body composites), and three fish tissue samples will be collected and analyzed for human health (3 fillet samples) risk assessment parameters. The ecological tissue samples will be analyzed for metals, the 12 dioxin-like PCB congeners and PCB homologues. The human health fish tissue samples will be filleted and analyzed for metals, PCBs (Aroclors), and the 12 dioxin-like PCB congeners. Both sets of fish tissue samples, and the frog samples, will also be analyzed for percent lipids and percent moisture. All collected fish and frogs will be externally examined for abnormalities and species, and length and weight will be measured.

How "good" do the data need to be in order to support the environmental decision?

- The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of possible sources of contaminants and the associated potential risks. In order to ensure quality analytical data, the laboratories have obtained accreditation from the DoD Environmental Laboratory Accreditation Program (ELAP) for definitive data analytical methods. See **Worksheet #31** for more information.
- Because the data will be used in HHRAs and ERAs to make further investigation/action decisions, the laboratories will follow the Measurement Performance Criteria (MPC) in **Worksheet #12** for field QC samples and **Worksheet #28** for laboratory QC samples**.** These MPC are consistent with the DoD QSM Version 4.1 as applicable and laboratory in-house limits where the QSM does not apply.
- Data will be validated by a DV using the procedure described in **Worksheet #36**. A full Level IV equivalent data package and QC sampling are required for these data. A Level IV equivalent data package includes a case narrative, all field sample results, QC forms, and raw data. QC sample requirements are detailed in **Worksheet #20**. A data usability study will be conducted by the project team following DV. This process is outlined in **Worksheet # 37**.

How much data should be collected (number of samples for each analytical group, matrix, and concentration)?

Enough data will be collected to meet the objectives of the RI. Data to be collected will include:

- Six surface water samples to be collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals (total and dissolved) plus cyanide. Water quality parameters (pH, DO, temperature, conductivity, salinity, ORP, and turbidity) will be measured at all locations with sufficient water. Water depth will be measured and flow rate (if applicable) estimated. If the water depth exceeds 4 feet, water quality measurements will be taken at the top and bottom of the water column. If the water depth exceeds 10 feet, these parameters will be measured at the top, middle, and bottom of the water column. Surface water samples will also be measured for hardness.
- Fifteen surface sediment samples to be collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals plus cyanide. Sediment samples will also be analyzed for pH, TOC, sieve grain size, and AVS/SEM.
- Thirteen subsurface sediment samples to be collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals plus cyanide. Sediment samples will also be analyzed for pH, TOC, sieve grain size, and AVS/SEM.
- Six surface soil samples to be collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and metals plus cyanide. The physical parameters pH, TOC, and sieve grain size will also be analyzed.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

- Six fish and three frog tissue samples will be collected and analyzed for ecological (3 whole-body composites for fish and three whole-body composites for frogs) and human health (3 fillet samples) risk assessment parameters. The ecological fish and frog tissue samples will be analyzed for metals, the 12 dioxin-like PCB congeners, and PCB homologues. The human health fish tissue samples will be filleted and analyzed for metals, PCBs (Aroclors), and the 12 dioxin-like PCB congeners. Both sets of fish tissue samples, and the frog samples, will also be analyzed for percent lipids and percent moisture. All collected fish and frogs will be externally examined for abnormalities and species, and length and weight will be measured.

Where, when, and how should the data be collected/generated?

- Detailed information on where, when and how the data will be collected is provided in **Worksheet #14**.
- Proposed sample locations are shown on **Figure 4**. Sample locations will be field-verified (and may be field-adjusted based on conditions encountered), marked with a stake (if possible), and coordinates documented with a global positioning system (GPS) unit. Descriptions of the soil or sediment collected will also be recorded in a field log book.
- Samples will be collected during one field mobilization event, which is expected to occur in October 2012; this mobilization will also include sample collection for the Site 4 and Penniman Lake RIs, including the collection of aquatic reference samples for all three assessments.
- Data will be collected and generated in accordance with the procedures outlined in this UFP-SAP and as presented in the standard operating procedures (SOPs) in **Appendix A**.

Who will collect and generate the data? How will the data be reported?

- CH2M HILL field staff will collect the samples according to the procedures presented in **Worksheet #21** and **Appendix A** of this SAP.
- Laboratory analysis for waters and soils will be performed by ENCO, Orlando, Florida and their 3 sublabs: GEL, Charleston, South Carolina for explosives; CAS, Rochester, New York for AVS/SEM, and Kemron, Atlanta, Georgia for grain size.
- Laboratory analysis for fish tissue samples will be performed by Katahdin, Scarborough, Maine, and their sublab, TestAmerica, West Sacramento, California.
- The data report will include a Contract Laboratory Program (CLP) Level IV-equivalent package. This will include a Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD) in Microsoft Excel format and a hardcopy of the raw data.
- See **Appendix B** for the Navy CLEAN Data Management Plan.

How will the data be archived?

Data will be archived according to procedures dictated via the Navy CLEAN program/contract and will be uploaded to the NIRIS data base. At the end of the project, archived data will be returned to the Navy. Results will be presented in an RI Report.

List the PQOs in the form of if/then qualitative and quantitative statements

Quantifiable analytical results will be the primary basis for project decisions. The limit of quantitation (LOQ), which is defined as the minimum concentration or quantity of a target analyte that can be reported with accurate quantitation, will be the metric to define whether an analytical result is quantifiable.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

Soil and Sediment from the Surface Features (Figure 6)

If organic constituents in samples from the surface features are undetected (are below the MDLs), or if detected inorganic constituent concentrations are below the background 95% UTL (CH2M HILL, 2011), then it will be assumed that soil and sediment from the sampled locations are not a source of contamination to Youth Pond. A Technical Memorandum will be prepared presenting the results from the surface features.

If any detected analytes are below the Project Action Limits (PALs), the surface features may be a source of contamination into Youth Pond. However, it will be assumed that these constituents at these locations do not pose an unacceptable risk or represent a significant continuing source to Youth Pond, and no further action for them will be necessary.

If any detected analytes are above the project-specific PALs, then the surface features are a potential pathway to Youth Pond and a determination will be made as to whether the source of contamination has been identified. If the source of contamination has been identified, a SAP addendum will be prepared outlining proposed additional sampling activities at the source.

Sediment and Surface Water from Youth Pond (Figure 7)

If the analysis of samples determines that analytes are undetected (are below the MDLs) or if any detected analytes are below the Project Action Limits (PALs), then it will be assumed that these constituents do not pose an unacceptable risk in Youth Pond and no further action for them will be necessary.

If the analysis of samples determines that the analytes are detected above the project-specific PALs, then a determination will be made as to whether the nature and extent of contamination is sufficiently delineated.

If contamination is not sufficiently delineated, a SAP addendum will be prepared outlining proposed additional sampling activities. If contamination is sufficiently delineated, then a quantitative HHRA and ERA will be conducted to identify COPCs as follows:

Human Health Risk Decision Logic

Results of the RI sediment sampling will be used to determine if there may be unacceptable risks to potential human receptors:

- Analyte concentrations from the RI will be compared to ten times the adjusted residential soil RSLs (adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted). If the maximum detected concentration of a constituent exceeds the applicable RSL, the constituent will be identified as a COPC.
- If a constituent is identified as a COPC, human health risks will be evaluated for exposure to the COPCs indentified in sediment for current/future recreational users (adult and child), current/future maintenance worker, and current/future construction workers. The 95 percent UCL of the mean sediment concentration will be used as the exposure concentration for the risk calculations. If all risks are within acceptable USEPA risk levels, no further action/assessment based on human health risk will be required for sediment. If the risks are greater than acceptable USEPA risk levels, the constituent will be identified as a COC.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

Results of the RI surface water sampling will be used to determine if there may be unacceptable risks to potential human receptors:

- Analyte concentrations from the RI will be compared to ten times the adjusted tap water RSLs (ten times to account for direct human health exposure to surface water as a result of fishing in the pond and adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted). If the maximum detected concentration of a constituent exceeds the applicable RSL, the constituent will be identified as a COPC.
- If a constituent is identified as a COPC, human health risks will be evaluated for exposure to the COPCs indentified in surface water for current/future recreational users (adult and child), current/future maintenance worker, and current/future construction workers. The 95 percent UCL of the mean surface water concentration will be used as the exposure concentration for the risk calculations. If all risks are within acceptable USEPA risk levels, no further action/assessment based on human health risk will be required for surface water. If the risks are greater than acceptable USEPA risk levels, the constituent will be identified as a COC.

Results of the RI tissue sampling will be used to determine if there may be unacceptable risk to potential human receptors:

- Analyte concentrations from the RI will be compared to the adjusted fish tissue RSLs (adjusted meaning that RSLs based on non-noncarcinogenic effects are divided by 10 to account for exposure to more than one constituent that affects the same target organ; RSLs based on carcinogenic endpoints are not adjusted). The fish tissue RSLs will be obtained from the 2012 USEPA Regional Screening Levels calculator. If the maximum detected concentration of a constituent exceeds the applicable RSL, the constituent will be identified as a COPC.
- If a constituent is identified as a COPC, human health risks will be evaluated for exposure to the COPCs indentified in fish tissue for current/future recreational users (adult and child). The 95 percent UCL of the mean fish tissue concentration will be used as the exposure concentration for the risk calculations. If all risks are within acceptable USEPA risk levels, no further action/assessment based on human health risk will be required for fish tissue. If the risks are greater than acceptable USEPA risk levels, the constituent will be identified as a COC.

Ecological Risk Decision Logic

Results of the sediment and surface water sampling will be evaluated as follows to determine if potential risks to aquatic receptors may be occurring:

- Contaminant concentrations from each site sediment and surface water sample will be compared to literature-based freshwater sediment and surface water screening values (**Appendix D**). Mean concentrations will also be compared with screening values (samples may be partitioned by spatial area when calculating means).
- Site sediment and surface water contaminant concentrations will be compared to reference sediment and surface water concentrations.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

- If the mean site contaminant concentration equals or exceeds the respective sediment and/or surface water screening values, and the maximum concentration equals or exceeds reference concentrations, then the chemical will be considered a COPC. For chemicals whose maximum HQ equals or exceeds one but whose mean HQ is less than one, the magnitude of the maximum HQ, the frequency of detection, the frequency of exceedance, and the spatial distribution of exceedances will be used as lines of evidence to determine if specific constituents warrant retention as COPCs and to account for possible spatially-limited areas of contamination. The uncertainties associated with this evaluation will be discussed in the ERA portion of the RI report.

Results of the fish and frog tissue sampling will be evaluated as follows to determine if there is an unacceptable risk to piscivorous wildlife:

- Site and reference sample concentrations will be statistically compared to determine if site fish tissue concentrations are elevated relative to background.
- Mean and maximum site concentrations (for bioaccumulative chemicals) will be entered into food web models in place of modeled estimates. Potential risks are considered unacceptable if the MATC-based HQ equals or exceeds one based upon the mean concentration.
- In addition, fish tissue concentrations will be compared with literature-based tissue screening values, if available, for bioaccumulative chemicals.

Field QC samples will not be collected for grain size and TOC analysis; therefore, these parameters are not included in **Worksheet #12**. Laboratory QC sample Measurement Performance criteria for grain size and TOC are given in **Worksheet #28**.

Matrix: Soil, Sediment

Analytical Group: PCBs

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Equipment Rinsate Blank	PCBs	One per day of sampling per type of equipment	Contamination/Bias	all target compounds < ½ Level of Quantitation (LOQ)	S&A
Cooler Temperature Blank		One per cooler to the laboratory	Accuracy/ Representativeness	samples at 4 ± 2 degrees Celsius (°C) when received	S
Field Duplicate		One per 10 field samples	Precision	Relative percent difference (RPD) ≤ 35 percent	S&A

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SAP Worksheet #12-1—Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil, Surface Water

Analytical Group: VOCs

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	DQIs	Measurement Performance Criteria
Field Duplicate[1]	VOCs	1 per 10 field samples of similar matrix	Precision	Relative Percent Difference (RPD) ≤ 30%
Equipment Blank		1 per day of sampling for decontaminated equipment, 1 per lot for disposable equipment	Bias/Contamination	No target analytes detected > 1/2 LOQ
Trip Blank		1 per cooler to the laboratory containing VOC samples	Bias/Contamination	No target analytes detected > 1/2 LOQ
Cooler Temperature Indicator		1 per cooler to the laboratory	Representativeness	Temperature ≤ 6 °C

Notes:

[1] Field QA/QC will be collected separately for each matrix.

SAP Worksheet #12-2—Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil, Surface Water

Analytical Group: SVOCs, Pesticides, PCBs

Concentration Level: Medium / Low

QC Sample	Analytical Group[1]	Frequency	DQIs	Measurement Performance Criteria
Field Duplicate[2]	SVOCs, Pesticides, PCBs	1 per 10 field samples of similar matrix	Precision	Relative Percent Difference (RPD) ≤ 30%
Equipment Blank		1 per day of sampling for decontaminated equipment, 1 per lot for disposable equipment	Bias / Contamination	No target analytes detected > 1/2 LOQ
Cooler Temperature Indicator		1 per cooler to the laboratory	Representativeness	Temperature ≤ 6 °C

Notes:

[1] Field QA/QC as described in this table will be collected and analyzed for each of the analytical groups listed.

[2] Field QA/QC will be collected separately for each matrix.

SAP Worksheet #12-3—Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil, Surface Water

Analytical Group: Explosives, Total and/or Dissolved Metals, Cyanide, Hexavalent Chromium

Concentration Level: Medium / Low

QC Sample	Analytical Group[1]	Frequency	DQIs	Measurement Performance Criteria
Field Duplicate[2]	*Explosives, Total and Dissolved Metals, Cyanide, Hexavalent Chromium*	1 per 10 field samples of similar matrix	Precision	Relative Percent Difference (RPD) ≤ 20%
Equipment Blank		1 per day of sampling for decontaminated equipment, 1 per lot for disposable equipment	Bias/Contamination	No target analytes detected > 1/2 LOQ
Cooler Temperature Indicator		1 per cooler to the laboratory	Representativeness	Temperature ≤ 6 °C

Notes:

[1] Field QA/QC as described in this table will be collected and analyzed for each of the analytical groups listed; hexavalent chromium applies to surface soil samples only; dissolved metals applies to surface water samples only.

[2] Field QA/QC will be collected separately for each matrix.

SAP Worksheet #12-4—Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil, Surface Water

Analytical Group: Wet Chemistry and/or AVS/SEM

Concentration Level: Low

QC Sample	Analytical Group	Frequency	DQIs	Measurement Performance Criteria
Cooler Temperature Indicator	Wet Chemistry	1 per cooler to the laboratory	Representativeness	Temperature ≤ 6 °C

SAP Worksheet #12-5—Measurement Performance Criteria Table for Field QC Samples

Matrix: Tissue

Analytical Group: PCBs, PCB Congeners and/or Homologues, Metals

Concentration Level: Medium / Low

QC Sample	Analytical Group[1]	Frequency	DQIs	Measurement Performance Criteria
Cooler Temperature Indicator	PCBs, PCB Congeners, Metals	1 per cooler to the laboratory	Representativeness	Temperature ≤ 6 °C

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SAP Worksheet #13—Secondary Data Criteria and Limitations Table

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Youth Pond Data	2001 Pond Study Report Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site (Baker, 2001)	Baker Environmental, Inc.	The results of this investigation indicated that there was contamination in Youth Pond from an unidentified source. Data from this source will be used to compare current constituent concentrations with historical concentrations.	None known
CAX Background Data	Final Cheatham Annex background Report (CH2M HILL, 2011)	CH2M Hill	Data from this source will be used to compare contaminant concentration levels to background levels to help characterize the nature and extent of contaminant release to soil.	None known

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SAP Worksheet #14—Summary of Project Tasks

The technical approach for the proposed field activities at Youth Pond is detailed below. The Master Project Plans (Baker, 2005) address the protocols and SOPs to be used for the Youth Pond RI sampling.

Mobilization

Prior to mobilization, NAVFAC Mid-Atlantic, USEPA, and VDEQ will be notified to allow for appropriate oversight and coordination.

As part of the field mobilization, CH2M HILL will procure the following subcontractors to support investigation activities:

- Analytical laboratories
- DV
- IDW handler
- Utility Locator

Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities.

Prior to beginning any phase of work, CH2M HILL and its subcontractors will review this SAP and the project-specific HSP. A field team kickoff meeting will be held to discuss the scope of field activities, discuss any safety issues and ensure that personnel are familiar with work items and worker responsibilities.

Utility Clearance

Prior to beginning any intrusive activities, CH2M HILL will coordinate utility clearance with Miss Utility of Virginia and the base's approving authority. Additionally, a separate utilities subcontractor will be procured to ensure the accuracy of the utility markings.

Sampling and Analysis

Soil Sampling

Six surface soil samples (0 to 6 inches bgs) will be collected using a stainless steel hand auger and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives and metals plus cyanide, as outlined in **Worksheet #18**. In addition, the physical parameters pH, TOC and sieve grain size will also be measured. Any relevant information pertaining to contamination or visual observations will be recorded in the sample log book. The SOPs to be employed are included in **Appendix A**.

Surface soil locations are shown on **Figure 4**. In general, sample locations were selected based on potential migration pathways and areas most likely to be impacted by contamination (e.g., near storm water drains, outfalls and along drainage channels). Sampling will be biased towards any visual areas of staining within the designated sampling location to ensure the sample is representative of potential contamination. In order to ensure samples remain representative of soil conditions, areas with heavy debris or obvious water saturation will be avoided.

With the exception of samples for VOCs, soil samples will be homogenized in stainless bowls prior to placement in laboratory-prepared sample containers. Samples collected for VOC analysis will be placed directly into sample containers.

Following sample collection, horizontal coordinates of sample locations will be surveyed using a hand-held GPS unit.

SAP Worksheet #14—Summary of Project Tasks (continued)

Sediment Sampling

Fifteen surface (0 to 4 inches bss) and 13 subsurface (4 to 8 inches bss) sediment samples will be collected using a Ponar dredge or hand corer and analyzed as outlined in **Worksheets #10 and #15**. Any relevant information pertaining to visual observations (color, texture, etc.) will be recorded in the sample log book. Samples will be collected in accordance with the SOPs included in **Appendix A**.

Sediment sampling locations are shown on **Figure 4**. In general, sample locations reflect areas where contaminant impacts to the water bodies are most likely to be represented (i.e., depositional environments) and will be collected starting with downstream locations and working upstream. Because the depth of Youth Pond is unknown, a jon boat will be available to collect these samples; however, certain locations may be accessible with waders.

All sample locations will be approached from downstream to avoid disturbance of bottom sediments as much as possible. Prior to sample collection, water quality data will be measured from the top, middle, and bottom of the water column (where applicable) using a Horiba U-22 water quality meter (pH, conductivity, turbidity, DO, temperature, salinity, and ORP). Water depth and flow rate (if applicable) will also be measured. Sediment cores, approximately 12 inches in length, will be collected at each location using a sediment/sludge sampler and cores will be logged according to the USCS. Surface (0 to 4 inches bss) and subsurface (4 to 8 inches bss) samples will be collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives and metals plus cyanide as identified in **Worksheets #10 and #15**. In addition, the physical parameters pH, TOC, sieve grain size and AVS/SEM will also be measured.

With the exception of VOC and AVS/SEM samples, sediment will be homogenized in stainless bowls prior to placement in laboratory-prepared sample containers. Samples collected for VOCs and AVS/SEM analysis will placed directly into sample containers. Following sample collection, horizontal coordinates of sample locations will be surveyed to the nearest one meter using a hand-held GPS unit.

Surface Water Sampling

A total of six surface water samples will be collected at Youth Pond. Proposed sample locations are shown on **Figure 4**. Sample locations in Youth Pond will be co-located with corresponding sediment samples as indicated on the figure. Prior to sample collection, water quality data will be measured from the top, middle, and bottom of the water column (where applicable) using a Horiba U-22 water quality meter (pH, conductivity, turbidity, DO, temperature, salinity, and ORP). Water depth and flow rate (if applicable) will also be measured. Surface water samples will be collected in accordance with the SOPs included in **Appendix A**. Samples will be collected just below the water surface, however, if the water depth exceeds 4 feet, the sample will be collected at mid-depth. Samples will be collected using a decontaminated collection sampler such as an unpreserved laboratory jar. The collected surface water will then be decanted into the sample containers. The GPS coordinates of surface water sampling locations will be surveyed to the nearest one meter.

Surface water samples will be collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives and metals (total and dissolved) plus cyanide as identified in **Worksheets #10 and #15**. In addition, hardness will also be measured as a physical parameter.

SAP Worksheet #14—Summary of Project Tasks (continued)

Aquatic Biological Surveys and Fish Tissue Sampling

A reconnaissance-level biological survey of fish and other aquatic organisms will be conducted in Youth Pond to determine the presence and type of aquatic community that exists within this water body. The results of this survey will be used to characterize the ecological receptors that are present and to guide the collection of fish tissue samples. In addition, qualitative surveys of benthic macroinvertebrates will also be conducted to characterize the type of community that is present. The organisms will be identified and enumerated in the field.

General methods for the fish sampling are summarized in the associated SOPs included in **Appendix A** of this SAP. Appropriate collection permits will be obtained prior to the start of sample collection.

Fish Tissue Sampling. There are no known fish tissue sampling data currently available for Youth Pond. The biological survey will be used to determine the nature of the fish population that may be consumed by humans or serve as a prey base for piscivorous birds and mammals.

Whole-body fish tissue samples of an appropriate size range for piscivorous wildlife (4 to 12 cm based upon the size range of possible receptors such as great blue heron, belted kingfisher, and mink) will be collected from Youth Pond. Samples for ERA will be submitted for analysis as whole-body fish, while samples collected for HHRA will be submitted for analysis as fish fillets. The species to be targeted will be determined by the results of the biological survey and will be based upon abundance, trophic level, and life history. Three frog tissues samples will also be collected.

A total of three fish samples will be collected from Youth Pond for the ERA, and a total of three fish samples will be collected for the HHRA. The species and guild (e.g., bottom-feeding fish, water-column fish) to be sampled will be determined based upon the results of the biological survey. Fish samples will be collected using a combination of electro-shocking techniques, seines, or traps, depending upon the site conditions (e.g., water depth).

The compositing of ecological samples will be necessary to achieve the required tissue mass for analysis and to increase the representativeness of the sample. At least one of the three ecological samples from the pond will contain triple weight (for laboratory matrix spike/matrix spike duplicate [MS/MSD] QC samples). Composite samples will be composed of the same species and age (size) group whenever possible. Ingesta will not be purged prior to analysis of either whole-body or fillet fish samples.

Information on species, number, size class (length and weight), location, and physical condition will be recorded for the fish captured. Any physical abnormalities will be noted. Sample stations will be mapped and information on habitat condition of each sample station will be recorded, including water depth, substrate type, shoreline profile or vegetation, and degree of shading.

Whole-body fish and frog samples will be analyzed for TAL metals and select PCB congener analysis to include the 12 dioxin-like congeners and PCB homologues. Fillet fish samples will be analyzed for TAL metals, TCL PCBs, and select PCB congener analysis to include the 12 dioxin-like congeners. All sets of tissue samples will also be analyzed for percent lipids and percent moisture.

Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. Decontamination will follow the SOPs in the Master Sampling and Analysis Plan, Sections 3.23.1 and 3.23.3, of the Master Project Plans.

SAP Worksheet #14—Summary of Project Tasks (continued)

In general, all non-disposable sampling equipment will be decontaminated before and immediately after each use as described in the applicable SOPs included in **Appendix A**. Equipment will be decontaminated with Liquinox® (or equivalent solution) and allowed to dry between each use. The water-level indicator will be scrubbed with deionized water between each measurement. All decontamination liquids will be containerized and handled according to the Investigation-derived Waste Handling section below. Disposable equipment (e.g., tubing for low-flow sampling, filters, paper towels, disposable PPE) will be disposed as solid waste.

Heavy equipment, such as drill rig equipment (augers, rods or split spoons), will be steam-cleaned before use at each new monitoring well location. A decontamination pad will be set up onsite to prevent runoff of the decontamination water and to allow easy collection of decontamination fluids into a 55-gallon drum. Decontamination rinseate water will be treated as IDW.

Investigation-derived Waste Management

All IDW will be managed and disposed in accordance with the Master Sampling and Analysis Plan, Section 3.24, of the Master Project Plans. Liquid and solid IDW will be sampled for full Toxicity Characteristic Leaching Procedure (TCLP) analyses to determine the disposal options.

All IDW generated during this project is anticipated and assumed to be non-hazardous; however, it will be fully characterized in order to ensure it is transported and disposed of in accordance with all pertinent regulations.

The IDW generated during sampling will be minimal, consisting mainly of excess soil from sampling and solutions used to decontaminate non-disposable sampling equipment. Solid and aqueous IDW will be containerized separately in Department of Transportation-approved 55-gallon drums, which will be stored on site. Secondary containment for IDW storage will be large enough to contain 10 percent of the volume of containers or the volume of the largest container, whichever is greater. The IDW storage area will be covered with a tarp to minimize exposure of the drums and to prevent rain water from accumulating in the secondary containment. It is anticipated that 1 drum of solid IDW and 1 drum of aqueous IDW will be generated.

Unless there is evidence of gross contamination, one composite soil sample and one composite aqueous sample will be collected for the purpose of IDW characterization; each sample will be analyzed for full TCLP, ignitability, corrosivity, and reactivity analyses. All drums will be removed from the site within 90 days of generation (with Navy approval).

Disposable equipment, including PPE and paper towels, will be disposed as ordinary solid waste.

Shipments

All analytical samples and equipment will be shipped by FedEx. All samples will be shipped in accordance with the Master Sampling and Analysis Plan, Section 3.21, of the Master Project Plans.

Quality Control

All QC samples are listed on **Worksheet #20**. In reference to the field tasks, all field work will be overseen by an FTL who is responsible for the QC of the sampling and making sure the proper SOPs are followed for each task.

SAP Worksheet #14—Summary of Project Tasks (continued)

Sample Analysis

The laboratories will maintain, test, inspect, and calibrate analytical instruments (**Worksheets #24 and #25**). The laboratories will analyze soil, surface water, surface and subsurface sediment samples for various groups of parameters as shown on **Worksheets # 15 and #18**.

Data Management

The Project PDM, Hilary Ott, is responsible for data tracking and storage. In addition, the DV will receive all analytical data from the laboratories and the definitive data will be validated prior to their use by the Navy. All screening data will be checked by the project chemist prior to use. See **Worksheet #36** for more information. All validated analytical data will be loaded into the NIRIS database.

Procedures for Recording and Correcting Data

- Field data will be recorded in field logbooks.
- Project Assessment/Audit: **Worksheets #31 and #32**
- DV: **Worksheets #35 and #36**
- Data Usability Assessment: **Worksheet #37**

The CLEAN Data Management Plan (**Appendix B**) provides guidance for the following:

- Computerized and manual procedures of data generation through final use and storage and QC checks for error detection to ensure data integrity
- Guidance on data management steps such as data recording, data transformation, data reduction, data transfer and transmittal, data analysis, and data review
- Procedures for data tracking, storage, archiving, retrieval and security for both electronic and hardcopy data.

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SAP Worksheet #15-1—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: VOCs

Analyte	CAS Number	Surface Soil PALs[1, 3]		Sediment PAL[1,3]		Project QL Goal[2,3] (milligrams per kilogram [mg/kg])	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Adjusted Residential Soil RSL (Nov 2011) (mg/kg)	Soil ESV (mg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (mg/kg)	Freshwater Sediment ESV (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
Dichlorodifluoromethane (Freon-12)	75-71-8	9.4	NC	94	NC	4.7	0.001	0.001	0.0006	35	135	
Chloromethane	74-87-3	12	5	120	NC	2.5	0.001	0.001	0.0006	50	130	
Vinyl chloride	75-01-4	0.06	0.412	0.6	NC	0.03	0.001	0.001	0.0004	60	125	
Bromomethane	74-83-9	0.73	NC	7.3	NC	0.365	0.001	0.001	0.0008	30	160	
Chloroethane	75-00-3	1500	5	2100	NC	2.5	0.001	0.001	0.0005	40	155	
Trichlorofluoromethane (Freon-11)	75-69-4	79	NC	790	NC	39.5	0.001	0.001	0.0005	25	185	
1,1-Dichloroethene	75-35-4	24	0.173	240	0.031	0.0155	0.001	0.001	0.0006	65	135	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	76-13-1	910	NC	910	NC	455	0.001	0.001	0.0006	**70**	**130**	
Acetone	67-64-1	6100	NC	61000	NC	3050	0.025	0.012	0.0008	20	160	
Carbon disulfide	75-15-0	82	NC	740	0.00085	0.000425	0.005	0.005	0.0014	45	160	
Methyl acetate	79-20-9	7800	NC	29000	NC	3900	0.01	0.005	0.0016	**70**	**130**	
Methylene chloride	75-09-2	11	1.25	110	0.370	0.185	0.01	0.005	0.0006	55	140	
trans-1,2-Dichloroethene	156-60-5	15	0.447	150	0.4	0.2	0.001	0.001	0.0007	65	135	
Methyl-tert-butyl ether (MTBE)	1634-04-4	43	NC	430	NC	21.5	0.001	0.001	0.0003	**58**	**123**	
1,1-Dichloroethane	75-34-3	3.3	0.548	33	0.027	0.0135	0.001	0.001	0.0006	75	125	
cis-1,2-Dichloroethene	156-59-2	16	0.447	160	0.4	0.2	0.001	0.001	0.0005	65	125	30
2-Butanone	78-93-3	2800	NC	28000	NC	1400	0.005	0.0025	0.0014	30	160	
Chloroform	67-66-3	0.29	1.844	2.9	0.022	0.011	0.001	0.001	0.0004	70	125	
1,1,1-Trichloroethane	71-55-6	640	1.025	640	0.17	0.085	0.001	0.001	0.0004	70	135	
Cyclohexane	110-82-7	120	6	120	NC	3	0.002	0.001	0.0005	**70**	**130**	
Carbon tetrachloride	56-23-5	0.61	3.4	6.1	1.2	0.305	0.001	0.001	0.0006	65	135	
Benzene	71-43-2	1.1	1.14	11	0.057	0.0285	0.001	0.001	0.0004	75	125	
1,2-Dichloroethane	107-06-2	0.43	2.19	4.3	0.25	0.125	0.001	0.001	0.0003	70	135	
Trichloroethene	79-01-6	0.44	0.5	4.4	1.6	0.22	0.001	0.001	0.0005	75	125	
Methylcyclohexane	108-87-2	NC	NC	NC	NC	0	0.002	0.001	0.0003	**70**	**130**	
1,2-Dichloropropane	78-87-5	0.94	38.8	9.4	NC	0.47	0.001	0.001	0.0006	70	120	
Bromodichloromethane	75-27-4	0.27	NC	2.7	NC	0.135	0.001	0.001	0.0004	70	130	
cis-1,3-Dichloropropene	10061-01-5	1.7	5	17	0.000051	2.55E-05	0.001	0.001	0.0003	70	125	
4-Methyl-2-pentanone	108-10-1	530	NC	3400	NC	265	0.005	0.0025	0.0014	45	145	
Toluene	108-88-3	500	40	820	0.67	0.335	0.001	0.001	0.0005	70	125	
trans-1,3-Dichloropropene	10061-02-6	1.7	5	17	0.000051	2.55E-05	0.001	0.001	0.0003	65	125	

SAP Worksheet #15-1—Reference Limits and Evaluation Table (continued)

Analyte	CAS Number	Surface Soil PALs[1, 3]		Sediment PAL[1,3]		Project QL Goal[2,3] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Adjusted Residential Soil RSL (Nov 2011) (mg/kg)	Soil ESV (mg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (mg/kg)	Freshwater Sediment ESV (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
1,1,2-Trichloroethane	79-00-5	0.16	2	1.6	1.2	0.08	0.001	0.001	0.0006	60	125	
Tetrachloroethene	127-18-4	0.55	0.179	5.5	0.53	0.0895	0.001	0.001	0.0003	65	140	
2-Hexanone	591-78-6	21	NC	210	NC	10.5	0.005	0.0025	0.0009	45	145	
Dibromochloromethane	124-48-1	0.68	NC	6.8	NC	0.34	0.001	0.001	0.0002	65	130	
1,2-Dibromoethane	106-93-4	0.034	0.3	0.34	NC	0.017	0.001	0.001	0.0003	70	125	
Chlorobenzene	108-90-7	29	2.4	290	0.82	0.41	0.001	0.001	0.0005	75	125	
Ethylbenzene	100-41-4	5.4	1.815	54	3.6	0.9075	0.001	0.001	0.0006	75	125	
Xylene (total)	1330-20-7	63	1.3	260	0.16	0.08	0.003	0.003	0.0014	**70**	**130**	
Styrene	100-42-5	630	64	870	0.559	0.2795	0.001	0.001	0.0004	75	125	
Bromoform	75-25-2	62	0.3	620	0.65	0.15	0.001	0.001	0.0003	55	135	
Isopropylbenzene	98-82-8	210	NC	270	0.086	0.043	0.001	0.001	0.0005	75	130	
1,1,2,2-Tetrachloroethane	79-34-5	0.56	5	5.6	0.94	0.28	0.001	0.001	0.0003	55	130	
1,3-Dichlorobenzene	541-73-1	NC	1	NC	1.7	0.5	0.001	0.001	0.0004	70	125	
1,4-Dichlorobenzene	106-46-7	2.4	1.28	24	0.35	0.175	0.001	0.001	0.0004	70	125	
1,2-Dichlorobenzene	95-50-1	190	1	380	0.34	0.17	0.001	0.001	0.0004	75	120	
1,2-Dibromo-3-chloropropane	96-12-8	0.0054	NC	0.054	0.34	0.0027	0.001	0.001	0.0003	40	135	
1,2,4-Trichlorobenzene	120-82-1	6.2	1.27	62	9.2	0.635	0.001	0.001	0.0006	65	130	
1,2,3-Trichlorobenzene	87-61-6	4.9	1.15	49	0.858	0.429	0.001	0.001	0.0008	60	135	

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] Project QL goals are equal to half of the minimum PAL.

[3] PALs and Project QL Goals assume dry weight basis.

[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

NC indicates that no criterion exists for this analyte.

SAP Worksheet #15-2—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: SVOCs

Analyte	CAS Number	Full Scan or SIM	Surface Soil PALs[1, 3]		Sediment PALs[1, 3]		Project QL Goal[2,3] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[5]		
			Adjusted Residential Soil RSL (Nov 2011) (mg/kg)	Soil ESV[4] (mg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (mg/kg)	Freshwater Sediment ESV (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
1,1-Biphenyl	92-52-4	full scan	5.1	13.6	51	NC	2.55	0.33	0.1	0.095	**64**	**87**	
2,2'-Oxybis(1-chloropropane)	108-60-1	full scan	4.6	NC	46	NC	2.3	0.33	0.1	0.082	20	115	
2,4,5-Trichlorophenol	95-95-4	full scan	610	1.35	6100	NC	0.675	0.33	0.1	0.058	50	110	
2,4,6-Trichlorophenol	88-06-2	full scan	6.1	0.58	61	NC	0.29	0.33	0.1	0.06	45	110	
2,4-Dichlorophenol	120-83-2	full scan	18	0.5	180	NC	0.25	0.33	0.1	0.071	45	110	
2,4-Dimethylphenol	105-67-9	full scan	120	1	1200	NC	0.5	0.33	0.1	0.074	30	105	
2,4-Dinitrophenol	51-28-5	full scan	12	20	120	NC	6	0.33	0.3	0.12	15	130	
2,4-Dinitrotoluene	121-14-2	full scan	1.6	11	16	NC	0.8	0.33	0.1	0.072	50	115	
2,6-Dinitrotoluene	606-20-2	full scan	6.1	8.5	61	NC	3.05	0.33	0.1	0.069	50	110	
2-Chloronaphthalene	91-58-7	full scan	180	PAH	180	NC	90	0.33	0.1	0.065	45	105	
2-Chlorophenol	95-57-8	full scan	39	0.5	390	NC	0.25	0.33	0.1	0.082	45	105	
2-Methylnaphthalene	91-57-6	SIM	31	PAH	310	NC	15.5	0.033	0.025	0.021	45	105	
2-Methylphenol	95-48-7	full scan	310	1	3100	NC	0.5	0.33	0.1	0.07	40	105	
2-Nitroaniline	88-74-4	full scan	61	NC	610	NC	30.5	0.33	0.1	0.067	45	120	
2-Nitrophenol	88-75-5	full scan	39	1	390	NC	0.5	0.33	0.1	0.078	40	110	
3,3'-Dichlorobenzidine	91-94-1	full scan	1.1	NC	11	NC	0.55	0.33	0.1	0.091	10	130	
3-Nitroaniline	99-09-2	full scan	NC	NC	NC	NC	Lab LOD	0.33	0.1	0.074	25	110	
4,6-Dinitro-2-methylphenol	534-52-1	full scan	0.49	1	4.9	NC	0.245	0.33	0.3	0.13	30	135	
4-Bromophenyl-phenylether	101-55-3	full scan	NC	NC	NC	NC	Lab LOD	0.33	0.1	0.073	45	115	30
4-Chloro-3-methylphenol	59-50-7	full scan	610	0.5	6100	NC	0.25	0.33	0.1	0.067	45	115	
4-Chloroaniline	106-47-8	full scan	2.4	0.5	24	NC	0.25	0.33	0.1	0.092	10	100	
4-Chlorophenyl-phenylether	7005-72-3	full scan	31	NC	310	NC	15.5	0.33	0.1	0.067	45	110	
4-Methylphenol	106-44-5	full scan	31	1	310	NC	0.5	0.33	0.2	0.16	40	105	
4-Nitroaniline	100-01-6	full scan	24	NC	240	NC	12	0.33	0.1	0.082	35	115	
4-Nitrophenol	100-02-7	full scan	4.8	0.38	48	NC	0.19	0.33	0.1	0.082	15	140	
Acenaphthene	83-32-9	SIM	340	PAH	3400	0.29	0.145	0.033	0.025	0.022	45	110	
Acenaphthylene	208-96-8	SIM	340	PAH	3400	0.16	0.08	0.033	0.025	0.019	45	105	
Acetophenone	98-86-2	full scan	780	NC	2500	NC	390	0.33	0.1	0.083	**52**	**86**	
Anthracene	120-12-7	SIM	1700	PAH	17000	0.0572	0.0286	0.033	0.025	0.014	55	105	
Atrazine	1912-24-9	full scan	2.1	0.0119	21	NC	0.00595	0.33	0.1	0.074	**45**	**120**	
Benzaldehyde	100-52-7	full scan	780	NC	1200	NC	390	0.33	0.1	0.099	**60**	**83**	
Benzo(a)anthracene	56-55-3	SIM	0.15	PAH	1.5	0.108	0.054	0.033	0.025	0.0093	**50**	**110**	
Benzo(a)pyrene	50-32-8	SIM	0.015	PAH	0.15	0.15	0.0075	0.033	0.025	0.0067	**50**	**110**	
Benzo(b)fluoranthene	205-99-2	SIM	0.15	PAH	1.5	0.24	0.075	0.033	0.025	0.012	**45**	**115**	
Benzo(g,h,i)perylene	191-24-2	SIM	170	PAH	1700	0.17	0.085	0.033	0.025	0.012	**40**	**125**	
Benzo(k)fluoranthene	207-08-9	SIM	1.5	PAH	15	0.24	0.12	0.033	0.025	0.012	**45**	**125**	

SAP Worksheet #15-2—Reference Limits and Evaluation Table (continued)

Analyte	CAS Number	Full Scan or SIM	Surface Soil PALs[1, 3]		Sediment PALs[1, 3]		Project QL Goal[2,3] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[5]		
			Adjusted Residential Soil RSL (Nov 2011) (mg/kg)	Soil ESV[4] (mg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (mg/kg)	Freshwater Sediment ESV (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
bis(2-Chloroethoxy)methane	111-91-1	full scan	18	NC	180	NC	9	0.33	0.1	0.064	45	110	
bis(2-Chloroethyl)ether	111-44-4	full scan	0.21	NC	2.1	NC	0.105	0.33	0.1	0.092	40	105	
bis(2-Ethylhexyl)phthalate	117-81-7	full scan	35	30	350	0.75	0.375	0.33	0.1	0.085	45	125	
Butylbenzylphthalate	85-68-7	full scan	260	30	2600	NC	15	0.33	0.1	0.093	50	125	
Caprolactam	105-60-2	full scan	3100	NC	31000	NC	1550	0.33	0.2	0.1	**14**	**125**	
Carbazole	86-74-8	full scan	NC	NC	NC	NC	Lab LOD	0.33	0.1	0.068	45	115	
Chrysene	218-01-9	SIM	15	PAH	150	0.166	0.083	0.033	0.025	0.011	55	110	
Dibenz(a,h)anthracene	53-70-3	SIM	0.015	PAH	0.15	0.033	0.0075	0.033	0.025	0.011	40	125	
Dibenzofuran	132-64-9	full scan	7.8	NC	78	5.1	2.55	0.33	0.1	0.066	50	105	
Diethylphthalate	84-66-2	full scan	4900	26.8	49000	0.63	0.315	0.33	0.1	0.075	50	115	
Dimethyl phthalate	131-11-3	full scan	NC	10.64	NC	NC	5.32	0.33	0.1	0.062	50	110	
Di-n-butylphthalate	84-74-2	full scan	610	40	6100	0.11	0.055	0.33	0.1	0.079	55	110	
Di-n-octylphthalate	117-84-0	full scan	35	30	350	NC	15	0.33	0.1	0.067	40	130	
Fluoranthene	206-44-0	SIM	230	PAH	2300	0.423	0.2115	0.033	0.025	0.013	55	115	
Fluorene	86-73-7	SIM	230	PAH	2300	0.0774	0.0387	0.033	0.025	0.021	50	110	
Hexachlorobenzene	118-74-1	full scan	0.3	1	3	0.02	0.01	0.33	0.1	0.081	45	120	
Hexachlorobutadiene	87-68-3	full scan	6.1	NC	61	NC	3.05	0.33	0.1	0.08	40	115	
Hexachlorocyclopentadiene	77-47-4	full scan	37	2	370	NC	1	0.33	0.1	0.093	**24**	**120**	
Hexachloroethane	67-72-1	full scan	4.3	NC	43	NC	2.15	0.33	0.1	0.074	35	110	
Indeno(1,2,3-cd)pyrene	193-39-5	SIM	0.15	PAH	1.5	0.2	0.075	0.033	0.025	0.012	40	120	
Isophorone	78-59-1	full scan	510	NC	5100	NC	255	0.33	0.1	0.072	45	110	
Naphthalene	91-20-3	SIM	3.6	PAH	36	0.176	0.088	0.033	0.025	0.023	40	105	
Nitrobenzene	98-95-3	full scan	4.8	2.26	48	NC	1.13	0.33	0.1	0.079	40	115	
n-Nitroso-di-n-propylamine	621-64-7	full scan	0.069	NC	0.69	NC	0.0345	0.33	0.1	0.09	40	115	
n-Nitrosodiphenylamine	86-30-6	full scan	99	1.09	990	NC	0.545	0.33	0.2	0.14	50	115	
Pentachlorophenol	87-86-5	full scan	0.89	5	8.9	NC	0.445	0.33	0.3	0.14	25	120	
Phenanthrene	85-01-8	SIM	1700	PAH	17000	0.204	0.102	0.033	0.025	0.018	50	110	
Phenol	108-95-2	full scan	1800	1.88	18000	0.048	0.024	0.33	0.1	0.076	40	100	
Pyrene	129-00-0	SIM	170	PAH	1700	0.195	0.0975	0.033	0.025	0.012	45	125	
2,3,4,6-Tetrachlorophenol	58-90-2	full scan	NC	NC	NC	NC	Lab LOD	0.33	0.2	0.074	**18**	**98**	
1,2,4,5-Tetrachlorobenzene	95-94-3	full scan	1.8	NC	18	NC	0.9	0.33	0.1	0.069	**59**	**81**	

Notes:
[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.
[2] Project QL goals are equal to half of the minimum PAL.
[3] PALs and Project QL Goals assume dry weight basis.
[4] Site-Specific ESVs for PAHs are based on whether they are Low Molecular Weight (LMW) or High Molecular Weight (HMW). For surface soil, the cumulative LMW ESV is 29 mg/kg and the cumulative HMW ESV is 18 mg/kg. For sediment, the cumulative LMW ESV is 0.786 mg/kg and the cumulative HMW ESV is 2.9 mg/kg.
[5] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.
NC indicates that no criterion exists for this analyte.
Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-3—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: Pesticides

Analyte	CAS Number	Surface Soil PALs[1, 3]		Sediment PAL[1,3]		Project QL Goal[2,3] (micrograms per kilogram [µg/kg])	Laboratory-Specific (µg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Adjusted Residential Soil RSL (Nov 2011) (µg/kg)	Soil ESV (µg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (µg/kg)	Freshwater Sediment ESV (µg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
alpha-BHC	319-84-6	77	226	770	6	3	1.7	1	0.49	60	125	30
beta-BHC	319-85-7	270	342	2700	5	2.5	1.7	1	1	60	125	
delta-BHC	319-86-8	270	226	2700	3	1.5	1.7	1	0.48	55	130	
gamma-BHC (Lindane)	58-89-9	520	7.75	5200	2.37	1.185	1.7	1	0.45	60	125	
Heptachlor	76-44-8	110	52.9	290	NC	26.45	1.7	1	0.53	50	140	
Aldrin	309-00-2	29	3.63	290	2	1	1.7	1	0.49	45	140	
Heptachlor epoxide	1024-57-3	53	52.9	530	2.47	1.235	1.7	1	0.48	65	130	
Endosulfan I	959-98-8	37000	6.32	370000	NC	3.16	1.7	1	0.39	15	135	
Dieldrin	60-57-1	30	10.5	300	1.9	0.95	1.7	1	0.45	65	125	
4,4'-DDE	72-55-9	1400	114	14000	3.16	1.58	1.7	1	0.52	70	125	
Endrin	72-20-8	1800	1.95	18000	2.22	0.975	1.7	1	0.74	60	135	
Endosulfan II	33213-65-9	37000	6.32	370000	NC	3.16	1.7	1	0.48	35	140	
4,4'-DDD	72-54-8	2000	583	20000	4.88	2.44	1.7	1	0.48	30	135	
Endosulfan sulfate	1031-07-8	37000	6.32	370000	NC	3.16	1.7	1	0.49	60	135	
4,4'-DDT	50-29-3	1700	100	17000	4.16	2.08	1.7	1	0.66	45	140	
Methoxychlor	72-43-5	31000	500	310000	NC	250	1.7	1	0.86	55	145	
Endrin ketone	53494-70-5	1800	1.95	18000	2.22	0.975	1.7	1	0.45	65	135	
Endrin aldehyde	7421-93-4	1800	1.95	18000	2.22	0.975	1.7	1	0.5	35	145	
alpha-Chlordane	5103-71-9	1600	11	16000	3.24	1.62	1.7	1	0.45	65	120	
gamma-Chlordane	5103-74-2	1600	11	16000	3.24	1.62	1.7	1	0.45	65	125	
Toxaphene	8001-35-2	440	500	4400	NC	220	33	20	8	**60**	**140**	**40**

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] Project QL goals are equal to half of the minimum PAL.

[3] PALs and Project QL Goals assume dry weight basis.

[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

SAP Worksheet #15-4—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: PCBs

Analyte	CAS Number	Surface Soil PALs[1, 3]		Sediment PAL[1,3]		Project QL Goal[2,3] (µg/kg)	Laboratory-Specific (µg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Adjusted Residential Soil RSL (Nov 2011) (µg/kg)	Soil ESV (µg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (µg/kg)	Freshwater Sediment ESV (µg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
Aroclor-1016	12674-11-2	390	8000	3900	59.8	29.9	40	20	6.9	40	140	30
Aroclor-1221	11104-28-2	140	8000	1400	59.8	29.9	40	20	12	**29**	**185**	
Aroclor-1232	11141-16-5	140	8000	1400	59.8	29.9	40	20	13	**29**	**185**	
Aroclor-1242	53469-21-9	220	8000	2200	59.8	29.9	40	20	10	**29**	**185**	
Aroclor-1248	12672-29-6	220	8000	2200	59.8	29.9	40	20	5.5	**29**	**185**	
Aroclor-1254	11097-69-1	110	8000	1100	59.8	29.9	40	20	12	**29**	**185**	
Aroclor-1260	11096-82-5	220	8000	2200	59.8	29.9	17	10	3	60	130	

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] Project QL goals are equal to half of the minimum PAL.

[3] PALs and Project QL Goals assume dry weight basis.

[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

SAP Worksheet #15-5—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil
Analytical Group: Metals, Cyanide, Hexavalent Chromium

Analyte	CAS Number	Surface Soil PALs[1, 3]			Sediment PAL[1,3]		Project QL Goal[2,3] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Adjusted Residential Soil RSL (Nov 2011) (mg/kg)	Soil ESV (mg/kg)	CAX Surface Soil 95%UTL BKG (mg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (mg/kg)	Freshwater Sediment ESV (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
Aluminum	7429-90-5	7700	pH < 5.5	12200	77000	25,500	3850	10	5	1.9	80	120	20
Antimony	7440-36-0	3.1	78	NE	31	3	1.5	2	1	0.19			
Arsenic	7440-38-2	0.39	18	6.36	3.9	9.79	0.195	2	1	0.26			
Barium	7440-39-3	1500	330	52.9	15000	20	10	0.5	0.25	0.011			
Beryllium	7440-41-7	16	40	0.587	160	NC	0.2935	0.05	0.025	0.0061			
Cadmium	7440-43-9	7	32	NE	70	0.99	0.495	0.1	0.05	0.014			
Calcium	7440-70-2	NC	NC	2290	NC	NC	1145	25	6.25	1.9			
Chromium	7440-47-3	0.29	64	18.2	2.9	43.4	0.145	0.5	0.25	0.029			
Chromium (hexavalent)[5]	18540-29-9	0.29	NC	NC	NA	NA	0.15	0.4	0.2	0.065	LCS: 80 MS: 75	LCS: 120 MS: 125	20
Cobalt	7440-48-4	2.3	13	9.93	23	50	1.15	0.5	0.25	0.023	80	120	20
Copper	7440-50-8	310	70	4.25	3100	31.6	2.125	0.5	0.25	0.076			
Iron	7439-89-6	5500	5 < pH > 8	19900	55000	20000	2750	10	5	1.5			
Lead	7439-92-1	400	120	17.4	4000	35.8	8.7	1	0.5	0.1			
Magnesium	7439-95-4	NC	NC	1070	NC	NC	535	25	6.25	1.8			
Manganese	7439-96-5	180	220	324	1800	460	90	1	0.5	0.026			
Mercury	7439-97-6	2.3	0.1	0.111	23	0.18	0.05	0.048	0.024	0.011			
Nickel	7440-02-0	150	38	9.52	1500	22.7	4.76	0.5	0.25	0.02			
Potassium	7440-09-7	NC	NC	708	NC	NC	354	50	25	4.1			
Selenium	7782-49-2	39	0.52	0.51	390	2	0.255	2	1	0.31			
Silver	7440-22-4	39	560	NE	390	1	0.5	0.5	0.25	0.059	75		
Sodium	7440-23-5	NC	NC	521	NC	NC	260.5	25	6.25	2.7	80		
Thallium	7440-28-0	0.078	1	NC	0.78	NC	0.039	1	0.5	0.14			
Vanadium	7440-62-2	39	130	27.9	390	NC	13.95	1	0.25	0.046			
Zinc	7440-66-6	2300	120	26.5	23000	121	13.25	1	0.5	0.19			
Cyanide	57-12-5	160	15.8	NC	1600	NC	7.9	0.48	0.18	0.062	**85**	**115**	

Notes:
[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.
[2] Project QL goals are equal to half of the minimum PAL.
[3] PALs and Project QL Goals assume dry weight basis.
[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.
[5] Hexavalent chromium will only be analyzed in 3 of the surface soil samples. Sediment PALs are not applicable (NA).
NC indicates that no criterion exists for this analyte.
NE indicates that the analyte was not evaluated for a 95% UTL value.
Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-6—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: Explosives

Analyte	CAS Number	Surface Soil PALs[1, 3]		Sediment PAL[1,3]		Project QL Goal[2,3] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Adjusted Residential Soil RSL (Nov 2011) (mg/kg)	Soil ESV (mg/kg)	Adjusted Residential Soil RSL x 10 for Sediment (Nov 2011) (mg/kg)	Freshwater Sediment ESV (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	380	10	3800	0.0047	0.00235	0.5	0.3	0.15	75	125	30
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	5.6	10	56	0.0127	0.00635	0.5	0.3	0.15	70	135	
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	220	NC	2200	0.0024	0.0012	0.5	0.3	0.15	75	125	
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.61	NC	6.1	0.0067	0.00335	0.5	0.3	0.15	80	125	
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	24	10	240	NC	5	0.5	0.3	0.15	10	150	
Nitrobenzene (NB)	98-95-3	4.8	2.26	48	1.779	0.8895	0.5	0.3	0.15	75	125	
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	3.6	10	36	0.092	0.046	0.5	0.3	0.15	55	140	
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	15	80	150	0.0232	0.0116	0.5	0.3	0.15	80	125	
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	15	80	150	0.0132	0.0066	0.5	0.3	0.15	80	125	
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	1.6	11	16	0.0416	0.0208	0.5	0.3	0.15	80	125	
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	6.1	8.5	61	0.0558	0.0279	0.5	0.3	0.15	80	120	
2-Nitrotoluene (2-NT)	88-72-2	2.9	NC	29	6.204	1.45	0.5	0.3	0.15	80	125	
3-Nitrotoluene (3-NT)	99-08-1	0.61	NC	6.1	1.922	0.305	0.5	0.3	0.15	75	120	
4-Nitrotoluene (4-NT)	99-99-0	24	NC	240	4.06	2.03	0.5	0.3	0.15	75	125	
Nitroglycerin [5]	55-63-0	0.61	NC	6.1	NC	0.305	1.00	0.50	0.25	**49**	**135**	30
PETN [5]	78-11-5	12	NC	120	0.0127	0.00635	2.00	1.46	0.73	**58**	**150**	
3,5-Dinitroaniline [5]	618-87-1	NC	NC	NC	NC	Lab LOD	1.00	0.50	0.25	**76**	**126**	
Nitroguanidine [5]	556-88-7	610	NC	6100	NC	305	0.10	0.050	0.025	**70**	**130**	**30**

Notes:
[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.
[2] Project QL goals are equal to half of the minimum PAL.
[3] PALs and Project QL Goals assume dry weight basis.
[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.
[5] This explosive will only be tested for in reference sediment samples. Refer to **Worksheet #18** for a list of reference samples.
NC indicates that no criterion exists for this analyte.
Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-7—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment

Analytical Group: AVS/SEM

Analyte	CAS Number[2]	Laboratory-Specific (umol/g)			LCS, MS and MSD %R and RPD Limits[3]		
		LOQ	LOD[4]	DL	LCL	UCL	RPD
Acid volatile sulfide	ACIDSO2	0.09	NA	0.0758	**10**	**183**	**30**
Cadmium	7440-43-9	0.00044	NA	0.00006	**LCS: 80 MS/MSD: 75**	**LCS: 120 MS/MSD: 125**	**20**
Copper	7440-50-8	0.0031	NA	0.0012			
Lead	7439-92-1	0.0024	NA	0.0002			
Mercury	7439-97-6	0.00001	NA	0.00000092			
Nickel	7440-02-0	0.00682	NA	0.00071			
Silver	7440-22-4	0.00093	NA	0.00009			
Zinc	7440-66-6	0.031	NA	0.011			

Notes:

[1] The ratio of SEM/AVS will be used to evaluate the potential bioavailability of certain metals in sediment.

[2] In some instances a contractor-specific identifier is used.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

[4] The analytical laboratory does not have LODs established for AVS or SEM. Non-detects will be reported at the LOQ.

SAP Worksheet #15-8—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: Wet Chemistry

Analyte	CAS Number[3]	Units	Laboratory-Specific			LCS, MS, and MSD %R and RPD Limits[4]		
			LOQ	LOD	DL	LCL	UCL	RPD
Total organic carbon (TOC)[1]	TOC	mg/kg	500	500	500	**50**	**150**	**25**
pH[2]	PH	pH	NA	NA	NA	**99**	**101**	NA

Notes:

[1] TOC data in sediment will be used to adjust equilibrium partitioning-based ecological screening values and to evaluate habitat conditions.

[2] Data for pH in soil will be used as the ecological screening value for certain metals (aluminum and iron).

[3] A contractor-specific identifier is used.

[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

SAP Worksheet #15-9—Reference Limits and Evaluation Table

Matrix: Surface Sediment, Subsurface Sediment, Surface Soil

Analytical Group: Grain-size[1]

Analyte	CAS Number[2]	Units
GS03 Sieve 3" (75 mm)	SIEVE75.0	% Passing
GS05 Sieve 2" (50 mm)	SIEVE50.0	% Passing
GS06 Sieve 1.5" (37.5 mm)	SIEVE37.5	% Passing
GS07 Sieve 1" (25.0 mm)	SIEVE25.0	% Passing
GS08 Sieve 0.75" (19.0 mm)	SIEVE19.0	% Passing
GS10 Sieve 0.375" (9.5 mm)	SIEVE9.5	% Passing
Sieve No. 004 (4.75 mm)	SIEVE4.75	% Passing
Sieve No. 010 (2.00 mm)	SIEVE2.0	% Passing
Sieve No. 020 (850 um)	SIEVE850	% Passing
Sieve No. 040 (425 um)	SIEVE425	% Passing
Sieve No. 060 (250 um)	SIEVE250	% Passing
Sieve No. 080 (180 um)	SIEVE180	% Passing
Sieve No. 100 (150 um)	SIEVE150	% Passing
Sieve No. 200 (75um)	SIEVE75	% Passing
Gravel (%)	GRAVEL	%
Sand (%)	14808-60-7	%
Coarse Sand (%)	COARSESAND	%
Medium Sand (%)	MEDIUMSAND	%
Fine Sand (%)	FINESAND	%
Fines (%)	FINES	%

Notes:

There are no action limits, laboratory reporting limits, or LCS recovery limits for grain-size analytes.

[1] Grain-size data will be used to characterize sediment and soil conditions in terms of habitat for certain invertebrates, and to compare site to reference habitat conditions.

[2] A contractor-specific identifier is used.

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SAP Worksheet #15-10—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: VOCs

Analyte	CAS Number	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (micrograms per liter [µg/L])	MCL[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
						LOQ	LOD	DL	LCL	UCL	RPD
Dichlorodifluoromethane (Freon-12)	75-71-8	190	NC	NC	95	1	1	0.74	30	155	30
Chloromethane	74-87-3	190	NC	5500	95	1	1	0.82	40	125	
Vinyl chloride	75-01-4	0.15	2	930	0.075	1	1	0.71	50	145	
Bromomethane	74-83-9	7	NC	110	3.5	1	1	0.95	30	145	
Chloroethane	75-00-3	21000	NC	NC	10500	1	1	0.98	60	135	
Trichlorofluoromethane (Freon-11)	75-69-4	1100	NC	NC	550	1	1	0.68	60	145	
1,1-Dichloroethene	75-35-4	260	7	25	3.5	1	1	0.94	70	130	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	76-13-1	53000	NC	NC	26500	1	1	0.73	**47**	**173**	
Acetone	67-64-1	12000	NC	1500	750	12	12	1.8	40	140	
Carbon disulfide	75-15-0	720	NC	0.92	0.46	5	5	1.9	35	160	
Methyl acetate	79-20-9	16000	NC	NC	8000	2	1	0.95	**24**	**129**	
Methylene chloride	75-09-2	47	5	2200	2.5	5	5	0.69	55	140	
trans-1,2-Dichloroethene	156-60-5	86	100	590	43	1	1	0.72	60	140	
Methyl-tert-butyl ether (MTBE)	1634-04-4	120	NC	11070	60	1	1	0.6	65	125	
1,1-Dichloroethane	75-34-3	24	NC	47	12	1	1	0.57	70	135	
cis-1,2-Dichloroethene	156-59-2	28	70	590	14	1	1	0.49	70	125	
2-Butanone	78-93-3	4900	NC	14000	2450	12	12	4.5	30	150	
Chloroform	67-66-3	1.9	80	28	0.95	1	1	0.54	65	135	
1,1,1-Trichloroethane	71-55-6	7500	200	11	5.5	1	1	0.59	65	130	
Cyclohexane	110-82-7	13000	NC	NC	6500	2	1	0.93	**45**	**147**	
Carbon tetrachloride	56-23-5	3.9	5	240	1.95	1	1	0.65	65	140	
Benzene	71-43-2	3.9	5	130	1.95	1	1	0.58	80	120	
1,2-Dichloroethane	107-06-2	1.5	5	910	0.75	1	1	0.5	70	130	
Trichloroethene	79-01-6	2.6	5	47	1.3	1	1	0.55	70	125	
Methylcyclohexane	108-87-2	NC	NC	NC	Lab LOD	2	1	0.59	**55**	**121**	
1,2-Dichloropropane	78-87-5	3.8	5	525	1.9	1	1	0.8	75	125	
Bromodichloromethane	75-27-4	1.2	80	NC	0.6	1	1	0.49	75	120	
cis-1,3-Dichloropropene	10061-01-5	4.1	NC	24.4	2.05	1	1	0.59	70	130	
4-Methyl-2-pentanone	108-10-1	1000	NC	170	85	12	12	2.8	60	135	
Toluene	108-88-3	860	1000	9.8	4.9	1	1	0.58	75	120	
trans-1,3-Dichloropropene	10061-02-6	4.1	NC	24.4	2.05	1	1	0.64	55	140	
1,1,2-Trichloroethane	79-00-5	0.41	5	1200	0.205	1	1	0.63	75	125	
Tetrachloroethene	127-18-4	0.72	5	98	0.36	1	1	0.76	45	150	
2-Hexanone	591-78-6	34	NC	99	17	5	2.5	1.4	55	130	

SAP Worksheet #15-10—Reference Limits and Evaluation Table (continued)

Analyte	CAS Number	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	MCL[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
						LOQ	LOD	DL	LCL	UCL	RPD
Dibromochloromethane	124-48-1	1.5	80	NC	0.75	1	1	0.44	60	135	
1,2-Dibromoethane	106-93-4	0.065	0.05	NC	0.025	1	1	0.78	80	120	
Chlorobenzene	108-90-7	72	100	64	32	1	1	0.51	80	120	
Ethylbenzene	100-41-4	13	700	290	6.5	1	1	0.69	75	125	
Xylene (total)	1330-20-7	190	10000	13	6.5	3	3	1.3	**70**	**130**	
Styrene	100-42-5	1100	100	72	36	1	1	0.49	65	135	
Bromoform	75-25-2	79	80	320	39.5	1	1	0.75	70	130	
Isopropylbenzene	98-82-8	390	NC	2.6	1.3	1	1	0.67	75	125	
1,1,2,2-Tetrachloroethane	79-34-5	0.66	NC	610	0.33	1	1	0.54	65	130	
1,3-Dichlorobenzene	541-73-1	NC	NC	71	35.5	1	1	0.53	75	125	
1,4-Dichlorobenzene	106-46-7	4.2	75	15	2.1	1	1	0.46	75	125	
1,2-Dichlorobenzene	95-50-1	280	600	14	7	1	1	0.57	70	120	
1,2-Dibromo-3-chloropropane	96-12-8	0.0032	0.2	NC	0.0016	1	1	0.96	50	130	
1,2,4-Trichlorobenzene	120-82-1	3.9	70	110	1.95	1	1	0.7	65	135	
1,2,3-Trichlorobenzene	87-61-6	5.2	NC	8	2.6	1	1	0.86	55	140	

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] PQL goals are equal to half of the minimum applicable PAL.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

NC indicates that no criterion exists for this analyte.

Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-11—Reference Limits and Evaluation Table

Matrix: Surface Water
Analytical Group: SVOCs

Analyte	CAS Number	Full Scan or SIM	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	MCL[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
							LOQ	LOD	DL	LCL	UCL	RPD
1,1-Biphenyl	92-52-4	full scan	3.1	NC	14	1.55	10	9	7	**46**	**83**	
2,2'-Oxybis(1-chloropropane)	108-60-1	full scan	890	NC	NC	445	10	6	3.1	25	130	
2,4,5-Trichlorophenol	95-95-4	full scan	9	NC	63	4.5	10	6	3.6	50	110	
2,4,6-Trichlorophenol	88-06-2	full scan	35	NC	4.9	2.45	10	6	3.7	50	115	
2,4-Dichlorophenol	120-83-2	full scan	270	NC	11	5.5	10	6	3.3	50	105	
2,4-Dimethylphenol	105-67-9	full scan	30	NC	100	15	10	6	2.7	30	110	
2,4-Dinitrophenol	51-28-5	full scan	2	NC	19	1	10	6	5.2	15	140	
2,4-Dinitrotoluene	121-14-2	full scan	15	NC	44	7.5	10	6	2.8	50	120	
2,6-Dinitrotoluene	606-20-2	full scan	550	NC	81	40.5	10	3	2.7	50	115	
2-Chloronaphthalene	91-58-7	full scan	71	NC	0.4	0.2	10	3	3	50	105	
2-Chlorophenol	95-57-8	full scan	27	NC	24	12	10	6	2.8	35	105	
2-Methylnaphthalene	91-57-6	SIM	720	NC	330	165	0.1	0.08	0.046	45	105	
2-Methylphenol	95-48-7	full scan	150	NC	13	6.5	10	3	2.3	40	110	
2-Nitroaniline	88-74-4	full scan	71	NC	NC	35.5	10	3	2.8	50	115	
2-Nitrophenol	88-75-5	full scan	1.1	NC	1920	0.55	10	6	3.1	40	115	
3,3'-Dichlorobenzidine	91-94-1	full scan	NC	NC	4.5	2.25	10	6	3.2	20	110	
3-Nitroaniline	99-09-2	full scan	1.2	NC	NC	0.6	10	3	2.8	20	125	
4,6-Dinitro-2-methylphenol	534-52-1	full scan	NC	NC	2.3	1.15	10	6	6	40	130	
4-Bromophenyl-phenylether	101-55-3	full scan	1100	NC	1.5	0.75	10	6	3.3	50	115	30
4-Chloro-3-methylphenol	59-50-7	full scan	3.2	NC	0.3	0.15	10	6	2.6	45	110	
4-Chloroaniline	106-47-8	full scan	27	NC	232	13.5	10	6	2.7	15	110	
4-Chlorophenyl-phenylether	7005-72-3	full scan	72	NC	NC	36	10	6	3.2	50	110	
4-Methylphenol	106-44-5	full scan	33	NC	543	16.5	10	6	4.5	30	110	
4-Nitroaniline	100-01-6	full scan	1.2	NC	NC	0.6	10	3	2.7	35	120	
4-Nitrophenol	100-02-7	full scan	400	NC	300	150	10	3	2.3	0	125	
Acenaphthene	83-32-9	SIM	400	NC	23	11.5	0.1	0.08	0.049	45	110	
Acenaphthylene	208-96-8	SIM	1500	NC	4840	750	0.1	0.08	0.052	50	105	
Acetophenone	98-86-2	full scan	1300	NC	NC	650	10	3	3	**41**	**92**	
Anthracene	120-12-7	full scan	2.6	NC	0.73	0.365	0.1	0.08	0.044	55	110	
Atrazine	1912-24-9	full scan	1500	3	1.8	0.9	10	3	2.9	**47**	**101**	
Benzaldehyde	100-52-7	full scan	0.29	NC	NC	0.145	10	6	5.4	**43**	**87**	
Benzo(a)anthracene	56-55-3	SIM	0.029	NC	0.027	0.0135	0.1	0.08	0.049	55	110	
Benzo(a)pyrene	50-32-8	SIM	0.29	0.2	0.014	0.007	0.1	0.08	0.058	55	110	
Benzo(b)fluoranthene	205-99-2	SIM	87	NC	9.07	4.535	0.1	0.08	0.051	45	120	
Benzo(g,h,i)perylene	191-24-2	SIM	2.9	NC	7.64	1.45	0.1	0.08	0.063	40	125	
Benzo(k)fluoranthene	207-08-9	SIM	47	NC	9.07	4.535	0.1	0.08	0.054	45	125	
bis(2-Chloroethoxy)methane	111-91-1	full scan	0.12	NC	NC	0.06	10	6	2.7	45	105	

SAP Worksheet #15-11—Reference Limits and Evaluation Table (continued)

Analyte	CAS Number	Full Scan or SIM	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	MCL[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
							LOQ	LOD	DL	LCL	UCL	RPD
bis(2-Chloroethyl)ether	111-44-4	full scan	0.71	NC	1900	0.355	10	6	3.2	35	110	
bis(2-Ethylhexyl)phthalate	117-81-7	full scan	140	6	32	3	10	6	3.5	40	125	
Butylbenzylphthalate	85-68-7	full scan	7700	NC	19	9.5	10	3	2.8	45	115	
Caprolactam	105-60-2	full scan	NC	NC	NC	Lab LOD	10	3	2.7	**10**	**51**	
Carbazole	86-74-8	full scan	29	NC	NC	14.5	10	3	2.5	50	115	
Chrysene	218-01-9	SIM	0.029	NC	NC	0.0145	0.1	0.08	0.04	55	110	
Dibenz(a,h)anthracene	53-70-3	SIM	5.8	NC	NC	2.9	0.1	0.08	0.069	40	125	
Dibenzofuran	132-64-9	full scan	11000	NC	3.7	1.85	10	3	2.8	55	105	
Diethylphthalate	84-66-2	full scan	NC	NC	270	135	10	3	3	40	120	
Dimethyl phthalate	131-11-3	full scan	670	NC	330	165	10	3	2.9	25	125	
Di-n-butylphthalate	84-74-2	full scan	0.71	NC	35	0.355	10	3	2.7	55	115	
Di-n-octylphthalate	117-84-0	full scan	630	NC	22	11	10	6	3.4	35	135	
Fluoranthene	206-44-0	SIM	220	NC	8.1	4.05	0.1	0.08	0.054	55	115	
Fluorene	86-73-7	SIM	0.42	NC	3.9	0.21	0.1	0.08	0.049	50	110	
Hexachlorobenzene	118-74-1	full scan	2.6	1	3.68	0.5	10	3	3	50	110	
Hexachlorobutadiene	87-68-3	full scan	22	NC	1.3	0.65	10	6	3.6	25	105	
Hexachlorocyclopentadiene	77-47-4	full scan	5.1	50	1.04	0.52	10	6	3.8	**13**	**120**	
Hexachloroethane	67-72-1	full scan	0.29	NC	12	0.145	10	3	2.9	30	100	
Indeno(1,2,3-cd)pyrene	193-39-5	SIM	670	NC	4.31	2.155	0.1	0.08	0.067	45	125	
Isophorone	78-59-1	full scan	1.4	NC	1170	0.7	10	3	2.9	50	110	
Naphthalene	91-20-3	SIM	1.2	NC	12	0.6	0.1	0.08	0.045	40	100	
Nitrobenzene	98-95-3	full scan	0.093	NC	270	0.0465	10	6	3.1	45	110	
n-Nitroso-di-n-propylamine	621-64-7	full scan	100	NC	NC	50	10	6	3.4	35	130	
N-nitrosodiphenylamine/Diphenylamine	86-30-6	full scan	1.7	NC	210	0.85	10	6	5.4	50	110	
Pentachlorophenol	87-86-5	full scan	1300	1	14.95431669	0.5	10	9	6.3	40	115	
Phenanthrene	85-01-8	SIM	4500	NC	6.3	3.15	0.1	0.08	0.044	50	115	
Phenol	108-95-2	full scan	87	NC	110	43.5	10	3	1.4	0	115	
Pyrene	129-00-0	full scan	NC	NC	0.025	0.0125	0.1	0.08	0.053	50	130	
2,3,4,6-Tetrachlorophenol	58-90-2	full scan	1.2	NC	NC	0.6	10	6	4.7	**61**	**94**	
1,2,4,5-Tetrachlorobenzene	95-94-3	full scan	NC	NC	NC	Lab LOD	10	6	3.2	**24**	**69**	

Notes:
[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.
[2] Project QL goals are equal to half of the minimum PAL.
[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.
NC indicates that no criterion exists for this analyte.
Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-12—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: Pesticides

Analyte	CAS Number	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	MCL[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
						LOQ	LOD	DL	LCL	UCL	RPD
alpha-BHC	319-84-6	0.062	NC	2.2	0.031	0.05	0.05	0.032	60	130	30
beta-BHC	319-85-7	0.22	NC	2.2	0.11	0.05	0.05	0.028	65	125	
delta-BHC	319-86-8	0.22	NC	2.2	0.11	0.05	0.05	0.043	45	135	
gamma-BHC (Lindane)	58-89-9	0.36	0.2	0.08	0.04	0.05	0.05	0.03	25	135	
Heptachlor	76-44-8	0.018	0.4	0.0069	0.00345	0.05	0.05	0.038	40	130	
Aldrin	309-00-2	0.0021	NC	0.3	0.00105	0.05	0.05	0.033	25	140	
Heptachlor epoxide	1024-57-3	0.033	0.2	0.0069	0.00345	0.05	0.05	0.027	60	130	
Endosulfan I	959-98-8	78	NC	0.056	0.028	0.05	0.05	0.025	50	110	
Dieldrin	60-57-1	0.015	NC	0.056	0.0075	0.05	0.05	0.031	60	130	
4,4'-DDE	72-55-9	2	NC	0.013	0.0065	0.05	0.05	0.023	35	140	
Endrin	72-20-8	1.7	2	0.036	0.018	0.05	0.05	0.019	55	135	
Endosulfan II	33213-65-9	78	NC	0.056	0.028	0.05	0.05	0.023	30	130	
4,4'-DDD	72-54-8	2.8	NC	0.011	0.0055	0.05	0.05	0.023	25	150	
Endosulfan sulfate	1031-07-8	78	NC	0.056	0.028	0.05	0.05	0.02	55	135	
4,4'-DDT	50-29-3	2	NC	0.013	0.0065	0.05	0.05	0.015	45	140	
Methoxychlor	72-43-5	27	40	0.03	0.015	0.05	0.05	0.014	55	150	
Endrin ketone	53494-70-5	1.7	2	0.15	0.075	0.05	0.05	0.012	75	125	
Endrin aldehyde	7421-93-4	1.7	2	0.15	0.075	0.05	0.05	0.024	55	135	
alpha-Chlordane	5103-71-9	1.9	NC	0.17	0.085	0.05	0.05	0.027	65	125	
gamma-Chlordane	5103-74-2	1.9	NC	0.17	0.085	0.05	0.05	0.038	60	125	
Toxaphene	8001-35-2	0.13	3	0.011	0.0055	1.3	0.64	0.18	**60**	**140**	**40**

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] Project QL goals are equal to half of the minimum PAL.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

NC indicates that no criterion exists for this analyte.

Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-13—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: PCBs

Analyte	CAS Number	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	MCL[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
						LOQ	LOD	DL	LCL	UCL	RPD
Aroclor-1016	12674-11-2	1.1	0.5	0.14	0.07	0.5	0.5	0.32	25	145	**20**
Aroclor-1221	11104-28-2	0.043	0.5	0.28	0.0215	0.5	0.5	0.46	**11**	**162**	**23**
Aroclor-1232	11141-16-5	0.043	0.5	0.58	0.0215	0.5	0.5	0.45	**11**	**162**	**23**
Aroclor-1242	53469-21-9	0.34	0.5	0.053	0.0265	0.5	0.5	0.49	**11**	**162**	**23**
Aroclor-1248	12672-29-6	0.34	0.5	0.081	0.0405	0.5	0.5	0.24	**11**	**162**	**23**
Aroclor-1254	11097-69-1	0.31	0.5	0.033	0.0165	0.5	0.5	0.46	**11**	**162**	**23**
Aroclor-1260	11096-82-5	0.34	0.5	0.14	0.07	0.5	0.5	0.48	30	145	**19**

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] Project QL goals are equal to half of the minimum PAL.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-14—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: Total and Dissolved Metals, Cyanide

Analyte	CAS Number	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	MCL[1] (µg/L)	Surface Water Eco SV - Total Metals[1] (µg/L)	Surface Water Eco SV - Dissolved Metals[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
							LOQ	LOD	DL	LCL	UCL	RPD
Aluminum	7429-90-5	16000	NC	87	87	43.5	50	25	6.8			
Antimony	7440-36-0	6	6	30	30	3	2	0.44	0.11			
Arsenic	7440-38-2	0.45	10	150	150	0.225	20	10	0.61			
Barium	7440-39-3	2900	2000	4	4	2	10	8	2			
Beryllium	7440-41-7	16	4	0.66	0.66	0.33	0.74	0.37	0.094			
Cadmium	7440-43-9	6.9	5	0.270622773	0.245996341	0.12	8	4	0.11			
Calcium	7440-70-2	NC	NC	NC	NC	Lab LOD	2400	1200	36			
Chromium	7440-47-3	0.31	100	11.4	11	0.155	6	3	0.45			
Cobalt	7440-48-4	4.7	NC	23	23	2.35	1	0.84	0.21			
Copper	7440-50-8	620	1300	9.328907606	8.955751301	4.48	1	0.88	0.22			
Iron	7439-89-6	11000	NC	1000	1000	500	30	15	3.8			
Lead	7439-92-1	15	15	3.181591829	2.516643724	1.26	1.2	0.6	0.16	80	120	20
Magnesium	7439-95-4	NC	NC	NC	NC	Lab LOD	240	120	30			
Manganese	7439-96-5	320	NC	120	120	60	2.56	1.28	0.32			
Mercury	7439-97-6	4.3	2	0.91	0.77	0.385	0.2	0.069	0.023			
Nickel	7440-02-0	300	NC	52.16302848	52.0065394	26.00	2.4	1.2	0.32			
Potassium	7440-09-7	NC	NC	NC	NC	Lab LOD	3500	1750	48			
Selenium	7782-49-2	78	50	5	4.61	2.305	5.2	2.6	0.65			
Silver	7440-22-4	71	NC	0.36	0.36	0.18	0.24	0.12	0.029			
Sodium	7440-23-5	NC	NC	NC	NC	Lab LOD	240	120	32			
Thallium	7440-28-0	0.16	2	12	12	0.08	0.46	0.23	0.058			
Vanadium	7440-62-2	78	NC	20	20	10	1	0.8	0.2			
Zinc	7440-66-6	4700	NC	119.8164153	118.1389855	59.07	12	6	1.6			
Cyanide	57-12-5	310	200	5.2	NA	2.6	22	11	3.8	**83.7**	**110**	20

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] Project QL goals for aqueous samples are equal to half of the minimum PAL.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

NC indicates that no criterion exists for this analyte.

Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-15—Reference Limits and Evaluation Table

Matrix: Surface Water
Analytical Group: Explosives

Analyte	CAS Number	Adjusted Tapwater RSL X10 for SW (Nov 2011)[1] (µg/L)	Surface Water Eco SV[1] (µg/L)	Project QL Goal[2] (µg/L)	Laboratory-Specific (µg/L)			LCS, MS, and MSD %R and RPD Limits[3]		
					LOQ	LOD	DL	LCL	UCL	RPD
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	780	330	165	0.33	0.17	0.085	80	115	30
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.1	186	3.05	0.33	0.13	0.065	50	160	
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	460	11	5.5	0.325	0.16	0.078	65	140	
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	1.5	17	0.75	0.325	0.13	0.065	45	160	
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	63	NC	31.5	0.65	0.32	0.16	20	175	
Nitrobenzene (NB)	98-95-3	1.2	270	0.6	0.325	0.13	0.065	50	140	
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	7.6	93	3.8	0.325	0.13	0.065	50	145	
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	30	19	9.5	0.325	0.13	0.065	55	155	
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	30	19	9.5	0.325	0.1	0.065	50	155	
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	2	44	1	0.325	0.16	0.078	60	135	
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	15	81	7.5	0.325	0.13	0.065	60	135	
2-Nitrotoluene (2-NT)	88-72-2	2.7	3400	1.35	0.325	0.26	0.13	45	135	
3-Nitrotoluene (3-NT)	99-08-1	1.3	750	0.65	0.325	0.26	0.13	50	130	
4-Nitrotoluene (4-NT)	99-99-0	37	1900	18.5	0.65	0.34	0.17	50	130	
Nitroglycerin [4]	55-63-0	1.5	138	0.75	0.65	0.43	0.22	**45**	**134**	30
PETN [4]	78-11-5	30	85000	15	0.65	0.26	0.13	**56**	**139**	
3,5-Dinitroaniline [4]	618-87-1	NC	59	Lab LOD	0.39	0.78	1.30	**68**	**115**	
Nitroguanidine [4]	556-88-7	1600	220	800	10	5.00	2.50	**60**	**120**	**30**

Notes:

[1] Refer to **Worksheets #10** and **#11** for a detailed discussion on the development of PALs.

[2] Project QL goals are equal to half of the minimum PAL.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

[4] This explosive will only be tested for in reference sediment samples. Refer to **Worksheet #18** for a list of reference samples.

SAP Worksheet #15-16—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: Wet Chemistry

Analyte	CAS Number[2]	Units	Laboratory-Specific			LCS, MS, and MSD %R and RPD Limits[3]		
			LOQ	LOD	DL	LCL	UCL	RPD
Hardness	HARDNESS	mg/kg	2	2	2	**90**	**110**	**10**

Notes:

[1] Surface water ecological screening values for some target analytes are dependent on the hardness of the media. Hardness data will be used to support the ERA.

[2] A contractor-specific identifier is used.

[3] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

SAP Worksheet #15-17—Reference Limits and Evaluation Table

Matrix: Tissue

Analytical Group: PCBs

Analyte	CAS Number	Fish Ingestion RSLs[1,3] (µg/kg)	Project QL Goal[2] (µg/kg)	Laboratory-Specific (µg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
				LOQ	LOD	DL	LCL	UCL	RPD
Aroclor-1016	12674-11-2	9.46	4.73	17	8.5	6	40	140	30
Aroclor-1221	11104-28-2	1.58	0.79	17	8.5	7.9	NA	NA	NA
Aroclor-1232	11141-16-5	1.58	0.79	17	10	9.3	NA	NA	NA
Aroclor-1242	53469-21-9	1.58	0.79	17	8.5	5.8	NA	NA	NA
Aroclor-1248	12672-29-6	1.58	0.79	17	8.5	6.1	NA	NA	NA
Aroclor-1254	11097-69-1	1.58	0.79	17	8.5	4.7	NA	NA	NA
Aroclor-1260	11096-82-5	1.58	0.79	17	8.5	6	60	130	30

Notes:

1 Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

2 PQL goals are equal to half of the minimum applicable PAL.

3 PALs and Project QL Goals assume dry weight basis.

4 DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

NC indicates that no criterion exists for this analyte.

Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-18—Reference Limits and Evaluation Table

Matrix: Tissue
Analytical Group: PCB Congeners and Homologues

Analyte	CAS Number	PAL for Ecological Health[2,5] (pg/g)	PAL for Human Health[3,5]	Project QL Goal[4,5] (pg/g)	Laboratory-Specific (pg/g)			LCS, MS, and MSD %R and RPD Limits[7]		
			Fish Ingestion RSLs (pg/g)		LOQ	LOD	DL	LCL	UCL	RPD
Total Monochlorobiphenyls	TOTALMONOCB	PCB Total	NA	Lab LOD	20	NA	NA	NA[8]	NA[8]	NA[8]
Total Dichlorobiphenyls	TOTALDICB	PCB Total		Lab LOD	20	NA	NA			
Total Trichlorobiphenyls	TOTALTRICB	PCB Total		Lab LOD	20	NA	NA			
Total Tetrachlorobiphenyls	TOTALTETRACB	PCB Total		Lab LOD	20	NA	NA			
Total Pentachlorobiphenyls	TOTALPENTACB	PCB Total		Lab LOD	20	NA	NA			
Total Hexachlorobiphenyls	TOTALHEXACB	PCB Total		Lab LOD	20	NA	NA			
Total Heptachlorobiphenyls	TOTALHEPTACB	PCB Total		Lab LOD	20	NA	NA			
Total Octachlorobiphenyls	TOTALOCTACB	PCB Total		Lab LOD	20	NA	NA			
Total Nonachlorobiphenyls	TOTALNONACB	PCB Total		Lab LOD	20	NA	NA			
Decachlorobiphenyl (209)	2051-24-3	PCB Total		Lab LOD	20	NA	NA	60	135	20
3,3',4,4'-Tetrachlorobiphenyl (77)	32598-13-3	NA	243	121.5	2	1	0.49			
3,4,4',5-Tetrachlorobiphenyl (81)	70362-50-4		80.9	40.45	2	1	0.57			
2,3,3',4,4'-Pentachlorobiphenyl (105)	32598-14-4		809	404.5	2	1	0.9			
2,3,4,4',5-Pentachlorobiphenyl (114)	74472-37-0		809	404.5	2	1	0.65			
2,3',4,4',5-Pentachlorobiphenyl (118)	31508-00-6		809	404.5	2	1	0.89			
2,3',4,4',5'-Pentachlorobiphenyl (123)	65510-44-3		809	404.5	2	1	0.88			
3,3',4,4',5-Pentachlorobiphenyl (126)	57465-28-8		0.243	0.1215	**2**	**1**	**0.62**			
2,3,3',4,4',5-Hexachlorobiphenyl (156)	38380-08-4		809	404.5	2	1	0.99			
2,3,3',4,4',5'-Hexachlorobiphenyl (157)	69782-90-7		809	404.5	2	1	0.99			
2,3',4,4',5,5'-Hexachlorobiphenyl (167)	52663-72-6		809	404.5	2	1	0.44			
3,3',4,4',5,5'-Hexachlorobiphenyl (169)	32774-16-6		0.809	0.4045	2	1	0.71			
2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)	39635-31-9		809	404.5	2	1	0.59			
Toxic Equivalents (Total TEQ) [6]	TOTALTEQ	20.8	TBD	10.4	0.26	0.13	NA	NA	NA	NA
Polychlorinated biphenyls (PCBs)	1336-36-3	2.9×10^6	1580	1.5×10^6	NA	NA	NA	NA	NA	NA

Notes:
[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.
[2] For PCB Congener and homologue analysis of Ecological (whole-body) samples. there are PALs for Total TEQ and Total PCBs, but not for individual congeners or homologue groups.
[3] PCB homologue analysis will not be performed on human health (filleted) samples.
[4] PQL goals are equal to half of the minimum applicable PAL.
[5] PALs and Project QL Goals assume dry weight basis.
[6] Total TEQ is the summation of detected concentrations multiplied by their respective Toxicity Equivalency Factors (TEFs). Therefore, the laboratory limits depend on how many, and which, of the 12 dioxin-like congeners are detected. The laboratory limits shown in this table assume detection of all 12 dioxin-like congeners, and assume the applicable TEFs are the TEFs from the World Health Organization (WHO, 2005).
[7] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where statistical in-house limits are used. Isomers in the homologue groups must meet the ongoing limits specified in EPA method 1668C.
[8] Each isomer in the homologue group must meet the limits specified in EPA method 1668C.
NC indicates that no criterion exists for this analyte.
Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #15-19—Reference Limits and Evaluation Table

Matrix: Tissue

Analytical Group: Metals

Analyte	CAS Number	PAL for Ecological Health[2,5]	PAL for Human Health[3,5]	Project QL Goal[4,5] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R and RPD Limits[4]		
		Fish/Frog PAL (mg/kg)	Fish Ingestion RSLs (mg/kg)		LOQ	LOD	DL	LCL	UCL	RPD
Aluminum	7429-90-5	NC	135	67.5	30	4.0	0.51			
Antimony	7440-36-0	NC	0.0541	0.02705	0.1	0.05	0.020			
Arsenic	7440-38-2	7.20	0.0021	0.00105	0.50	0.40	0.15			
Barium	7440-39-3	NC	27	13.5	0.20	0.10	0.037			
Beryllium	7440-41-7	NC	0.27	0.135	0.10	0.020	0.0041			
Cadmium	7440-43-9	2.76	0.135	0.0675	0.1	0.020	0.0076			
Calcium	7440-70-2	NC	NC	Lab LOD	10	8.0	3.83			
Chromium	7440-47-3	2.32	NC	1.16	0.40	0.30	0.05			
Cobalt	7440-48-4	NC	0.0406	0.0203	0.10	0.030	0.0054			
Copper	7440-50-8	13.6	5.41	2.705	0.30	0.20	0.071			
Iron	7439-89-6	NC	94.6	47.3	10	6.0	2.40			
Lead	7439-92-1	18.4	NC	9.2	0.10	0.050	0.0070	80	120	20
Magnesium	7439-95-4	NC	NC	Lab LOD	10	8.0	1.37			
Manganese	7439-96-5	NC	18.9	9.45	0.20	0.10	0.042			
Mercury	7439-97-6	0.124	NC	0.062	0.033	0.017	0.0052			
Nickel	7440-02-0	3.28	2.7	1.35	0.20	0.12	0.026			
Potassium	7440-09-7	NC	NC	Lab LOD	100	40	4.6			
Selenium	7782-49-2	4.00	0.676	0.338	0.50	0.30	0.039			
Silver	7440-22-4	0.24	0.676	0.12	0.10	0.040	0.0066			
Sodium	7440-23-5	NC	NC	Lab LOD	100	40	2.6			
Thallium	7440-28-0	NC	0.00135	0.000675	0.10	0.04	0.0094			
Vanadium	7440-62-2	NC	NC	Lab LOD	0.50	0.40	0.11			
Zinc	7440-66-6	316	40.6	5.733	1.0	0.80	0.13			

Notes:

[1] Refer to **Worksheet #11** for a detailed discussion on the development of PALs and for specific identification of PALs by matrix.

[2] PQL goals are equal to half of the minimum applicable PAL.

[3] PALs and Project QL Goals assume dry weight basis.

[4] DoD QSM v.4.1 is the basis for LCS and MS/MSD limits: values are bolded to indicate instances where in-house limits are used.

NC indicates that no criterion exists for this analyte.

Shading indicates instances where the PAL is lower than the LOD. Non-detects will not be treated as exceedances, though they will be reported at a value greater than the PAL.

SAP Worksheet #16—Project Schedule/Timeline Table

The project schedule below is tentative specific to the RI sampling activities as outlined in this SAP. The schedule will be revised accordingly throughout the various steps of the RI.

Activities	Organization	Dates (MM/DD/YY)		Deliverable
		Anticipated Date(s) of Initiation	Anticipated Date of Completion	
Subcontractor/Field Work Preparation	CH2M HILL	09/01/2012	10/1/2012	None
Field Sampling (including fieldwork preparation)	CH2M HILL	10/1/2012	10/30/2012	None
Laboratory Analysis	ENCO, Katahdin, and their subcontractors	10/30/2012	11/31/2012	Electronic data deliverable (EDD) and data hardcopies
Data Management	CH2M HILL	11/30/2012	12/15/2012	None
DV	CH2M HILL	2/15/2012	12/31/2012	None
Report Generation	CH2M HILL	1/1/2013	04/30/2013	Draft RI Report

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SAP Worksheet #17—Sampling Design and Rationale

Matrix	Depth to Samples	Analysis	Method	Number of Samples	Rationale	*Sampling Strategy
Soil (surface)	0-6 inches bgs	VOCs	SW846 8260B	6	Sampling to identify source of PCBs and other contaminants. Rationale for analytical suite is based on contaminants detected during the March 2000 Pond Study. Rationale for the depth is the limited data collected thus far.	Surface soil samples will be collected at a depth of 0–6 inches bgs using a stainless steel hand auger. See **Figure 4** for proposed sampling locations.
		SVOCs	SW846 8270C & 8270-SIM			
		Pesticides/PCBs	SW846 8081A/8082			
		Explosives	SW846 8330A			
		Metals	SW846 6010C, 7471A			
		Hexavalent Chromium	SW-846 7199	3		
		Cyanide	SW846 9014	6		
		TOC	Lloyd Kahn		Samples will support the ecological risk evaluation and any future investigations. TOC, pH and grain size have no associated screening criteria; these will be analyzed to assess the bioavailability of certain metals. Sample results will also be used to evaluate soil characteristics within the vicinity of the site.	
		pH	SW846 9045C			
		Grain Size analysis	ASTM D422			
Surface Water	Just below the water surface or mid-depth if the depth of water exceeds 4 feet	VOCs	SW846 8260B	6	Sampling to determine the nature and extent of contamination in surface water and to compare current concentrations to historical concentrations from the March 2000 Pond Study. Rationale for analytical suite is based on contaminants detected during the March 2000 Pond Study.	Surface water samples will be collected using a decontaminated collection sampler such as an unpreserved laboratory jar. The sample will then be decanted into the sample containers. See **Figure 4** for proposed sampling locations.
		SVOCs	SW846 8270C & 8270-SIM			
		Pesticides/PCBs	SW846 8081A/8082			
		Explosives	SW846 8330A			
		Total Metals	SW846 6020, 7470A			
		Cyanide	SW846 9014			
		Dissolved Metals	SW846 6020, 7470A			
		Hardness	SM 2340B		Used to adjust some of the surface water ESVs.	

SAP Worksheet #17—Sampling Design and Rationale (continued)

Matrix	Depth to Samples	Analysis	Method	Number of Samples	Rationale	*Sampling Strategy
Sediment (surface)	0-4 inches bss	VOCs	SW846 8260B	15	Sampling to determine the nature and extent of contamination in surface sediment and to compare current concentrations to historical concentrations from the March 2000 Pond Study. Rationale for analytical suite is based on contaminants detected during the March 2000 Pond Study. Rationale for the depth is the limited data collected thus far.	Surface sediment samples will be collected at a depth of 0–4 inches bss using a stainless steel Ponar (or similar) dredge or sediment core. See **Figure 4** for proposed sampling locations.
		SVOCs	SW846 8270C & 8270-SIM			
		Pesticides/PCBs	SW846 8081A/8082			
		Explosives	SW846 8330A			
		Metals	SW846 6010C, 7471A			
		Cyanide	SW846 9014			
		TOC	Lloyd Kahn		Samples will support the ecological risk evaluation and any future investigations. TOC, pH, AVS/SEM and grain size have no associated screening criteria; these will be analyzed to assess the bioavailability of certain organic and metals constituents. Samples will also be used to evaluate sediment characteristics within the pond.	
		pH	SW846 9045C			
		Grain Size analysis	ASTM D422			
		AVS/SEM	USEPA 821-R-91-100			
Sediment (sub surface)	4-8 inches bss	VOCs	SW846 8260B	13	Sampling to determine the nature and extent of contamination in sub-surface sediment. Rationale for analytical suite is based on contaminants detected during the March 2000 Pond Study. Rationale for the depth is the limited data collected thus far.	Sub surface sediment samples will be collected at a depth of 4–8 inches bss using a stainless steel Ponar (or similar) dredge or sediment core. See **Figure 4** for proposed sampling locations.
		SVOCs	SW846 8270C & 8270-SIM			
		Pesticides/PCBs	SW846 8081A/8082			
		Metals	SW846 6010, 7471A			
		Explosives	SW846 8330A			
		Cyanide	SW846 9014			
		TOC	Lloyd Kahn		Evaluate sediment characteristics within the pond from historical deposition and subsequent burial.	
		pH	SW846 9045C			
		Grain Size analysis	ASTM D422			
		AVS/SEM	USEPA 821-R-91-101			

SAP Worksheet #17—Sampling Design and Rationale (continued)

Matrix	Depth to Samples	Analysis	Method	Number of Samples	Rationale	*Sampling Strategy
Fish and Frog Tissue	NA	TCL Metals	SW-846 6020A	9	Sampling will be used to evaluate bioaccumulative chemicals and their potential effect on human health, fish communities, and piscivorous wildlife.	Fish and frog samples will be collected using a combination of electro-shocking techniques, seines, or traps, depending upon the site conditions (e.g., water depth).
		TCL PCBs	SW846 8081A/8082			
		12 dioxin-like PCB congeners	EPA 1668A (using limits from 1668C)			
		PCB Homologues	EPA 1668A (using limits from 1668C)			
		Percent Moisture	Laboratory SOP (CA-717)		To allow wet to dry weight conversions and lipid normalization of PCB data.	
		Percent Lipids	Laboratory SOP (CA-538)			

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SAP Worksheet #18-1—Sampling Locations and Methods/SOP Requirements Table

Station ID	Sample ID[1]	Depth	Matrix	Analytical Group	Number of Samples[2]	Sampling SOP Reference
Sediment Samples						
CAYP-SWSD01	CAYP-SD01-MMYY	0 - 4 inches	SD	VOCs, SVOCs, Pest/PCBs, TAL Metals, Explo, AVS/SEM, TOC, pH, grain-size	1	Refer to **Worksheet #21**
	CAYP-SSD01-MMYY	4 - 8 inches	SD		2 (FD)	
	CAYP-SSD01P-MMYY	4 - 8 inches	SD			
CAYP-SWSD02	CAYP-SD02-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD02-MMYY	4 - 8 inches	SD		3 (MS/MSD)	
	CAYP-SSD02-MMYY-MS	4 - 8 inches	SD			
	CAYP-SSD02-MMYY-SD	4 - 8 inches	SD			
CAYP-SWSD03	CAYP-SD03-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD03-MMYY	4 - 8 inches	SD		1	
CAYP-SWSD04	CAYP-SD04-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD04-MMYY	4 - 8 inches	SD		1	
CAYP-SWSD05	CAYP-SD05-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD05-MMYY	4 - 8 inches	SD		1	
CAYP-SWSD06	CAYP-SD06-MMYY	0 - 4 inches	SD		3 (MS/MSD)	
	CAYP-SD06-MMYY-MS	0 - 4 inches	SD			
	CAYP-SD06-MMYY-SD	0 - 4 inches	SD			
	CAYP-SSD06-MMYY	4 – 8 inches	SD		1	
CAYP-SD07	CAYP-SD07-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD07-MMYY	4 – 8 inches	SD		1	
CAYP-SD08	CAYP-SD08-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD08-MMYY	4 – 8 inches	SD		1	
CAYP-SD09	CAYP-SD09-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD09-MMYY	4 – 8 inches	SD		2 (FD)	
	CAYP-SSD09P-MMYY	4 – 8 inches	SD			
CAYP-SD10	CAYP-SD10-MMYY	0 - 4 inches	SD		2 (FD)	
	CAYP-SD10P-MMYY	0 - 4 inches	SD			
	CAYP-SSD10-MMYY	4 – 8 inches	SD		1	
CAYP-SD11	CAYP-SD11-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD11-MMYY	4 – 8 inches	SD		1	
CAYP-SD12	CAYP-SD12-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD12-MMYY	4 – 8 inches	SD		1	
CAYP-SD13	CAYP-SD13-MMYY	0 - 4 inches	SD		1	
	CAYP-SSD13-MMYY	4 – 8 inches	SD		1	
CAYP-SD14	CAYP-SD14-MMYY	0 - 4 inches	SD		1	
CAYP-SD15	CAYP-SD15-MMYY	0 - 4 inches	SD		1	

SAP Worksheet #18-1—Sampling Locations and Methods / SOP Requirements Table (continued)

	Sample ID[1]	Depth	Matrix	Analytical Group	Number of Samples[2]	Sampling SOP Reference
Soil						
CAYP-SO01	CAYP-SS01-MMYY	0 - 6 inches	SS	VOCs, SVOCs, Pest/PCBs, TAL Metals, Cyanide, Hexavalent Chromium (3 samples only), Explo, TOC, pH, grain-size	2 (FD)	
	CAYP-SS01P-MMYY	0 - 6 inches	SS			
CAYP-SO02	CAYP-SS02-MMYY	0 - 6 inches	SS		3 (MS/MSD)	
	CAYP-SS02-MMYY-MS	0 - 6 inches	SS			
	CAYP-SS02-MMYY-SD	0 - 6 inches	SS			
CAYP-SO03	CAYP-SS03-MMYY	0 - 6 inches	SS		1	
CAYP-SO04	CAYP-SS04-MMYY	0 - 6 inches	SS		1	
CAYP-SO05	CAYP-SS05-MMYY	0 - 6 inches	SS		1	
CAYP-SO06	CAYP-SS06-MMYY	0 - 6 inches	SS		1	
Surface Water						
CAYP-SWSD01	CAYP-SW01-MMYY	Just below the water surface or mid-depth if the depth of water exceeds 4 feet	SW	VOCs, SVOCs, Pest/PCBs, TAL Metals (Total & Dissolved), Cyanide, Explo, hardness	2 (FD)	
	CAYP-SW01P-MMYY		SW			
CAYP-SWSD02	CAYP-SW02-MMYY		SW		3 (MS/MSD)	
	CAYP-SW02-MMYY-MS		SW			
	CAYP-SW02-MMYY-SD		SW			
CAYP-SWSD03	CAYP-SW03-MMYY		SW		1	
CAYP-SWSD04	CAYP-SW04-MMYY		SW		1	
CAYP-SWSD05	CAYP-SW05-MMYY		SW		1	
Tissue[1]						
CAYP-FS01	CAYP-FS01-MMYY	NA	FISH	PCB Congeners, PCB Homologues, % Lipids, % Moisture	1	
CAYP-FS02	CAYP-FS02-MMYY-MS	NA	FISH	PCBs, select PCB Congeners, % Lipids, % Moisture	3 (MS/MSD)	
CAYP-FS02	CAYP-FS02-MMYY-SD	NA	FISH	PCBs, select PCB Congeners, % Lipids, % Moisture		
CAYP-FS02	CAYP-FS02-MMYY	NA	FISH	PCBs, select PCB Congeners, % Lipids, % Moisture		

SAP Worksheet #18-1—Sampling Locations and Methods / SOP Requirements Table (continued)

	Sample ID[1]	Depth	Matrix	Analytical Group	Number of Samples[2]	Sampling SOP Reference
CAYP-FS03	CAYP-FS03-MMYY	NA	FISH	PCB Congeners, PCB Homologues, % Lipids, % Moisture	1	
CAYP-FS04	CAYP-FS04-MMYY-F	NA	FISH	PCBs, select PCB Congeners, % Lipids, % Moisture	2 (FD)	
CAYP-FS04	CAYP-FS04P-MMYY-F	NA	FISH	PCBs, select PCB Congeners, % Lipids, % Moisture		
CAYP-FS05	CAYP-FS05-MMYY-F	NA	FISH	PCB Congeners, PCB Homologues, % Lipids, % Moisture	1	
CAYP-FS06	CAYP-FS06-MMYY-F	NA	FISH	PCBs, select PCB Congeners, % Lipids, % Moisture	1	
CAYP-FS07	CAYP-FS07-MMYY	NA	FROG	PCB Congeners, PCB Homologues, % Lipids, % Moisture	1	
CAYP-FS08	CAYP-FS08-MMYY	NA	FROG		1	
CAYP-FS06	CAYP-FS09-MMYY	NA	FROG		1	
QA/QC						
CAYP-QC	CAYP-TBMMDDYY	NA	TB	VOCs	TBD[3]	
	CAYP-EBMMDDYY	NA	EB	same as associated media, not including wet chemistry	TBD[3]	

Notes:

[1] MMYY in sample ID is a place-holder for the two-digit month and two-digit year in which sampling takes place. Equipment blank IDs will also reflect the two-digit day. The 'F' at the end of select tissue samples indicates "filleted" for samples to be filleted at the laboratory.

[2] Matrix QA/QC samples may be collected from different locations than are indicated in the sample IDs provided. If so, sample IDs will reflect the location from which the sample was collected.

[3] Field QC counts are dependent on the duration of field event. Frequency of QA/QC sample collection is as follows :

Field Duplicate - One per 10 field samples of similar matrix

MS/MSD - One pair per 20 field samples of similar matrix (including field duplicates)

Trip Blank - One per cooler containing VOC samples

Equipment Blank - For decontaminated equipment, one per type of sampling equipment, per day of sampling; for disposable equipment, one per lot

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SAP Worksheet #18-2—Reference Sampling Locations and Methods/SOP Requirements Table

Station ID	Sample ID[1]	Depth	Matrix	Analytical Group	Number of Samples[2]	Sampling SOP Reference
Reference Surface Water Samples						
CAREFYP-SWSD01	CAREFS04-SW01-MMYY	Just below the water surface or mid-depth if the depth of water exceeds 4 feet	SW	VOCs, SVOCs, Pest/PCBs, TAL Metals (Total), TAL Metals (Dissolved), Cyanide, Explo (including PETN, NG, 3,5-DNA and Nitroguanidine), Hardness **no hardness for duplicates or MS/MSD	1	Refer to **Worksheet #21**
CAREFYP-SWSD02	CAREFS04-SW02-MMYY		SW		1	
	CAREFS04-SW02P-MMYY		SW		1 (duplicate)	
CAREFYP-SWSD03	CAREFS04-SW03-MMYY		SW		3 (MS/MSD)	
	CAREFS04-SW03-MMYY-MS		SW			
	CAREFS04-SW03-MMYY-SD		SW			
Reference Surface Sediment Samples						
CAREFYP-SWSD01	CAREFS04-SD01-MMYY	0-4 inches	SD	VOCs, SVOCs, Pest/PCBs, TAL Metals (Total), TAL Metals (Dissolved), Cyanide, Explo (including PETN, NG, 3,5-DNA and Nitroguanidine), pH, TOC, grain-size, AVS/SEM ** not included for duplicates or MS/MSD	1	Refer to **Worksheet #21**
CAREFYP-SWSD02	CAREFS04-SD02-MMYY		SD		1	
	CAREFS04-SD02P-MMYY		SD		1	
CAREFYP-SWSD03	CAREFS04-SD03-MMYY		SD		3 (MS/MSD)	
	CAREFS04-SD03-MMYY-MS		SD			
	CAREFS04-SD03-MMYY-SD		SD			

SAP Worksheet #18-2—Reference Sampling Locations and Methods/SOP Requirements Table (continued)

SAP Worksheet #18-2—Reference Sampling Locations and Methods/SOP Requirements Table						
Station ID	**Sample ID[1]**	**Depth**	**Matrix**	**Analytical Group**	**Number of Samples[2]**	**Sampling SOP Reference**
Reference Subsurface Sediment Samples						
CAREFYP-SWSD01	CAREFS04-SD01-MMYY	4-8 inches	SD	VOCs, SVOCs, Pest/PCBs, TAL Metals (Total), TAL Metals (Dissolved), Cyanide, Explo (including PETN, NG, 3,5-DNA and Nitroguanidine), pH, TOC, grain-size, AVS/SEM ** not included for duplicates or MS/MSD	1	Refer to **Worksheet #21**
CAREFYP-SWSD02	CAREFS04-SD02-MMYY		SD		1	
	CAREFS04-SD02P-MMYY		SD		1	
CAREFYP-SWSD03	CAREFS04-SD03-MMYY		SD		3 (MS/MSD)	
	CAREFS04-SD03-MMYY-MS		SD			
	CAREFS04-SD03-MMYY-SD		SD			
Sampling Blanks						
CAREFS04-QC	CAREFS04-EB-MMDDYY-SD	NA	EB (SD equipment)	VOCs, SVOCs, Pest/PCBs, TAL Metals (Total), TAL Metals (Dissolved), Cyanide, Explo (including PETN, NG, 3,5-DNA and Nitroguanidine),	1	Refer to **Worksheet #21**
	CAREFS04-EB-MMDDYY-SW		EB (SW equipment)		1	
	CAREFS04-TB0#-MMDDYY		TB		1	

Notes:

[1] MMYY in sample ID is a place-holder for the two-digit month and two-digit year in which sampling takes place. Equipment blank IDs will also reflect the two-digit day.

[2] Matrix QA/QC samples may be collected from different locations than are indicated in the sample IDs provided. If so, sample IDs will reflect the location from which the sample was collected.

[3] Field QC counts are dependent on the duration of field event. Frequency of QA/QC sample collection is as follows :

Field Duplicate - One per 10 field samples of similar matrix

MS/MSD - One pair per 20 field samples of similar matrix (including field duplicates)

Trip Blank - One per cooler containing VOC samples

Equipment Blank - For decontaminated equipment, one per type of sampling equipment, per day of sampling; for disposable equipment, one per lot

SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group[1]	Analytical Method / SOP Reference	Containers (Number, Size, and Type)	Minimum Sample Amount Required for Analysis	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time[1] (Preparation/Analysis)
Sediment or Soil	VOCs	SW-846 8260B / VGCMS-05	3X 40mL VOA Vials + stirbar (tared)	5g	Store in 5mL water (2 vials), store in methanol (1 vial)	48 hours to freeze (for water-preserved only) / 14 day to analysis
	SVOCs	SW-846 8270D and 8270D-SIM / SVGCMS-03	4 of 4 oz glass jar	40g	Cool to <6°C	14 days/40 days
	Pesticides	SW-846 8081B / SVGC-04		40g		14 days/40 days
	PCBs	SW-846 8082A / SVGC-07				14 days/40 days
	Metals	SW-846 6010C / MET-05		10g		180 days
		SW-846 7471A / MET-16		10g		28 days
	Cyanide	SW-846 9014 / WETS-27		5g		14 days
	Hexavalent Chromium	SW-846 7199 / GEN-7199	1 of 4oz wide-mouth soil jar	2.5g	Cool to <6°C	30 days until digestion
	Explosives (with or without PETN, NG, 3,5-DNA)	SW-846 8330A / GL-OA-E-033	1 of 4oz, wide mouth glass jar	25g	Cool to <6°C	14 days/40 days
	TOC	Walkley Black / WETS-90	1 of 4 oz glass jar	10 g	Cool to <6°C	14 days
	pH	SW-846 9045D/WETS-56		20g		Analyze immediately
	Grain-size	ASTM D422	1 of 4 oz glass jar	varies	none	none
Sediment	Nitroguanidine	Empirical SOP 233	1 of 4 oz glass jar	2g	Cool to <6°C	14 days/40 days
	AVS/SEM	EPA 821_R-91-100 / GEN-AVS/SEM	1 of 4 oz jar	10g	Cool to <6°C	14 days
Surface Water or Aqueous QC	VOCs	SW-846 8260B/5030B / VGCMS-05	3 of 40mL Vials, glass	3 X 40mL (no headspace)	HCl to pH<2, Cool to <6°C	14 days
	SVOCs	SW-846 8270D and 8270D-SIM/3510C / SVGCMS-03/EXSV-27	2 of 1L amber glass	500 mL	Cool to <6°C	7 days/40 days
	Organochlorine Pesticides/PCB	SW-846 8081B / SVGC-04 /EXSV-27	2 of 1L amber glass	1000mL	Cool to <6°C	7 days/40 days
	PCBs	SW-846 8082A/ EXSV-27/SVGC-07		1000mL	Cool to <6°C	7 days/40 days
	Filtered Metals	EPA 6020A/7470B/3005A / MET-15 and EXMT-12/MET-03	2 of 250mL HDPE	100mL	HNO3 to pH<2 Cool to <6°C	180 days or 28 days (Hg)
	Total Metals	EPA 6020A/7470B/3005A / MET-15 and EXMT-12/MET-03	2 of 250mL HDPE	100mL	HNO3 to pH<2 Cool to <6°C	180 days or 28 days (Hg)
	Hardness	EPA 130.2 / WETS-10		50mL	HNO3 to pH<2 Cool to <6°C	180 days

SAP Worksheet #19—Analytical SOP Requirements Table (continued)

Matrix	Analytical Group[1]	Analytical Method / SOP Reference	Containers (Number, Size, and Type)	Minimum Sample Amount Required for Analysis	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time[1] (Preparation/Analysis)
Surface Water or Aqueous QC (cont.)	Cyanide	SW-846 9014 / WETS-27	1 of 250mL HDPE	50mL	NaOH to ph>12 Cool to <6°C	14 days
	Hexavalent Chromium	SW-846 7199 / GEN-7199	1 of 250mL HDPE	10mL	Cool to <6°C	**24 hours**
	Explosives	SW-846 8330A / GL-OA-E-033	2 of 1L amber glass	1000mL	Cool to <6°C	7 days / 40 days
	Nitroguanidine	Empirical SOP 233	(2) 40ml VOA Vials	20 mL	Cool to ≤6°C	47 days to extraction/analysis
Tissue [1] (whole body)	PCB Congeners	EPA 1668A (using limits from 1668C) /	Resealable plastic bags, 100g to be homogenized	10g	for shipping, cool to < 6°C. **Samples are to be frozen to -10°C within 48 hours**	one year / 45 days
	Metals	SW-846 6020A / CA-627		2g		6 months
		SW-846 7471A / CA-611		0.5g		28 days
	Percent Solids	Lab SOP for % Solids / CA-717		5 g		28 days
	Percent Lipids	Lab SOP for % lipids / CA-538		5g		14 days
Tissue [1] (filleted)	PCB Congeners	EPA 1668A (using limits from 1668C) /	Resealable plastic bags, 150-200g to be homogenized	10g	for shipping, cool to < 6°C. **Samples are to be frozen to -10°C within 48 hours**	one year / 45 days
	PCBs	SW-846 8082A / CA-329		30 g		one year / 45 days
	Metals	SW-846 6020A / CA-627		2g		6 months
		SW-846 7471A / CA-611		0.5g		28 days
	Percent Solids	Lab SOP for % Solids / CA-717		5 g		28 days
	Percent Lipids	Lab SOP for % lipids / CA-538		5g		14 days

Notes

[1] To reduce sampling efforts and ensure that tissues samples are collected when fish are largest and presumably have the highest concentration of bioaccumlated COPCs, tissue samples will be collected before the end of fall 2012, preferably in early September. If the partnering team has not endorsed the UFP-SAP by this time, the contractor will have the laboratory freeze tissue samples until the UFP-SAP is signed by all members of the partnering team. It is assumed that the time samples are stored at -10°C will not contribute to the hold-times for mercury, %solids, and %lipids.

SAP Worksheet #20-1—Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/ MSDs	No. of Field Blanks	No. of Equip. Blanks	Total No. of Samples to Lab[1]
Surface Sediment	VOCs	15	2	1/1	-	2	21
	SVOCs	15	2	1/1	-	2	21
	Pesticides	15	2	1/1	-	2	21
	PCBs	15	2	1/1	-	2	21
	Metals	15	2	1/1	-	2	21
	Cyanide	15	2	1/1	-	2	21
	Explosives	15	2	1/1	-	2	21
	Wet Chemistry (includes TOC and pH)	15	-	-	-	-	15
	Grain-size	15	-	-	-	-	15
	AVS/SEM	15	-	-	-	-	15
Subsurface Sediment	VOCs	13	2	1/1	-	-	17
	SVOCs	13	2	1/1	-	-	17
	Pesticides	13	2	1/1	-	-	17
	PCBs	13	2	1/1	-	-	17
	Metals	-13	2	1/1	-	-	17
	Cyanide	13	2	1/1	-	-	17
	Explosives	13	2	1/1	-	-	17
	Wet Chemistry (includes TOC and pH)	13	-	-	-	-	13
	Grain-size	13	-	-	-	-	13
	AVS/SEM	13	-	-	-	-	13
Surface Soil	VOCs	6	1	1/1	-	1	10
	SVOCs	6	1	1/1	-	1	10
	Pesticides	6	1	1/1	-	1	10
	PCBs	6	1	1/1	-	1	10
	Metals	6	1	1/1	-	1	10
	Cyanide	6	1	1/1	-	1	10
	Hexavalent Chromium	3	1	1/1	-	1	7
	Explosives	6	1	1/1	-	1	10
	Wet Chemistry (includes TOC and pH)	6	-	-	-		6
	Grain-size	6	-	-	-		6

SAP Worksheet #20-1—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/ MSDs	No. of Field Blanks	No. of Equip. Blanks	Total No. of Samples to Lab[1]
Surface Water	VOCs	6	1	1/1	-	1	10
	SVOCs	6	1	1/1	-	1	10
	Pesticides	6	1	1/1	-	1	10
	PCBs	6	1	1/1	-	1	10
	Metals	6	1	1/1	-	1	10
	Cyanide	6	1	1/1	-	1	10
	Explosives	6	1	1/1	-	1	10
	Hardness	6	-	-	-	-	6
Tissue (whole body)	PCB Congeners	6	-	1/1	-	-	8
	Metals	6	-	1/1	-	-	8
	Wet Chemistry (includes percent solids and percent lipids)	6	-	-	-	-	6
Tissue (filleted)	PCBs	3	-	1/1	-	-	5
	PCB Congeners	3	-	1/1	-	-	5
	Metals	3	-	1/1	-	-	5
	Wet Chemistry (includes percent solids and percent lipids)	3	-	-	-	-	3

Notes:

[1]The number of field QC samples to be collected is dependent on the number of parent samples and the number of days of the sampling event.

- Field duplicates are collected at a frequency of 1 per 10 field samples per matrix.
- MS/MSD pairs are collected at a frequency of 1 per 20 samples per matrix sent to the laboratory (including duplicates).
- Field Blanks will not be collected as part of this investigation.
- - Equipment Blanks for deconned equipment are collected once per day of sampling, per type of equipment. Equipment Blanks for disposable equipment are collected once per lot.

SAP Worksheet #20-2—Field Quality Control Sample Summary Table for Reference Samples

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/ MSDs	No. of Field Blanks	No. of Equip. Blanks	Total No. of Samples to Lab[1]
Surface Sediment	VOCs	3	1	1/1	-	1	7
	SVOCs	3	1	1/1	-	1	7
	Pesticides	3	1	1/1	-	1	7
	PCBs	3	1	1/1	-	1	7
	Metals	3	1	1/1	-	1	7
	Cyanide	3	1	1/1	-	1	7
	Explosives including PETN, NG, 3,5-DNA & Nitroguanidine	3	1	1/1	-	1	7
	Wet Chemistry (includes TOC and pH)	3	-	-	-	-	3
	Grain-size	3	-	-	-	-	3
	AVS/SEM	3	-	-	-	-	3
Subsurface Sediment	VOCs	3	1	1/1	-	-	6
	SVOCs	3	1	1/1	-	-	6
	Pesticides	3	1	1/1	-	-	6
	PCBs	3	1	1/1	-	-	6
	Metals	3	1	1/1	-	-	6
	Cyanide	3	1	1/1	-	-	6
	Explosives including PETN, NG, 3,5-DNA & Nitroguanidine	3	1	1/1	-	-	6
	Wet Chemistry (includes TOC and pH)	3	-	-	-	-	6
	Grain-size	3	-	-	-	-	3
	AVS/SEM	3	-	-	-	-	3
Surface Water	VOCs	3	1	1/1	-	1	7
	SVOCs	3	1	1/1	-	1	7
	Pesticides	3	1	1/1	-	1	7
	PCBs	3	1	1/1	-	1	7
	Metals	3	1	1/1	-	1	7
	Cyanide	3	1	1/1	-	1	7
	Explosives including PETN, NG, 3,5-DNA & Nitroguanidine	3	1	1/1	-	1	7
	Hardness	3	-	-	-	-	3

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SAP Worksheet #21—Project Sampling SOP References Table

SOP Reference Number	Title/Author	Revision Date or Version Number	Location of SOP (if not included in the SAP)	Any planned deviation for Project Work	Comments
001_BlankPrep	*Equipment Blank and Field Blank Preparation*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Sample Preparation and Handling	N/A	N/A
002_COC	*Chain-of-Custody*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Sample Preparation and Handling	N/A	N/A
003_Decon	*Decontamination of Personnel and Equipment*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Decontamination	N/A	N/A
004_DeconRig	*Decontamination of Drilling Rigs and Equipment*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Decontamination	N/A	N/A
005_Disposal	*Disposal of Waste Fluids and Solids*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Decontamination	N/A	N/A
006_GPS	*Global Positioning System*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Other	N/A	N/A
007_HomoSamp	*Homogenization of Soil and Sediment Samples*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Sample Preparation and Handling	N/A	N/A
008_FieldLog	*Preparing Field Log Books*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Log Books	N/A	N/A
009_MiniRAE	*Mini RAE Photoionization Detector (PID)*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Health and Safety	N/A	N/A
010_SBLog	*Logging of Soil Borings*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Soil Sampling	N/A	N/A
011_SWSamp	*Surface Water Sampling*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Surface-Water and Sediment Sampling	N/A	N/A
012_SedSamp	*Sediment Sampling*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Surface-Water and Sediment Sampling	N/A	N/A
013_SoilSampShallow	*Shallow Soil Sampling*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Soil Sampling	N/A	N/A

SAP Worksheet #21—Project Sampling SOP References Table (continued)

SOP Reference Number	Title/Author	Revision Date or Version Number	Location of SOP (if not included in the SAP)	Any planned deviation for Project Work	Comments
014_Ship	*Packaging and Shipping Procedures for Low-Concentration Samples*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Sample Preparation and Handling	N/A	N/A
015_SoilSamp	*Soil Sampling*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Soil Sampling	N/A	N/A
016_UtilLoc	*Locating and Clearing Underground Utilities*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Utility Location	N/A	N/A
017_VOC SampGW	*VOC Sampling-Water*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Sample Preparation and Handling	N/A	N/A
018_FieldParam	*Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using a Water Quality Parameter Meter with Flow-through Cell*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Field Parameters	N/A	N/A
019_FishSampElectro	*Fish Community Sampling Using Electroshocking Methods*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Ecology	N/A	N/A
020_FishSampSeine	*Fish Community Sampling Using Seines*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Ecology	N/A	N/A
021_TissSampPrep	*Tissue Sample Preparation*	5/2011	\\orion\proj\CLEANII\SOPS\1 - MASTER\Ecology	N/A	N/A

SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	Frequency	Acceptance Criteria	CA	Resp. Person	SOP Reference	Comments
N/A							

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SAP Worksheet #23-1—ENCO Labs Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work?
LOGINS-03	*RECEIVING SAMPLES (Rev. 10, Effective 1/23/2010)*	4/20/2011	NA	NA	NA	none	No
ADMIN-14	*WASTE DISPOSAL AND CHARACTERIZATION (Rev. 6, 09/16/2011)*	NA	NA	NA	NA	none	No
MET-03	*Mercury in Waters by Digestion/CVAA (Rev. 5, 02/20/2012)*	NA	Definitive	Aqueous, Metals	CVAA	Do not Perform MSA	No
MET-05	*Metals Analysis by ICP-AES (Rev. 9, 03/09/2012)*	NA	Definitive	Aqueous/Solids, Metals	ICP		No
Met-15	*Metals Analysis by ICP-MS (Rev. 5, 2/14/2011)*	2/1/2012	Definitive	Aqueous/Solids, Metals	ICP-MS		No
MET-16	*Mercury in Soils By Digestion/CVAA (Rev. 5, 03/12/2012)*	NA	Definitive	Soils, Metals	CVAA		No
EXMT-07	*Acid Digestion of Aqueous Samples & Extracts for Analysis by ICP or ICP-MS (Rev.7, 08/23/2011)*	NA	NA	Aqueous Extraction, Metals	NA	none	No
EXMT-09	*Acid Digestion of Soil and Waste Samples for Analysis by ICP and (Rev. 6, 08/31/2011) ICP-MS*	NA	NA	Solid Extraction, Metals	NA	none	No
VGCMS-05	*Analysis of Volatile Organic Compounds by GC/MS (Rev. 17, 08/26/2011)*	NA	Definitive	Aqueous/Solids, Volatile Organics	GCMS	none	No
SVGCMS-03	*Semivolatile Organic Compounds by GC/MS (Rev. 17, 08/15/2011)*	NA	Definitive	Aqueous/Solids, Semivolatile Organics	GCMS	See Note 1	No
SVGC-04	*Organochlorine Pesticides by GC/ECD (Rev. 10, 09/21/2011*	NA	Definitive	Aqueous/Solids, Pesticides	GC	See Note 2	No
SVCG-07	*Polychlorinated Biphenyls by GC/ECD (Rev.5, 03/22/2012)*	NA	Definitive	Aqueous/Solids, PCB	GC	See Note 3	No
EXSV-16	*Extraction of Soil/Solid Samples Using Sonication (Rev. 6, 03/23/2010)*	4/14/2011	NA	Solids Extraction, Semivolatile	NA	none	No
EXSV-27	*Extraction of Samples Using Separatory Funnel Techniques (Rev. 5, 09/15/2011)*	NA	NA	Aqueous Extraction, Semivolatiles	NA	none	No
WETS-10	*Hardness, Total; EPA 130.2; SM2340C (Rev. 8, 06/30/2011)*	NA	Definitive	Aqueous, Wet Chemistry	Buret	none	No
WETS-27	*Colorimetric Determination of Total Cyanides (Rev. 11, 1/12/2010)*	1/6/2012	Definitive	Aqueous/Solids, Wet Chemistry	Spectrophotometer	none	No

SAP Worksheet #23-1—ENCO Labs Analytical SOP References Table (continued)

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work?
WETS-56	*pH (Electrometric, Solid/Waste Samples) (Rev. 3, 03/23/2010)*	1/10/2012	Definitive	Solids, pH	Electrode	none	No
WETS-90	*Total Organic Carbon in Soil Using Walkley Black Titration (Rev. 1, 01/12/2010)*	4/21/2011	Definitive	Solids, TOC	Buret	none	No

Notes:

DoD ELAP certification is required for this work, this laboratory's DoD ELAP certification expires June 30, 2012.

[1] ENCO routinely utilizes SW-846 8270D criteria allowing 20% relative standard deviation (RSD) for calibration.

[2] With the exception of Toxaphene and Chlordane, ENCO proposes utilizing SW-846 Method 8000 internal standard procedures for performing Method 8081B. A 12 hour clock opening with CCV and Performance Evaluation Mixture shall be utilized.

[3] Toxaphene and Chlordane are not included in LCS/Matrix Spikes/CCVs. These analytes are included in the ICAL and all chromatograms are examined for the presence of Toxaphene and Chlordane. In the event Toxaphene or Chlordane are identified, the sample extracts are re-analyzed with Toxaphene/Chlordane-specific QC.

SAP Worksheet #23-2—GEL&Empirical Laboratories Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Laboratory Performing Analysis	Variance to QSM	Modified for Project Work?
GL-OA-E-03	Nitroaromatics and Nitramines by High Performance Liquid Chromatography, 30-Jan-2012, GL-OA-E-033, Rev. 21	1/30/2012	Definitive	Aqueous/Solids, Explo	HPLC	GEL	None	No
SOP233	Nitroguanidine in Soil and Water By High Performance Liquid Chromatography (HPLC), R04	10/6/2011	Definitive	Aqueous/Solids, Nitroguanidine	HPLC/UV-vis	Empirical	None	No

Notes:

DoD ELAP certification is required for this work, GEL's DoD ELAP certification expires June 30, 2013. Empirical's DoD ELAP certification expires November 30, 2012, the lab intends to continue certification without lapse.

SAP Worksheet #23-3—CAS-Rochester Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work?
GEN-AVS/SEM	*Sulfide, Acid Volatile & Simultaneously Extracted Metals*	7/18/11 revised	Screening	solids, AVS/SEM	Spectrophotometer	None	No
Met 200.7/6010B	*Determination of Metals & Trace elements by ICP*	7/18/11 revised	Screening	solids, AVS/SEM	ICP-AES,CVAA	None	No
GEN-7199	*Hexavalent Chromium by Ion Chromatography, Rev. 3, 1/13/11*	1/13/11	Definitive	solids, hexavalent chromium	IC	None	No

Notes:

CAS-Rochester is a DoD ELAP accredited lab, and has certification for the analysis of hexavalent chromium, sulfide and metals, which is valid through May 21, 2012. The laboratory's certifications do not apply to the AVS/SEM sample preparation.

SAP Worksheet #23-4—Katahdin Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work?
CA-329	*Analysis Of PCBs as Total Arochlors by Gas Chromatography/Electron Capture Detector (GC/ECD): SW-846 Method 8082, 07/11, Revision 12.*	NA	Definitive	Tissue / PCBs	GC/ECD	See Note 1	No
CA-524	*Preparation of Sediment/Soil Samples by Soxhlet Extraction Using Method 3540 for Pesticide/PCB Analysis, 08/10, Revision 7.*	In Review	Definitive	Tissue / Extractions	Soxhlet	None	No
CA-538	*Determination of Total Percentage Lipid in Tissue Samples by Accelerated Solvent Extraction Using Method 3545, 12/10, Revision 2.*	NA	Definitive	Tissue / Extractions	ASE	None	No
CA-605	*Acid Digestion of Solid Samples by USEPA Method 3050 for Metals Analysis by ICP-AES And GFAA, 09/10, Revision 5.*	02/12	Definitive	Tissue / Digestions	Digester	None	No
CA-611	*Digestion and Analysis of Solid Samples for Mercury by USEPA Method 7471, 12/10, Revision 8.*	NA	Definitive	Tissue / Mercury	CVAA	See Note 1	No
CA-627	*Trace Metals Analysis By ICP-MS Using USEPA Method 6020, 04/10, Revision 7.*	In Review	Definitive	Tissue / Metals	ICP/MS	See Note 1	No
CA-717	*Total Solids/Total Volatile Solids Determination in Solid Matrices, 06/10, Revision 7.*	In Review	Definitive	Tissue / Wet Chemistry	Balance	None	No

Notes:

DoD ELAP certification is required for this work. Katahdin Analytical Services, Inc. Meets these requirements, their DoD ELAP certification expires 11/4/2012.

[1] Variance is to the flagging criteria for CCV, LCS, MS, MSD, Surrogate. If reanalysis cannot be performed, it is explained in the case narrative.

SAP Worksheet #23-5—TestAmerica Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work?
WS-ID-0013	*PCB Analysis by HRGC/HRMS (Revision 4.1 Effective 11/11/2011)*	Definitive	Tissue PCBs	GC/HRMS	TestAmerica West Sacramento	Refer to "TestAmerica_1668-DOD QSM Exceptions", in **Appendix B**	No
WS-QA-0003	*Sample Receipt Procedures (revision 11.5 Effective 11/18/2011)*	NA	NA	NA	TestAmerica West Sacramento	none	No

Notes:

DoD ELAP certification is required for this work. TestAmerica West Sacramento meets these requirements, their DoD ELAP certification expires in April 30, 2012. The contractor is in communication with the laboratory concerning their DoD ELAP Certification, and laboratory certification will be current at the time of sampling.

SAP Worksheet #24—Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
GC-MS (VOA)	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Analyst	VGCMS-05
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: VOCs ≥0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; VOCs ≥0.1 for chloromethane, bromoform, and 1,1-dichloroethane. 2. RSD for RFs for CCCs: VOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression r ≥ 0.995; Option 3: non-linear regression coefficient of determination (COD) r2 ≥ 0.990 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ± 20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	Retention time window position establishment for each analyte and surrogate.	Once per ICAL.	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.	NA.		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average RF for SPCCs: VOCs≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. 2. %Difference/Drift for all target compounds and surrogates: VOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	DoD project level approval must be obtained for each of the failed analytes or CA must be taken. Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.		
GC-MS (SVOA)	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Analyst	SVGCMS-03
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: SVOCs≥ 0.050. 2. RSD for RFs for CCCs: SVOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression r ≥ 0.995; Option 3: non-linear regression coefficient of determination (COD) r2 ≥ 0.990 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ± 20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	Retention time window position establishment for each analyte and surrogate.	Once per ICAL.	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.	NA.		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average RF for SPCCs: SVOCs ≥ 0.050. 2. %Difference/Drift for all target compounds and surrogates: SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	DoD project level approval must be obtained for each of the failed analytes or CA must be taken. Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
GC/ECD (Pesticides)	Breakdown Check	At the beginning of each 12 hour sequence, prior to analysis of samples.	Degradation ≤15% for both DDT and Endrin.	Correct the problem, repeat breakdown check.	Analyst	SVGC-04
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	One of the following options: Option 1: RSD for each analyte ≤20% Option 2: Linear regression fit, r≥0.995.	Correct the problem, repeat ICAL.		
	Retention time window position establishment	Once per ICAL and at the beginning of the analytical shift.	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.	NA.		
	Second Source Calibration Verification (SCV)	Immediately following the ICAL.	Within 80-120% of true value.	Correct the problem: rerun SCV. If that fails, repeat ICAL.		
	Continuing Calibration Verification (CCV)	At the beginning of every 12-hour sequence, after the pesticide breakdown check.	Within 80-120% of true value.	Correct the problem, then rerun CCV. If that fails, repeat ICAL. Re-analyze all samples since the last successful calibration verification.		
GC/ECD (PCBs)	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	One of the following options: Option 1: RSD for each analyte ≤20% Option 2: Linear regression fit, r≥0.995.	Correct the problem, repeat ICAL.	Analyst	SVGC-07, CA-329
	Retention time window position establishment	Once per ICAL and at the beginning of the analytical shift.	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.	NA.		
	Second Source Calibration Verification (SCV)	Immediately following the ICAL.	Within 80-120% of true value.	Correct the problem, rerun SCV. If that fails, repeat ICAL.		
	Continuing Calibration Verification (CCV)	Prior to any samples in sequences that do not include ICAL, after every 10th sample, and at the end of the sequence.	Within 80-120% of true value.	Correct the problem, then rerun CCV. If that fails, repeat ICAL. Re-analyze all samples since the last successful calibration verification.		
ICP-AES (Metals and SEM)	Initial calibration (ICAL) - minimum one high standard and a calibration blank for all analytes	Daily ICAL prior to sample analysis.	More than one calibration standard is used, R≥ 0.995.	Correct problem, then repeat ICAL.	Analyst	MET-05, MET-200.7/6010C
	Low-level calibration check standard	Daily, after one-point ICAL.	Within ± 20% of true value.	Correct problem, then reanalyze.		
	Second source calibration verification	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes within ± 10% of true value.	Verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	Continuing calibration verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All analytes within ± 10% of true value (for AVS/SEM, all analytes within ± 20%)	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.		
	Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
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; For stability, RSD≤ 5% for at least four replicate analyses.	Retune instrument then reanalyze tuning solutions.	Analyst	MET-15, CA-627
	Initial calibration (ICAL) for all analytes (minimum 2 point calibration)	Daily ICAL prior to sample analysis.	More than one calibration standard is used, R≥ 0.995.	Correct problem, then repeat ICAL.		
	Second source calibration verification	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes within ± 10% of true value.	Verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	Continuing calibration verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All analytes within ± 10% of true value	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.		
	Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.		
	Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.		
CVAA (Mercury, Metals and SEM)	Initial Calibration (ICAL) minimum 5 standards and a calibration blank	Initial calibration daily prior to sample analysis.	Correlation coefficient >0.995; accepted if the initial calibration verification (ICV) passes.	Correct problem, then repeat initial calibration.	Analyst	MET-03 and MET-16, MET-7470A/ 245.1, CA-611
	Second-source Calibration Verification (SCV)	Once per initial calibration, prior to beginning a sample run.	Less than 10% difference from ICV for all target analytes.	Correct problem, then repeat. If still fails, repeat initial calibration.		
	Continuing Calibration Verification (CCV)	Following SCV, after every 10 samples and the end of the sequence.	Within +/- 20% of true value.	Correct problem, then repeat. If still fails, repeat initial calibration. Re-analyze all samples since the last successful calibration verification.		
	Calibration blank	Daily after initial calibration and every ten samples.	No analytes detected > LOD.	Correct problem, re-prep and reanalyze calibration blank. Re-analyze all samples following the last acceptable calibration blank.		
Cyanide Analyzer	Initial Calibration (ICAL) - six standards and a calibration blank	Daily ICAL prior to sample analysis.	r≥0.995	Correct problem, then repeat ICAL.	Analyst	WETS-027
	Second Source Calibration Verification (SCV)	Once after each ICAL, prior to beginning a sample run.	Within ± 15% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
IC/UV-VIS (hexavalent Chromium)	ICAL	Prior to sample analysis.	Minimum Blank and 3 Standards (typically more), r > 0.999.	Correct problem then repeat ICAL.	Analyst/Supervisor	GEN-7199
	ICV	After each ICAL.	90-110% Recovery.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.		
	CCV	At the beginning of the analytical sequence; after each 10 field samples; at the end of the analytical sequence.	90-110% Recovery.	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last acceptable CCV.		
High Pressure Liquid Chromatography (HPLC)	Retention time window width calculated for each analyte and surrogate	At method set up and after major maintenance (column change).	RT width is +/- 3 times the standard deviation for each analyte from a 72-hour study.	NA	Analyst	GEL GL-OA-E-033 Empirical SOP SOP233
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis	One of the options: Option 1: RSD for each analyte < 20% or Option 2: linear least squares regression: r > 0.995	Correct problem then repeat ICAL		
	RT window position establishment for each analyte and surrogate	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, use initial CCV.	NA		
	Second source calibration verification (ICV)	Immediately following ICAL	All project analytes within established retention time windows. HPLC methods: All project analytes within +/- 15% of the expected value from the ICAL.	Correct the problem, then rerun ICV. If that fails, then repeat ICAL.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
High Pressure Liquid Chromatography (HPLC) (cont.)	Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence	All project analytes within established retention time windows.	Correct the problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification	Analyst	GL-OA-E-03
			HPLC methods: All project analytes within +/- 15% of the expected value from the ICAL.			
Spectrophotometer (AVS)	ICAL	As needed	The correlation coefficient must be ≥ 0.995	Correct problem then repeat ICAL	Lab Section Supervisor	GEN-AVS
	ICV	After each initial calibration	± 10% of the expected value	Correct problem and rerun ICV. If that fails, correct problem and repeat ICAL.		
	CCV	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	± 10% of the expected value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last acceptable CCV.		
pH Meter	Refer to the manufacturer's manual for instrument calibration	Refer to manufacturer's manual.	Refer to manufacturer's manual.	Correct problem then repeat ICAL.	Analyst	WETS-056
	The pH meter is calibrated daily using 4.0 (± 0.1) and 10.0 (±0.1) buffers.	Deviation within 99 - 101% of true value.	Recalibrate, reanalyze all samples analyzed since the last pH buffer that met criteria.	Correct problem then repeat ICAL.		
GC/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. End of run check must be ≥ 5,000.	Retune instrument & verify. Assess data for impact if end resolution is less than 10,000 narrate or reinject as necessary.	Laboratory Manager / Analyst	WS-ID-0013
	GC Column Performance Check (CPSM/WDM per method)	Prior to ICAL or calibration verification.	The congener pairs 23/34 and 182/187 are checked for chromatographic resolution. The valley between each pair must be less than 40% of the shorter of the two peaks. The CS-3 (CCV) is used to define chromatographic windows. First and last eluter must be present in each window.	1) Readjust windows. 2) Evaluate system. 3) Perform maintenance. 4) Reanalyze CPSM.		
	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 calibration verification, internal standard or recovery standard solutions.	RSD ≤ 20% for response factors for Toxic/LOC compounds. (The toxics/LOCs are the 27 congeners that are calibrated by a multipoint curve. They encompass the WHO list toxic congeners and the first and last eluter for each level of chlorination [LOC]. All other congeners are quantified off of a daily single point standard.)	Evaluate standard and instrument response. If problem with instrument (autosampler failure, response poor, etc) or standards, correct as appropriate, then repeat initial calibration.		
	Second-source calibration verification	Immediately following ICAL.	All project analytes within ± 30% of the expected value from the ICAL.	Evaluate standards and instrument response. If standard issue, repeat or remake then repeat standard as appropriate. If still fails, repeat initial calibration		
	Calibration Verification (CCV)	At the beginning of each 12-hour period.	Ion abundance ratios in accordance with SOP; and RF (unlabelled standards) within ± 30%D of average RF from ICAL for Toxic/LOC compounds; and RF (labeled standards) within ± 50%D of average RF from ICAL.	Correct problem, repeat calibration verification. If fails, repeat ICAL and reanalyze all samples analyzed since last successful CCV		

[1] Refer to **Worksheet #23** for a complete reference to relevant analytical SOPs.

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[1]
GC/MS	Clean sources, maintain vacuum pumps.	Tuning	Instrument performance and sensitivity.	Service vacuum pumps twice per year, other maintenance as needed.	Tune and CCV pass criteria.	Recalibrate instrument.	Analyst	VGCMS-05
	Change septum, clean injection port, change or clip column, install new liner, change trap.	Sensitivity check	Instrument performance and sensitivity.	Daily or as needed.	Tune and CCV pass criteria.	Re-inspect injector port, cut additional column, re-analyze CCV, and re-calibrate instrument.		
GC-ECD	Injection port maintenance.	Degradation check run every 12 hrs	DDT and Endrin breakdown <15%.	Beginning of each 12 hour 8081 sequence.	DDT and Endrin breakdown <15%.	Clip the guard column, replace the injection port liner, replace the gold seal, clean the injection port and repeat degradation check.	Analyst	SVGC-04
	Injection port maintenance.	NA.	Evaluate baseline and peak shapes.	As needed.	Analyst judgment of excessive tailing or baseline fluctuation.	Clip the guard column, replace the injection port liner, replace the gold seal, clean the injection port		SVGC-04, SVGC-07
ICP-AES	Change tubing	None	None	Every other run	None	None	Analyst	MET-05
	Clean air filter	Inspect air filters	Visual	Monthly	Air Filters are clean	Clean, replace air filters		
	Clean lenses	Inspect lenses for cleanliness	Visual	As needed.	Lenses are clean	None		
	Clean injector	Inspect injector for cleanliness	Visual	As needed.	verify injector is clean	None		
CVAA	Replace disposables, flush lines.	Sensitivity check	Instrument performance and sensitivity.	Daily or as needed.	CCV pass criteria.	Recalibrate.		MET -03 and MET-16
	Clean lens.	Sensitivity check	Instrument performance and sensitivity.	Daily or as needed.	Method Blank pass criteria.	Recalibrate.		
	Replace pump tubing.	Flow Rate Check	Instrument performance and sensitivity.	As needed.	Monitor flow rate for variation.	Replace windings, recalibrate and re-analyze.		
ICP-MS	Clean, inspect, change cones.	Monitor ISTD counts for variation	Instrument performance and sensitivity.	As needed.	Monitor ISTD counts for variation.	Re-calibrate.	Analyst	MET-15
	Clean, inspect, change spray chamber, injector, torch.	Monitor ISTD counts for variation	Instrument performance and sensitivity.	As needed.	Monitor ISTD counts for variation.	Re-calibrate.		
	Replace pump windings.	Monitor ISTD counts for variation	Instrument performance and sensitivity.	As needed.	Monitor ISTD counts for variation.	Replace windings, re-calibrate and re-analyze.		
Cyanide Analyzer	Clean sample cell before use	Turn on instrument and wait 15 minutes to warm-up	Visual	Before each run	Calibrate by zeroing. Blank and CCV pass criteria.	Recalibrate instrument.	Analyst	WETS-27
IC/UV-VIS (hexavalent Chromium)	Change column bed supports.	Hexavalent Chromium	Change column bed supports.	Monthly or as needed.	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Supervisor	GEN-7199
	Clean column.		Clean column.	Monthly or as needed.				
	Change column.		Change column.	Every 6 months or as needed.				
	Change tubing.		Change tubing.	Annually or as needed.				
HPLC	Preventative	Explosives, PAHs	Check back pressure on analytical column. Check mobile phase volumes.	Daily	Back pressure on column is not excessive or significantly higher than the previous day. Sufficient mobile phase volumes in reservoirs to perform the intended analysis.	Replace prefilter or column frit. Back flush or replace column if necessary. Prepare additional mobile phase for analysis sequence.	Analyst	GEL GL-OA-E-033 Empirical SOP SOP233
ICP-AES (for SEM)	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	Analytical QC sample performance	Torch, filters, nebulizer chamber, pump, pump tubing	Perform as needed.	must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service.	Lab Area Supervisor	MET-200.7/6010B
CVAA (for SEM)	Clean or replace dehydrator tubing and sample mixing coil tubing; replace sample probe; replace pump tubing; clean optical cell.	Analytical QC sample performance	Tubing, sample probe, optical cell	Perform as needed.		Repeat maintenance activity or remove from service.	Lab Area Supervisor	MET-7470A/245.1
Spectrophotometer (for AVS)	Inspect lamp alignment. Adjust zero. Replace lamp as needed.	Analytical QC sample performance	Check wavelengths against NIST traceable standards	Every 6 months	Within 3% of certified transmittance density values or 2nm for holmium oxide	Repeat maintenance activity or remove from service.	Lab Area Supervisor	GEN-AVS
pH Meter	Clean and change probe fluid	NA	Fluid is low or crystal have formed	as needed	NA	NA	Analyst	WETS-014

SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[1]
GC/ECD (for PCBs in Tissue)	Check pressure and gas supply daily. Change septa and/or liner as needed, replace or cut column as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Injector liner, septa, column, column flow.	Prior to initial calibration and/or as necessary.	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Supervisor	CA-329
ICPMS (Metals in Tissue)	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Torch, nebulizer, spray chamber, pump tubing	Prior to initial calibration and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-627
Mercury Analyzer (for Mercury in Tissue)	Replace peristaltic pump tubing, replace mercury lamp, replace drying tube, clean optical cell and/or clean liquid/gas separator as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Tubing, sample probe, optical cell	Prior to initial calibration and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Supervisor	CA-611, CA-615
GC/HRMS (for PCB Congeners in Tissue)	Parameter Setup	Physical check	Physical check	Initially; prior to DCC	Correct Parameters	Reset if incorrect	TestAmerica Chemist	WS-ID-0005
	Tune Check	Instrument Performance	Conformance to instrument tuning.	Initially; prior to DCC	Compliance to ion abundance criteria	Correct the problem and repeat tune check	TestAmerica Chemist	WS-ID-0005

[1] Refer to **Worksheet #23** for a complete reference to relevant analytical SOPs.

SAP Worksheet #26-1—Sample Handling System for Non-tissue Samples

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Team/CH2M HILL
Sample Packaging (Personnel/Organization): FTL/ CH2M HILL
Coordination of Shipment (Personnel/Organization): FTL/ CH2M HILL
Type of Shipment/Carrier: Overnight Carrier/ FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Logins/ENCO Labs, GEL Labs, CAS-Rochester, Empirical Labs
Sample Custody and Storage (Personnel/Organization): Logins/ENCO Labs, GEL Labs, CAS-Rochester, Empirical Labs
Sample Preparation (Personnel/Organization): Inorganic Prep and Organic Prep/ENCO Labs, GEL Labs, CAS-Rochester, Empirical Labs
Sample Determinative Analysis (Personnel/Organization): Analysts/ENCO Labs, GEL Labs, CAS-Rochester, Empirical Labs
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 45
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 45
Microbial Sample Storage (No. of days from sample collection): not applicable
SAMPLE DISPOSAL
Personnel/Organization: Sample Custody Personnel/ENCO Labs, GEL Labs, CAS-Rochester
Number of Days from Analysis: 45

SAP Worksheet #26-2—Sample Handling System for Tissue Samples

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Team/CH2M HILL Sample Packaging (Personnel/Organization): FTL/ CH2M HILL Coordination of Shipment (Personnel/Organization): FTL/ CH2M HILL Type of Shipment/Carrier: Overnight Carrier/ FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Logins/Katahdin, TestAmerica Sample Custody and Storage (Personnel/Organization): Logins/Katahdin, TestAmerica Sample Preparation (Personnel/Organization): Inorganic Prep and Organic Prep/Katahdin, TestAmerica Sample Determinative Analysis (Personnel/Organization): Analysts/Katahdin, TestAmerica
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 45 Sample Extract/Digestate Storage (No. of days from extraction/digestion): 45 Microbial Sample Storage (No. of days from sample collection): not applicable
SAMPLE DISPOSAL
Personnel/Organization: Sample Custody Personnel/Katahdin, TestAmerica Number of Days from Analysis: 45

SAP Worksheet #27—Sample Custody Requirements Table

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

Samples will be collected by field team members under the supervision of the FTL. As samples are collected, they will be places into containers and labeled. Labels will be taped to the containers to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples <6 °C until they are received by the laboratory.

The COC will be placed into the cooler in a Ziploc bag. Coolers will be taped up and shipped to the laboratories via Fed Ex overnight, with the air bill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples to CH2M HILL.

See **Worksheet #21** for SOPs containing sample custody guidance.

All reference samples will be shipped to various laboratories (usually the laboratory performing the analysis, such that the expedited turnaround may be met. All samples will go to ENCO labs in Orlando FL, except the following, which will go to the labs noted:

- Explosives – GEL Labs
- Nitroguanidine – Empirical Labs

All water and soil samples will be shipped to ENCO Labs in Orlando, FL, with the exception of hexavalent chromium samples. ENCO will send samples for explosives analysis to GEL Labs in Charleston, SC and will send samples for AVS/SEM to CAS-Rochester.

All hexavalent chromium samples will be shipped directly to CAS-Rochester due to the short hold time.
All tissue samples will be shipped to Katahdin in Scarborough, ME. Katahdin will fillet fish tissue samples (if applicable) and homogenize samples. Katahdin will send homogenized aliquots for PCB congener analysis to TestAmerica in West Sacramento, CA.

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

Laboratory custody procedures can be found in the laboratory SOPs, which are referenced in **Worksheet #23**. Laboratory SOPs will be provided upon request.

Sample Identification Procedures:

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservation, and sampler's initials. The field logbook will identify the sample ID with the location and time collected and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the COC and **Worksheet #18**. The laboratory will send sample log-in forms to the PDM to check that sample IDs and parameters are correct.

COC Procedures:

COCs will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID. Date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain-of-custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the Laboratory Information Management Systems (LIMS) database for each sample.

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SAP Worksheet #28-1—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water
Analytical Group: VOA
Analytical Method/SOP Reference: SW-846 8260B / VGCMS-05

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method blank	One per preparatory batch	No target analytes > 1/2 LOQ (>LOQ for common lab contaminants), *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct problem. Re-prep and re-analyze method blank and all samples processed with the contaminated blank.	Analyst	Bias/ contamination	Same as Method/SOP QC Acceptance Limits.
Laboratory Control Sample (LCS)		Refer to **Worksheet #15.**	LCS is reanalyzed. If still fails, samples along with QC, are re-prepped and re-analyzed. Client will be contacted for guidance about whether to re-prep samples. In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Matrix Spike (MS)		Same as LCS.	In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Matrix Spike Duplicate (MSD)		Same as LCS and RPD ≤30%.	In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Internal Standards (IS)	Spiked in Every Sample	Retention time within 30 seconds from retention time of the midpoint standard in the ICAL; areas within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.		Precision and Accuracy	
Surrogates		<u>Solids</u> Dibromofluoromethane *74-133%*, Toluene-d8 85-115%, 1,2-Dichloroethane-d4 *59-133%*, 4-Bromofluorobenzene 85-120% <u>Waters</u> Dibromofluoromethane 85-115%, Toluene-d8 85-120%, 1,2-Dichloroethane-d4 70-120%, 4-Bromofluorobenzene 75-120%	Re-prep and re-analyze sample unless objective evidence of suspected or confirmed sample matrix effects are available. If insufficient sample exists for reanalysis, client will be contacted for instructions. In the absence of client instruction, data will be qualified.		Precision and Accuracy/Bias	

Notes:
[1] Italicized limits are in-house, DoD QSM v. 4.1 does not specify limits for this surrogate.

SAP Worksheet #28-2—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water
Analytical Group: SVOA
Analytical Method/SOP Reference: SW-846 8270D and 8270D-SIM / SVGCMS-03

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No target analytes > 1/2 LOQ (>LOQ for common lab contaminants), *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct problem. Re-prep and re-analyze method blank and all samples processed with the contaminated blank.	Analyst	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
Laboratory Control Sample (LCS)		See **Worksheet #15.**	LCS is reanalyzed. If still fails, samples, along with QC, are re-prepped and re-analyzed. Client will be contacted for guidance about whether to re-prep samples. In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Matrix Spike (MS)		Same as LCS.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Matrix Spike Duplicate (MSD)		Same as LCS and RPD ≤30%.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Surrogate Spike	Spiked in every sample	<u>Solids</u> 2-Fluorobiphenyl 45-105%, Terphenyl-d_{14} 30-125%, Nitrobenzene-d_5, 35-100% <u>Waters</u> 2-Fluorobiphenyl 50-110%, Terphenyl-d14 50-135%, Nitrobenzene-d5, 40-110%.	Re-prep and re-analyze sample unless objective evidence of suspected or confirmed sample matrix effects are available. If insufficient sample exists for reanalysis, client will be contacted for instructions. In absence of client instruction, data will be qualified.		Precision and Accuracy/Bias	
Internal Standards		Retention time within 30 seconds from retention time of the midpoint standard in the ICAL; areas within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning.		Precision and Accuracy	

SAP Worksheet #28-3—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water

Analytical Group: Pesticides

Analytical Method/SOP Reference: SW-846 8081B / SVGC-04

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > 1/2 LOQ, *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct problem. Re-prep and re-analyze method blank and all samples processed with the contaminated blank.	Analyst	Bias/ Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		See **Worksheet #15**.	Correct problem, then re-prep and re-analyze the LCS and all samples in the associated preparatory batch for failed analytes.		Precision and Accuracy/Bias	
MS		Same as LCS.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
MSD		See **Worksheet #15**.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Surrogates	Spiked in every sample	<u>Solids</u> Decachlorobiphenyl 55-130% <u>Waters</u> Decachlorobiphenyl 30-135%	For QC and field samples, correct problem then re-prep and re-analyze all failed samples for failed surrogates in the associated preparatory batch.		Precision and Accuracy/Bias	
Internal Standards (IS)		RT within 30 seconds of ICAL reference standard; %R = 50 - 200% of ICAL reference standard.	In absence of matrix interference evidence, re-analyze the sample.		Precision and Accuracy	

SAP Worksheet #28-4—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water

Analytical Group: PCBs

Analytical Method/SOP Reference: SW-846 8082A / SVGC-07

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 LOQ, *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct problem. Re-prep and re-analyze method blank and all samples processed with the contaminated blank.	Analyst	Bias/ Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		See **Worksheet #15**	Correct problem, then re-prep and re-analyze the LCS and all samples in the associated preparatory batch for failed analytes.		Precision and Accuracy/Bias	
MS		Same as LCS	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
MSD		Same as LCS and RPD ≤ 30%.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Surrogates	Spiked in every sample.	<u>Solids</u> Decachlorobiphenyl 60 - 125%, *2,4,5,6-TCX 20-137%.*[1] <u>Waters</u> Decachlorobiphenyl 40-135%, *2,4,5,6-TCX 38-142%.*	For QC and field samples, correct problem then re-prep and re-analyze all failed samples for failed surrogates in the associated preparatory batch.		Precision and Accuracy/Bias	

Notes:

[1] Italicized limits are in-house, DoD QSM v. 4.1 does not specify limits for this surrogate.

SAP Worksheet #28-5—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water
Analytical Group: Explosives
Analytical Method/SOP Reference: SW-846 8330A / GEL GL-OA-E-033

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per preparatory batch up to 20 samples of the same matrix	No target analytes detected > 1/2 LOQ *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct the problem. Reprep and reanalyze method blank and all associated sample processed with the contaminated blank.	Laboratory analysts	Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	Correct the problem. Reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.		Precision	
Matrix Spike		Same as LCS.	Examine project specific DQOs. Contact client for additional measures to be taken.		Accuracy/Bias	
Matrix Spike Duplicate or Sample Duplicate		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.			Accuracy/Bias	
Surrogates	All field and QC samples	<u>Solids</u> 3,4-Dinitrotoluene: *75 - 139%R* <u>Waters</u> 3,4-Dinitrotoluene: *62 - 128 %R*	Correct problem and then reprep and reanalyze samples for failed recoveries in the associated preparation batch, if sufficient volume is available.		Bias	
Confirmation Analysis	When target analytes are detected on the primary column using the UV Detector at concentrations exceeding the LOD.	Calibration and QC criteria are the same as for initial or primary column analysis. Results between primary and second column RPD ≤40%.	Report from both columns.		Accuracy	

Notes:
[1] Italicized limits are in-house, DoD QSM v. 4.1 does not specify limits for this surrogate.

SAP Worksheet #28-6—Laboratory QC Samples

Matrix: Sediment, Surface Water
Analytical Group: Explosives
Analytical Method/SOP Reference: Empirical SOP SOP233,

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per preparatory batch up to 20 samples of the same matrix	No target analytes detected > 1/2 LOQ *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct the problem. Reprep and reanalyze method blank and all associated sample processed with the contaminated blank.	Laboratory analysts	Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	Correct the problem. Reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.		Precision	
Matrix Spike		Same as LCS.	Examine project specific DQOs. Contact client for additional measures to be taken.		Accuracy/Bias	
Matrix Spike Duplicate or Sample Duplicate		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.			Accuracy/Bias	
Confirmation Analysis	When target analytes are detected on the primary UV Detector at concentrations exceeding the LOD.	Calibration and QC criteria are the same as for initial or primary detector analysis. Results between primary and second column RPD ≤40%.	Report from both columns.		Accuracy	

Notes:
[1] Italicized limits are in-house, DoD QSM v. 4.1 does not specify limits for this surrogate.

SAP Worksheet #28-7—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment

Analytical Group: Metals (except mercury)

Analytical Method/SOP Reference: SW-846 6010C / MET-05

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 LOQ. *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem; then repeat. If the method blank still fails; redigest and analyze all affected samples.	Analyst	Bias/ Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch.		Precision and Accuracy/Bias	
MS		Same as LCS.	If matrix spike falls outside of QC acceptance limits, additional QC tests are required to evaluate matrix effects (dilution test, post-digestion spike).		Precision and Accuracy/Bias	
MSD		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.			Precision and Accuracy/Bias	
Dilution Test		Recovery within ±10% of true value.	Perform Post Spike (PS)		Precision and Accuracy/Bias	
Post Spike (PS)	One is performed when dilution test fails or analyte concentration for all samples < 50x LOD.	Recovery within ± 25% of true value.	If dilution test recoveries are outside of QC acceptance limits but post spike meets QC acceptance criteria, and matrix effects are not confirmed, reprep and reanalyze sample.		Precision and Accuracy/Bias	
Interference check solutions (ICS)	After beginning of the analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD. ICS-AB: Within 20% of true value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.		Precision and Accuracy/Bias	

SAP Worksheet #28-8—Laboratory QC Samples

Matrix: Surface water
Analytical Group: Total and Dissolved Metals (except mercury)
Analytical Method/SOP Reference: SW-846 6020A / MET-15

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No target analytes > 1/2 LOQ *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct problem; then repeat. If the method blank still fails; redigest and analyze all affected samples.	Analyst	Bias/Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	LCS is re-analyzed. If still fails, samples, along with QC, are re-prepped and re-analyzed. Client will be contacted for guidance about whether to re-prep samples. In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
MS		Same as LCS.	Perform a dilution test and/or post spike to evaluate matrix effects.		Precision and Accuracy/Bias	
MSD		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	Perform a dilution test and/or post spike to evaluate matrix effects.		Precision and Accuracy/Bias	
Dilution Test		Recovery within ±10% of true value.	Perform post spike.		Precision and Accuracy/Bias	
Post Spike (PS)	When dilution test fails or analyte concentration for all samples < 50x LOD.	Recovery within ±25% of true value.	If dilution test recovers outside of QC acceptance limits but post spike meets QC acceptance criteria, matrix effects are not confirmed, reprep and reanalyze sample.		Precision and Accuracy/Bias	
Internal Standard (IS)	Spiked in every sample.	IS intensity within 30-120% of intensity of IS in ICAL.	Re-analyze sample at 5X dilution with the addition of appropriate amounts of IS		Precision and Accuracy	

SAP Worksheet #28-9—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water

Analytical Group: Total and dissolved metals (mercury)

Analytical Method/SOP Reference: SW-846 7470A/7471A / MET-03, MET-16

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > 1/2 LOQ. *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem; then repeat. If the method blank still fails; re-prep and re-analyze all samples processed with contaminated blank.	Analyst	Bias/Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch.		Precision and Accuracy/Bias	
MS		Same as LCS.	Examine the project specific DQOs. In absence of project specific instruction, flag the data.		Precision and Accuracy/Bias	
MSD		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	Examine the project-specific DQOs, Contact the client as to additional measures to be taken.		Precision and Accuracy/Bias	

SAP Worksheet #28-10—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Water

Analytical Group: Metals (Cyanide)

Analytical Method/SOP Reference: SW-846 9014/ WETS-27

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem; then repeat. If the method blank still fails; redigest and analyze all affected samples.	Analyst	Bias/ Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		See **Worksheet #15-1.**	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.		Precision and Accuracy/Bias	
MS		Same as LCS.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
MSD		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	

SAP Worksheet #28-11—Laboratory QC Samples

Matrix: solid (AVS extract digested as a liquid by MET-3010)
Analytical Group: SEM Metals (except mercury)
Analytical Method/SOP Reference: EPA 821_R-91-100 (SW-846 6010C) / MET-200.7

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples. This blank carries through AVS extraction and SEM digestion and analysis.	Target analytes must be ≤ LOQ (for common lab contaminants ≤ LOQ) *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct the problem; reprep and reanalyze the method blank and all samples processed with the contaminated blank	Analyst/ Laboratory Area Supervisor	Contamination/ Bias	Same as Method/ SOP QC Acceptance Limits.
Digestion Blank	One is performed for each batch of 20 samples. This blank does not undergo AVS extraction. It only undergoes SEM digestion and analysis.				Contamination/ Bias	
LCS	One is performed for each batch of 20 samples. The LCS is spiked after AVS extraction and before SEM digestion.	Refer to **Worksheet #15**.	Re-prepare and analyze all associated samples.		Accuracy/Bias	
MS/MSD	One is performed for each batch of 20 samples. The MS is spiked after AVS extraction and before SEM digestion.	Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Serial Dilution	One is performed for each preparation batch with sample concentration(s) > 50x LOQ	The five-fold dilution result must agree within ± 10% of the original sample result.	Qualify the results.		Precision / Accuracy	
Post Digestion Spike	One is performed when serial dilution fails or analyte concentration(s) in all samples < 50x LOD.	The result must agree within ± 25% of expected result.	Run all associate sample in the preparatory batch by method of standard additions or qualify results.		Precision / Accuracy	

SAP Worksheet #28-12—Laboratory QC Samples

Matrix: solid (AVS extract digested as a liquid)

Analytical Group: SEM Mercury

Analytical Method/SOP Reference: EPA 821_R-91-100 (SW-846 7470A) / MET-245.1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples. This blank carries through AVS extraction and SEM digestion and analysis.	Target analytes must be ≤ LOQ, *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct the problem; reprep and reanalyze the method blank and all samples processed with the contaminated blank	Analyst/ Laboratory Area Supervisor	Contamination/ Bias	Same as Method/ SOP QC Acceptance Limits.
Digestion Blank	One is performed for each batch of 20 samples. This blank does not undergo AVS extraction. It only undergoes SEM digestion and analysis.				Contamination/ Bias	
LCS	One is performed for each batch of 20 samples. The LCS is spiked after AVS extraction and before SEM digestion.	Refer to **Worksheet #15**.	Re-prepare and analyze all associated samples.		Accuracy/Bias	
MS/MSD	One is performed for each batch of 20 samples. The MS is spiked after AVS extraction and before SEM digestion.	Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	

SAP Worksheet #28-13—Laboratory QC Samples

Matrix: solid (AVS extract)

Analytical Group: AVS

Analytical Method/SOP Reference: EPA 821_R-91-100 / GEN-AVSSEM

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	Analytes must be ≤LOQ, *and* 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank results do not otherwise affect sample results.	Correct the problem; reprep and reanalyze the method blank and all samples processed with the contaminated blank	Analyst/Laboratory Area Supervisor	Contamination/Bias	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	Re-prepare and analyze all associated samples.		Accuracy/Bias	
DUP		≤30 RPD	Note outlier in case narrative		Precision	
MS		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	Examine results of LCS. If both the LCS and MS are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy/Bias	

SAP Worksheet #28-14—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment

Analytical Group: Wet Chemistry (TOC)

Analytical Method/SOP Reference: Walkley Black/WETS-090

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per Batch	Method blank results are utilized to standardize results; therefore acceptance limits are not applicable.	There are no CAs for the method blank.	Analyst	Cleanliness	Same as Method/ SOP QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	The LCS is reanalyzed to confirm the contamination, which if confirmed, requires re-analysis of all associated samples.		Precision and Accuracy	
MS/MSD		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	Non-conforming results must be flagged with LIMS qualifier QM-07("The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.")		Precision and Accuracy	
			Non-conforming results must be flagged with the LIMS qualifier QM-11 ("Precision between duplicate matrix spikes of the same sample was outside acceptance limits.")		Precision and Accuracy	

SAP Worksheet #28-15—Laboratory QC Samples

Matrix: Surface Soil, Subsurface Soil, Sediment

Analytical Group: Wet Chemistry (pH)

Analytical Method/SOP Reference: SW-846 9045D/WETS-56

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
LCS	One per Batch	99-101%	The LCS is reanalyzed to confirm the contamination, which if confirmed, requires re-analysis of all associated samples.	Analyst	Precision and Accuracy	Same as Method/ SOP QC Acceptance Limits.
Duplicate		25%	If precision between duplicate samples is outside of the acceptance limits, the sample and its duplicate must be reanalyzed		Precision and Accuracy	

SAP Worksheet #28-16—Laboratory QC Samples

Matrix: Surface water

Analytical Group: Total Hardness

Analytical Method/SOP Reference: EPA 130.2/WETS-010

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	Result must be <MDL/MRL	Correct problem; then repeat. If the method blank still fails; reprep and analyze all affected samples.	Analyst	Bias/ Contamination	Same as Method/ SOP QC Acceptance Limits.
LCS		See **Worksheet #15-1.**	The LCS is reanalyzed to confirm the contamination, which if confirmed, requires re-analysis of all associated samples.		Precision and Accuracy/Bias	
MS		Same as LCS.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
MSD		Same as LCS and refer to **Worksheet #15** for MS/MSD RPD.	In absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	
Continuing Calibration Verification (CCV)		Recovery within 10% of true value.	The CCV is reanalyzed to confirm the contamination, which if confirmed, requires re-analysis of all associated samples.		Precision and Accuracy/Bias	

SAP Worksheet #28-17—Laboratory QC Samples

Matrix: Tissue

Analytical Group: PCB congeners and/or homologues

Analytical Method/SOP Reference: EPA 1668A, using limits from 1668C / WS-ID-0013

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparation batch	No target analytes detected ≥ 1/2 LOQ or ≥ 20% of the associated regulatory limit or ≥ 5% of the sample result for the analyte, whichever is greater.	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 CA or flagging is necessary for "totals".	Chemist	Accuracy/Bias Contamination	Same as Method/ SOP QC Acceptance Limits.
Laboratory Control Sample (LCS)		Ongoing Precision Recovery limits specified in method EPA 1668C. Refer to **Worksheet #15**.	Reanalyze LCS once. If acceptable, report. Otherwise, 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 Manager / Analyst	Accuracy/Bias Contamination	
MS/MSD	One MS/MSD per analytical/preparation batch	QSM or laboratory statistically derived control limits, RPD ≤ 20%.	Identify problem; if not related to matrix interference, re-extract and reanalyze MS/MSD and all associated batch samples in accordance with DoD QSM requirements.		Precision and Accuracy/Bias	
Internal Standard Spike	Every field sample, standard and QC sample	Recovery for each IS in the original sample (prior to dilutions) must be within 10-145%R.	Correct problem, then reprep and reanalyze the samples with failed IS.		Precisions and Accuracy/Bias	

SAP Worksheet #28-18—Laboratory QC Samples

Matrix: Tissue

Analytical Group: PCBs

Analytical Method/SOP Reference: SW-846 8082A / CA-329

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). See Box D-1 of DoD QSM v 4.2.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	Same as Method/ SOP QC Acceptance Limits.
Laboratory Control Sample		Refer to **Worksheet #15.** Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.		Accuracy/Bias	
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		Accuracy/Bias	
Matrix Spike Duplicate		Same as MS and refer to **Worksheet #15.**	Same as MS		Accuracy/Bias, Precision	
Surrogates	2 Per Sample	TCMX: *56-115%* Decahlorobiphenyl: 40-135%	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy/Bias	

Notes:

[1] Italicized limits are in-house, DoD QSM v. 4.2 does not specify limits for this surrogate.

SAP Worksheet #28-19—Laboratory QC Samples

Matrix: Tissue

Analytical Group: Metals (except mercury)

Analytical Method/SOP Reference: SW-846 6020 / CA-627

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst, Department Manager	Accuracy/Bias, Contamination	Same as Method/SOP QC Acceptance Limits.
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.		Accuracy/Bias, Contamination	
Interference Check Solutions (ICS)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked 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.		Accuracy/Bias	
Laboratory Control Sample	One per preparatory batch.	Refer to **Worksheet #15**. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.		Accuracy/Bias	

SAP Worksheet #28-19—Laboratory QC Samples (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional QC tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.		Accuracy/Bias	
Matrix Spike Duplicate		Same as MS and refer to **Worksheet #15**.	Same as MS		Accuracy/Bias, Precision	
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.		Accuracy	
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.		Accuracy	

SAP Worksheet #28-20—Laboratory QC Samples

Matrix: Tissue
Analytical Group: Metals (mercury)
Analytical Method/SOP Reference: SW-846 7471A / CA-611

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. See Box D-1 of DoD QSM v 4.2.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst, Supervisor	Accuracy/Bias, Contamination	Same as Method/ SOP QC Acceptance Limits.
Laboratory Control Sample		Refer to **Worksheet #15**. Limits are as per DoD QSM v. 4.2.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.		Accuracy/Bias	
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.		Accuracy/Bias, Contamination	
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional QC tests are required to evaluate matrix effects.		Accuracy/Bias	
Matrix Spike Duplicate		Same as MS and %RPD ≤ 20 between MS and MSD.	Same as MS		Accuracy/Bias, Precision	

SAP Worksheet #28-21—Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: Total Metals and Dissolved Metals (Hexavalent Chromium)

Analytical Method/SOP Reference: SW-846 7199 / GEN-7199

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per batch of 20 or fewer samples.	No target compounds detected >1/2 LOQ.	Reclean, reanalyze and/or qualify the data.	Analyst/Supervisor	Bias/ Contamination	Same as QC Acceptance Limits.
LCS		Refer to **Worksheet #15**.	Evaluate, reanalyze batch if possible. If the LCS recoveries are high and the sample results are <QL narrate.		Accuracy/Bias	
MS		Same as LCS and refer to **Worksheet #15**.	If LCS acceptable, may report with qualifier and note outliers in the case narrative.		Accuracy/ Bias	
Duplicate (or MSD)		If parent concentration is >4x the LOQ, RPD<20%; if the parent concentration is <4x the LOQ, duplicate is acceptable if the difference is not > +/- LOQ.	Repeat sample and duplicate unless obvious or historical interferences or lack of volume.		Precision	

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
• Field Notebooks • Chain of custody Records • Air Bills • Custody Seals • CA Forms • Electronic Data Deliverables (EDDs) • Identification of QC Samples • Release of Analytical Data • Meteorological Data from Field • Sampling instrument calibration logs • Sampling locations and sampling plan • Sampling notes • Sample Receipt, CoC, and Tracking Records • Standard Traceability Logs • Equipment Calibration Logs • Sample Prep Logs • Run Logs • Equipment Maintenance, Testing, and Inspection Logs • Reported Field Sample Results • Reported Result for Standards, QC Checks, and QC Samples • Instrument printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples • Sample disposal records • Extraction/Clean-up Records • Raw Data (stored on disk and in hardcopy format) • DV Reports • Method Detection Limit (MDL) Study Information	• Field data deliverables such as logbooks entries, chain of custodies, air bills, EDDs, etc will be kept on CH2M HILL's local internet server. • Field parameter data will be loaded with the analytical data into NIRIS • Analytical laboratory hardcopy deliverables and DV reports will be saved on the network server. • Electronic data from the laboratory will be loaded into NIRIS • Following project completion, hardcopy deliverables such as logbooks, chain of custodies, etc will be archived at Iron Mountain: Iron Mountain Headquarters 745 Atlantic Avenue Boston, MA 02111 (800) 899-IRON • Following project completion, hardcopy deliverables including chain of custodies and raw data will be archived indefinitely at the Washington National Records Center: Washington National Records Center 4205 Suitland Road Suitland, Maryland 20746-8001 301-778-1550

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SAP Worksheet #30—Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory / Organization
Subsurface Sediment	VOCs	Refer to **Worksheet #18-1** And **Worksheet #18-2**	SW-846 8260B	28 calendar days, except for reference samples 7 calendar days for reference samples	ENCO Labs 10775 Central Port Drive Orlando, FL 32824 Marcia Colon - 407-826-5314	TBD
Surface Sediment						
Surface Soil						
Surface Water						
Subsurface Sediment	SVOCs		SW-846 8270C, 8270C-SIM			
Surface Sediment						
Surface Soil						
Surface Water						
Subsurface Sediment	Pesticides		SW-846 8081B			
Surface Sediment						
Surface Soil						
Surface Water						
Subsurface Sediment	PCBs		SW-846 8082A			
Surface Sediment						
Surface Soil						
Surface Water						
Subsurface Sediment	Metals		SW-846 6010C, 7471A		6010 at ENCO-Jacksonville, 7471 at ENCO Orlando	
Surface Sediment						
Surface Soil						
Surface Water			SW-846 6020A, 7470A		ENCO-Orlando	
Subsurface Sediment	Cyanide		SW-846 9014			
Surface Sediment						
Surface Soil						
Surface Water						

SAP Worksheet #30—Analytical Services Table (continued)

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory / Organization
Subsurface Sediment	Explosives		SW-846 8330A		ENCO with GEL Laboratories 2040 Savage Road Charleston, SC 29407 Ann Skradski - 843-556-8171	
Surface Sediment						
Surface Soil						
Surface Water						
Surface Water	Nitroguanidine		Empirical SOP233		ENCO with Empirical Laboratories 621 Mainstream Drive; Suite 270 Nashville, TN 37228 (615) 345-1115	
Surface Sediment						
Subsurface Sediment						
Subsurface Sediment	Wet Chemistry (includes TOC and pH)		Walkley Black, SW-846 9045D		ENCO - Orlando	
Surface Sediment						
Surface Soil						
Surface Water			EPA 130.2			
Surface Soil	Hexavalent Chromium		SW-846 7199		Columbia Analytical Services, Inc 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton - 585-672-7473	
Subsurface Sediment	AVS/SEM		EPA 821_R-91-100			
Surface Sediment						
Subsurface Sediment	Grain-size		ASTM D422		Kemron Environmental Services, Inc. Tommy Jordan - 404-516-3172	
Surface Sediment						
Surface Soil						
Tissue	PCB Congeners		EPA 1668A with limits from 1668C		Katahdin with TestAmerica, Inc. 880 Riverside Parkway West Sacramento, CA 95605 Karen Sellers - 916-373-5600	
	PCBs		SW-846 8082A		Katahdin Analytical Services, Inc. 600 Technology Way Scarborough, ME 04074 Jennifer Obrin - 207-874-2400	
	Metals		SW-846 6020A, 7470A			
	Wet Chemistry (includes percent lipids and percent moisture)		% Lipids and % Moisture by laboratory SOP			

SAP Worksheet #31—Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
Field QA and H&S Audit	Once during field work	Internal	CH2M HILL	FTL CH2M HILL	FTL and Field Staff	Stephanie Sawyer PM CH2M HILL	Brett Doerr AQM CH2M HILL Mark Orman HSO CH2M HILL
Safe Work Observation	Once per week during field work	Internal	CH2M HILL	SSC CH2M HILL	FTL and Field Staff	Mark Orman RHSM CH2M HILL	Mark Orman HSO CH2M HILL
Third Party Laboratory Technical Systems Audit	Laboratories must have current DoD ELAP accreditation which will identify the period of performance.	External	Third party accrediting body	TBD, Third party accrediting body	Lab PM and Lab QAO at respective laboratories	Lab PM and Lab QAO at respective laboratories	Anita Dodson, Navy CLEAN Program Chemist, CH2M HILL

Notes:

Stop Work Order: Any field member can immediately stop work if an unsafe condition which is immediately threatening to human health is observed. Ultimately, the FTL, PM, and AM can stop work for a period of time. NAVFAC Mid-Atlantic can stop work at any time.

DoD ELAP accreditation is required for definitive data only. CAS is generating screening data only; therefore, they are not included in this worksheet.

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SAP Worksheet #31-1—Laboratory Corrective Action Form

Person initiating corrective action (CA) _____ Date_____

Description of problem and when identified:_____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

Sequence of CA: (including date implemented, action planned and personnel/data affected) _____

_____

_____

_____

_____

_____

_____

CA implemented by: _____ Date: _____

CA initially approved by: _____ Date:_____

Follow-up date:_____

Final CA approved by: _____ Date: _____

Information copies to:

Anita Dodson/ Navy CLEAN Program Chemist

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SAP Worksheet #31-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ **Date:** _____

Project Location: _____ **Signature:** _____

Team Members:

Yes No 1) Is the approved work plan being followed?
Comments

Yes No 2) Was a briefing held for project participants?
Comments

Yes No 3) Were additional instructions given to project participants?
Comments

Sample Collection:

Yes No 1) Is there a written list of sampling locations and descriptions?
Comments

Yes No 2) Are samples collected as stated in the Master SOPs?
Comments

Yes No 3) Are samples collected in the type of containers specified in the work plan?
Comments

Yes No 4) Are samples preserved as specified in the work plan?
Comments

Yes No 5) Are the number, frequency, and type of samples collected as specified in the work plan?
Comments

Yes No 6) Are QA checks performed as specified in the work plan?
Comments

Yes No 7) Are photographs taken and documented?
Comments

SAP Worksheet #31-2—Field Performance Audit Checklist (continued)

Document Control:

Yes	No	1)	Have any accountable documents been lost? Comments
Yes	No	2)	Have any accountable documents been voided? Comments
Yes	No	3)	Have any accountable documents been disposed of? Comments
Yes	No	4)	Are the samples identified with sample tags? Comments
Yes	No	5)	Are blank and duplicate samples properly identified? Comments
Yes	No	6)	Are samples listed on a chain-of-custody record? Comments
Yes	No	7)	Is chain-of-custody documented and maintained? Comments

SAP Worksheet #31-3—Safe Work Observation Form

Safe Behavior Observation Form		
Project Number:	Client/Program:	☐CCI ☐INC
Project Name:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/ qualified/ experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

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SAP Worksheet #32—Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Field Performance Audit	Field Performance Audit Checklist	Field Team PM Environmental Manager	Within one day of audit	Verbal and CA Form	FTL CH2M HILL	Within one day of receipt of CA Form
Safe Work Observation (SWO)	Safe Work Observation Form	FTL Field Team PM	Immediately (person involved or observed person). Following day (field team). Within 1 week if worthy of elevation (HSO)	On SWO Form	FTL and individual being observed, and the PM and if elevated to the HSO.	Corrected in the field immediately, and within 1 week if elevated.
Laboratory Performance and Systems Audits	Written Audit Report from Third party accrediting body	Lab QAO at respective laboratories	Within 2 months of audit	Memorandum	Third Party Auditor, TBD	Within 2 months of receipt of initial notification.

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SAP Worksheet #33—QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date	Person Responsible for Report Preparation	Report Recipient(s)
Field Audit Report	One during sampling activities	Submitted with report in which data are analyzed and presented	PM: Stephanie Sawyer/ CH2M HILL	Regional Health, Safety, Environment, and Quality Manager: Mark Orman/M HILL Included in project files.
DV Reports	Once, after analysis by laboratory, for all laboratory analytical data.	Submitted by the DV within 14 calendar-days of notification to begin	PM: Herb Kelly/CH2M HILL	PC: Clairette Campbell/M HILL PDM: Hillary Ott/M HILL PM: Stephanie Sawyer/M HILL
Data Usability Assessments (Data Quality Evaluation)	Once, as an appendix to the report in which data are analyzed and presented.	Along with the Site Inspection report.	PC: Clairette Campbell/ CH2M HILL	Stakeholders, **Worksheet #4**
Remedial Investigation Report	Post- Field Event	Fall 2012	Doug Bitterman/ CH2M HILL	Stakeholders, **Worksheet #4**

The Site Inspection Report will address the following:

- Summary of project QA/QC requirements/procedures
- Conformance of project to UFP-SAP requirements/procedures
- Status of project schedule
- Deviations from the UFP-SAP and approved amendments that were made
- Results of data review activities (how much usable data was generated)
- CAs if needed and their effectiveness
- Data usability with regards to: precision, accuracy, representativeness, completeness, comparability, and sensitivity
- Limitations on data use

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SAP Worksheets #34-36—Data Verification and Validation (Steps I and IIa/IIb) Process Table

Data Review Input	Description	Responsible for Verification	Internal/ External[2]
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	Field Team Leader / CH2M HILL	Internal
Chains of Custody and Shipping Forms	Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody will be initialed by the reviewer, a copy of the chains-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment. Chains-of-custody will also be reviewed for adherence to the SAP by the project chemist.	Field Team Leader / CH2M HILL Project Chemist / CH2M HILL PDM / CH2M HILL	Internal & External
Sample Condition upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the PDM in the form of laboratory logins.	PDM / CH2M HILL	External
Documentation of Laboratory Method Deviations	Laboratory Method Deviations will be discussed and approved by the project chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Project Chemist / CH2M HILL	External
Electronic Data Deliverables	Electronic Data Deliverables will be compared against hardcopy laboratory results (10% check).	PDM / CH2M HILL	External
Case Narrative	Case narratives will be reviewed by the Data Validator during the DV process. This is verification that they were generated and applicable to the data packages.	Data Validator / CH2M HILL	External
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Respective Laboratory QAO	Internal
Laboratory Data	The data will be verified for completeness by the PDM.	PDM / CH2M HILL	External
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and CA forms will be reviewed internally to ensure that all appropriate CAs have been taken and that CA reports are attached. If CAs have not been taken, the Site Manager will be notified to ensure action is taken.	PM / CH2M HILL PC / CH2M HILL	Internal
CA Reports	CA reports will be reviewed by the PC or PM and placed into the project file for archival at project closeout.	PM / CH2M HILL Project Chemist / CH2M HILL	External
Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Project Chemist / CH2M HILL	External
Target Compound List and Target Analyte List	Ensure the laboratory reported all analytes from each analysis group.	Project Chemist / CH2M HILL	External

SAP Worksheets #34-36—Data Verification and Validation (Steps I and IIa/IIb) Process Table (continued)

Data Review Input	Description	Responsible for Verification	Internal/ External[2]
Reporting Limits	Ensure the laboratory met the project-designated quantitation limits. If quantitation limits were not met, the reason will be determined and documented.	Project Chemist / CH2M HILL	External
Field SOPs	Ensure that all field SOPs were followed.	Field Team Leader /CH2M HILL	Internal
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Respective Laboratory QAO	Internal
Raw Data	10 percent review of raw data to confirm laboratory calculations.	Data Validator / CH2M HILL	External
Onsite Screening	All non-analytical field data will be reviewed against SAP requirements for completeness and accuracy based on the field calibration records.	Field Team Leader / CH2M HILL	Internal
Documentation of Method QC Results	Establish that all required QC samples were run.	Data Validator / CH2M HILL	External
Documentation of Field QC Sample Results	Establish that all required QC samples were run.	Project Chemist / CH2M HILL	Internal
DoD ELAP Evaluation	Ensure that each laboratory is DoD ELAP Certified for the analyses they are to perform. Ensure evaluation timeframe does not expire.	Project Chemist / CH2M HILL	External
Analytical data for VOCs, SVOCs, Pesticides, PCBs, PCB Congeners, Metals (total and dissolved), Cyanide, Explosives in all matrixes analyzed, e.g. surface sediment, subsurface sediment, surface soil, and/or surface water, as well all reference surface water or sediment samples.	Analytical methods and laboratory SOPs as presented in this SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers used are those presented in *Region III Modifications to the National Functional Guidelines for Organic Data Review* (EPA, September 1994) and in *Region III Modifications to the Laboratory Data Validation Guidelines for Inorganic Data Review* (EPA, April 1993). National Functional Guidelines will not be used for DV; however, the specific qualifiers listed therein may be applied to data should non-conformances against the QA/QC criteria as presented in this SAP be identified.	Data Validator / CH2M HILL	External
Analytical data for wet chemistry, AVS/SEM or grain-size in all matrixes analyzed, e.g. surface sediment, subsurface sediment, surface soil, and/or surface water.	Wet chemistry, AVS/SEM, and grain-size analytical data will not undergo third-party DV, but are subject to all other data review protocols detailed above.	NA	NA

Notes:
[1] Verification (Step I) is a completeness check that is performed before the data review process continues in order to determine whether the required information (complete data package) is available for further review. Validation (Step IIa) is a review to confirm that the data generated is in compliance with analytical methods, procedures, and contracts. Validation (Step IIb) is a comparison of generated data against measurement performance criteria in the SAP (both sampling and analytical).
[2] Internal or external is in relation to the data generator.

SAP Worksheet #37—Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

- During verification and validation steps, data may be qualified as estimated with the following qualifiers: J, UJ, K, L, or UL. These qualifiers represent minor QC deficiencies which will not affect the usability of the data. When major QC deficiencies are encountered, data will be qualified with an R and in most cases is not considered usable for project decisions. If R-qualified data are used in evaluations and, ultimately, project decisions, the rationale for their use will be included in the RI Report.
- For statistical comparisons non-detect values will be represented by a concentration equal to one-half the sample reporting limit. For duplicate sample results, the most conservative value will be used for project decisions.
- J - Analyte present. Reported value may or may not be accurate or precise
- UJ - Analyte not detected. Quantitation limit (QL) may be inaccurate or imprecise
- K - Analyte present. Reported value may be biased high. Actual value is expected to be lower
- L - Analyte present. Reported value may be biased low. Actual value is expected to be higher
- UL - Analyte not detected. QL is probably higher.
- R - Rejected result. Result not reliable.
- Additional qualifiers that may be given by the DV are:
- B - Not detected substantially above the level reported in laboratory or field blanks (less than 5 times the concentration in the blanks).
- E - Interferences present which may cause the results to be biased high
- N - Tentative Identification. Consider Present. Special methods may be needed to confirm its presence or absence in future sampling efforts
- NJ - Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity
- U - Not Detected
- Analytical data will be checked to ensure the values and any qualifiers are appropriately transferred to the electronic database. These checks include comparison of hardcopy data and qualifiers to the electronic data deliverable. Once the data has been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be compared as RPD between the two results.
- Deviations from the SAP will be reviewed to assess whether CA is warranted and to assess impacts to achievement of project objectives.

Describe the evaluative procedures used to assess overall measurement error associated with the project.

- To assess whether a sufficient quantity of acceptable data are available for decision-making, the data will be reconciled with Measurement Performance Criteria following validation and review of DQIs.
- If significant biases are detected with laboratory QA/QC samples it will be evaluated to assess impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present at the site.

SAP Worksheet #37—Usability Assessment (continued)

- If significant deviations are noted between laboratory and field precision the cause will be further evaluated to assess impact on decision making.

Describe the documentation that will be generated during the usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

- Data tables will be produced to reflect detected and non-detected analytes. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.

Identify the personnel responsible for performing the usability assessment.

- The PM, PC, and other team members will be responsible for compiling the data. The data will then be presented to the Partnering Team who, as a whole, will evaluate the data usability according to project objectives.

References

Baker Environmental, Inc. (Baker). 2001. *Pond Study Report, Naval Weapons Station Yorktown, Cheatham Annex, Williamsburg, Virginia.* August.

Baker. 2005. *Final Master Project Plans Naval Weapons Station Yorktown, Yorktown, Virginia and Cheatham Annex, Williamsburg, Virginia.* June.

United States Environmental Protection Agency (USEPA). 1994. *Region III Modification to National Functional Guidelines for Organic Data Review, MultiMedia, Multi Concentration.* September.

USEPA. 1998. *Aerial Photographic Analysis USN Supply Center – Cheatham Annex, Williamsburg, Virginia.* May.

USEPA. 2002. *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS*. December.

USEPA. 2004. *Uniform Federal Policy for Quality Assurance Project Plans.* July.

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Tables

TABLE 1

Historical Surface Sediment Exceedance Results

Youth Pond UFP-SAP

Cheatham Annex

Williamsburg, Virginia

Sample ID Sample Date	Region III Criteria - Residential Soil RBC Value (2000)	Freshwater Sediment ESVs (2000)	Freshwater Sediment ESVs (2012)	RSLs Residential Soil X 10 for Sediment Adjusted (Nov 2011)	00-POND-SD08 03/28/00	00-POND-SD09 03/28/00
Chemical Name						
Volatiles (ug/kg)						
2-Butanone (MEK)	4,692,851	--	1331	28,000,000	**100**	**140**
Acetone	782,143	--	--	61,000,000	**280**	**380**
Toluene	1,564.29	--		820,000	61 U	**8.5 J**
Semivolatiles (ug/kg)						
Fluoranthene	312,857	600	423	2,300,000	20000 U	**1100 J**
Pesticides / PCBs (ug/kg)						
4,4'-DDE	1,879	2.2	3.16	14,000	20.833 U	**50 K**
Chlordane, Alpha-	1,825	7	3.24	16,000	10.417 U	**11 K**
Dieldrin	39.9	2	1.9	300	**25 K**	**86 K**
Endosulfan sulfate	46,929	--	26.6	370,000	20.833 U	**50 K**
Endrin	2,346	3	2.22	18,000	**25 K**	**54 K**
Endrin ketone	2,346	3	2.22	18,000	**52 K**	**100 K**
Heptachlor epoxide	70.2	5	2.47	530	10.417 U	**14 K**
Aroclor-1260	319.4	22.7	59.8	2,200	**1900 K**	**6400 L**
Herbicides (mg/kg)						
No Detections						
Explosives (mg/kg)						
1,3,5-Trinitrobenzene	234.6	--	--	2,200,000	**0.093 J**	0.25 U
2,4,6-Trinitrotoluene	21.3	--	--	36,000	**0.079 J**	0.25 U
Inorganics (mg/kg)						
Aluminum	7,821	25,500	25,500	77,000,000	**11600**	**10700**
Arsenic	0.4	8.2	9.79	3,900	**27.2**	**56.2**
Barium	547.5	500	20	15,000,000	**68.6**	**65**
Beryllium	15.6	--	--	160,000	**1.5**	**1.3**
Cadmium	3.9	1.2	0.99	70,000	**6**	**3.8**
Calcium	--	--	--	--	**7540**	**23100**
Chromium	24	81	43.4	2,900	**35.4**	**33.3**
Cobalt	469.3	50	50	23,000	**8.6**	**7.6**
Copper	312.9	34	31.6	3,100,000	**163**	**68.2**
Iron	2,346	188400	20,000	55,000,000	**28800**	**34800**
Lead	400	46.7	35.8	4,000,000	**65.5**	**103**
Magnesium	--	--	--	--	**2330**	**1340**
Manganese	156.4	460	460	1,800,000	**202**	**236**
Mercury	2.3	0.15	0.18	23,000	**0.13**	**0.2**
Nickel	156.4	20.9	22.7	1,500,000	**11.9**	12 U
Potassium	--	--	--	--	**1580**	**1360**
Sodium	--	--	--	--	**164**	**100**
Vanadium	54.8	57	57	390,000	**39**	**46.1**
Zinc	2,346	150	121	23,000,000	**521**	**537**
Inorganics - AVS/SEM (umole/g)						
Cadmium	--	--	--	--	**0.07**	**0.03**
Copper	--	--	--	--	**2.74**	**0.85**
Lead	--	--	--	--	**0.36**	**0.4**
Mercury	--	--	--	--	**0**	**0**
Nickel	--	--	--	--	**0.19**	**0.12**
Zinc	--	--	--	--	**8.51**	**6.85**
Total SEM	--	--	--	--	**11.9**	**8.3**

TABLE 1

Historical Surface Sediment Exceedance Results

Youth Pond UFP-SAP

Cheatham Annex

Williamsburg, Virginia

Sample ID **Sample Date**	**Region III Criteria - Residential Soil RBC Value (2000)**	**Freshwater Sediment ESVs (2000)**	**Freshwater Sediment ESVs (2012)**	**RSLs Residential Soil X 10 for Sediment Adjusted (Nov 2011)**	**00-POND-SD08** **03/28/00**	**00-POND-SD09** **03/28/00**
Chemical Name						
Acid Volatile Sulfide	--	--	--	--	**56**	**35**
Wet Chemistry						
Percent Moisture (%)	--	--	--	--	**85**	**86.7**
pH	--	--	--	--	**6.8**	**7.2**
Solids-Total Residue (wt %)	--	--	--	--	**16**	**18**
Total Organic Carbon (mg/kg)	--	--	--	--	**33300**	**32900**

Exceeds Region III Criteria - Residential Soil RBC Value (2000)

Exceeds Freshwater Sediment ESVs (2000)

Exceeds Region III Criteria - Residential Soil RBC Value (2000) and Freshwater Sediment ESVs (2000)

Exceeds Freshwater Sediment ESVs (2012)

Exceeds RSLs Residential Soil X 10 for Sediment Adjusted (Nov 2011)

Bold text indicates detection

RBCs and ESVs are taken from USEPA, April 2000

B - Analyte not detected above the level reported in blanks

J - Analyte present. Value may or may not be accurate or precise

K - Analyte present. Value may be biased high. Value may be lower

L - Analyte present. Value may be biased low. Value may be higher

NA - Not applicable

U - The material was analyzed for, but not detected

UJ - The material was analyzed for, but not detected. The quantitation limit is estimated

mg/kg - milligrams per kilogram

ug/kg - micrograms per kilogram

umole/g - micromoles per gram

TABLE 2

Historical Surface Water Exceedance Results

Youth Pond UFP-SAP

Cheatham Annex

Williamsburg, Virginia

Sample ID Sample Date	Region III Tap Water X 10 RBC Value (2000)	Freshwater Screening ESV Value (2000)	Freshwater Screening ESV Value (2012)	RSLs Tap X 10 for Surface Water Adjusted (Nov 2011)	00-POND-SW08 03/28/00	00-POND-SW09 03/28/00
Chemical Name						
Volatiles (ug/L)						
No Detections						
Semivolatiles (ug/L)						
No Detections						
Pesticides/PCBs (ug/L)						
No Detections						
Explosives (ug/L)						
2-Amino-4,6-dinitrotoluene	2.2	--	19	30	**0.091 J**	0.2 U
4-Amino-2,6-dinitrotoluene	2.2	--	19	30	**0.19 J**	**0.091 J**
Total Inorganics (ug/L)						
Aluminum	36,500	87	87	16000	**126**	**52.5**
Barium	2,555	1000	4	2900	**12.1**	**11.9**
Calcium	--	--	--	--	**44400**	**44900**
Iron	10,950	320	1000	11000	**364**	**297**
Magnesium	--	--	--	--	**1350**	**1370**
Manganese	730	120	120	320	**27.2**	**30.4**
Potassium	--	--	--	--	**1400**	**1220**
Sodium	--	--	--	--	**3690**	**3920**
Thallium	2.6	40	12	0.16	**4.2**	3.28 U
Zinc	10,950	134	120	4700	**9.4**	**11.8**
Filtered Inorganics (ug/L)						
Aluminum	36,500	NA	87	16000	**23.8**	16.44 U
Antimony	14.6	NA	30	2900	**4.1**	**2.9**
Barium	2,555	NA	4	--	**13.9**	**10**
Calcium	--	NA	--	11000	**45800**	**42800**
Iron	10,950	NA	1000	--	**29.9**	**33.8**
Magnesium	--	NA	--	320	**1290**	**1310**
Manganese	730	NA	120	--	**27.7**	**14.9**
Potassium	--	NA	--	--	**1320**	**1360**
Sodium	--	NA	--	0.16	**3670**	**3670**
Zinc	10,950	NA	118	4700	**7.9**	**5.8**
WCHEM (ug/L)						
Hardness	--	--	--	--	**116000**	**118000**

Notes:

Exceeds Region III Tap Water X 10 RBC Value (2000)

Exceeds Freshwater Screening ESV Value (2000)

Exceeds Freshwater Screening ESV Value (2012)

Exceeds RSLs Tap X 10 for Surface Water Adjusted (Nov 2011)

Bold text indicates detection

RBCs and ESVs are taken from USEPA, April 2000

Freshwater Screening ESV Values are not applicable to filtered inorganics

J - Analyte present. Value may or may not be accurate or precise

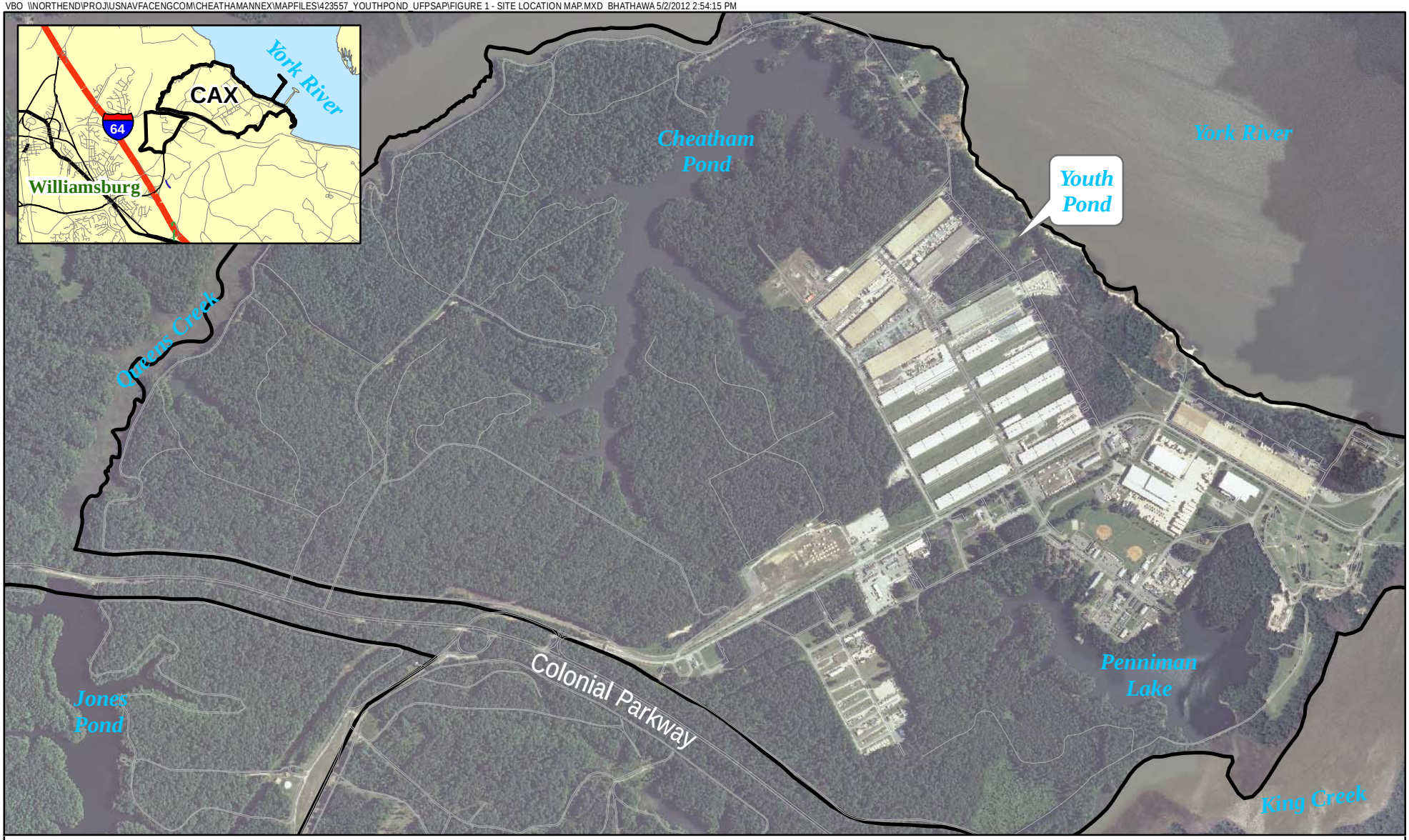
NA - Not Applicable

U - The material was analyzed for, but not detected

ug/L - Micrograms per liter

Figures

VBO \\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\423557_YOUTHPOND_UFPSAP\FIGURE 1 - SITE LOCATION MAP.MXD BHATHAWA 5/2/2012 2:54:15 PM



Legend

Cheatham Annex Boundary

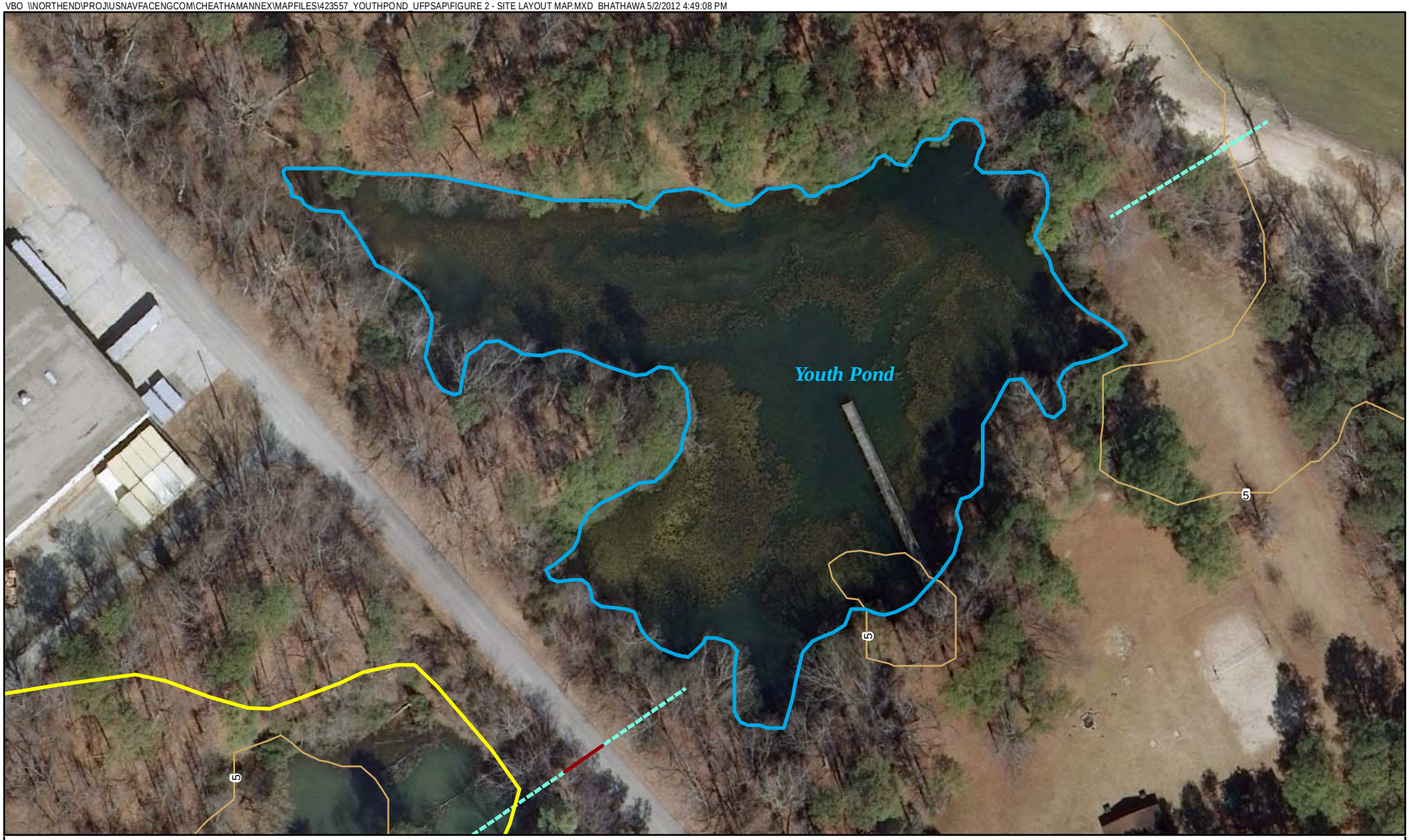
N
W E
S

0 750 1,500
Feet

Figure 1
Site Location Map
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

VBO \\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\423557_YOUTHPOND_UFPSAP\FIGURE 2 - SITE LAYOUT MAP.MXD BHATHAWA 5/2/2012 4:49:08 PM



Legend

- Culvert
- Storm Water Line
- Site Boundary 4
- Youth Pond

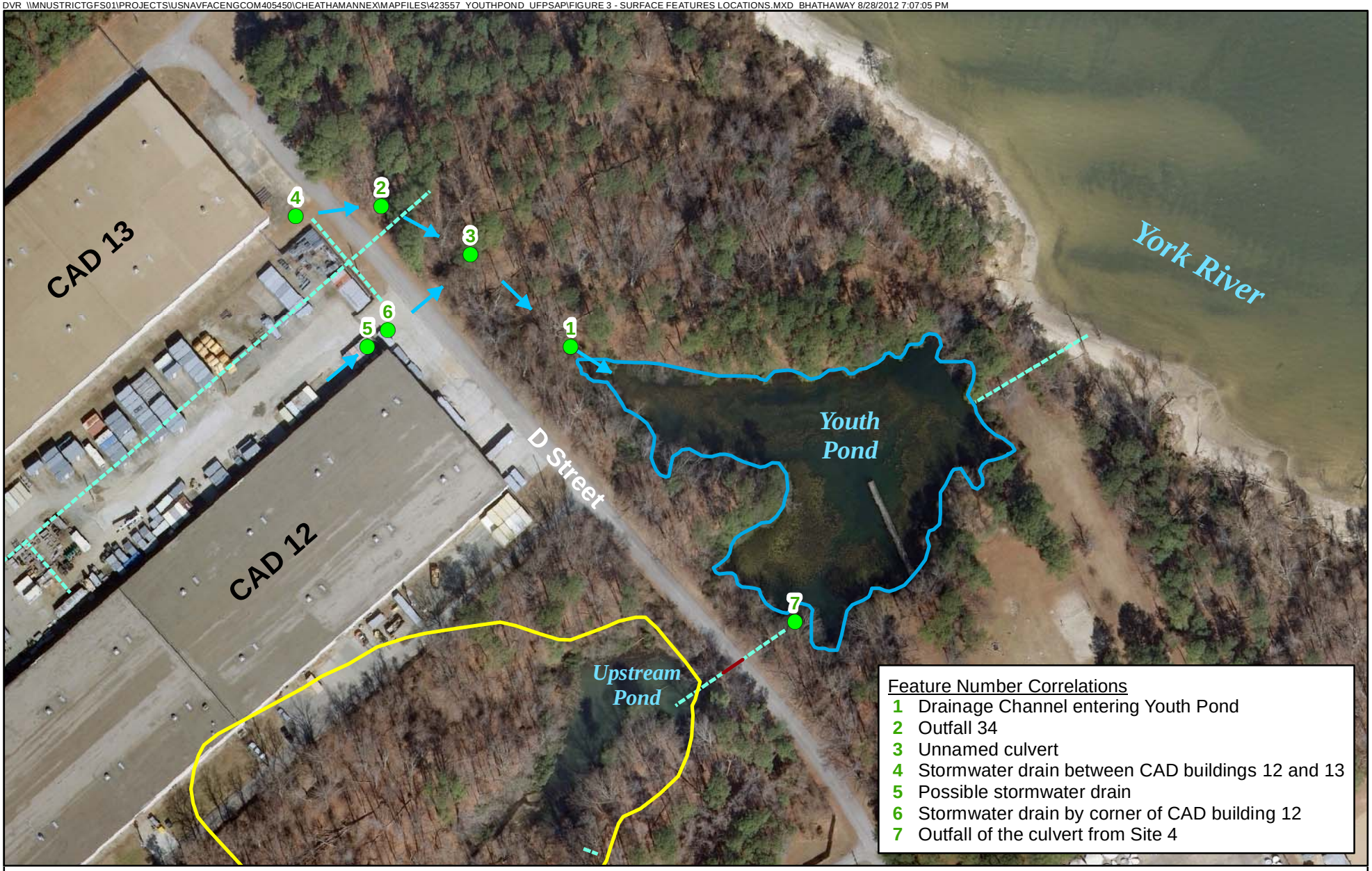
N
W E
S

0 40 80
Feet

Figure 2
Site Layout Map
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHEATHAMANNEX\MAPFILES\423557_YOUTHPOND_UFPSAP\FIGURE 3 - SURFACE FEATURES LOCATIONS.MXD BHATHAWAY 8/28/2012 7:07:05 PM



Legend

- Surface Feature Location
- Surface Runoff Flow Direction
- Youth Pond Study Area Boundary
- Site 4 Boundary
- Culvert
- Storm Water Line

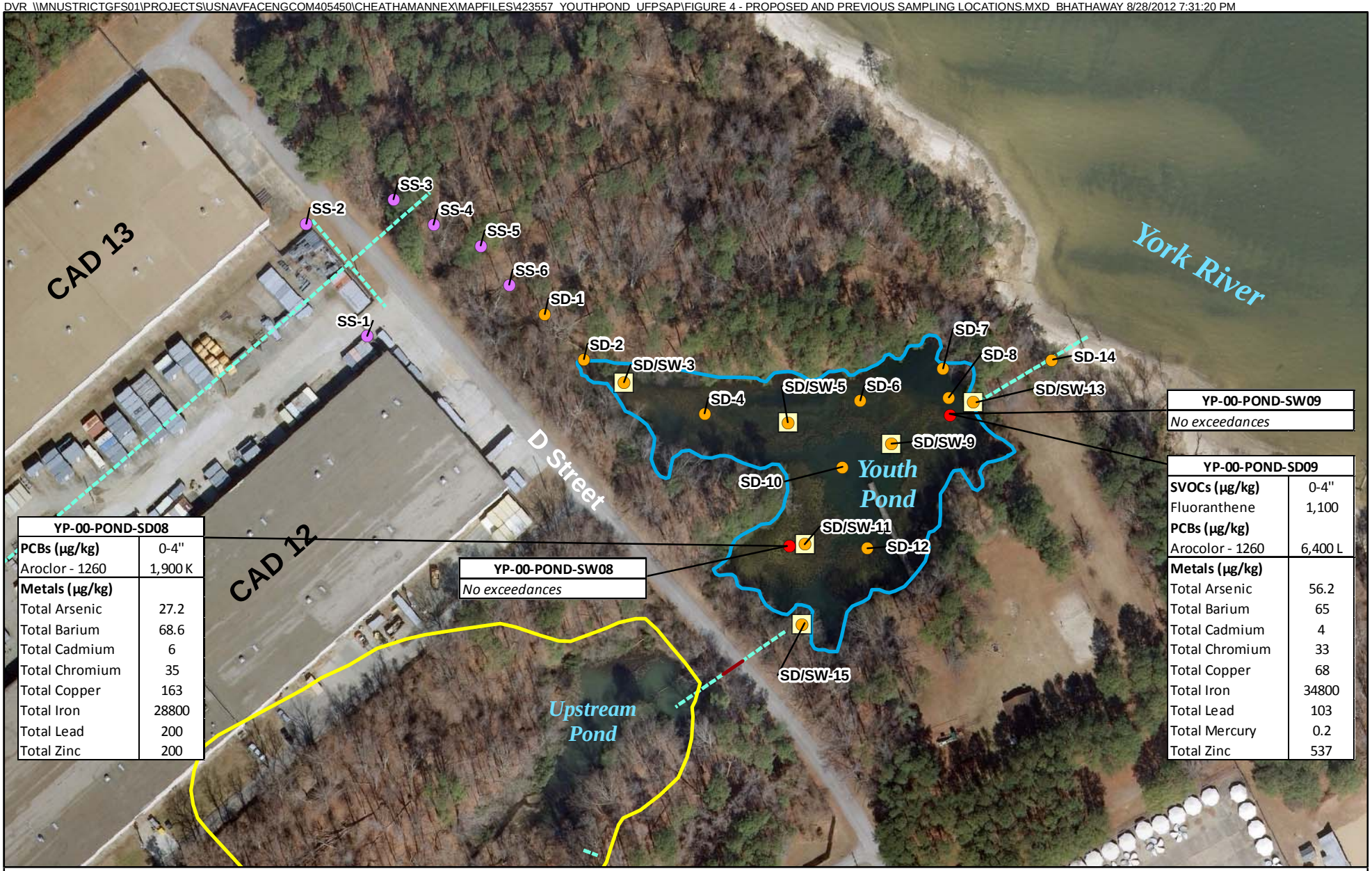
N
W E
S

0 75 150
Feet

Figure 3
Surface Features Locations
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHEATHAMANNEX\MAPFILES\423557_YOUTHPOND_UFPSAP\FIGURE 4 - PROPOSED AND PREVIOUS SAMPLING LOCATIONS.MXD BHATHAWAY 8/28/2012 7:31:20 PM



YP-00-POND-SD08	
PCBs (µg/kg)	0-4"
Aroclor - 1260	1,900 K
Metals (µg/kg)	
Total Arsenic	27.2
Total Barium	68.6
Total Cadmium	6
Total Chromium	35
Total Copper	163
Total Iron	28800
Total Lead	200
Total Zinc	200

YP-00-POND-SW08
No exceedances

YP-00-POND-SW09
No exceedances

YP-00-POND-SD09	
SVOCs (µg/kg)	0-4"
Fluoranthene	1,100
PCBs (µg/kg)	
Arocolor - 1260	6,400 L
Metals (µg/kg)	
Total Arsenic	56.2
Total Barium	65
Total Cadmium	4
Total Chromium	33
Total Copper	68
Total Iron	34800
Total Lead	103
Total Mercury	0.2
Total Zinc	537

Legend

- Proposed Sediment Sample Location
- Proposed Sediment/Surface Water Sample Location
- Proposed Surface Soil Sample Location
- Previous Sample Locations
- Culvert
- Storm Water Line
- Site 4 Boundary
- Youth Pond Study Area Boundary

N W E S

0 75 150 Feet

Figure 4
Proposed and Previous Sampling Locations
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

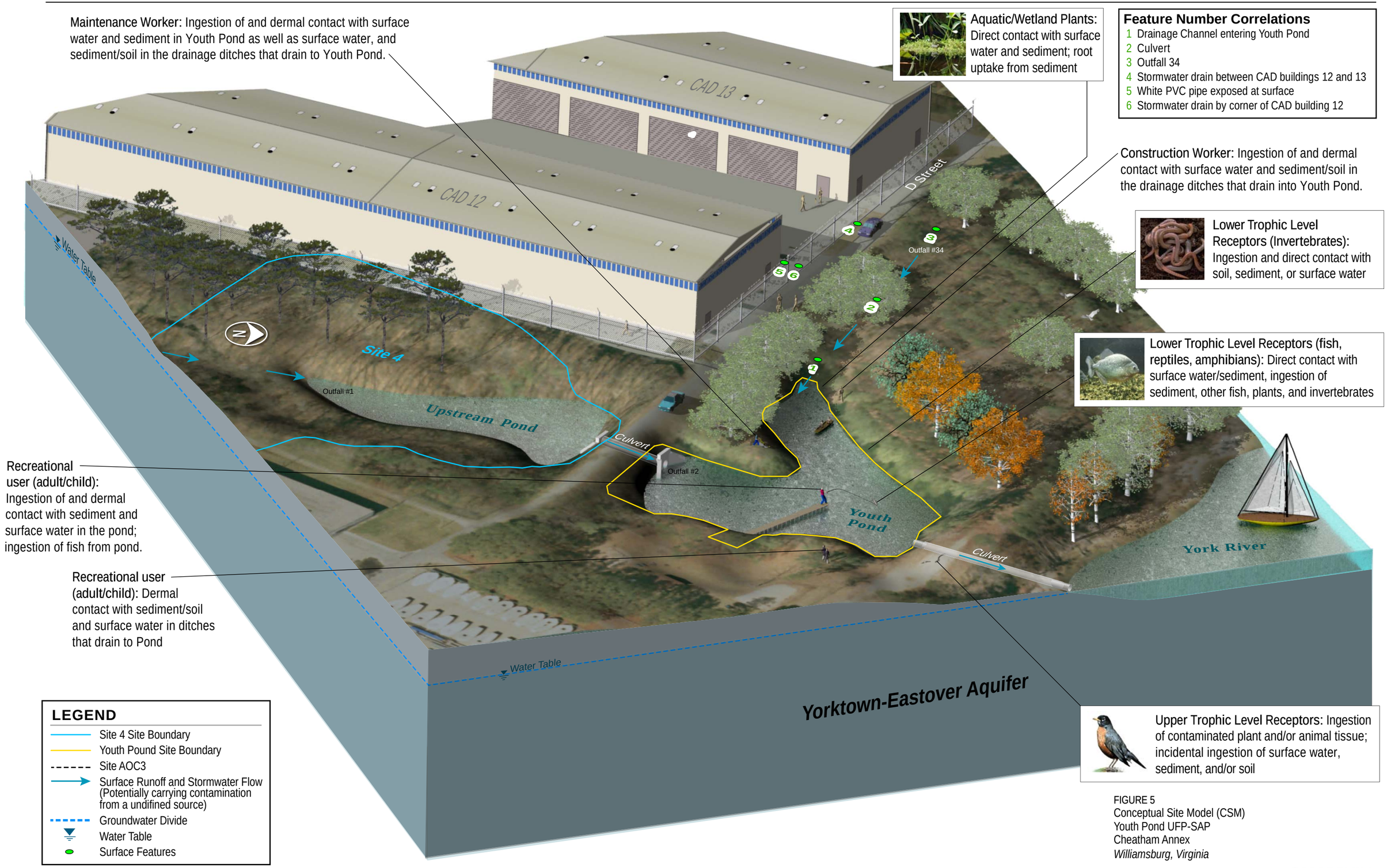


FIGURE 5
Conceptual Site Model (CSM)
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

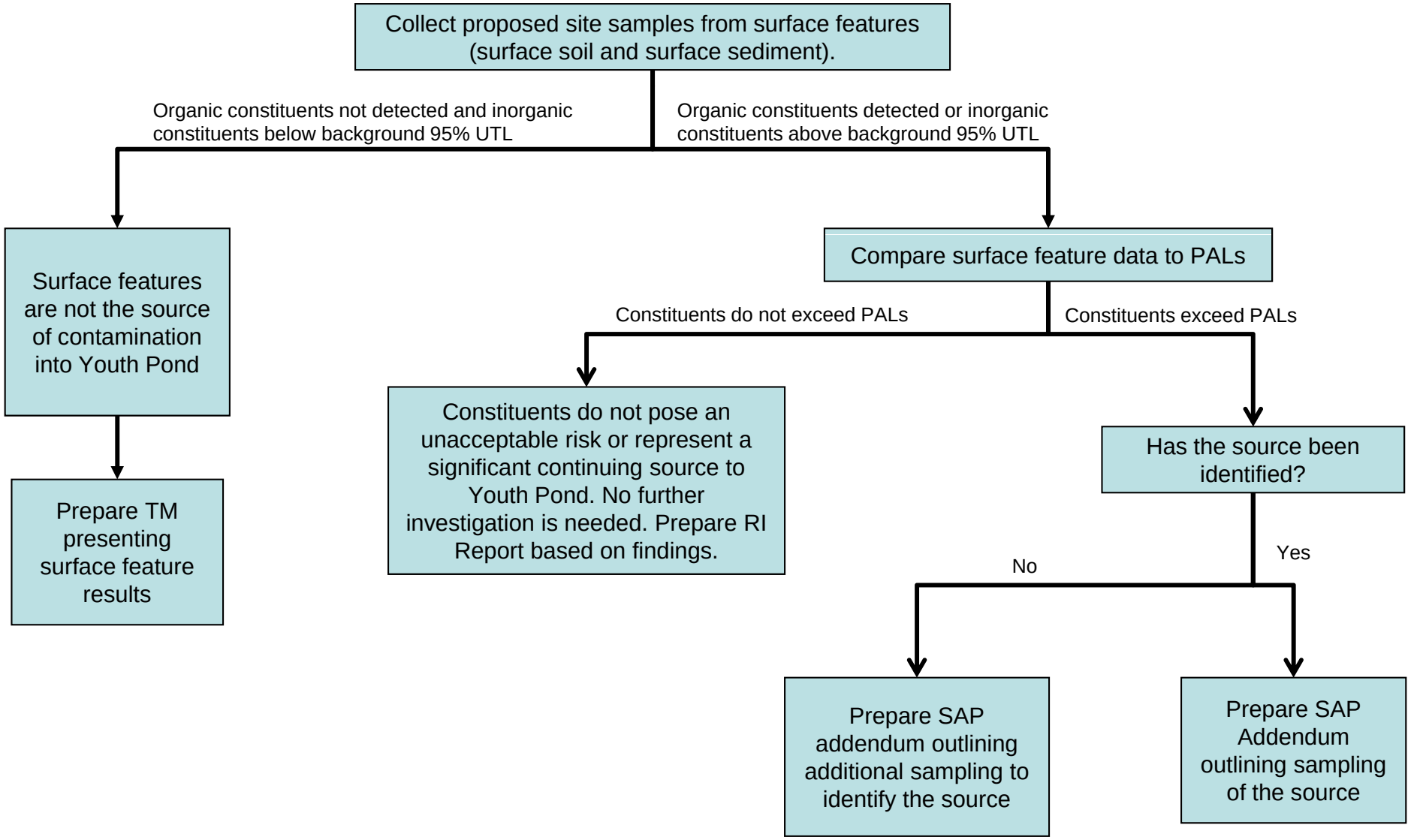


Figure 6
Surface Features Decision Tree
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

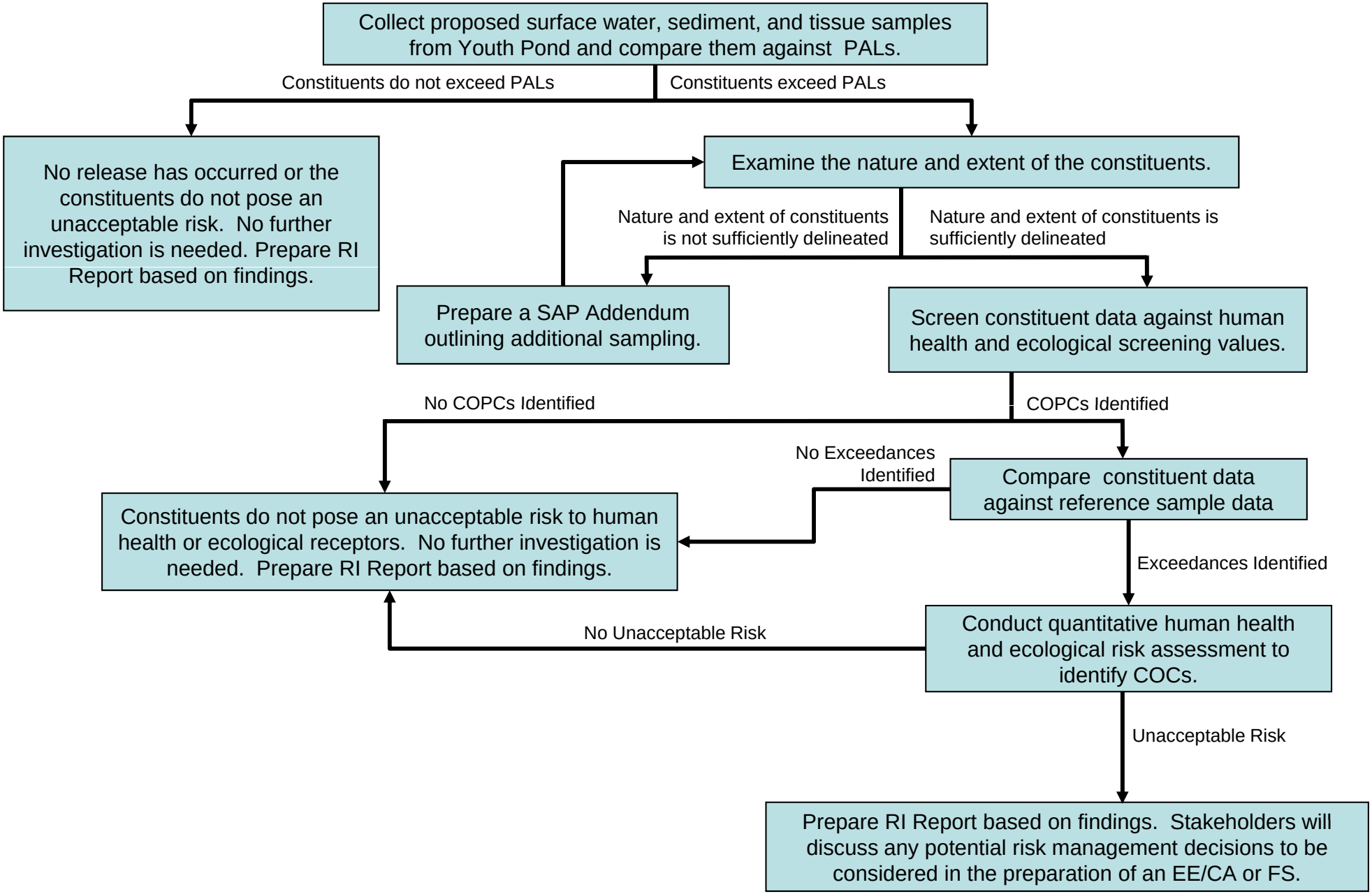


Figure 7
Sediment and Surface Water Decision Tree
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

Appendix A
Field Standard Operating Procedures

STANDARD OPERATING PROCEDURE

Equipment Blank and Field Blank Preparation

I. Purpose

To prepare blanks to determine whether decontamination procedures are adequate and whether any cross-contamination is occurring during sampling due to contaminated air and dust.

II. Scope

The general protocols for preparing the blanks are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II or lab grade water)
- Millipore™ deionized water
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment.*

B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook as well as the type and lot number of the water used.

For non-volatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.

D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.

E. Document and ship samples in accordance with the procedures for other samples.

F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II or lab grade water.

STANDARD OPERATING PROCEDURE

Chain-of-Custody

I Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under the CLEAN Program.

II Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

III Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sample Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

V Procedures

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

V.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When *in situ* measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,
- Sample location or sampling station number,
- Date and time of sample collection and/or measurement,

- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

Samples, other than for *in situ* measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project - CTO Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 01/21/08).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site). The field team should always follow the sample ID system prepared by the project EIS and reviewed by the Project Manager.

V.2 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.

- A Chain-of-Custody Record will be prepared for each individual cooler shipped and will include ***only*** the samples contained within that particular cooler. The Chain-of-Custody Record for that cooler will then be sealed in a zip-log bag and placed in the cooler prior to sealing. This ensures that the laboratory properly attributes trip blanks with the correct cooler and allows for easier tracking should a cooler become lost during transit.

- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample/ location number should be included.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. **A Chain-of-Custody Record Form must be completed for each cooler and should include only the samples contained within that cooler**. A Chain-of-Custody Record Form example is shown in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (CTO number, samplers, and project name).

- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).

- Sign, date, and enter the time under "Relinquished by" entry.

- Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).

- If a carrier is used, enter the airbill number under "Remarks," in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.

- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.

- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.

- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

VI Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

VII Attachments

A. Sample Label
B. Chain of Custody Form
C. Custody Seal

VIII References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

Attachment A

Example Sample Label

Quality Analytical Laboratories, Inc.
2567 Fairlane Drive
Montgomery, Alabama 36116
PH. (334)271-2440

Client _____
Sample No. _____
Location _____
_____
Analysis _____
_____
Preservative HCL
Date _____ By _____

CEIMIC
CORPORATION
10 Dean Knauss Drive, Narragansett, R.I. 02882 • (401) 782-8900

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

SAMPLE TYPE

☐ Grab ☐ Composite ☐ Other _____

COLLECTED BY:

Attachment B

Example Chain-of-Custody Record

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐

Purchase Order #:

Project Name:

Company Name CH2M HILL Office:

Project Manager & Phone #:
Mr. [ ]
Ms. [ ]
Dr. [ ]

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

Sampling Date	Sampling Time	Type: COMP	Type: GRAB	Matrix: WATER	Matrix: SOIL	Matrix: AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	LAB TEST CODES	ANALYSES REQUESTED	REMARKS	LAB 1 ID	LAB 2 ID

SHADED AREA– FOR LAB USE ONLY

Lab 1 #	Lab 2 #
Quote #	Kit Request #
Project #	
No. of Samples	Page of
Login	LIMS Ver

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other ____ Shipping #
Work Authorized By (Please sign and print name)	Remarks	

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

Attachment C

Example Custody Seal

CH2M HILL

CUSTODY SEAL

Date

Signature

STANDARD OPERATING PROCEDURE

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® (or Alconox®) and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- Large plastic pails or tubs for Liquinox® and water, scrub brushes, squirt bottles for Liquinox® solution, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Personal Protective Equipment as specified by the Health and Safety Plan
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in Liquinox® solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox® solution, remove, and discard into DOT-approved 55-gallon drum.

2. Wash outer gloves in Liquinox® solution, rinse, remove, and discard into DOT-approved 55-gallon drum.

3. Remove disposable coveralls ("Tyveks") and discard into DOT-approved 55-gallon drum.

4. Remove respirator (if worn).

5. Remove inner gloves and discard.

6. At the end of the work day, shower entire body, including hair, either at the work site or at home.

7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.

2. Spread plastic on the ground to keep equipment from touching the ground

3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.

4. Turn pump back on and pump 1 gallon of Liquinox® solution through the sampling pump.

5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).

6. Rinse with 1 gallon of tap water.

7. Rinse with 1 gallon of deionized water.

8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.

9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.

10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in either DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

C. SAMPLING EQUIPMENT DECONTAMINATION—OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution.
5. Rinse with potable water.
6. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
7. Air dry.
8. Rinse with deionized water.
9. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
10. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
11. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox® solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with Liquinox® solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.

2. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Facility

2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox®, methanol, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

STANDARD OPERATING PROCEDURE

Decontamination of Drilling Rigs and Equipment

I. Purpose and Scope

The purpose of this guideline is to provide methods for the decontamination of drilling rigs, downhole drilling tools, and water-level measurement equipment. Personnel decontamination procedures are not addressed in this SOP; refer to the site safety plan and SOP *Decontamination of Personnel and Equipment*. Sample bottles will not be field decontaminated; instead they will be purchased with certification of laboratory sterilization.

II. Equipment and Materials

- Portable steam cleaner and related equipment
- Potable water
- Phosphate-free detergent such as Liquinox®
- Buckets
- Brushes
- Methanol, pesticide grade
- Personal Protective Equipment as specified by the Health and Safety Plan
- ASTM–Type II grade water or Lab Grade DI Water
- Aluminum foil

III. Procedures and Guidelines

A. Drilling Rigs and Monitoring Well Materials

Before the onset of drilling, after each borehole, before drilling through permanent isolation casing, and before leaving the site, heavy equipment and machinery will be decontaminated by steam cleaning at a designated area. The steam-cleaning area will be designed to contain decontamination wastes and waste waters and can be an HDPE-lined, bermed pad. A pumping system will be used to convey decontaminated water from the pad to drums.

Surface casings may be steam cleaned in the field if they are exposed to contamination at the site prior to use.

B. Downhole Drilling Tools

Downhole tools will be steam cleaned before the onset of drilling, prior to drilling through permanent isolation casing, between boreholes, and prior to leaving the site. This will include, but is not limited to, rods, split spoons or similar samplers, coring equipment, augers, and casing.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for physical characterization, the sampler shall be cleaned by scrubbing with a detergent solution followed by a potable water rinse.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for chemical analysis, the sampler shall be decontaminated following the procedures outlined in the following subsection.

C. Field Analytical Equipment

1. Water Level Indicators

   Water level indicators that consist of a probe that comes into contact with the groundwater must be decontaminated using the following steps:

   a. Rinse with tap water
   b. Rinse with de-ionized water
   c. Solvent rinse with methanol
   d. Rinse with de-ionized water

2. Probes

   Probes, for example, pH or specific ion electrodes, geophysical probes, or thermometers that would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise. For probes that make no direct contact, for example, OVM equipment, the probe will be wiped with clean paper-towels or cloth wetted with methanol.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- The effectiveness of field cleaning procedures may be monitored by rinsing decontaminated equipment with organic-free water and submitting the rinse water in standard sample containers for analysis.

STANDARD OPERATING PROCEDURE

Disposal of Waste Fluids and Solids

I. Purpose and Scope

This SOP describes the procedures used to dispose of hazardous fluid and solid materials generated as a result of the site operations. This SOP does not provide guidance on the details of Department of Transportation regulations pertaining to the transport of hazardous wastes; the appropriate Code of Federal Regulations (49 CFR 171 through 177) should be referenced. Also, the site investigation-derived waste management plan should be consulted for additional information and should take precedence over this SOP.

II. Equipment and Materials

A. Fluids

- DOT-approved 55-gallon steel drums or Baker® Tanks
- Tools for securing drum lids
- Funnel for transferring liquid into drum
- Labels
- Paint Pens
- Marking pen for appropriate labels
- Seals for 55-gallon steel drums

B. Solids

- DOT-approved 55-gallon steel drums or rolloffs
- Tools for securing drum lids
- Paint Pens
- Plastic sheets
- Labels
- Marking pen for appropriate labels

III. Procedures and Guidelines

A. Methodology

Clean, empty drums or rolloffs or Baker® Tanks will be brought to the site by the drilling subcontractor for soil and groundwater collection and storage. The empty drums will be located at the field staging area and moved to drilling locations as required. The drums will be filled with the drilling and well installation wastes, capped, sealed, and moved to the onsite drum storage area by the drilling subcontractor. The full drums will separate types of wastes by media. The drums will

be labeled as they are filled in the field and labels indicating that the contents are pending analysis affixed.

The drum contents will be sampled to determine the disposal requirements of the drilling wastes. The drum sampling will be accomplished through the collection and submittal of composite samples, one sample per 10 drums containing the same media. Similar compositing will be performed in each rolloff to obtain a representative sample. The compositing of the sample will be accomplished by collecting a specific volume of the material in each drum into a large sample container. When samples from each of the drums being sampled in a single compositing are collected, the sample will be submitted for TCLP, ignitability, corrosivity, and reactivity analysis. The analysis will be used to determine if drilling wastes are covered by land disposal restrictions.

If rolloffs are used, compositing and sampling of soil will comply with applicable state and federal regulations.

B. Labels

Drums and other containers used for storing wastes from drilling operations will be labeled when accumulation in the container begins. Labels will include the following minimum information:

- Container number
- Container contents
- Origin (source area including individuals wells, piezometers, and soil borings)
- Date that accumulation began
- Date that accumulation ended
- Generator Contact Information
- When laboratory results are received, drum labels will be completed or revised to indicate the hazardous waste constituents in compliance with Title 40 of the Code of Federal Regulations, Part 262, Subpart C if the results indicate hazardous waste or labeled as non-hazardous if applicable.

C. Fluids

Drilling fluids generated during soil boring and groundwater discharged during development and purging of the monitoring wells will be collected in 55-gallon, closed-top drums. When a drum is filled, the bung will be secured tightly. Fluids may also be transferred to Baker® Tanks after being temporarily contained in drums to minimize the amount of drums used.

When development and purging is completed, the water will be tested for appropriate hazardous waste constituents. Compositing and sampling of fluids will comply with applicable state and federal regulations.

D. Solids

The soil cuttings from well and boring drilling will constitute a large portion of the solids to be disposed of.

The solid waste stream also will include plastic sheeting used for decontamination pads, Tyveks, disposable sampling materials, and any other disposable material used during the field operations that appears to be contaminated. These materials will be placed in designated drums.

E. Storage and Disposal

The wastes generated at the site at individual locations will be transported to the drum storage area by the drilling services subcontractor. Drums should be stored on pallets on plastic sheeting with a short berm wall (hay bales or 2 x 4 planks or equivalent) to capture small spills.

Waste solid materials that contain hazardous constituents will be disposed of at an offsite location in a manner consistent with applicable solid waste, hazardous waste, and water quality regulations. Transport and disposal will be performed by a commercial firm under subcontract.

The liquid wastes meeting acceptable levels of discharge contamination may be disposed of through the sanitary sewer system at the site. However, prior to disposal to the sanitary sewer system, approval and contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- Check that representative samples of the containerized materials are obtained.
- Be sure that all state and federal regulations are considered when classifying waste for disposal.

STANDARD OPERATING PROCEDURE

Global Positioning System

I. Purpose

The procedure describes the calibration, operation, and functions associated with a Trimble® Pro XRS GPS Unit with a TSC-1 Asset Surveyor for datalogging. GPS signal information is differentially corrected to sub-meter accuracy on a continual basis using a second satellite signal broadcast from OmniSTAR satellite subscription service. The procedure applies to all field data collection activities.

II. Scope

This procedure provides information regarding the field operation and general maintenance of a Trimble® Pro XRS GPS Unit with a TSC-1 Asset Surveyor for datalogging. The information contained herein presents the operation procedures for this equipment. Review of the equipment's instruction manual is a necessity for more detailed descriptions pertaining to the operation and maintenance of the equipment.

III. Definitions

GPS: Global Positioning System - A system of 24 satellites developed and operated by the US DOD. Continuous 3D coordinate information is broadcast free of charge on a worldwide basis enabling precise positional location. Three standard categories of positional accuracy are generally used:

1. Uncorrected Signal - accuracy +/-10 meters - a single satellite transmission is used
2. Differentially Corrected Signal - accuracy +/- <1 meter - additional positional transmissions are recorded simultaneously and used to triangulate coordinate position.
3. Carrier Phase Signal- accuracy +/- <1 centimeter - requires a second receiver and additional software. Both receivers need to be equipped to receive Carrier Phase signals.

IV. Procedures and Guidelines

The procedure for calibration, operation, and maintenance of the GPS unit is outlined below. Daily calibration and battery recharging is typical operating procedure; frequencies other than daily shall be noted in the logbook and reason for increased frequency recorded. If using a different instrument, the operation manual supplied by the manufacturer should be consulted for instructions.

The procedures described below include additional features pre-programmed into the GPS datalogger to aid the data collection process.

A. Calibration

1. Check to ensure that the datalogger and antenna cables are properly connected to the receiver and that the batteries are securely connected.
2. Turn the datalogger unit on by pressing the green **On** key in the bottom left corner. The datalogger will perform a self-calibration. Wait to ensure that the antenna is receiving a sufficient number of satellite signals (usually a minimum of 3).
3. Once the datalogger receives a satellite signal then it is ready for operation.

B. Operations for surveying coordinates of a location

1. The datalogger and GPS receiver are ready for use after the initial self-calibration.
2. Field data may be immediately recorded in the datalogger.
3. The first screen view is the 'Main Menu'. Use the round keypad to select 'Data Collection' and press the **Enter** key.
4. Use the round keypad to select either 'Create new file' or 'Open existing file' and press the **Enter** key. It is not necessary to create a new file at each new location; however, it may be useful to create a new file at the beginning of each day.
5. If a new file is created then the GPS unit will automatically assign it a file name. The file name may be changed if desired. Press the enter key after the file name is assigned. If opening an existing file then use the round keypad to scroll through existing file names.
6. The next screen is 'Antenna options'. Press the **Enter** key to move to the next screen.
7. Select the type of activity to be performed. At the beginning of each day 'Sample Site Detail' should be completed. This allows the operator to enter each field team member, weather, objectives, health and safety meetings, etc. Once the 'Sample Site Detail' is completed then data entry activities may begin including well purging, water level elevations, and sample collection
8. The datalogger prompts the operator when a data field is required and by using the round key pad, numeric, alphanumeric, enter, and escape keys, the operator can perform electronic data capture on the GPS datalogger.
9. Once all information pertaining to an individual site has been recorded, press enter to complete data entry. If GPS signal is obstructed (tree canopy, building height, etc) user may choose to remain in same location until satellite transmission clears the obstruction. This usually takes only a few moments. Data may still be captured and recorded electronically even if GPS signal is insufficient for positioning.
10. To shut down, press the **Escape** key to return to the 'Main Menu'. The unit can be turned off by pressing the green key in the left hand corner. The datalogger should only be turned off when the 'Main Menu' screen is displayed.
11. All data from the datalogger should be downloaded into Trimble Pathfinder Office software on a PC a minimum of once daily. It is recommended that data is downloaded twice daily. Data may be viewed and mapped using Pathfinder Office or exported to

other software. Export file formats support standard ASCII text, generic database .dbf and most GIS and CAD software.

C. Operations for locating a point using coordinates/reacquiring a previously surveyed location

1. The datalogger and GPS receiver are ready for use after the initial self-calibration.
2. Use the Trimble Pathfinder software to load the data file containing the coordinates for each desired location ("programmed location").
3. The first screen view is the 'Main Menu'. Use the keypad to select 'Navigation' and press the **Enter** key.
4. Use the round keypad to select 'Open existing file' to open the file loaded in Step 2 above.
5. Select the location to be reacquired from the screen and press the enter key.
6. A circle with an arrow will appear. As you begin walking, the arrow will point in the direction of the programmed location. Walk in the direction indicated by the arrow.
7. Once you are within 10-feet of the location being reacquired, the GPS unit will display a circle (representing the programmed location) and an "X" (representing the GPS unit). Continue to walk in the direction of the circle until the "X" is centered in the circle. Once the "X" is centered, you are standing at the programmed location.
8. To shut down, press the **Escape** key to return to the 'Main Menu'. The unit can be turned off by pressing the green key in the left hand corner. The datalogger should only be turned off when the 'Main Menu' screen is displayed.

D. Preventive Maintenance

The antenna and datalogger are weatherproof. It is recommended that the receiver remain in the provided backpack carrier. Care should be taken not to crease, pinch or bend the antenna cable. Data should be downloaded from the datalogger a minimum of once daily, twice daily is preferred. At the end of each day the receiver batteries should be recharged. For technical assistance call the rental company through which you acquired the Trimble® unit. Guidance is also provided in the manual and at http://www.trimble.com.

STANDARD OPERATING PROCEDURE

Homogenization of Soil and Sediment Samples

I. Purpose

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample.

II. Scope

Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for VOCs or field GC screening; samples for these analyses should NOT be homogenized.

III. Equipment and Materials

Sample containers, stainless steel spoons or spatulas, and stainless steel pans.

IV. Procedures and Guidelines

Soil and sediment samples to be analyzed for semivolatiles, pesticides, PCBs, metals, cyanide, or field XRF screening should be homogenized in the field. After a sample is taken, a stainless steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

Samples for VOCs should be taken immediately upon collection and should not be homogenized.

Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample. The sample should be placed in a decontaminated stainless steel pan and thoroughly mixed using a stainless steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, and then rolled to the center of the pan and mixed with the entire sample again.

All stainless steel spoons, spatulas, and pans must be decontaminated following procedures specified in SOP *Decontamination of Personnel and Equipment* prior to homogenizing the sample. A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

V. Attachments

None.

VI. Key Checks and Items

- Take VOC samples immediately and do not homogenize the soil.
- Homogenize soil for analyses other than VOCs in a clean, stainless steel bowl.

STANDARD OPERATING PROCEDURE

Preparing Field Log Books

I. Purpose

This SOP provides general guidelines for entering field data into log books during site investigation and remediation activities.

II. Scope

This is a general description of data requirements and format for field log books. Log books are needed to properly document all field activities in support of data evaluation and possible legal activities.

III. Equipment and Materials

- Log book
- Indelible pen

IV. Procedures and Guidelines

Properly completed field log books are a requirement for much of the work we perform under the Navy CLEAN contract. Log books are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field log book entries.

A. PROCEDURES FOR COMPLETING FIELD LOG BOOKS

1. Field notes commonly are kept in bound, hard-cover logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.

2. On the inside cover of the log book the following information should be included:

   - Company name and address
   - Log-holders name if log book was assigned specifically to that person
   - Activity or location

- Project name
- Project manager's name
- Phone numbers of the company, supervisors, emergency response, etc.

3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."

4. If errors are made in the log book, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.

5. Daily entries will be made chronologically.

6. Information will be recorded directly in the field log book during the work activity. Information will not be written on a separate sheet and then later transcribed into the log book.

7. Each page of the log book will have the date of the work and the note takers initials.

8. The final page of each day's notes will include the note-takers signature as well as the date.

9. Only information relevant to the subject project will be added to the log book.

10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

1. Entries into the log book should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.

2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.

3. Scope: Describe the general scope of work to be performed each day.

4. Weather: Record the weather conditions and any significant changes in the weather during the day.

5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified,

and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.

6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.

7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.

8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.

9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.

10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.

11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.

12. Heath and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.

13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.

14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.

15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.

16. Any conditions that might adversely affect the work or any data obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

17. Sampling Information; Specific information that will be relevant to most sampling jobs includes the following:

- Description of the general sampling area – site name, buildings and streets in the area, etc.
- Station/Location identifier
- Description of the sample location – estimate location in comparison to two fixed points – draw a diagram in the field log book indicating sample location relative to these fixed points – include distances in feet.
- Sample matrix and type
- Sample date and time
- Sample identifier
- Draw a box around the sample ID so that it stands out in the field notes
- Information on how the sample was collected – distinguish between "grab," "composite," and "discrete" samples
- Number and type of sample containers collected
- Record of any field measurements taken (i.e. pH, turbidity, dissolved oxygen, and temperature, and conductivity)
- Parameters to be analyzed for, if appropriate
- Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

1. Use the left side border to record times and the remainder of the page to record information (see attached example).

2. Use tables to record sampling information and field data from multiple samples.

3. Sketch sampling locations and other pertinent information.

4. Sketch well construction diagrams.

V. Attachments

Example field notes.

0715 ARRIVE ON SITE AT XYZ SITE.
CH2M HILL STAFF:
John Smith: FIELD TEAM LEADER
Bob Builder: SITE SAFETY COORD.
WEATHER: OVERCAST + COOL, 45°F
CHANCE OF LATE SHOWERS
SCOPE: • COLLECT GROUNDWATER SAMPLES for LTM work at SITE 14
• SUPERVISE SURVEY CREW
AT SITE 17
0725 BB ~~Con~~ ~~JS~~ (JS) CALIBRATES
PID: 101 ppm/100 ppm ok
PID Model #, SERIAL #
0730 BB CALIBRATES HORIBA METER
Model #, SERIAL #
→ List calibration RESULTS
0738 SURVEY CREW ARRIVES ON SITE
→ List NAMES
0745 BB Holds H+S TALK ON Slips, Trips, Falls, Ticks + AIR Monitoring
JS + SURVEY CREW ATTEND
No H+S ISSUES IDENTIFIED as CONCERNS. All work is in "Level D."
0755 JS conducts site-WIDE AIR Monitoring
All readings = 0.0 ppm in

JS 5-12-03

SITE 14 LTM
BREATHING ZONE (BZ)
0805 Mobilize to well MW-22 to SAMPLE, surveyors setting up AT SITE 17
0815 PM (PAUL PAPER PUSHER) CALLS AND INFORMS JS to collect GW SAMPLE AT well MW-44 today for 24 hour TAT ANALYSIS OF VOC'S
0820 Purging MW-22
→ RECORD WATER QUALITY DATA
JS 5-12-03
0843 Collect SAMPLE AT MW-22 for total TAL Metals AND VOC'S. No Dissolved Metals Needed PER PM.
0905 JS + BB Mobilize to SITE 17 to show surveyors wells to Survey.
0942 Mobilize to well MW-22 to Collect SAMPLE
0950 CAN not ACCESS WELL MW-22 due to BASE OPERATIONS; CONTACT PAUL PAPERPUSHER AND HE STATED HE will check on GAINING ACCESS with BASE contact.
0955 Mobilize to well MW-19

JS 5-12-03

STANDARD OPERATING PROCEDURE

Mini RAE Photoionization Detector (PID)

I. Purpose

The purpose of this SOP is to provide general reference information for using the Mini RAE PID in the field. Calibration and operation, along with field maintenance, will be included in this SOP.

II. Scope

This procedure provides information on the field operation and general maintenance of the Mini RAE PID. Review of the information contained herein will ensure that this type of field monitoring equipment will be properly utilized. Review of the owner's instruction manuals is a necessity for more detailed descriptions.

III. Definitions

Volatile Organic Compound (VOC) – Expresses the VOC concentration in ppm

ppm - parts per million: parts of vapor or gas per million parts of air by volume.

IV. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other approved procedures are developed. The Project Manager is responsible for selecting qualified individuals for the monitoring activities.

Health and Safety Coordinator - The Health and Safety Coordinator is responsible for developing a site-specific Health and Safety Plan (HASP) which specifies air monitoring requirements.

Field Team Leader - It is the responsibility of the Field Team Leader to implement these procedures in the field, and to ensure that the field team performing air monitoring activities have been briefed and trained to execute these procedures before the start of site operations.

Safety Coordinator-Hazard Worker (SC-HW)- The SC-HW is responsible for ensuring that the specified air monitoring equipment is on site, calibrated, and used correctly by the field personnel. The SC-HW will coordinate these activities with the Field Team Leader if the SC-HW is not the Field Team Leader as well.

Field team - It is the responsibility of the field team to follow these procedures or to follow documented project-specific procedures as directed by the Field Team

Leader/ Safety Coordinator-Hazard Worker. The field personnel are responsible for documenting all air monitoring results in the field logbook during each field investigation.

V. Procedures

The Mini RAE utilizes the principle of a detecting sensor. The PID operates on the principle that most organic compounds and some inorganic compounds are ionized when they are bombarded by high-energy ultraviolet light. These compounds absorb the energy of the light, which excites the molecules and results in a loss of electron and the formation of a positively charged ion. The number of ions formed and the ion current produced is directly proportional to mass and concentration. The amount of energy required to displace an electron is called ionization potential (IP). The air sample is drawn into a UV lamp using a pump or a fan. The energy of the lamp determines whether a particular chemical will be ionized. Each chemical compound has a unique ionizing potential. When the UV light energy is greater than the ionization potential of the chemical, ionization will occur. When the sample is ionized, the electrical signal is displayed on an analog or digital output. Although the output does not distinguish between chemicals, it does detect an increase in the ion current. If only one chemical is present in the air, it is possible to use PIDs quantitatively. Chemical structure and lamp intensity affects the sensitivity of the instrument to a given contaminant. All PID readings are relative to the calibration gas, usually isobutylene. It is important to calibrate the PID in the same temperature and elevation that the equipment will be used, and to determine the background concentrations in the field before taking measurements. For environments where background readings are high, factory zero calibration gas should be used.

The following subsections will discuss Mini RAE calibration, operation, and maintenance. These sections, however, do not take the place of the instruction manual.

A. Calibration

Start up Instrument

- Press **Mode** button
- Observe displays:

On!……..

Version X.XX

Model Number SN XXXX

Date Time Temp

- After the monitor is turned on and it runs through the startup menus, the display will read "Ready". Press the **[Y/+]** key to start the pump.
- The pump will start, the seconds will count down to zero, and the instrument will be ready for use

Calibration Check and Adjustment

Allow instrument to warm up for 15 minutes.

- Depress the **[N/-]** key first, then while depressing the **[N/-]**, depress the **[Mode]** key also and depress both keys for 5 seconds.
- Display will read:

```
Calibrate
Monitor?
```

- Press the **[Y/+]** key
- Display will read:

```
Fresh Air
Calibration?
```

- Perform the Fresh Air Calibration in an area free of any detectable vapor near your work zone.
- Press the **[Y/+]** key
- Display will read:

```
Zero….
In progress…
```

```
Wait…
```

```
Update data…
```

```
Zeroed…
```

```
Reading = X.X ppm
```

- Press any key and the display will go back to:

```
Fresh Air
Calibration?
```

- Press the **[N/+]** key
- Display will read:

```
Span/Cal?
```

- Press the **[Y/+]** key
- Display will read:

Isobutylene = 100 ppm

Apply Gas Now!

- Press the **[Y/+]** key
- Apply calibration gas – use either HAZCO Services Part Number R-SGRAE4 or Rae Systems Part Number 008-3002 – using a .5 LPM regulator and direct tubing.

Wait…30

- The display will count down showing the number of remaining seconds:

Reading = 100

Update data, span cal done. Turn off gas!

- Calibration readings between 99 and 102 ppm are within the acceptable range.
- Display will read:

Span/Cal?

- **CALIBRATION IS COMPLETE!**
- Press any key to return to operational mode.

B. Operation

Due to the Mini RAE having many functions in terms of operation, it is recommended that you follow the operational procedures as outlined in the instruction manual from pages 2-5 to 2-14.

C. Site Maintenance

After each use, the meter should be recharged and the outside of the instruments should be wiped clean with a soft cloth.

D. Scheduled Maintenance

Function	Frequency
Check alarm and settings	Monthly/before each use
Clean screens and gaskets around sensors	Monthly

Replace sensors	Biannually or when calibration is unsuccessful

VI. Quality Assurance Records

Quality assurance records will be maintained for each air monitoring event. The following information shall be recorded in the field logbook.

- Identification - Site name, date, location, CTO number, activity monitored, (surface water sampling, soil sampling, etc), serial number, time, resulting concentration, comments and identity of air monitoring personnel.
- Field observations - Appearance of sampled media (if definable).
- Additional remarks (e.g, Mini RAE had wide range fluctuations during air monitoring activities.)

VII. References

Mini RAE 2000 Portable VOC PGM-7600, RAE Systems, Revision E, May 2005.

STANDARD OPERATING PROCEDURE

Logging of Soil Borings

I. Purpose and Scope

This SOP provides guidance to obtain accurate and consistent descriptions of soil characteristics during soil-sampling operations. The characterization is based on visual examination and manual tests, not on laboratory determinations.

II. Equipment and Materials

- Indelible pens
- Tape measure or ruler
- Field logbook
- Spatula
- HCl, 10 percent solution
- Squirt bottle with water
- Rock- or soil-color chart (e.g., Munsell)
- Grain-size chart
- Hand lens
- Unified Soil Classification System (USCS) index charts and tables to help with soil classification (attached)

III. Procedures and Guidelines

This section covers several aspects of soil characterization: instructions for completing the CH2M HILL soil boring log Form D1586 (attached), field classification of soil, and standard penetration test procedures.

A. Instructions for Completing Soil Boring Logs

Soil boring logs will be completed in the field log books or on separate soil boring log sheets. Information collected will be consistent with that required for Form D1586 (attached), a standard CH2M HILL form (attached), or an equivalent form that supplies the same information.

The information collected in the field to perform the soil characterization is described below.

Field personnel should review completed logs for accuracy, clarity, and thoroughness of detail. Samples also should be checked to see that information is correctly recorded on both jar lids and labels and on the log sheets.

B. Heading Information

Boring/Well Number. Enter the boring/well number. A numbering system should be chosen that does not conflict with information recorded for previous exploratory work done at the site. Number the sheets consecutively for each boring.

Location. If station, coordinates, mileposts, or similar project layout information is available, indicate the position of the boring to that system using modifiers such as "approximate" or "estimated" as appropriate.

Elevation. Elevation will be determined at the conclusion of field activities through a survey.

Drilling Contractor. Enter the name of the drilling company and the city and state where the company is based.

Drilling Method and Equipment. Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger). Information on the drilling equipment (e.g., CME 55, Mobile B61) also is noted.

Water Level and Date. Enter the depth below ground surface to the apparent water level in the borehole. The information should be recorded as a comment. If free water is not encountered during drilling or cannot be detected because of the drilling method, this information should be noted. Record date and time of day (for tides, river stage) of each water level measurement.

Date of Start and Finish. Enter the dates the boring was begun and completed. Time of day should be added if several borings are performed on the same day.

Logger. Enter the first and last name.

C. Technical Data

Depth Below Surface. Use a depth scale that is appropriate for the sample spacing and for the complexity of subsurface conditions.

Sample Interval. Note the depth at the top and bottom of the sample interval.

Sample Type and Number. Enter the sample type and number. SS-1 = split spoon, first sample. Number samples consecutively regardless of type. Enter a sample number even if no material was recovered in the sampler.

Sample Recovery. Enter the length to the nearest 0.1-foot of soil sample recovered from the sampler. Often, there will be some wash or caved material above the sample; do not include the wash material in the measurement. Record soil recovery in feet.

Standard Penetration Test Results. In this column, enter the number of blows required for each 6 inches of sampler penetration and the "N" value, which is the sum of the blows in the middle two 6-inch penetration intervals. A typical standard penetration test involving successive blow counts of 2, 3, 4, and 5 is recorded as 2-3-4-5 and (7). The standard penetration test is terminated if the sampler encounters refusal. Refusal is a penetration of less than 6 inches with a blow count of 50. A

partial penetration of 50 blows for 4 inches is recorded as 50/4 inches. Penetration by the weight of the slide hammer only is recorded as "WOH."

Samples should be collected using a 140-pound hammer and 2-inch diameter split spoons. Samples may be collected using direct push sampling equipment. However, blow counts will not be available. A pocket penetrometer may be used instead to determine relative soil density of fine grained materials (silts and clays).

Sample also may be collected using a 300-pound hammer or 3-inch-diameter split-spoon samples at the site. However, use of either of these sample collection devices invalidates standard penetration test results and should be noted in the comments section of the log. The 300-pound hammer should only be used for collection of 3-inch-diameter split-spoon samples. Blow counts should be recorded for collection of samples using either a 3-inch split-spoon, or a 300-pound hammer. An "N" value need not be calculated.

Soil Description. The soil classification should follow the format described in the "Field Classification of Soil" subsection below.

Comments. Include all pertinent observations (changes in drilling fluid color, rod drops, drilling chatter, rod bounce as in driving on a cobble, damaged Shelby tubes, and equipment malfunctions). In addition, note if casing was used, the sizes and depths installed, and if drilling fluid was added or changed. You should instruct the driller to alert you to any significant changes in drilling (changes in material, occurrence of boulders, and loss of drilling fluid). Such information should be attributed to the driller and recorded in this column.

Specific information might include the following:

- The date and the time drilling began and ended each day
- The depth and size of casing and the method of installation
- The date, time, and depth of water level measurements
- Depth of rod chatter
- Depth and percentage of drilling fluid loss
- Depth of hole caving or heaving
- Depth of change in material
- Health and safety monitoring data
- Drilling interval through a boulder

D. Field Classification of Soil

This section presents the format for the field classification of soil. In general, the approach and format for classifying soils should conform to ASTM D 2488, Visual-Manual Procedure for Description and Identification of Soils (attached).

The Unified Soil Classification System is based on numerical values of certain soil properties that are measured by laboratory tests. It is possible, however, to estimate these values in the field with reasonable accuracy using visual-manual procedures (ASTM D 2488). In addition, some elements of a complete soil

description, such as the presence of cobbles or boulders, changes in strata, and the relative proportions of soil types in a bedded deposit, can be obtained only in the field.

Soil descriptions should be precise and comprehensive without being verbose. The correct overall impression of the soil should not be distorted by excessive emphasis on insignificant details. In general, similarities rather than differences between consecutive samples should be stressed.

Soil descriptions must be recorded for every soil sample collected. The format and order for soil descriptions should be as follows:

1. Soil name (synonymous with ASTM D 2488 Group Name) with appropriate modifiers. Soil name should be in all capitals in the log, for example "POORLY-GRADED SAND."
2. Group symbol, in parentheses, for example, "(SP)."
3. Color, using Munsell color designation
4. Moisture content
5. Relative density or consistency
6. Soil structure, mineralogy, or other descriptors

This order follows, in general, the format described in ASTM D 2488.

E. Soil Name

The basic name of a soil should be the ASTM D 2488 Group Name on the basis of visual estimates of gradation and plasticity. The soil name should be capitalized.

Examples of acceptable soil names are illustrated by the following descriptions:

- A soil sample is visually estimated to contain 15 percent gravel, 55 percent sand, and 30 percent fines (passing No. 200 sieve). The fines are estimated as either low or highly plastic silt. This visual classification is SILTY SAND WITH GRAVEL, with a Group Symbol of (SM).
- Another soil sample has the following visual estimate: 10 percent gravel, 30 percent sand, and 60 percent fines (passing the No. 200 sieve). The fines are estimated as low plastic silt. This visual classification is SANDY SILT. The gravel portion is not included in the soil name because the gravel portion was estimated as less than 15 percent. The Group Symbol is (ML).

The gradation of coarse-grained soil (more than 50 percent retained on No. 200 sieve) is included in the specific soil name in accordance with ASTM D 2488. There is no need to further document the gradation. However, the maximum size and angularity or roundness of gravel and sand-sized particles should be recorded. For fine-grained soil (50 percent or more passing the No. 200 sieve), the name is modified by the appropriate plasticity/elasticity term in accordance with ASTM D 2488.

Interlayered soil should each be described starting with the predominant type. An introductory name, such as "Interlayered Sand and Silt," should be used. In addition, the relative proportion of each soil type should be indicated (see Table 1 for example).

Where helpful, the evaluation of plasticity/elasticity can be justified by describing results from any of the visual-manual procedures for identifying fine-grained soils, such as reaction to shaking, toughness of a soil thread, or dry strength as described in ASTM D 2488.

F. Group Symbol

The appropriate group symbol from ASTM D 2488 must be given after each soil name. The group symbol should be placed in parentheses to indicate that the classification has been estimated.

In accordance with ASTM D 2488, dual symbols (e.g., GP-GM or SW-SC) can be used to indicate that a soil is estimated to have about 10 percent fines. Borderline symbols (e.g., GM/SM or SW/SP) can be used to indicate that a soil sample has been identified as having properties that do not distinctly place the soil into a specific group. Generally, the group name assigned to a soil with a borderline symbol should be the group name for the first symbol. The use of a borderline symbol should not be used indiscriminately. Every effort should be made to first place the soil into a single group.

G. Color

The color of a soil must be given. The color description should be based on the Munsell system. The color name and the hue, value, and chroma should be given.

H. Moisture Content

The degree of moisture present in a soil sample should be defined as dry, moist, or wet. Moisture content can be estimated from the criteria listed on Table 2.

I. Relative Density or Consistency

Relative density of a coarse-grained (cohesionless) soil is based on N-values (ASTM D 1586 [attached]). If the presence of large gravel, disturbance of the sample, or non-standard sample collection makes determination of the in situ relative density or consistency difficult, then this item should be left out of the description and explained in the Comments column of the soil boring log.

Consistency of fine-grained (cohesive) soil is properly based on results of pocket penetrometer or torvane results. In the absence of this information, consistency can be estimated from N-values. Relationships for determining relative density or consistency of soil samples are given in Tables 3 and 4.

J. Soil Structure, Mineralogy, and Other Descriptors

Discontinuities and inclusions are important and should be described. Such features include joints or fissures, slickensides, bedding or laminations, veins, root holes, and wood debris.

Significant mineralogical information such as cementation, abundant mica, or unusual mineralogy should be described.

Other descriptors may include particle size range or percentages, particle angularity or shape, maximum particle size, hardness of large particles, plasticity of fines, dry strength, dilatancy, toughness, reaction to HCl, and staining, as well as other information such as organic debris, odor, or presence of free product.

K. Equipment and Calibration

Before starting the testing, the equipment should be inspected for compliance with the requirements of ASTM D 1586. The split-barrel sampler should measure 2-inch or 3-inch O.D., and should have a split tube at least 18 inches long. The minimum size sampler rod allowed is "A" rod (1-5/8-inch O.D.). A stiffer rod, such as an "N" rod (2-5/8-inch O.D.), is required for depths greater than 50 feet. The drive weight assembly should consist of a 140-pound or 300-pound hammer weight, a drive head, and a hammer guide that permits a free fall of 30 inches.

IV. Attachments

Soil Boring Log (Sample Soil Boring Log.xls)

CH2M HILL Form D1586 and a completed example (Soil_Log_Examp.pdf)

ASTM D 2488 *Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)* (ASTM D2488.pdf)

ASTM 1586 *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils* (ASTM D1586.pdf)

Tables 1 through 4 (Tables 1-4.pdf)

V. Key Checks and Preventive Maintenance

- Check entries to the soil-boring log and field logbook in the field; because the samples will be disposed of at the end of fieldwork, confirmation and corrections cannot be made later.
- Check that sample numbers and intervals are properly specified.
- Check that drilling and sampling equipment is decontaminated using the procedures defined in SOP *Decontamination of Drilling Rigs and Equipment*.

STANDARD OPERATING PROCEDURE

Surface Water Sampling

I. Purpose and Scope

This procedure presents the techniques used in collecting surface water samples. Materials, equipment, and procedures may vary; refer to the Field Sampling Plan and operators manuals for specific details.

II. Materials and Equipment

Materials and equipment vary depending on type of sampling; the Field Sampling Plan should be consulted for project-specific details. Typical equipment required includes:

- Open tube sampler
- Dip sampler
- Weighted bottle sampler
- Hand pump
- Kemmerer or Van Dorn sampler
- Depth-integrating sampler
- Peristaltic pump
- Sample containers
- Meters for specific conductance, temperature, pH, and dissolved oxygen

III. Procedures and Guidelines

Before surface water samples are taken, all sampler assemblies and sample containers are cleaned and decontaminated as described in SOP *Decontamination of Personnel and Equipment*. Surface water samples collected from water bodies tidally influenced should be collected at low tide and under low flow conditions to minimize the dilution of potential contaminants. Methods for surface water sample collection are described below.

A. Manual Sampling

Surface water samples are collected manually by submerging a clean glass, stainless steel, or Teflon container into the water body. Samples may be collected at depth with a covered bottle that can be removed with a tripline. The most common sampler types are beakers, sealable bottles and jars, pond samplers, and weighted bottle samplers. Pond samplers have a fixed or telescoping pole attached to the sample container. Weighted bottle samplers are lowered below water surface, where the attached bottle is opened, allowed to fill, and pulled out of the water. When retrieved, the bottle is tightly capped and removed from the sampler assembly.

Specific types of weighted bottle samplers include dissolved oxygen, Kemmerer, or Van Dorn, and are acceptable in most instances.

A sample is taken with the following specific steps:

1. The location and desired depth for water sampling are selected.
2. The sample site is approached from downstream in a manner that avoids disturbance of bottom sediments as much as possible. The sample bottle is gently submerged with the mouth pointed upstream and the bottle tilted slightly downstream. Bubbles and floating materials should be prevented from entering the bottle. If using a Peristaltic pump, lower the tubing into the water to the desired depth.
3. For weighted bottle samplers, the assembly is slowly lowered to the desired depth. The bottle stopper is unseated with a sharp tug and the bottle is allowed to fill until bubbles stop rising to the surface.
4. When the bottle is full, it is gently removed from the water. If sample transfer is required, it should be performed at this time.
5. Measure dissolved oxygen, specific conductance, temperature, and pH at the sampling location.

IV. Attachments

None.

V. Key Checks and Items

- Start downstream, work upstream
- Log exact locations using permanent features
- Beware of hidden hazards

STANDARD OPERATING PROCEDURE

Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples during field operations.

II. Scope

The sediment sampling procedures generally describe the equipment and techniques needed to collect representative sediment samples. Operators manual, if available, should be consulted for specific details

III. Equipment and Materials

- Sample collection device (hand corer, scoop, dredge, grab sampler, or other suitable device)
- Stainless steel spoon or spatula or plastic disposable scoop for media transfer
- Measuring tape
- Log book
- Personal protection equipment (rubber or latex gloves, boots, hip waders, etc.)
- Materials for classifying soils, particularly the percentage of fines
- Sample jars, including jars for Total Organic Carbon and pH, as appropriate

IV. Procedures and Guidelines

1. Field personnel will start downstream and work upstream to prevent contamination of unsampled areas. In surface water bodies that are tidally influenced, sampling will be performed at low tide and under low flow conditions to minimize the dilution of possible contaminants. Sediment sampling activities will not occur immediately after periods of heavy rainfall.
2. Make a sketch of the sample area that shows important nearby river features and permanent structures that can be used to locate the sample points on a map. Whenever possible, include measured distances from such identifying features. Also include depth and width of waterway, rate of flow, type and consistency of sediment, and point and depth of sample removal (along shore, mid-channel, etc).

3. Note in the field book any possible outside sources of contamination. For example, the outlet to a drainage culvert in the water body near your sampling location.

4. Transfer sample into appropriate sample jars with a stainless steel utensil or plastic disposable scoop. Be especially careful to avoid the loss of the very fine clay/silt particles when collecting the sample. The fine particles have a higher adsorption capacity than larger particles. Minimize the amount of water that is collected within the sample matrix. Decant the water off of the sample slowly and carefully to maximize retention of the very fine particles. The sampler's fingers should never touch the sediment since gloves may introduce organic interference into the sample. Classify the soil type of the sample using the Unified Soil Classification System, noting particularly the percentage of silt and clay.

5. Samples for volatile organics should immediately be placed in jars. Rocks and other debris should be removed before placement in jars.

6. For channel sampling, be on the alert for submerged hazards (rocks, tree roots, drop-offs, loss silt and muck) which can make wading difficult.

7. Sample sediment for TOC and pH also, to give context to organic and inorganic data during the risk assessment.

8. Follow the site safety plan designed for the specific nature of the site's sampling activities and locations.

9. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

V. Attachments

None.

VI. Key Checks and Items

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Beware of hidden hazards.

STANDARD OPERATING PROCEDURE

Packaging and Shipping Procedures for Low-Concentration Samples

I. Purpose and Scope

The purpose of this guideline is to describe the packaging and shipping of low-concentration samples of various media to a laboratory for analysis.

II. Scope

The guideline only discusses the packaging and shipping of samples that are anticipated to have low concentrations of chemical constituents. Whether or not samples should be classified as low-concentration or otherwise will depend upon the site history, observation of the samples in the field, odor, and photoionization-detector readings.

If the site is known to have produced high-concentration samples in the past or the sampler suspects that high concentrations of contaminants might be present in the samples, then the sampler should conservatively assume that the samples cannot be classified as low-concentration. Samples that are anticipated to have medium to high concentrations of constituents should be packaged and shipped accordingly.

If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling. As a result only employees who are trained under CH2M HILL Dangerous Goods Shipping course may ship or transport dangerous goods. Employees should utilize the HAZMAT ShipRight tool on the Virtual Office and/or contact a designated CH2M HILL HazMat advisor with questions.

III. Equipment and Materials

- Coolers
- Clear tape
- “This Side Up” labels
- “Fragile” labels
- Vermiculite
- Ziplock bags or bubble wrap
- Ice
- Chain-of-Custody form (completed)
- Custody seals

IV. Procedures and Guidelines

Low-Concentration Samples

A. Prepare coolers for shipment:

- Tape drains shut.
- Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
- Place mailing label with laboratory address on top of coolers.
- Fill bottom of coolers with about 3 inches of vermiculite or absorbent pads.

B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.

C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.

D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.

E. Arrange sample bottles in coolers so that they do not touch.

F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.

G. Fill remaining spaces with vermiculite or absorbent pads.

H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.

J Close lid and latch.

K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.

L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Cover custody seals with tape to avoid seals being able to be peeled from the cooler.

M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with potential additional restrictions. If applicable, the sample handler must refer to instructions associated with the shipping of dangerous goods for the necessary procedures for shipping by Federal Express or other overnight carrier. If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling. As a result only employees who are trained under CH2M HILL Dangerous Goods Shipping course may ship or transport dangerous goods. Employees should utilize the HAZMAT ShipRight tool on the Virtual Office and/or contact a designated CH2M HILL HazMat advisor with questions.

V. Attachments

None.

VI. Key Checks and Items

- Be sure laboratory address is correct on the mailing label
- Pack sample bottles carefully, with adequate vermiculite or other packaging and without allowing bottles to touch
- Be sure there is adequate ice
- Include chain-of-custody form
- Include custody seals

STANDARD OPERATING PROCEDURE

Shallow Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, Teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula or disposable plastic scoop should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Fiberglass measuring tape (at least 200 feet in length)
- GPS Unit (if available)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

   a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

b. Proceed to sample the points on the grid line.

c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal measurements: one to the previous grid line, and one to the previous sample on the same grid line.

d. Proceed to sample the points on the grid line as described in Section C below.

e. Repeat 1c and 1d above until all samples are collected from the area.

f. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

2. For non-grid samples:

a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).

b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.

c. Proceed to sample as described in Section C below.

d. Repeat 2a through 2c above until all samples are collected from the area.

e. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of roofs, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Leader (FTL). If the FTL concurs, the sampling point will be deleted from the program. The FTL will contact the CH2M HILL project manager (PM) immediately. The PM and Navy Technical Representative (NTR) will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the NTR in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel or disposable plastic scoopto scrape away surficial organic material (grass, leaves, etc.) adjacent to

the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

   a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging down to a depth of about 6 inches, or the depth specified in the workplan.

   b. Subsurface soil: Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take a photoionizaton detector (PID) reading of the sampled soil if organics are anticipated to be present and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan or dedicated sealable bag.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/ scoop or specialized sampling equipment (i.e. Encore® or Terra Core® sampler) and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP *Decontamination of Drilling Rigs and Equipment*.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with soil removed from the borehole. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Use phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

Standard Operating Procedure

Locating and Clearing Underground Utilities

I. Purpose

The purpose of this SOP is to provide general guidelines and specific procedures that must be followed on Navy CLEAN projects for locating underground utilities and clearing dig locations in order to maximize our ability to avoid hitting underground utilities and to minimize liabilities to CH2M HILL and its subcontractors and health and safety risks to our project staff.

This SOP shall be used by Activity Managers and Project Managers to, in-turn, develop Activity-specific and project-specific utility location procedures. The activity and project-specific procedures will become part of work plans and project instructions and will be used to prepare scopes of work (SOWs) for the procurement of utility location subcontractors to meet the needs of individual projects.

This SOP also identifies the types of utility locating services that are available from subcontractors and the various tools that are used to locate utilities, and discusses when each type of service and tool may or may not be applicable.

II. Scope

Depending on the Navy/Marine Activity we typically find ourselves in one of two scenarios:

Scenario 1

The Activity provides utility locating (or dig clearance) services through the public works department or similar organization, or has a contract with an outside utility clearance service. Some of these services are provided in the form of dig permits which are required before you can dig or drill. In other cases no official permit is required and the process is somewhat vague.

Scenario 2

The Activity does not get involved in any utility locating processes aside from possibly providing the most recent utility maps, and relies on CH2M HILL to clear the dig locations.

Table 1 provides an up to date summary of which scenarios apply to the various primary Activities served under the Navy CLEAN program.

Scenario 1 is preferred because under this scenario the Navy tends to assume the responsibility if the location is improperly cleared, a utility is struck, and property damage results. However, our experience has been that the clearance services provided by the Navy do not meet the standards that we consider to be adequate, in that they

often simply rely on available base maps to mark utilities and do not verify locations using field geophysics. And if they do use locating tools, they do not provide adequate documentation or marking to confirm that a location has been cleared. So while the Navy's process may protect us from liability for property damage, it does not adequately protect our staff and subcontractors from health risks nor does it compensate us for down time, should a utility be hit.

Therefore, regardless of what services the Navy provides, in most cases we still need to supplement this effort with clearance services from our own third party utility location subcontractor following the procedures and guideline outlined in Section IV of this SOP. The cost implications of providing this service will range from $500 to several $1,000 depending on the size of the project.

The scope of services that we ask our subcontractors to provide can involve utility marking/mapping or the clearing of individual dig locations. In the former we ask our subs to mark all utilities within a "site" and often ask them to prepare a map based on their work. In the later, we ask them to clear (identify if there are any utilities within) a certain radius of a proposed dig/drill location.

The appropriate requested scope of services for a project will depend on the project. Clearing individual boreholes is often less expensive and allows the sub to concentrate their efforts on a limited area. However if the scope of the investigation is fluid (all borehole locations are not predetermined) it may be best to mark and map an entire site or keep the subcontractor on call.

Clearance of individual dig locations should be done to a minimum 20 foot radius around the location.

An example SOW for a utility subcontractor procurement is provided in Attachment A.

III. Services and Equipment

This section provides a general description of the services available to help us locate subsurface utilities and describes the types of equipment that these services may (or may not) use to perform their work. It identifies the capabilities of each type of equipment to help the PM specify what they should require from our utility location subs.

Services

The services that are available to us for identifying and marking underground utilities are:

- The local public/private utility-run service such as Miss Utility
- Utility location subcontractors (hired by us)

Attachment B provides a detailed description of each type of organization. It also provides contact numbers and web sites for the various Miss-Utility-type organizations in the areas where we do work for the Navy and contacts and services provided by several subcontractors that we have used or spoken to in the past.

Equipment

Attachment C provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the PM determine if the equipment being used by a subcontractor is adequate.

It is important to make the potential subcontractors aware of the possible types of utilities (and utility materials) that are at the site, and to have them explain in their bid what types of equipment they will use to locate utilities /clear dig locations, and what the limitations of these equipment are.

A list of in-house experts that can be used to help you evaluate bids or answer questions you may have is provided in Appendix C.

IV. Procedures and Guidelines

This section presents specific procedures to be followed for the utility location work to be conducted by CH2M HILL and our subcontractors. In addition, a PM will have to follow the procedures required by the Activity to obtain their approvals, clearances and dig permits where necessary. These "dig permit" requirements vary by Activity and must be added to the project-specific SOP, or project instructions. It is preferable that the Activity perform their clearance processes before we follow up with our clearance work.

Activity Notification and Dig Permit Procedures

Identify Activity-specific permit and/or procedural requirements for excavation and drilling activities. Contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Activity Specific: To be provided by Activity or Project Manager

CH2M HILL Utility Clearance Procedures

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted by CH2M HILL as a follow-up to the services provided by the Navy. The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor (subcontracted to CH2M HILL) to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include (these are further described in Attachment C):

- **Ground Penetrating Radar (GPR),** which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF),** involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.

- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers,** are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- Contact utility companies or the state/regional utility protection service (such as Miss Utility) at least two (2) working days prior to intrusive activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation: this is a law. These services will only mark the location of public-utility-owned lines and not Navy-owned utilities. In many cases there will not be any public-utility-owned lines on the Activity. There may also be Base-access issues to overcome.
- Procure and schedule the independent survey.
- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project site, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions. ***The types of utilities must be provided to the bidding subcontractors in the SOW and procedures to be used must be specified by the bidder in their bid. It is extremely helpful to provide the sub with utility maps, with the caveat that all utilities are not necessarily depicted.***
- The survey subcontractor shall employ the same geophysical techniques used to identify the buried utilities, to survey the proposed path of subsurface investigation/construction work to confirm no buried utilities are present.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances provided by both the "Miss Utility" service and the CH2M HILL-subcontracted service are to be in writing, signed by the party conducting the clearance. The Miss Utility service will have standard notification forms/letters which typically simply state that they have been to the site and have done their work. The CH2M HILL subcontractor shall be required to fill out the form provided in Attachment D (this can be modified for a particular project) indicating that each dig/drill location has been addressed. ***This documentation requirement (with a copy of the form) needs to be provided in the subcontractor SOW.***
- Marking shall be done using the color coding presented in Attachment E. The type of material used for marking must be approved by the Activity prior to marking. Some base commanders have particular issues with persistent spray paint on their

sidewalks and streets. ***Any particular marking requirements need to be provided in the subcontractor SOW.***

- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Perform a field check prior to drilling/digging (preferably while the utility location sub is still at the site) to see if field utility markings coincide with locations on utility maps. Look for fire hydrants, valves, manholes, light poles, lighted signs, etc to see if they coincide with utilities identified by the subcontractor.
- Underground utility locations must be physically verified (or dig locations must be physically cleared) by hand digging using wood or fiberglass-handled tools, air knifing, or by some other acceptable means approved by CH2M HILL, when the dig location (e.g. mechanical drilling, excavating) is expected to be within 5 feet of a marked underground system. Hand clearance shall be done to a depth of four feet unless a utility cross-section is available that indicates the utility is at a greater depth. In that event, the hand clearance shall proceed until the documented depth of the utility is reached.
- Conduct a site briefing for employees at the start of the intrusive work regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

IV. Attachments

A- Example SOW for Utility Location Subcontractor Procurement
B - Services Available for Identifying and Marking Underground Utilities
C – Equipment Used for Identifying Underground Utilities
D – Utility Clearance Documentation Form
E – Utility Marking Color Codes

Attachment A – Example SOW for Subcontracting Underground Utilities Locating Services

CTO-XXX

Scope of Work

Subsurface Utility Locating

Site XX

Navy Activity

City, State

A licensed and insured utility locator will be subcontracted to identify and mark out subsurface utilities for an environmental investigation/remediation project at Site XX of <<insert name of base, city, and state>>. The subcontractor will need to be available beginning at <<insert time>> on <<insert date>>. It is estimated that the work can be completed within XX days.

Proposed Scope of Work

The subcontractor will identify and mark all subsurface utilities (CHOOSE 1) that lie within a radius of 20 feet of each of XX sampling locations at Site XX shown on the attached Figure 1; (OR) that lie within the bounds of Site XX as delineated on the attached Figure 1. (If multiple sites are to be cleared, provide maps of each site with sample locations or clearance boundaries clearly delineated and a scale provided.)

Utilities will be identified using all reasonably available as-built drawings, electronic locating devices, and any other means necessary to maintain the safety of drilling and sampling personnel and the protection of the base infrastructure. The location of utilities identified from as-built drawings or other maps must be verified in the field prior to marking.

Base utility drawings for the Site(s) (CHOOSE 1) can be found at <<insert specific department and address or phone number on the base>> and should be reviewed by the subcontractor and referenced as part of the utility locating. (OR), will be provided to the subcontractor by CH2M HILL upon the award of the subcontract. (OR), are not available. Utility drawings shall not be considered definitive and must be field verified.

Field verification will include detection using nonintrusive subsurface detection equipment (magnetometers, GPR, etc) as well as opening manhole covers to verify pipe directions. As part of the bid, the Subcontractor shall provide a list of the various

subsurface investigation tools they propose to have available and use at the site and what the limitations are of each tool.

A CH2M HILL representative shall be present to coordinate utility clearance activities and identify points and features to be cleared.

Field Marking and Documentation

All utilities located within **(CHOOSE 1)** ***a 20-ft radius of the XX proposed soil boring locations*** **(OR)** ***within the boundary of the site(s)*** as identified on the attached figure(s) will be marked using **paint** ***(some Bases such as the WNY may have restrictions on the use of permanent paint)*** and/or pin flags color coded to indicate electricity, gas, water, steam, telephone, TV cable, fiber optic, sewer, etc. The color coding shall match the industry standard as described on the attached form. In addition, the ***Buried Utility Location Tracking Form*** (attached) will be completed by the Subcontractor based upon what is identified in the field during the utility locating and submitted back to CH2M HILL (field staff or project manager) within 24 hours of completing the utility locating activities.

(OPTIONAL) ***The subcontractor shall also provide a map (or hand sketch) of the identified utilities to the Engineer within XX days of field demobilization. The map shall include coordinates or ties from fixed surface features to each identified subsurface utility.***

Bid Sheet/Payment Units

The subcontractor will bid on a time and materials basis for time spent on site and researching utility maps. Mobilization (including daily travel to the site) should be bid as a lump sum, as well as the preparation of the AHA and any required mapping. The per diem line item should be used if the field crew will require overnight accommodations at the project site.

Health and Safety Requirements

The utility locating subcontractor is to provide and assume responsibility for an adequate corporate Health and Safety Plan for onsite personnel. Standard personal safety equipment including: hard hat, safety glasses, steel-toed boots, gloves are recommended for all project activities. Specific health and safety requirements will be established by the Subcontractor for each project. The health and safety requirements will be subject to the review of CH2M HILL.

The subcontractor shall also prepare and provide to the Engineer, at least 48 hours prior to mobilization, an acceptable Activity Hazard Analysis (AHA) using the attached AHA form or similar.

It is also required that all subcontractor personnel who will be on site attend the daily 15-minute health and safety tailgate meeting at the start of each day in the field.

Subcontractor personnel showing indications of being under the influence of alcohol or illegal drugs will be sent off the job site and their employers will be notified. Subcontractor personnel under the influence of prescription or over-the-counter

medication that may impair their ability to operate equipment will not be permitted to do so. It is expected that the subcontractor will assign them other work and provide a capable replacement (if necessary) to operate the equipment to continue work.

Security

The work will be performed on US Navy property. CH2M HILL will identify the Subcontractor personnel who will perform the work to the appropriate Navy facility point-of-contact, and will identify the Navy point-of-contact to the Subcontractor crew. The Subcontractor bears final responsibility for coordinating access of his personnel onto Navy property to perform required work. This responsibility includes arranging logistics and providing to CH2M HILL, in advance or at time of entry as specified, any required identification information for the Subcontractor personnel. Specifically, the following information should be submitted with the bid package for all personnel that will perform the work in question (this information is required to obtain a base pass):

- Name
- Birth Place
- Birth Date
- Social Security Number
- Drivers License State and Number
- Citizenship

Please be advised that no weapons, alcohol, or drugs will be permitted on the Navy facility at any time. If any such items are found, they will be confiscated, and the Subcontractor will be dismissed.

Quality Assurance

The Subcontractor will be licensed and insured to operate in the State of <<state>> and will comply with all applicable federal, state, county and local laws and regulations. The subcontractor will maintain, calibrate, and operate all electronic locating instruments in accordance with the manufacturer's recommendations. Additionally, the Subcontractor shall make all reasonable efforts to review as-built engineering drawings maintained by Base personnel, and shall notify the CH2M HILL Project Manager in writing (email is acceptable) whenever such documentation was not available or could not be reviewed.

Subcontractor Standby Time

At certain periods during the utility locating activities, the Subcontractor's personnel may be asked to stop work and standby when work may normally occur. During such times, the Subcontractor will cease activities until directed by the CH2M HILL representative to resume operations. Subcontractor standby time also will include potential delays caused by the CH2M HILL representative not arriving at the site by the agreed-upon meeting time for start of the work day. Standby will be paid to the Subcontractor at the hourly rate specified in the Subcontractor's Bid Form attached to these specifications.

Cumulative Subcontractor standby will be accrued in increments no shorter than 15 minutes (i.e., an individual standby episode of less than 15 minutes is not chargeable).

During periods for which standby time is paid, the surveying equipment will not be demobilized and the team will remain at the site. At the conclusion of each day, the daily logs for the Subcontractor and CH2M HILL representative will indicate the amount of standby time incurred by the Subcontractor, if any. Payment will be made only for standby time recorded on CH2M HILL's daily logs.

Down Time

Should equipment furnished by the Subcontractor malfunction, preventing the effective and efficient prosecution of the work, or inclement weather conditions prevent safe and effective work from occurring, down time will be indicated in the Subcontractor's and CH2M Hill representative's daily logs. No payment will be made for down time.

Schedule

It is anticipated that the subsurface utility locating activities will occur on <<insert date>>. It is estimated that the above scope will be completed within XXX days.

Attachment B - Services Available for Identifying and Marking Underground Utilities

The services that are available to us for identifying and marking underground utilities are:

- The Activity's PWC (or similar organization)
- The local public/private utility -run service such as Miss Utility
- Utility location subcontractors (hired by CH2M HILL)

Each are discussed below.

Navy Public Works Department

A Public Works Department (PWD) is usually present at each Activity. The PWD is responsible for maintaining the public works at the base including management of utilities. In many cases, the PWD has a written permit process in place to identify and mark-out the locations of Navy-owned utilities [Note: The PWD is usually NOT responsible for the locations/mark-outs of non-Navy owned, public utilities (e.g., Washington Gas, Virginia Power, municipal water and sewer, etc.). Therefore, it is likely that we will have to contact other organizations besides the PWD in order to identify non-Navy owned, public utilities].

At some Activities, there may not be a PWD, the PWD may not have a written permit process in place, or the PWD may not take responsibility for utility locating and mark-outs. In these cases, the PWD should still be contacted since it is likely that they will have the best understanding of the utility locations at the Activity (i.e., engineering drawings, institutional knowledge, etc.). Subsequently, the PWD should be brought into a cooperative arrangement (if possible) with the other services employed in utility locating and mark-out in order to have the most comprehensive assessment performed.

At all Activities we should have a contact (name and phone number), and preferably an established relationship, with PWD, either directly or through the NAVFAC Atlantic, Midlant, or Washington NTR or Activity Environmental Office that we can work with and contact in the event of problems.

Miss Utility or "One Call" Services for Public Utility Mark-outs

Miss Utility or "One Call" service centers are information exchange centers for excavators, contractors and property owners planning any kind of excavation or digging. The "One Call" center notifies participating public utilities of the upcoming excavation work so they can locate and mark their underground utilities in advance to prevent possible damage to underground utility lines, injury, property damage and service outages. In some instances, such with southeastern Virginia bases, the Navy has entered into agreement with Ms. Utilities and is part of the response process for Miss Utilities. Generally, a minimum of 48 hours is required for the public utility mark-outs

to be performed. The "One Call" services are free to the public. Note that the "One Call" centers only coordinate with participating public utilities. There may be some public utilities that do NOT participate in the "One Call" center which may need to be contacted separately. For example, in Washington, DC, the Miss Utility "One Call" center does not locate and mark public sewer and water lines. Therefore, the municipal water and sewer authority must be contacted separately to have the sewer and water lines marked out. The AM should contact the appropriate one-call center to determine their scope of services.

A national listing of the "One Call" service centers for each state is presented on the web at http://www.underspace.com/refs/ocdir.htm. For the Mid-Atlantic region, the following "One Call" service centers are available.

Name	Phone	Website	Comments
Miss Utility of DELMARVA	800-257-7777	www.missutility.net	Public utility mark-outs in Delaware, Maryland, Washington, DC, and Northern Virginia
Miss Utility of Southern Virginia (One Call)	800-552-7001	not available	Public utility mark-outs in Southern Virginia
Miss Utility of Virginia	800-257-7777 800-552-7007	www.missutilityofvirginia.com	General information on public utility mark-outs in Virginia, with links to Miss Utility of DELMARVA and Miss Utility of Southern Virginia (One Call)
Miss Utility of West Virginia, Inc	800-245-4848	none	Call to determine what utilities they work with in West Virginia
North Carolina One Call Center	800-632-4949	www.ncocc.org/ncocc/default.htm	Public Utility Markouts in North Carolina

Private Subcontractors

1. Utility-locating support is required at some level for most all CH2M HILL field projects in "clearing" proposed subsurface boring locations on the project site. Utility location and sample clearance can include a comprehensive effort of GIS map interpretation, professional land surveying, field locating, and geophysical surveying. Since we can usually provide our own GIS-related services for projects and our professional land surveying services are normally procured separately, utility-locating subcontractors will normally only be required for some level of geophysical surveying support in the field. This level of geophysical surveying support can range widely from a simple electromagnetic (EM) survey over a known utility line, to a blind geophysical effort, including a ground-penetrating radar (GPR) survey and/or a comprehensive EM survey to delineate and characterize all unknown subsurface anomalies.

   The level of service required from the subcontractor will vary depending on the nature of the site. At sites where utility locations are well defined on the maps and recent construction is limited, CH2M HILL may be confident with a limited effort from a traditional utility-locating subcontractor providing a simple EM survey. At sites where utility locations are not well defined, where recent constructions may

have altered utility locations, or the nature of the site makes utility location difficult, CH2M HILL will require the services of a comprehensive geophysical surveying subcontractor, with a wide range of GPR and EM services available for use on an "as-needed" basis. Typical costs for geophysical surveying subcontractors will range from approximately $200 per day for a simple EM effort (usually one crew member and one instrument) to approximately $1,500 per day for a comprehensive geophysical surveying effort (usually a two-person crew and multiple instruments). Comprehensive geophysical surveying efforts may also include field data interpretation (and subsequent report preparation) and non-destructive excavation to field-verify utility depths and locations.

The following table provides a list of recommended geophysical surveying support subcontractors that can be used for utility-locating services:

Company Name and Address	Contact Name and Phone Number	Equipment[1]					Other Services[2]		
		1	2	3	4	5	A	B	C
US Radar, Inc.* PO Box 319 Matawan, NJ 07747	Ron LaBarca 732-566-2035			4					
Utilities Search, Inc.*	Jim Davis 703-369-5758	4				4	4	4	4
So Deep, Inc.* 8397 Euclid Avenue Manassas Park, VA 20111	703-361-6005	4					4	4	4
Accurate Locating, Inc. 1327 Ashton Rd., Suite 101 Hanover, MD 21076	Ken Shipley 410-850-0280	4	4						
NAEVA Geophysics, Inc. P.O. Box 7325 Charlottesville, VA 22906	Alan Mazurowski 434-978-3187	4	4	4	4	4	4	4	4
Earth Resources Technology. Inc. 8106 Stayton Rd. Jessup, MD 20794	Peter Li 240-554-0161	4	4	4	4	4	4	4	
Geophex, Ltd 605 Mercury Street Raleigh, NC 27603	I. J. Won 919-839-8515	4	4	4	4	4	4	4	4

Notes:

*Companies denoted with an asterisk have demonstrated reluctance to assume responsibility for damage to underground utilities or an inability to accommodate the insurance requirements that CH2M HILL requests for this type of work at many Navy sites.

[1]Equipment types are:

1. Simple electromagnetic instruments, usually hand-held
2. Other, more innovative, electromagnetic instruments, including larger instruments for more area coverage
3. Ground-penetrating radar systems of all kinds
4. Audio-frequency detectors of all kinds
5. Radio-frequency detectors of all kinds

[2]Other services include:

A. Data interpretation and/or report preparation to provide a permanent record of the geophysical survey results and a professional interpretation of the findings, including expected accuracy and precision.

B. Non-destructive excavation to field-verify the depths, locations, and types of subsurface utilities.

C. Concrete/asphalt coring and pavement/surface restoration.

Attachment C – Equipment Used for Identifying Underground Utilities

This attachment provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the AM and PM determine if the equipment being proposed by a subcontractor or Navy is adequate. A list of in-house experts that can be used to answer questions you may have is provided below.

CH2M HILL In-house Utility Location Experts

Tamir Klaff/WDC

Home Office Phone – 703-669-9611

Electromagnetic Induction (EMI) Methods

EMI instruments, in general, induce an electromagnetic field into the ground (the primary field) and then record the response (the secondary field), if any. Lateral changes in subsurface conductivity, such as caused by the presence of buried metal or by significant soil variations, cause changes in the secondary field recorded by the instrument and thus enable detection and mapping of the subsurface features. It should be noted that EMI only works for electrically conductive materials--plastic or PVC pipes are generally not detected with EMI. Water and gas lines are commonly plastic, although most new lines include a copper "locator" strip on the top of the PVC to allow for detection with EMI.

EMI technology encompasses a wide range of instruments, each with inherent strengths and weaknesses for particular applications. One major division of EMI is between "time-domain" and "frequency-domain" instruments that differ in the aspect of the secondary field they detect. Another difference in EMI instruments is the operating frequency they use to transmit the primary field. Audio- and radio-frequencies are often used for utility detection, although other frequencies are also used. Consideration of the type of utility expected, surface features that could interfere with detection, and the "congestion" of utilities in an area, should be made when choosing a particular EMI instrument for a particular site.

One common EMI tool used for utility location is a handheld unit that can be used to quickly scan an area for utilities and allows for marking locations in "real time". This method is most commonly used by "dig-safe" contractors marking out known utilities prior to excavation. It should be noted that this method works best when a signal (the primary field) can be placed directly onto the line (i.e., by clamping or otherwise connecting to the end of the line visible at the surface, or for larger utilities such as sewers, by running a transmitter through the utility). These types of tools also have a limited capability to scan an area for unknown utilities. Usually this requires having enough area to separate a hand held transmitter at least a hundred feet from the

receiver. Whether hunting for unknown, or confirming known, utilities, this method will only detect continuous lengths of metallic conductors.

In addition to the handheld EMI units, larger, more powerful EMI tools are available that provide more comprehensive detection and mapping of subsurface features. Generally, data with these methods are collected on a regular grid in the investigation area, and are then analyzed to locate linear anomalies that can be interpreted as utilities. These methods will usually detect *all* subsurface metal (above a minimum size), including pieces of abandoned utilities. In addition, in some situations, backfill can be detected against native soils giving information on trenching and possible utility location. Drawbacks to these methods are that the secondary signals from utilities are often swamped (i.e., undetectable) close to buildings and other cultural features, and that the subsurface at heavily built-up sites may be too complicated to confidently interpret completely.

Hand-held metal detectors (treasure-finders) are usually based on EMI technology. They can be used to locate shallow buried metal associated with utilities (e.g., junctions, manholes, metallic locators). Advantages of these tools is the ease of use and real-time marking of anomalies. Drawbacks include limited depths of investigations and no data storage capacity.

Ground Penetrating Radar (GPR)

GPR systems transmit radio and microwave frequency (e.g., 80 megaHertz to 1,000 megaHertz) waves into the ground and then record reflections of those waves coming back to the surface. Reflections of the radar waves typically occur at lithologic changes, subsurface discontinuities, and subsurface structures. Plastic and PVC pipes can sometimes be detected in GPR data, especially if they are shallow, large, and full of a contrasting material such as air in a wet soil, or water in a dry soil. GPR data are usually collected in regular patterns over an area and then analyzed for linear anomalies that can be interpreted as utilities. GPR is usually very accurate in x-y location of utilities, and can be calibrated at a site to give very accurate depth information as well. A significant drawback to GPR is that depth of investigation is highly dependant on background soil conductivity, and it will not work on all sites. It is not uncommon to get only 1-2 feet of penetration with the signal in damp, clayey environments. Another drawback to GPR is that sites containing significant fill material (e.g., concrete rubble, scrap metal, garbage) will result in complicated anomalies that are difficult or impossible to interpret.

Magnetic Field Methods

Magnetic field methods rely on detecting changes to the earth's magnetic field caused by ferrous metal objects. This method is usually more sensitive to magnetic metal (i.e., deeper detection) than EMI methods. A drawback to this method is it is more susceptible to being swamped by surface features such as fences and cars. In addition, procedures must usually be implemented that account for natural variations in the earth's background field as it changes throughout the day. One common use of the method is to measure and analyze the gradient of the magnetic field, which eliminates most of the drawbacks to the method. It should be noted this method only detects

ferrous metal, primarily iron and steel for utility location applications. Some utility detector combine magnetic and EMI methods into a single hand-held unit.

Optical Methods

Down the hole cameras may be useful in visually reviewing a pipe for empty conduits and/or vaults.

Attachment D – Utility Clearance Documentation Form

Buried Utility Location Tracking Form

(Submit to CH2M HILL PM within 24 hrs of location activities)

Project Location:
CH2M HILL Project No.:
CH2M HILL Project Manager: Name/Phone:
Fax:
Email:
CH2M HILL Field Team Leader: Name/Phone:

CH2M HILL Purchase Order:

Utility Location Subcontractor:
Subcontractor POC:

Dates of location activities:

Check each box using an "X" if a buried utility is present within 5 feet of a marked Station ID. If color of the flag or paint differs from listed color, note change in color on the form.

Station ID	Gas (Yellow)	Electric (Red)	Fiber optic (Orange)	Cable (Orange)	Water (Blue)	San. Sewer (Green)	Storm Sewer (Green)	Steam (Yellow)	Petroleum (Yellow)	Compressed air (Yellow)	Other ____	Other ____	Other ____	Other ____	Date completed	Technician initials	Notes (methods/tools used)

The findings of the buried utility location activities summarized herein were conducted in strict accordance with the CH2M HILL scope of work.

Subcontractor's Signature

Date

Attachment E – Utility Marking Color Codes

The following is the standard color code used by industry to mark various types of utilities and other features at a construction site.

White – Proposed excavations and borings

Pink – Temporary survey markings

Red – Electrical power lines, cables, conduits and lighting cables

Yellow – Gas, oil, steam, petroleum or gaseous materials

Orange – Communication, alarm or signal lines, cables, or conduits

Blue – Potable water

Purple – Reclaimed water, irrigation and slurry lines

Green – Sewer and storm drain lines

PMS 219

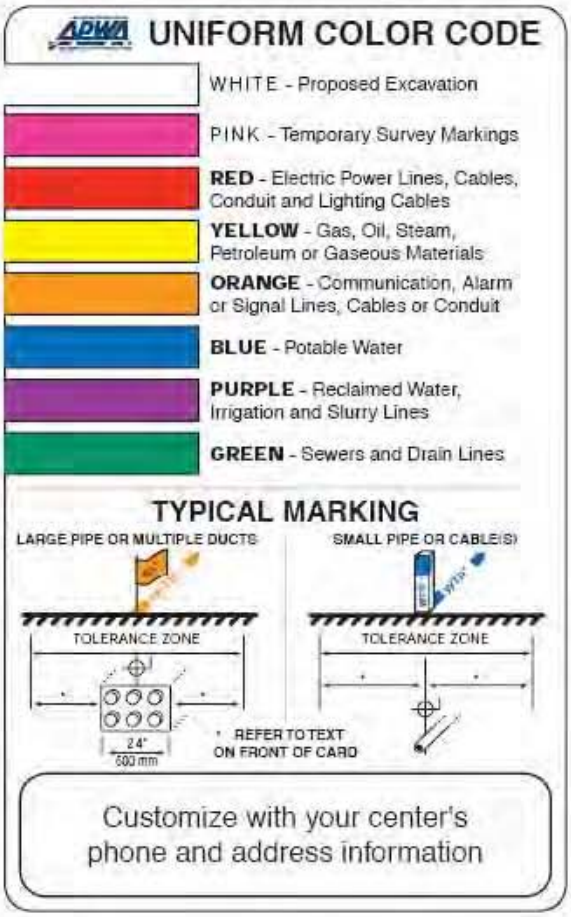
PMS 1795*

PMS 144*

13.5 parts process
2.5 parts reflex

PMS 253

PMS 3415



GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS
The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION
Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING
Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE
Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE
The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Rev. 4/99

STANDARD OPERATING PROCEDURE

VOC Sampling-Water

I. Purpose

To provide general guidelines for sampling aqueous volatile organic compounds.

II. Scope

Standard techniques for collecting representative samples are summarized. Site-specific details are discussed in the Field Sampling Plan.

III. Equipment and Materials

- Sample vials pre-preserved at laboratory with Hydrochloric acid (HCl)
- Surgical or latex gloves

IV. Procedures and Guidelines

1. Sample VOCs before sampling other analyte groups.

2. When sampling for VOCs, especially residential wells, evaluate the area around the sampling point for possible sources of air contamination by VOCs. Products that may give off VOCs and possibly contaminate a sample include perfumes and cosmetics, skin applied pharmaceuticals, automotive products (gasoline, starting fluid, windshield deicers, carburetor cleaners, etc.) and household paint products (paint strippers, thinners, turpentine, etc.).

3. Keep the caps off the sample vials for as short a time as possible.

4. Wear clean latex or surgical gloves.

5. Fill the sample vial immediately, allowing the water stream to strike the inner wall of the vial to minimize formation of air bubbles. DO NOT RINSE THE SAMPLE VIALS BEFORE FILLING.

6. Fill the sample vial with a minimum of turbulence, until the water forms a positive meniscus at the brim.

7. Replace the cap by gently setting it on the water meniscus. Tighten firmly, but DO NOT OVERTIGHTEN.

8. Invert the vial and tap it lightly. If you see air bubbles in the sample, do not add more sample. Use another vial to collect another sample. Repeat if necessary until you obtain a proper sample.

V. Attachments

None.

VI. Key Checks and Items

- Check for possible sources of contamination.
- Fill slowly, with as little turbulence as possible.
- Check for air bubbles.

STANDARD OPERATING PROCEDURE

Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using a Horiba or YSI Water Quality Parameter Meter with Flow-through Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using a water quality parameter meter (e.g., Horiba® or YSI) for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of aqueous samples. The YSI instrument does not measure turbidity. A separate turbidity meter (i.e., Hanna Turbidity Meter) will need to be used in conjunction with the YSI meter. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Water Quality Parameter Meter such as a Horiba® Water Quality Monitoring System or YSI with flow-though cell
- Auto-Calibration Standard Solution (provided by rental company)
- Distilled water in squirt bottle

III. Procedures and Guidelines

A. Parameters and Specifications:

Parameter	Range of measurement	Accuracy
pH	0 to 14 pH units	+/- 0.1 pH units
Specific conductance	0 to 9.99 S/m	+/- 3 % full scale
Turbidity	0 to 800 NTU	+/- 5 % full scale
Dissolved oxygen	0 to 19.99 mg/l	+/- 0.2 mg/l
Temperature	0 to 55 ^{o}C	+/- 1.0 ^{o}C
ORP	-999 to +999 mV	+/- 15 mV
Salinity	0 to 4 %	+/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water and calibrate using the Standard Solution.

Horiba Calibration procedure:

1. Fill a calibration beaker with standard solution to the recommended fill line.
2. Insert the probe into the beaker. All the parameter sensors will now be immersed in the standard solution except the D.O. sensor; the D.O. calibration is done using atmospheric air.
3. Turn power on and allow some time for the machine to warm-up prior to starting the calibration. When the initial readings appear to stabilize the instrument is ready to calibrate.
4. Press CAL key to put the unit in the calibration mode.
5. Press the ENT key to start automatic calibration. Wait a moment, and the upper cursor will gradually move across the four auto-calibration parameters one by one: pH, COND, TURB, and DO. When the calibration is complete, the readout will briefly show END. The instrument is now calibrated.
6. If the unit is calibrated properly the instrument readings, while immersed in the standard solution, will match the standard solution values provided on the solution container. The typical standard solution values are: pH = 4.0 +/- 3%, conductivity 4.49 mS/cm +/- 3%, and turbidity = 0 NTU +/- 3%.
7. Record the calibration data (e.g. time, instrument ID, solution lot number and expiration date, final calibrated readings, and solution temperature in the field logbook.

YSI Calibration procedure:

1. Press the **On/off** key to display the run screen
2. Press the **Escape** key to display the main menu screen
3. Use the arrow keys to highlight the **Calibrate**
4. Press the **Enter** key. The Calibrate screen is displayed
5. Choose the parameter to calibrate

A. Conductivity Calibration:

This procedure calibrates specific conductance (recommended), conductivity and salinity. Calibrating any one option automatically calibrates the other two.

1) Use the arrow keys to highlight the **Conductivity** selection
2) Press **Enter.** The Conductivity Calibration Selection Screen is displayed.
3) Use the arrow keys to highlight the Specific Conductance selection.
4) Press **Enter.** The Conductivity Calibration Entry Screen is displayed.
5) Place the correct amount of conductivity standard (see Instrument Manual) into a clean, dry or pre-rinsed transport/calibration cup.
6) Carefully immerse the sensor end of the probe module into the solution.
7) Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell.

NOTE: The sensor must be completely immersed past its vent hole. Using the recommended volumes from the Instrument Manual Calibration Volumes should ensure that the vent hole is covered.

8) Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not over tighten as this could cause damage to the threaded portions.

9) Use the keypad to enter the calibration value of the standard you are using.

   NOTE: Be sure to enter the value in **mS/cm at 25°C**.

10) Press **Enter**. The Conductivity Calibration Screen is displayed.
11) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
12) Observe the reading under Specific Conductance. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
13) Press **Enter**. This returns you to the Conductivity Calibrate Selection Screen
14) Press **Escape** to return to the calibrate menu.
15) Rinse the probe module and sensors in tap or purified water and dry.

B. Dissolved Oxygen Calibration:

This procedure calibrates dissolved oxygen. Calibrating any one option (% or mg/L) automatically calibrates the other.

1) Go to the calibrate screen as described in Section

   NOTE: The instrument must be on for at least 20 minutes to polarize the DO sensor before calibrating.

2) Use the arrow keys to highlight the **Dissolved Oxygen** selection.
3) Press **Enter**. The dissolved oxygen calibration screen is displayed.
4) DO calibration in mg/L is carried out in a water sample which has a known concentration of dissolved oxygen (usually determined by a Winkler titration).
5) Use the arrow keys to highlight the **DO mg/L** selection.
6) Press **Enter**. The DO mg/L Entry Screen is displayed.
7) Place the probe module in water with a known DO concentration.

   NOTE: Be sure to completely immerse all the sensors.

8) Use the keypad to enter the known DO concentration of the water.
9) Press **Enter**. The Dissolved Oxygen mg/L Calibration Screen is displayed.
10) Stir the water with a stir bar, or by rapidly moving the probe module, to provide fresh sample to the DO sensor.
11) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
12) Observe the DO mg/L reading, when the reading is stable (shows no significant change for approximately 30 seconds), press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
13) Press **Enter**. This returns you to the DO calibration screen.
14) Press **Escape** to return to the calibrate menu.
15) Rinse the probe module and sensors in tap or purified water and dry.

C. pH Calibration:

1) Go to the calibrate screen.
2) Use the arrow keys to highlight the **pH** selection.
3) Press **Enter**. The pH calibration screen is displayed.

- Select the **1-point** option only if you are adjusting a previous calibration. If a 2-point or 3-point calibration has been performed previously, you can adjust the calibration by carrying out a one point calibration. The procedure for this calibration is the same as for a 2-point calibration, but the software will prompt you to select only one pH buffer.
- Select the **2-point** option to calibrate the pH sensor using only two calibration standards. Use this option if the media being monitored is known to be either basic or acidic. For example, if the pH of a pond is known to vary between 5.5 and 7, a two-point calibration with pH 7 and pH 4 buffers is sufficient. A three point calibration with an additional pH 10 buffer will not increase the accuracy of this measurement since the pH is not within this higher range.
- Select the **3-point** option to calibrate the pH sensor using three calibration solutions. In this procedure, the pH sensor is calibrated with a pH 7 buffer and two additional buffers. The 3-point calibration method assures maximum accuracy when the pH of the media to be monitored cannot be anticipated. The procedure for this calibration is the same as for a 2-point calibration, but the software will prompt you to select a third pH buffer.

4) Use the arrow keys to highlight the **2-point** selection.
5) Press **Enter**. The pH Entry Screen is displayed.
6) Place the correct amount of pH buffer into a clean, dry or pre-rinsed transport/calibration cup.

   NOTE: For maximum accuracy, the pH buffers you choose should be within the same pH range as the water you are preparing to sample.

   NOTE: Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the pH sensor with a small amount of buffer that can be discarded. Be certain that you avoid cross-contamination of buffers with other solutions.
7) Carefully immerse the sensor end of the probe module into the solution.
8) Gently rotate and/or move the probe module up and down to remove any bubbles from the pH sensor.

   NOTE: The sensor must be completely immersed. Using the recommended volumes from Table 6.1 Calibration Volumes, should ensure that the sensor is covered.
9) Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not over tighten as this could cause damage to the threaded portions.
10) Use the keypad to enter the calibration value of the buffer you are using **at the current temperature**.

    NOTE: pH vs. temperature values are printed on the labels of all YSI pH buffers.
11) Press **Enter**. The pH calibration screen is displayed.
12) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
13) Observe the reading under pH, when the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
14) Press **Enter**. This returns you to the Specified pH Calibration Screen.

15) Rinse the probe module, transport/calibration cup and sensors in tap or purified water and dry.
16) Repeat steps 6 through 13 above using a second pH buffer.
17) Press **Enter**. This returns you to the pH Calibration Screen.
18) Press **Escape** to return to the calibrate menu.
19) Rinse the probe module and sensors in tap or purified water and dry.

D. ORP Calibration:

1) Go to the calibrate screen.
2) Use the arrow keys to highlight the **ORP** selection.
3) Press **Enter**. The ORP calibration screen is displayed.
4) Place the correct amount of a known ORP solution into a clean, dry or pre-rinsed transport/calibration cup.

   NOTE: Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the ORP sensor with a small amount of solution that can be discarded. Be certain that you avoid cross-contamination with other solutions.
5) Carefully immerse the sensor end of the probe module into the solution.
6) Gently rotate and/or move the probe module up and down to remove any bubbles from the ORP sensor.

   NOTE: The sensor must be completely immersed.
7) Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.
8) Use the keypad to enter the correct value of the calibration solution you are using at the current temperature.
9) Press **Enter**. The ORP calibration screen is displayed.
10) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
11) Observe the reading under ORP, when the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
12) Press **Enter**. This returns you to the Calibrate Screen.
13) Rinse the probe module and sensors in tap or purified water and dry.
    Record the calibration data (e.g. time, instrument ID, solution lot number and expiration date, final calibrated readings, and solution temperature in the field logbook.

C. Sample Measurement:

Horiba measurement procedure:

As water passes through the flow-through the flow cell, press MEAS to obtain reading; record data in a field notebook.

YSI measurement procedure:

As water passes through the flow-through the flow cell, the readings are displayed for each parameter. Record the water quality parameter data in a field notebook. In addition, the data is recorded in the YSI and can be downloaded to a computer following completion of the sampling event.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance and troubleshooting
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction.

V. References

YSI 556 Multi Probe System Operator Manual

STANDARD OPERATING PROCEDURE

Fish Sampling Using Electroshocking Techniques

I. Purpose

To provide a general guideline for conducting fish community surveys using electroshocking equipment.

II. Scope

A standard fish survey method is provided using electroshocking methods. Site-specific details are discussed in related sections of the Field Sampling Plan.

III. Equipment and Materials

- Field log book
- Data sheets
- Backpack electroshocker
- Boat-mounted electroshocker
- Seines
- Hip boots or chest waders
- Outer and inner rubber gloves
- Plastic bottles or containers
- Measuring board
- Cooler/Ice
- Water buckets
- Site Health and Safety Plan
- Instrument operation manuals
- Gasoline
- Formalin solution
- Waterproof labels
- Fish taxonomy keys

IV. Procedures and Guidelines

1. Fish in ponds, impoundments, lakes, and navigable streams/rivers should be collected with a boat-mounted electrofishing unit.

2. Fish in wetlands and wadable streams should be collected with a backpack electrofishing unit.

3. Sample intervals to be conducted at sample station should consist of approximately 30 minutes of shocking time or until no new fish species are collected in 10 minutes of shocking. Actual shocking time is to be recorded for each sample.

4. Fish will be collected with a long-handled dip net and placed in to a live well (tank) or bucket. Any fish not being kept for chemical analytical tissue samples, will be returned to the water As soon as possible

5. Information on species, size class, location and physical condition will be recorded for each fish captured. Record the proportion of individuals as hybrids and the proportion of individuals with DELTs (deformities, erosion [fins], lesions or tumors), other signs of disease, skeletal anomalies, and any other pertinent information on a field data sheet.

6. If too difficult to identify the specimen, or specimen are too numerous for effective field processing, preserve them for later processing (10% Formalin or 95% ethanol), and transport them to the office or laboratory for taxonomic work and measurements.

7. Sampling equipment including the fish measuring board will be cleaned and rinsed between each sample station.

8. Sample stations will be mapped and information on habitat condition of each sample station will be recorded including water depth, substrate type, shoreline profile or vegetation and degree of shading.

9. Photographs of sample stations in ponds, wetlands and creek habitats should be taken to supplement written descriptions.

V. Attachments

None

VI. Key Checks and Items

- Follow recommended safety precautions in operating the fish electroshocking equipment.
- Clean sample equipment between sample stations.

STANDARD OPERATING PROCEDURE

Fish Sampling Using Seines

I. Purpose

The purpose of this SOP is to provide general reference information and technical guidance on the procedure to sample and characterize fish communities using seining procedures. The collected samples provide information used in the determination of population statistics of the fish community and can be used to collect fish samples for chemical analysis of tissues. This information will be used in the assessment of risks to human health and the environment.

II. Scope

This guideline provides information on proper sampling equipment and techniques for the collection of fish in shallow streams, ponds, and near shore areas of lakes, impoundments, bays, estuaries, and ocean shoreline. This technique is more suited for use in smooth bottomed, low-sloped areas.

This procedure is not very effective when the seine is pulled over weeds and other obstructions as they may tend to roll up, and allow the fish to pass under the seine.

Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The technique described should be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methods.

III. Equipment and Materials

- Seine
- Fish Measuring Board
- 0-16 oz scale, 1-4 lb scale, 1-15 lb scale
- Appropriate sampling keys for species to be sampled, and any required instruments to aid in the identification
- Live Well (large tub) with overflow pipe to outside of boat
- Field sampling data sheets
- Glass jars for storage of fish
- Preservative (10% formalin or 95% ethanol)
- Black Permanent Marker
- Camera
- Required Personal Protective Equipment
- Portable Air Pumps

IV. Procedures

The primary considerations for collecting fish for population studies include identifying sampling locations, proper sampling techniques for the haul seine and proper documentation of samples. Detailed procedures for conducting fish populations utilizing the haul seine are described in the sections to follow.

A. Preliminary Activities

Apply-for- and receive applicable scientific collection permits as required by the state agencies with purview over the project site. Contact local fish & game and/or law enforcement officials and inform them of your activities.

Collect and determine all information pertinent to the fish sampling project, including water depth, station locations, nearby boat access locations, known sediment contamination, tidal variation, any waterway obstructions or inconsistencies (e.g. shallow or grassy areas, low structures, pipe crossings), any other biological studies previously conducted on or near the site, species used locally for human consumption and the degree of such consumption species most likely present, and the most appropriate sampling method for the species of interest that is permitted by law.

Before sampling occurs, conduct a site reconnaissance using a site map. The objective of this exercise is to categorize habitats, and map dividing lines and descriptors identifying the various types of habitats available. Make notations on the map depicting the abiotic characteristics of the reach including features such as substrate, water depth, channel shape, degree of bank erosion, piers, boat traffic, commercial trawling, potting activities, and relative current velocity and direction. Also make notations on the site map to show biotic characteristics of the reach including fish species observed, evidence of fisherman use, and aquatic and riparian vegetation including wetlands. In addition, identify station locations at this point, along with the total area to be sampled. Choose the station locations, where possible, to represent ecologically similar aquatic environments.

Ensure adequate number of sample collection jars and volume of preservative needed.

Set up a live well (e.g., large cooler, 50-gallon container) with site water.

B. Operating Procedure

Determine the area to be sampled, and mark it with flagging, if possible. Stretch the seine across the area to be sampled, with a minimum of one field personnel on either side of the seine. Ensure that the weighted side of the seine is at the bottom. Best results are achieved when the water level is no deeper than two thirds the height of the slack net.

Rapidly walk through the water at the same speed, while keeping a constant distance apart. If sampling in a stream, walk upstream against the current. As the end of the sampling area approaches, Pull the seine rapidly toward the shore, and lift the weighted end out of the water. Place the collected fish into the live wells.

If other field personnel are present, have them walk towards the seine to chase the fish in that direction. In addition, have them help to lift the seine when the sampling effort is complete.

Conduct sampling in areas that will ensure adequate qualitative and/or quantitative representation of the fish community, whichever is necessary. These areas should include riffles/runs, shorelines, snags, natural fish holding areas, vegetation beds and other habitats.

At the end of a sampling reach, identify, measure, weigh and release the specimens. Record the proportion of individuals as hybrids and the proportion of individuals with DELTs (deformities, erosion [fins], lesions or tumors), other signs of disease, skeletal anomalies, and any other pertinent information on a field data sheet.

To the extent possible, process all species in the field and return them to the water alive. If too difficult to identify the specimen, or specimen are too numerous for effective field processing, preserve them for later processing (10% Formalin or 95% ethanol), and transport them to the office or laboratory for taxonomic work and measurements.

At a minimum, preserve one representative fish from each species as a voucher specimen. Record the station location, date sampled, and species name on the label.

The following information will be recorded in the Field Logbook:

- Sample identification (site name, location, project no.; sample name/number and location; sample type and matrix; time and date; sampler's identity).
- Field observations and measurements (sample setting, appearance of substrate, sampling method, and photograph descriptions).
- Additional remarks, as appropriate.

Record all observations in the Field Logbook as described in SOP F202. Complete field sheets for the collected samples.

V. References

Brower, 1977. James E. Brower and H. Jerrold Zar. *Field and Laboratory Methods for General Ecology*. Wm. C. Brown Company Publishers. 1977.

Ricker, 1971. Ricker, W.E. *Methods for Assessment of Fish Production in Fresh Waters*. International Biological Programme Handbook No. 3. 1971.

U.S. EPA, 1987. U.S. Environmental Protection Agency. *A Compendium of Superfund Field Operations Methods*. Office of Emergency and Remedial Response, Office of Waste Programs Enforcement. December 1987.

U.S. EPA, 1989. Warren-Hicks, William, Parkhurst, Benjamin R., Baker, Samuel S. Jr. *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference*. U.S. EPA, Environmental Research Laboratory, Corvallis, OR 97333. March 1989.

STANDARD OPERATING PROCEDURE

Preparation of Fish and Shellfish Tissue Samples

I Purpose

The purpose of this SOP is to provide general reference information and technical guidance on the preparation of fish and shellfish tissue samples for chemical analysis. The chemical analysis of tissue provides information used in the determination of the potential bioaccumulation of contaminants for the assessment of risks to human and ecological receptors.

II Scope

This guideline provides information on proper methods for the preparation of fish and shellfish tissue samples for chemical analysis. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling and preparation techniques. The techniques described should be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments to the methods.

III. Equipment and Materials

- Fish Measuring Board or Ruler
- 0-16 oz, 1-4 lb, 1-15 lb spring scales
- Appropriate sampling keys for species to be sampled, and any required instruments to aid in the identification
- Field sampling data sheets
- Dangerous goods shipment procedures (if using dry ice)
- Decontamination supplies

IV. Procedures

The procedures for preparing the fish and shellfish samples for chemical analysis of tissues include collecting, weighing, measuring, and processing the fish and shellfish samples for shipment. The primary concerns in preparing the fish and shellfish for analysis is to ensure the sample size is adequate and the sample is not contaminated by improper handling.

A. Preliminary Activities

Contact a chemical analysis laboratory that has the required capability for tissue analysis and set up a subcontract agreement with them. Review the sample preparation requirements with the laboratory. Have the laboratory send an adequate number of coolers for shipping the tissue samples. Determine from the laboratory what the minimum amount of tissue sample required for analysis of all the specified parameters. In addition, determine the holding time for a processed sample, and any other special instructions the laboratory may have.

Ensure adequate volume of decontamination chemicals for entire trip. If dry ice is necessary for sample preservation (wet ice is normally good enough), determine where dry ice may be purchased within close proximity to the site or hotel, and where the closest FedEx drop-off is, or if FedEx picks up from the hotel.

Determine the recommended target sample weights of composite fish and shellfish tissue samples. Weight requirements are dictated by the chemical analytical laboratory and analytical method used. Because sample size requirements may vary among laboratories and the analytical methods used, determine the minimum amount of tissue required by the analytical laboratory for analysis of all the specified parameters for the specific project.

B. Selection of Target Species

When choosing a target species for collection to addressed human health, consideration will be given to the commonly consumed fish species in the area, the fish species ability to bio-accumulate contaminants, and the geographic distribution of the species. Table 2 from USEPA (1993) that present recommended target species for freshwater studies, recommended species for estuarine/marine studies are presented in Attachment 1.

Freshwater collection - at a minimum, target species for freshwater studies should include one bottom fish and one top carnivore and/or commercial and recreational fish species for determining human health and environment risks. In addition, one forage species and one shellfish species should be included for determining environmental risks.

Estuarine/Marine collection - target species for saltwater studies should include one shellfish and one top carnivore and/or commercial and recreational fish species for determining human health and environment risks. In addition, one forage species should be included for determining environmental risks.

When choosing a target species for collection to addressed ecological risks, consideration will be given to the habitat type, receptors present and food chain information.

C. Sample Processing Procedure

Gather fish specimen using the appropriate fish collecting SOP as determined by the site reconnaissance.

The following steps will be taken with each fish and shellfish collected: identify the sample specimen, sort and inspect the samples, rinse the samples and group by target species, prepare the sample for shipment to the laboratory.

Weigh the collected fish/shellfish to the nearest gram and measure to the nearest tenth of a centimeter. The total length of the fish will be measured by the distance in a straight line from the anterior-most projecting part of the head to the farthest tip of the caudal fin when its rays are squeezed together. The total length of the shellfish will be measured for bivalve mollusks by the distance (height) from the umbo to the anterior shell margin. The total length of the crustaceans will be measured for 1) crabs by the distance of the lateral width of the carapace, 2) shrimp and crayfish by the distance from the rostrum to the tip of the telson, and 3) lobsters, either the length of the carapace for spiny and clawed lobsters or the length of the

D. Composite Samples

For finfish, generally three to five individuals will be collected per target species per composite sample. For shellfish, generally three to ten individuals will be collected for a composite sample. A few of the shellfish collected may be resected (edible portions removed) to determine the wet weight of the edible portion to assist in estimating the number of individuals needed to obtain a 500 gram sample.

The same number of individuals will be collected for each composite sample per sampling location and per target species.

E. Preservation of Sample Integrity

Sample integrity is preserved by prevention of a loss of contaminants already existing in the tissue and prevention of extraneous tissue contamination. Sample integrity will be preserved by ensuring the fish skin is not lacerated by the sampling gear and ensuring the shellfish are not cracked. In addition, consideration will be taken in preventing the tissue samples and sample gear from coming directly in contact with grease, engine fluid, engine exhaust, dust, cooler, or ice.

F. Tissue Preparation for Shipment to Laboratory

After the initial processing to determine species, size, and morphological abnormalities, each fish or shellfish will be wrapped individually in aluminum foil and placed in a labeled waterproof freezer bag. If necessary, clean cork stoppers will be placed over the protruding spines or pincers of the shellfish before wrapping in foil, or spines/pincers will be clipped off. A 100% cotton paper label will be placed inside the bag, identifying the project, station location, date, and replicate number. A pencil will be used to mark the label. The outside of the bag also will be labeled with the project, station location, date, and replicate number using a black permanent marker. The bags will be stored on wet ice in coolers if shipment to the laboratories is within 48 hours. If longer, the bags will be stored in a freezer.

Carefully pack the samples in the coolers for shipment to the laboratory. Fill the top and bottom of the coolers with a sufficient amount of wet ice, if shipment to the laboratories is within 48 hours, or with a sufficient amount of dry ice. Enclose the chain-of-custody inside the cooler. Place a chain-of-custody seal on the cooler and

tape the cooler closed. Attach a completed FedEx airbill to the cooler and drop off at a FedEx office. If dry ice is being used, note on FedEx label and adhere to Dangerous Goods shipment procedures, if necessary.

The following information will be recorded in the Field Logbook:

- Sample identification (site name, location, project no.; sample name/number and location; sample type and matrix; time and date; sampler's identity).
- Field observations and measurements (sample setting, appearance of substrate, sampling method, and photograph descriptions).
- Additional remarks, as appropriate.

Proper chain-of-custody procedures play a crucial role in data gathering. SOP F201 describes requirements for completing a chain-of-custody form. Chain-of-custody forms are considered quality assurance records.

V. Attachments

Recommended Target Species Table from USEPA (1993)

VI. References

U.S. EPA, 1993. U.S. Environmental Protection Agency, *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 1 Fish and Sampling Analyses*. Office of Water. August 1993. EPA 823-R-93-002

ATTACHMENT 1

RECOMMENDED TARGET SPECIES TABLES

FROM USEPA, 1993

GUIDANCE FOR ASSESSING CHEMICAL CONTAMINANT DATA FOR USE IN FISH ADVISORIES. VOLUME I FISH SAMPLING AND ANALYSIS

3. TARGET SPECIES

Table 3-1
Recommended Target Species for Indland Fresh Waters

Family Name	Common Name	Scientific Name
Percichthyidae	White bass	*Morone chrysops*
Centrarchidae	Largemouth bass	*Micropterus salmoides*
	Smallmouth bass	*Micropterus dolomieui*
	Black crappie	***Pomoxis*** nigromaculatus
	Whfte crappie	*Pomoxis annulatis*
Percidae	Walleye	*Stizostedion vitreum*
	Yellow perch	*Perca flavescens*
Cyprinidae	Common carp	*Cyprinus caipio*
Catostomidae	White sucker	*Catostomus commersoni*
Ictaluridae	Channel catf ish	*lctalurus punctatus*
	Flathead catf ish	*Pylodictfs olivaris*
Esocidae	Northern pike	*Esox lurius*
Salmonidae	Lake trout	*Salvelinus namaycush*
	Brown trout	*Salmo trutta*
	Rainbow trout	*Oncorhynchus mykiss*[a]

aFormerly *Salmo gairdneti.*

Table 3-2
Recommended Target Species for Great Lakes Waters

Family Name	Common Name	Scientific Name
Percichthyidae	White bass	*Morone chrysops*
Centrarchidae	Smallmouth bass	*Micropterus dolomieui*
Percidae	Walleye	*Stizostedion vitreum*
Cyprinidae	Common carp	*Cyprinus caipio*
Catostomidae	White sucker	*Catostomus commersoni*
Ictaluridae	Channel catf ish	*lctalurus punctatus*
Esocidae	Muskellunge	*Esox lurius*
Salmonidae	Chinook salmon	*Oncorhynchus tschawytscha*
	Lake trout	*Salvelinus namaycush*
	Brown trout	*Salmo trutta*
	Rainbow trout	*Oncorhynchus mykiss*[a]

aFormerly *Salmo gairdneti.*

Table 3-7
Recommended Target Species for Northeast Atlantic Estuaries and Marine Waters (Maine through Connecticut)

Family Name	Common Name	Scientific Name
Finfish Species		
Anguillidae	American eel	*Anguilla rostrata*
Percichthyidae	Striped bass	*Morone saxatilis*
Pomatomidae	Bluefish	*Pomatomus saltatrix*
Sparidae	Scup	*Stenotomus chrysops*
Sciaenidae	Weakfish	*Cynoscion regales*
Bothidae	Summer flounder Four-spotted flounder	*Paralichthys dentatus* *Paralichthys oblongus*
Pleuronectidae	Winter flounder Yellowtail flounder American dab	*Pseudopleuronectes americanus* *Limanda ferruginea* *Hippoglossoides platessoides*
Shellfish Species		
Bivalves	Soft-shell clam Hard clam Ocean quahog Surf clam Blue mussel	*Mya arenaria* *Mercenaria mercenaria* *Arctica islandica* *Spisula solidissima* *Mytiius edulis*
Crustaceans	American lobster Eastern rock crab	*Homarus americanus* *Cancer irroratus*

Appendix B
Navy CLEAN Data Management Plan

Version 1

Navy CLEAN
Data Management Plan

Prepared for

Navy CLEAN & Joint Venture Programs

December 2009

CH2MHILL

Preface

This document presents the standardized six-step workflow process for environmental data management being performed for the Navy Comprehensive Long-Term Environmental Action - Navy (CLEAN) and Joint Venture Programs. Included in Appendix A is the responsible, approve, support, consult, and inform (RASCI) diagram along with the associated roles and responsibilities, which is the basis for the Navy CLEAN and Joint Venture Programs Data Management Plan (DMP). Following are the six steps in the workflow process:

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation and loading
5. Data management
6. Data evaluation and reporting

Figure P-1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs.

Figure P-2 presents, in more detail, the tools used in each step of the process. CH2M HILL uses the Sample Tracking Sheet (STS) to initiate the sample collection, documentation, and tracking processes. All field-related data is captured in the Field Data Entry Tool (FDETool). During the laboratory analysis and data validation phase, the SNEDD-QC-Tool software will be used to help evaluate the quality of the data. At the data management step, the SVMTool will be used to format the data and the CH-IMPTool will be used to transfer the data into the Navy CLEAN data warehouse. At the data evaluation stage, the XTabReports Tool will be used to query data from the data warehouse, and the Crosstab Cleanup Tool (CCTool) and the Raw, Detects, and Exceedance (RDE) Formatting Tool will produce and format data tables and comparisons to project action levels. Appropriate section(s) of the DMP include additional details on each of the tools used.

Change Management

This DMP is a "living" document and content may be revised or amended to accommodate changes in the scope of environmental investigations or data management requirements that affect the entire Navy CLEAN and Joint Venture Programs. In addition, the DMP appendices will be subject to modification as new or improved methods of data management are developed and implemented.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

Amendments will be versioned and released according to the following naming scheme: [Document Name_v#.#_yymmdd]. If a significant change is made to any of these files, the version number will increase by one integer. The revision history is shown in the following table.

REVISION HISTORY

Navy CLEAN and Joint Venture Programs Data Management Plan

Revision Date	Initiator	Purpose

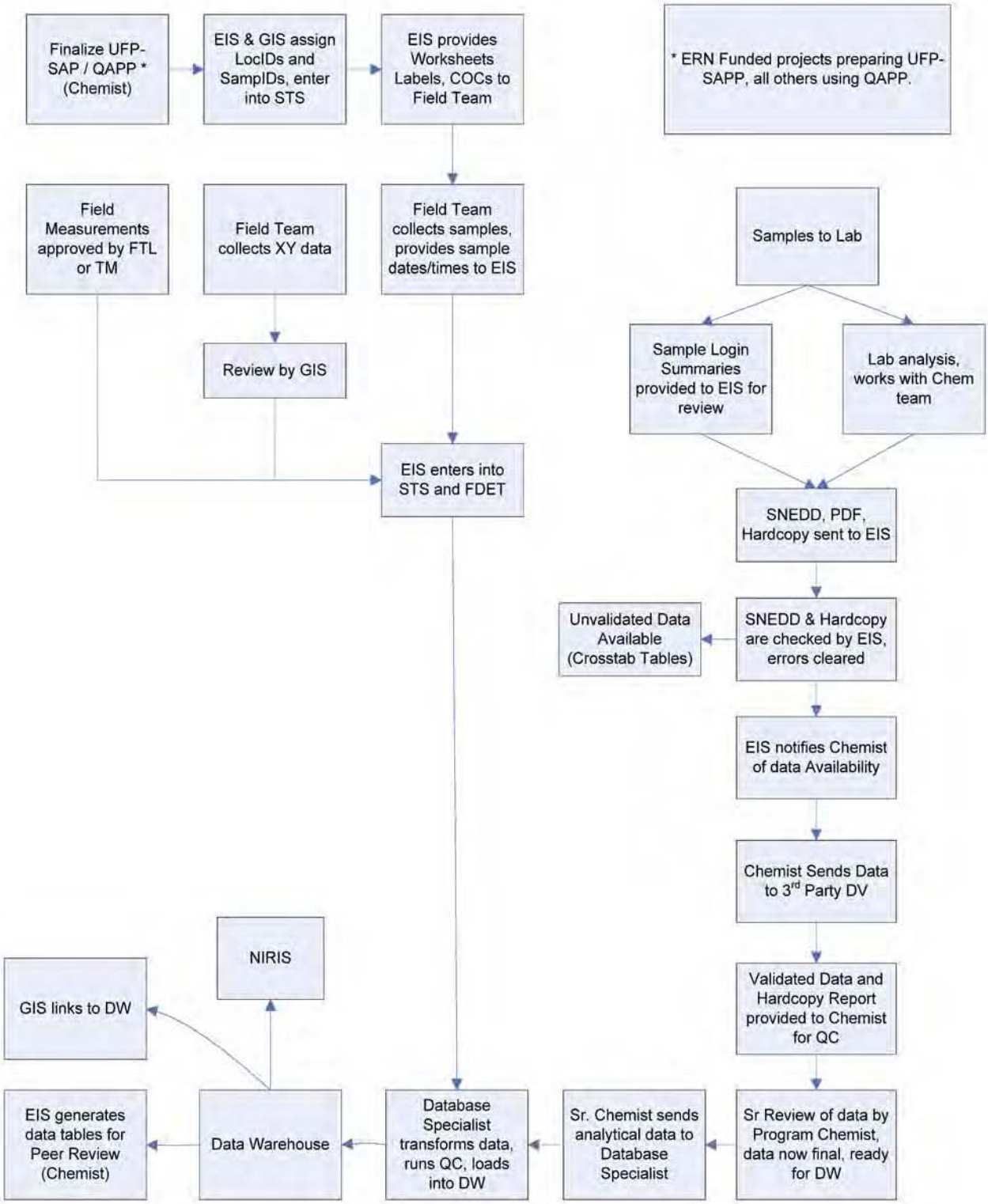


FIGURE P-1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

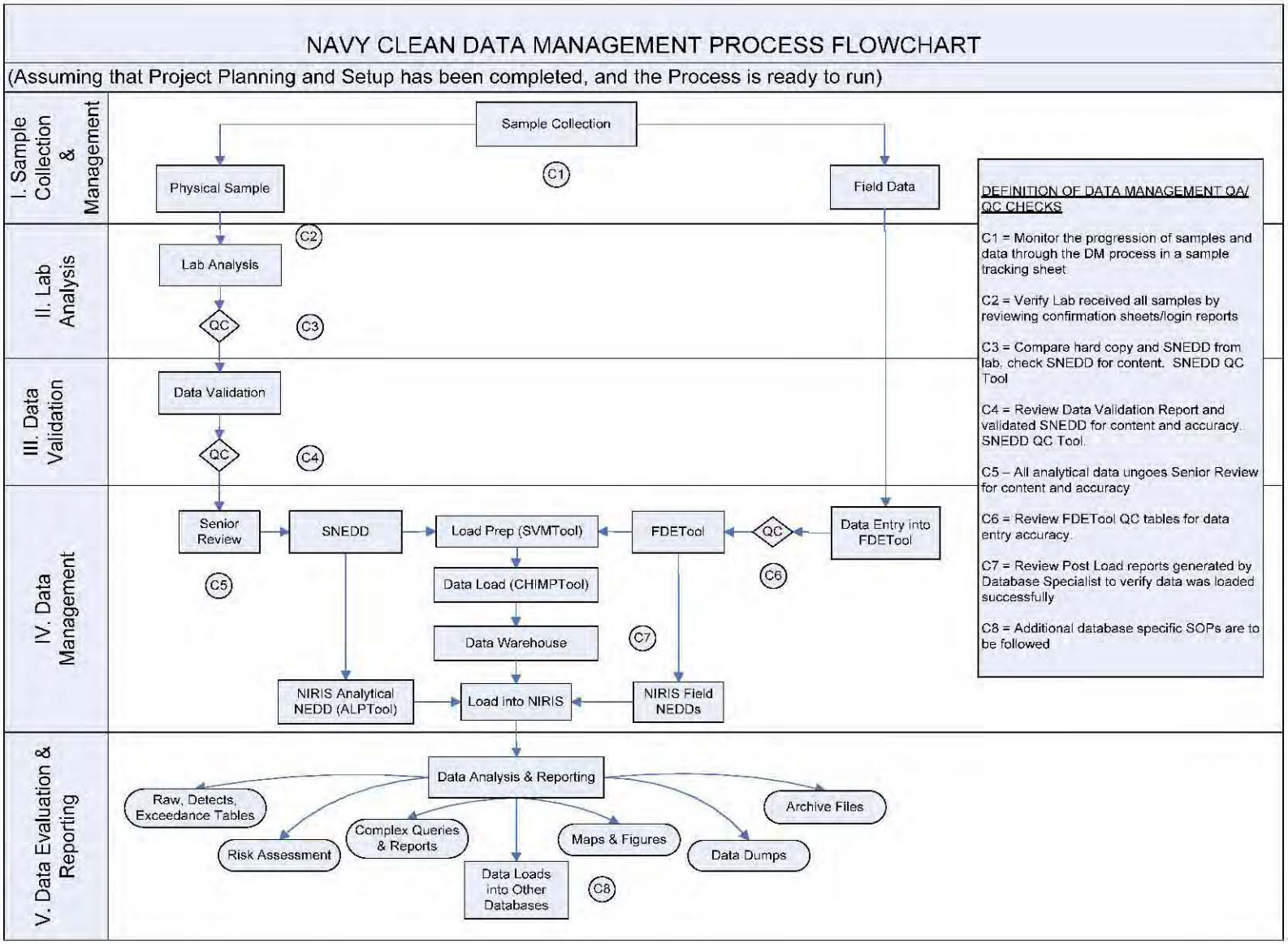


FIGURE P-2
DBMS PROCESS

Contents

Preface ..... **ii**

Contents ..... **vi**

Acronyms and Abbreviations ..... **viii**

Introduction **1-1**
1.1 Purpose 1-1
1.2 Scope of the Data Management Plan 1-1

Roles and Responsibilities **2-1**

Data Management System Description **3-1**

Phases of Data Management **4-1**
4.1 Project Planning and Setup 4-1
4.1.1 Database Setup and Administration 4-1
4.1.2 Data Security Procedures 4-3
4.1.3 Data Backup and Recovery 4-3
4.2 Sample Collection and Management 4-3
4.2.1 Sample Tracking Sheet 4-4
4.2.2 Sample Nomenclature Guidelines 4-4
4.2.3 Sample Collection 4-1
4.2.4 Chain-of-Custody 4-1
4.2.5 Sample and Document Tracking 4-1
4.2.6 Field Data 4-1
4.3 Laboratory Analysis 4-2
4.4 Data Validation 4-3
4.4.1 External Data Validation 4-3
4.4.2 Internal Data Validation 4-4
4.4.3 Unvalidated Data Preload Check 4-4
4.4.4 Senior Review 4-4
4.5 Data Preparation and Loading 4-4
4.5.1 Data Preparation 4-5
4.5.2 Data Loading 4-5
4.5.3 Data Warehouse 4-6
4.6 Data Reporting 4-6
4.6.1 Tables, Figures, and Diagrams 4-6
4.6.2 GIS 4-7
4.6.3 Site Information Management System 4-7
4.6.4 Legacy Data 4-7

Project Closeout **5-1**
5.1 Archive Procedures 5-1
5.2 Invoice Review and Approval 5-1

5.3 Project Closeout 5-2

Appendices

A RASCI/Workflow Process
B Data Collection Flow Diagram
C Standard Operating Procedures
D Electronic Data Deliverable Specifications

Tables

Revision History ..... **iii**

Table 1 ..... **2-2**

Table 2 ..... **4-1**
Table 3 4-1

Figures

Figure P-1 Environmental Data Management Workflow Process ..... **iv**

Figure P-2 DBMS Process ..... **v**

Figure 1 Environmental Data Management Workflow Process **3-2**

Figure 2 DBMS Process **3-3**

Figure 3 Project Planning **4-1**

Figure 4 Field Sampling **4-4**

Figure 5 Laboratory Analysis **4-2**

Acronyms and Abbreviations

AFCEE	Air Force Center for Engineering and the Environment
ALPTool	Archive Load and Prep Tool
AM	Activity Manager
CAD	computer-aided design
COC	chain-of-custody
DBMS	Database Management System
DBS	Database Specialist
EIS	Environmental Information Specialist
DMP	Data Management Plan
EDD	electronic data deliverable
EDM	Environmental Data Management
EMS	Enterprise Management Solutions
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EVS	Environmental Visualization System
FD	Field Duplicate
FDETool	Field Data Entry Tool
FTL	Field Team Leader
GA	GIS Analyst
GIS	geographic information system
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
MS	matrix spike
MSD	matrix spike duplicate
N/FD	normal/field duplicate
NAVFAC	Naval Facilities Engineering Command

NEDD	NIRIS Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
ODBC	open database connectivity
PC	Project Chemist
PCL	Program Chemistry Lead
PDL	Program Data Management Lead
PGL	Program GIS Lead
PM	Project Manager
QA	quality assurance
QC	quality control
RASCI	responsible, approve, support, consult, and inform
RDM	Regional Database Manager
SDG	Sample Delivery Group
SIMS	Site Information Management System
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
STS	Sample Tracking Sheet
SVMTool	SNEDD to VDMS Mapping Tool
VDMS	Validated Data Management System

SECTION 1

Introduction

This Data Management Plan (DMP) describes the methods CH2M HILL will use to manage and present environmental data to support work it is conducting for the Navy CLEAN and Joint Venture Programs. These processes and procedures are part of an overall environmental data management system called the SNEDD Approach to the Validation Data Management System (VDMS), hosted by CH2M HILL.

Project members and any subcontractors supporting program data needs for site characterization and remediation activities can use this DMP. It is a living document that is flexible enough to meet the dynamic needs of the teams and stakeholders. Data management program details and procedures are included in the appendices.

1.1 Purpose

This document outlines how environmental data for the Navy CLEAN and Joint Venture Programs will be obtained and managed using an Enterprise Management Solutions (EMS) approach. The systematic approach will facilitate the retrieval of data from project files and the data warehouse when they are needed, help ensure that the required data are collected and are of the appropriate quality, and help ensure that data records are not lost during transfer to the central program database repository.

1.2 Scope of the Data Management Plan

The scope of the data management activities addressed by this plan includes the following:

- **Roles.** Definition of staff roles and responsibilities.
- **Project Planning and Setup.** Use standard templates and database applications; provide guidance and standard operating procedures (SOPs) for formatting, reviewing, and transferring data collected in the field to the Database Management System (DBMS).
    - **Provide a structured, yet flexible data set.** The DBMS will store all types of environmental data and provides a standard framework for all projects within the Navy CLEAN Program to use. The DBMS is organized and structured, yet flexible enough to allow additional data and data types to be added at any time over the life of the program.
    - **Provide data that are well documented.** The DBMS will retain enough descriptive and source information for technical defensibility and legal admissibility of the data.
- **Sample Collection and Management.** Items that will be captured through standardized forms or applications include chains-of-custody (COCs), field parameter information, groundwater elevation data, and sample tracking records.
- **Laboratory Analysis.** Laboratory data will be reported in the Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD)

format specifications that analytical laboratories are required to use to transfer analytical data electronically to CH2M HILL. (Provided to laboratories via a scope of work.) Management and archive procedures will be implemented for hard copy and electronic project documentation.

- **Data Validation.** Internal and external data validation will be conducted in accordance with the appropriate Program and EPA requirements. All deliverables will be subjected to Senior Review quality assurance (QA) and quality control (QC) measures. Management and archive procedures will be implemented for hard copy and electronic project documentation.
- **Data Management.** QA and QC measures will be implemented to provide accurate representation of all data collected and to be stored in the DBMS. QA/QC procedures include restricting data import or entry to specific valid value lists that will not allow incorrect data to be included in the DBMS.
- **Data Evaluation and Reporting.** Reporting and delivery support will be provided from a single DBMS source and allow relatively simple and rapid access to stored data for environmental characterization, report generation, modeling, geographic information system (GIS) mapping, statistical analyses, and risk assessments.
    - **Provide data visualization capabilities.** Data will be accurately represented for use in models, GIS, boring log programs (Environmental Visualization System [EVS), computer-aided design (CAD), graphics, and other software used for mapping, graphing, charting, analyzing, and displaying environmental data.
    - **Provide the ability to compare data electronically.** Tools will allow the electronic comparison of project data to specific reference or screening criteria.
    - **Provide the ability to transfer data to different formats.** The DBMS will provide the ability to reformat, convert, and transfer the data to any format as required by specific end-user applications.

SECTION 2

Roles and Responsibilities

The Navy CLEAN and Joint Venture Programs Environmental Data Management (EDM) team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The EDM team is composed of data management, chemistry, and GIS resources. The EDM team is responsible for all aspects of planning, execution, management and reporting environmental of data. Data are derived from sampling events related to investigative and remedial activities for Navy CLEAN and Joint Venture projects.

Responsibilities related to data management and information solutions functions are grouped into roles, as listed in Table 1. The SNEDD DM Process Checklist referenced in Appendix C documents the specific responsibilities associated with each of these roles.

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Navy CLEAN Activity Manager (AM)	Various	Various	Various	Various
Navy CLEAN Project Manager (PM)	Various	Various	Various	Various
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TABLE 1
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The Navy CLEAN Program Data Management Plan

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SECTION 3

Data Management System Description

During field investigation, monitoring, and remedial activities, CH2M HILL will collect a variety of environmental information to support data analysis, reporting, and decision-making activities. To meet current regulatory QA requirements, a complete audit trail of the information flow must be implemented. The six steps in the workflow process are (Appendix B):

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation
5. Data management and loading
6. Data evaluation and reporting

Each step in the data management process must be adequately planned, executed, and documented. Figure 1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs. Figure 2 presents, in more detail, the tools used in each step of the process.

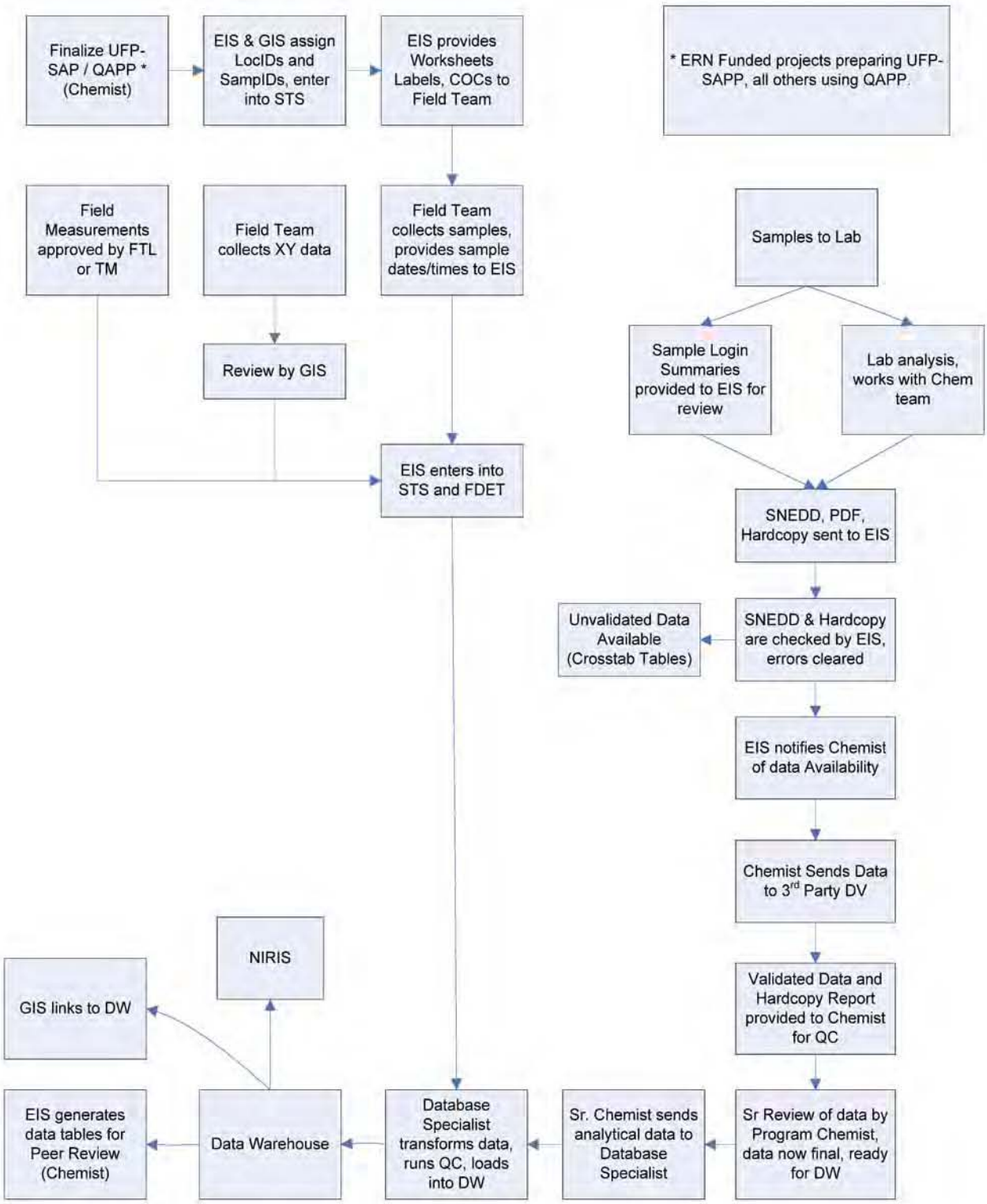


FIGURE 1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

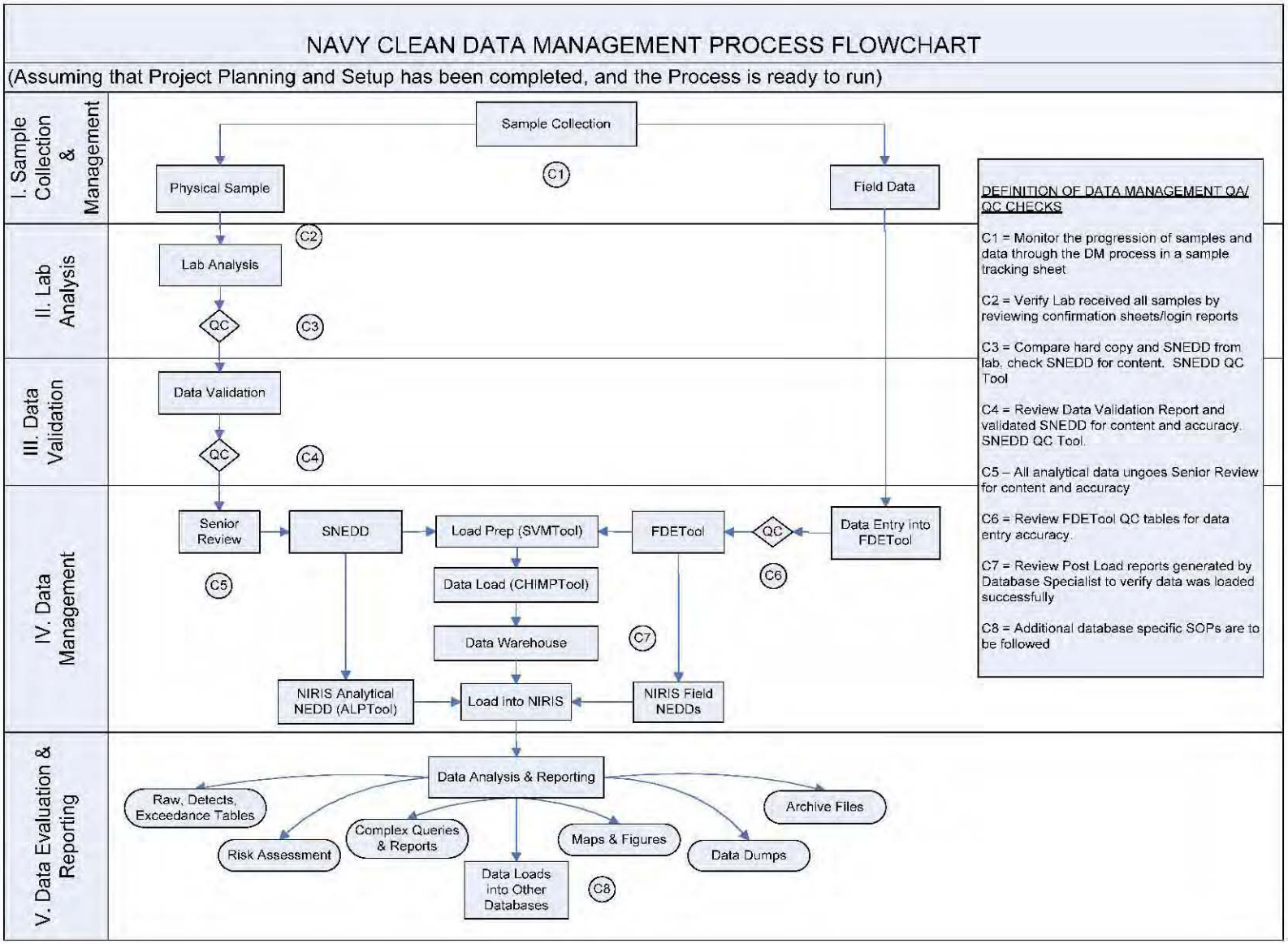


FIGURE 2
DBMS PROCESS

SECTION 4

Phases of Data Management

4.1 Project Planning and Setup

Project planning starts when a new project or task is identified in the program. Evaluation of what is required from data management and visualization occurs to determine the data needs. The Program Critigen Team Lead (Critigen Lead) works with the Program Data Management Lead (PDL) and the project and/or activity manager to determine what is expected and required from the data management and visualization team. Specific items that should be considered are as follows:

- Inputs – Determine what data will be collected and stored in the database. Determine frequency and quantity. Determine what tools will be used to handle data input.
- Historical Data – This is a unique data input and requires special consideration. The PDL ***must*** work with the other technical leads to assess what effort will be required. This step is often missed, and the resulting data quality issues created from inadequate planning in this area can plague the project for its entire duration.
- Outputs – Determine what data will need to be presented in reports, figures, and electronic deliverables. Determine frequency and quality requirements. Determine preliminary data, validated data, and what tools will most effectively handle the output requirements. Discuss how the outputs needed by the team will be requested and documented.
- Visualization – Determine necessity for GIS and CAD.

After the information above is determined, the data management scope, schedule, and budget are developed and endorsed by the Project Manager (PM), PDL, Program GIS Lead (PGL) and Program Chemistry Lead (PCL). The team can then proceed upon client authorization of the overall project budget. Figure 3 shows the process for project planning.

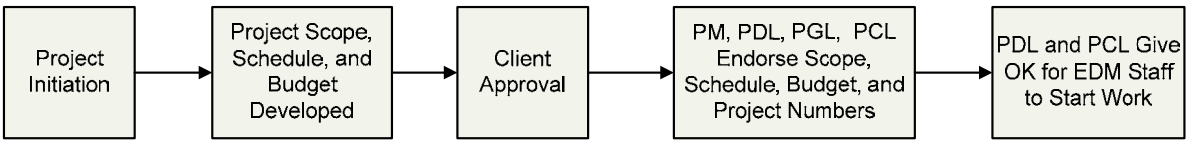


FIGURE 3
PROJECT PLANNING

4.1.1 Database Setup and Administration

CH2M HILL Database

The PDL will oversee the administration of the DBMS, including the design, development, and maintenance of the program database, tools and data management processes. Database and data management process design and development will focus on providing rapid data entry

and data retrieval while promoting data integrity through various automated procedures. The PDL will perform the database maintenance, which consists of the following:

- Assisting with the allocation of sufficient system storage for the program database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting and compacting the database for more efficient operation
- Upgrading database software and associated applications as necessary
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions
- Performing routine virus checks on incoming and outgoing data

The DBMS is comprised of the Data Warehouse and associated SNEDD-Approach tools, and will support the storage, analysis, display, and reporting of the Navy's environmental, analytical, and geotechnical data. The DBMS will consist of primary data tables that store the environmental data, dependent tables that store more details related to the data in the primary tables, and look-up tables that store valid values to provide input to the primary tables. The EIS will maintain the table content and the PDL will manage it.

Valid values are critical to any large relational database. Tables 2 and 3 provide examples of valid values for the Navy CLEAN and Joint Venture Programs' sites, stations, and samples. Inconsistencies in naming conventions, subtle analyte or method spelling differences, and the use of non-standard abbreviations can result in lost data and incorrect conclusions. Most tables and forms in the program database will use look-up tables for acceptable valid values and will not allow the entry of data that do not conform.

The primary purpose of managing data in a relational database environment is to ensure that each data record is unique and that the information contained within each field is consistent with conventions defined in other areas of the database. To ensure that each record is unique, a key field or fields will be identified within each data table. The VDMS Data Warehouse architecture supports this approach and eliminates the possibility of data redundancy.

NIRIS Database

All Navy CLEAN and Joint Venture data must be loaded into the Navy's own internal database system, the Naval Installation Restoration Information Solution (NIRIS). NIRIS is a web-based centralized database that has been implemented across all Naval Facilities Engineering Command (NAVFAC) offices and will be used by the Navy and contractors to manage, evaluate, and visualize data, documents and records for Navy and the Marine Corps sites. NIRIS manages all Environmental Restoration Program (ERP) analytical and spatial data, which includes the Munitions Response and Installation Restoration Program (IRP) data, ensuring institutional memory is preserved, land use controls are maintained, and remedial actions are effective.

CH2M HILL will use the SNEDD Approach to VDMS system to track, collect, review, and prepare Navy-related sample and project data for loading into NIRIS. Project data stored in the

VDMS Data Warehouse must be consistent and comparable with data that is loaded and stored within NIRIS. As such, all associations between VDMS and NIRIS valid values, output reports, and data tables will be tracked and maintained.

4.1.2 Data Security Procedures

Some SNEDD Approach to VDMS applications and data are stored in a secure location with login and password protection. Authorized users will have logins and passwords in advance. The PDL will provide security access to these tools. Access2003 must be installed on the computer that the user will be using to run these applications, and proper licenses distributed. Files received from any subcontractors will be scanned for common viruses using industry standard, current virus protection programs. The file servers storing the data must be running current virus software, with automatic virus signature updates.

NIRIS data are stored in a secure location with login and password protection. Users who require access to NIRIS and the data contained therein will need to follow procedures outlined in the SOP Access to NIRIS to procure security certificates, training, and access rights to installation-specific data. Authorized users of NIRIS will be assigned logins and passwords maintained by the Navy. For further information on NIRIS or obtaining NIRIS access, consult with the Critigen Lead or PDL.

4.1.3 Data Backup and Recovery

All project data management files will reside on CH2M HILL's terminal server, "Gaia," and will have a tape backup or equivalent created in accordance with CH2M HILL's network server management policy.

4.2 Sample Collection and Management

Sample control during the sampling phase is required to ensure the integrity of the associated data. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented using field logbooks and a Chain of Custody (COC). When custody of a sample is transferred from one party to another, the recipient of the sample assumes responsibility for maintaining control of the sample and documenting that control on the COC. Figure 4 shows the process for planning and executing field sampling events.

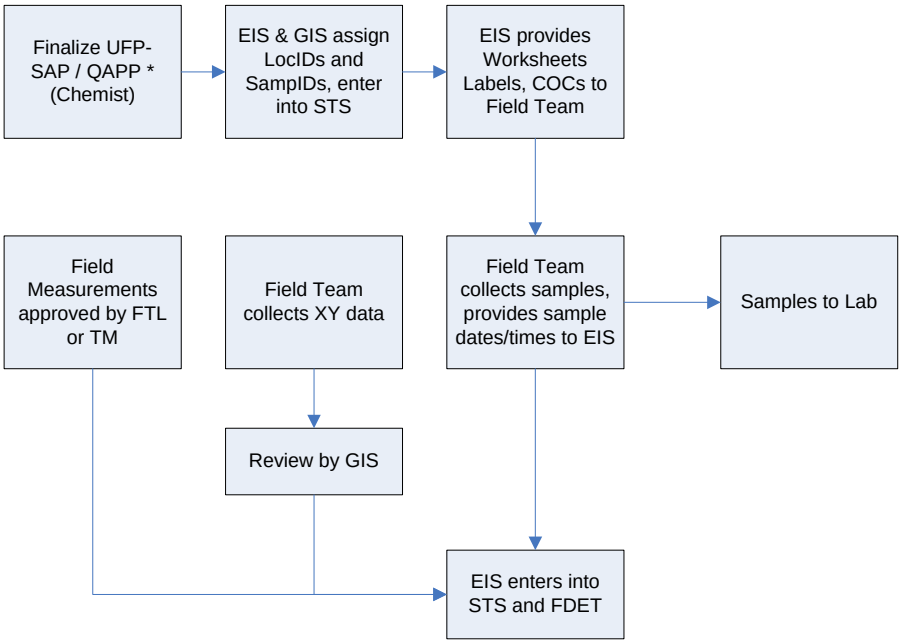


FIGURE 4
FIELD SAMPLING

4.2.1 Sample Tracking Sheet

During the planning stage, the PM specifies the data requirements for the sampling event. The work plan or similar document will provide project-specific data requirements for a given sampling event. The Project Chemist (PC) is responsible for reviewing the Sampling and Analysis Plan and ensuring that the FTL is aware of the number of field and laboratory QC samples required for the sampling event (trip blanks, equipment blanks, field blanks, field duplicates, matrix spikes, and matrix spike duplicates). All of this information is to be entered into the STS.

The STS will be used in advance to identify sampling container and preservation requirements, identify analytical laboratories for samples, aid in the generation of labels for sample bottles before the sampling event, and prepare COC forms after sampling is complete.

4.2.2 Sample Nomenclature Guidelines

The following guidelines are provided for sample nomenclature, COC clarification, and eData expectations.

Station ID (Location)

Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides a key in a database to which any samples collected from that location can be linked to form a relational database structure.

Before beginning fieldwork, the FTL will review the proposed level of effort and coordinate a list of unique station identification names, or station IDs, with the PDL or EIS. The FTL will be

responsible for enforcing the use of the standardized ID system and agreed upon station IDs during all field activities.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, station type, sequential station number, and possibly an additional qualifier as needed. The naming scheme to be used for the identification of a sampling station is documented in Table 2.

For example, if the first sample location at next month's event within Yorktown Site 30 is at a soil location, then the location ID could possibly be YS30-SO391 because that was the next available sequence number for soil locations. This should also be reflected in the Sample ID. QC and IDW station IDs must be established for each site that they are associated with.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a station is mislabelled and ensure there are unique identifiers for every sampling location. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample ID

Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the FTL will review the proposed level of effort and coordinate a list of unique sample identification names, or sample IDs, with the PDL or EIS. The FTL will be responsible for enforcing the use of the standardized ID system and agreed upon sample IDs during all field activities.

Each sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, sample/station type, sequential station number, modifier (as needed), depth (as needed), date, and date modifier (as needed). The naming scheme to be used for the identification of samples is documented in Table 3.

The standardized ID system will identify all samples collected during sampling activities. The system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. For example, a surface soil sample collected from station YS30-SO391 reference above in June of 2009 will result in a sample ID of YS30-SS391-0609.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a sample is mislabelled and ensure there are unique identifiers for every sample. Required deviations to this format in response to field conditions will be documented in the field logbook.

Navy Clean		
First Segment	**Second Segment**	
Facility, Site Number	Station Type	Station Number, Modifier
AA,ANN	AA	NNN_A
Notes: "A"= alphabetic "N"= numeric		

Facility:

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU Number – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG = Background locations (inside base)

QC and IDW Stations
Site ID (First Segment) followed by –QC or -IDW

Station Type:

AGT = Above Ground Tank
AS = Ash
BH = Borehole
CO = Concrete
DP = Direct Push
DR = Drill Rig
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IDW = Investigative Derived Waste
IW = Injection Well
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
QC = Quality Control
RK = Rock
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location
SP = Seep
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
SWS = Surface Water Body (for SW and SD)
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Station Number (i.e., 01, 02, 03…)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well

Example Station IDs:

YS01-DP02 = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1
CHR05-MW02S = Shallow monitoring well location 2, at the Cheatham Annex facility, Range 5.
NMBKL-SD02 = Background sediment location #2 located outside of NNMC
CHBS03-SO05 = Soil location #5, located in reference area outside of Site 3 in Cherry Point
VEW04-QC = QC Station at East Vieques SWMU-4
CAA08-IDW = IDW Station at Cheatham Annex AOC-8

TABLE 2

STATION ID SCHEME

Navy Clean			
First Segment	**Second Segment**	**3rd Segment**	**Fourth Segment**
Site ID Facility, AOC Number	Station/Sample Type, Station Number, Modifier	Depth (As Needed)	Date (MMYY) $_A$
AA,ANN	AANNN$_A$	A	NNNN$_A$
Notes: "A"= alphabetic "N"= numeric			

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG Background locations (inside base)

Sample Type:
AGT = Above Ground Tank
AH = Air - Headspace
AS = Ash
BH = Borehole
CO = Concrete
DR = Drill Rig
DS = Direct Push—Soil
DW = Direct Push—Groundwater
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IW = Injection Well
LF = Free Product
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
RK = Rock
SW = Surface Water
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SB = Subsurface Soil
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location (Composite)
SP = Seep
SS = Surface Soil
SSD = Subsurface Sediment
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Number (e.g., 001, 002, 003)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well
P = Duplicate

Depth:

Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C…

Sample Number:

1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. AB01-MW11P-0506

2. MS/MSD Samples – Append a modifier of '-MS' for matrix spike or '-SD' for matrix spike duplicate to the end of the sample ID.

3. QC & IDW Samples (Blank Samples & Waste Char.) - Format consists of Facility, AOC Number, Qualifier Code, Sequential Qualifier Number-Date (AAANN-AANN-MMDDYY). E.g. LSA05-TB02-061106

Qualifier Codes:
TB = Trip Blank
FB = Field Blank
EB = Equipment Blank
WQ = Source Blank
WS = Waste Char. Soil
WW = Waste Char. Water

4. Drill Rig Samples – Format consists of Facility, AOC Number, Station Type, Station Number, Date. E.g. YS12-DR02-020507

5. Multiple samples - Should multiple samples be collected from the same location in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C…

Example Sample IDs:

WNA01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at the Washington Navy Yard facility.
PIW01-SW023P-0306 = Pineros Island duplicate surface water sample collected at location 23, at SMWU-1 in March 2006.
SSW06-FB01-061106 = The first field blank collected on June 11, 2006 at SMWU-6 in Sabana Seca.

TABLE 3

STATION ID SCHEME

4.2.3 Sample Collection

A photocopy of each field logbook page completed during sampling and of each COC will be made by the FTL and forwarded to the EIS at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

Communication with field and laboratory staff will occur daily during the field event. The EIS will resolve issues that arise in the field (i.e. bottle ware shortage, equipment failure, etc). The lab will be informed of the shipment dates and the number of coolers or samples being sent. Laboratory login reports will be reviewed to ensure samples were received in good condition (i.e. no breakage, within holding time, within designated temperature). The field crew and PM will be notified if there were problems with shipment.

4.2.4 Chain-of-Custody

A single COC number per laboratory / cooler should be generated each day (there can be multiple pages to one COC number). MSs and MSDs will be requested at a set frequency for each project (usually one per 20 samples collected). MS and MSD samples should not be taken from field duplicates (FDs) or field blanks. FDs will be requested at a set frequency for each project (usually one per 10 samples). FDs should not be taken from MSs, MSDs, or field blanks. The MS and MSD samples listed on the COC should be spiked and analyzed by the laboratory.

A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made to the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter.

4.2.5 Sample and Document Tracking

The STS will be updated with sample collection and tracking information, and kept current throughout the data management process. All samples collected, resulting deliverables, and deliverable dates will be tracked throughout the data management process to ensure that the project schedule is met and subcontractor invoices are evaluated correctly.

All documentation acquired during the data management process, including Statements of Work (SOWs), Bids, COCs, Field Notes, Sample Tracking Sheets, Login Reports, Corrections-to-File Letters, FDETool QC tables, Post Load Reports, Invoices, and Communication Logs shall be compiled throughout the process to be stored in the appropriate Activity's Project Notebook.

4.2.6 Field Data

Once the field data and samples are collected, necessary field measurements, such as water levels and other data collected in the field should be entered into the FDETool. Any data entered into the FDETool must be exported into an excel file to facilitate a manual QC review of the data. The correction of any anomalies should be verified with the PM and PC. The information entered into the FDETool will be linked with related analytical data reported in the SNEDD within the SVMTool. Field data and laboratory analytical data are linked by sample ID and date/time. This allows verification analytical results for all samples have been received and reported by the laboratory.

4.3 Laboratory Analysis

Figure 5 shows the laboratory analysis process. Upon receipt of samples from the field, the laboratory will verify that the COC forms correctly identify and detail all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged in by the laboratory using information from the COC forms and the project instructions.

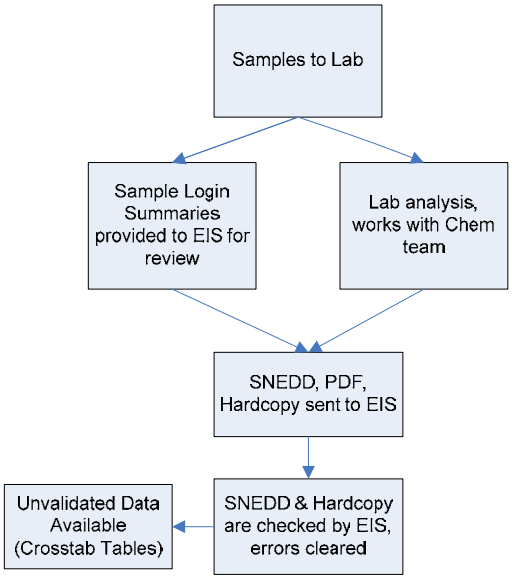


FIGURE 5
LABORATORY ANALYSIS

Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the EIS. Login summaries detailing all samples and analyses received by the lab should be provided daily to the EIS for review. All discrepancies should be corrected to ensure that all samples are analyzed as per project instructions.

The SNEDD-QC-Tool is used to QC the laboratory's SNEDD. Before the laboratory analytical data is formatted into data tables or sent for validation, the laboratory SNEDD must be processed through CH2M Hill's SNEDD-QC-Tool Microsoft Access database application. The SNEDD-QC-Tool includes several automated diagnostic checks to verify format and content compliance with SNEDD specifications.

- The analytical laboratory may, at their discretion, utilize the tool to QC and correct any errors before transmitting the SNEDD to CH2M HILL. The laboratory will forward the checked SNEDD and a hard copy of the data to the EIS, who will manage the SNEDD verification process.
- Upon receipt at CH2M Hill, the EIS will check the SNEDD using the SNEDD-QC-Tool to verify correct format and content. If errors are found, the laboratory will be notified of the errors, and the SNEDD corrected.

The laboratory will attach the signed COCs to their hard copy data deliverables to officially relinquish control of the data back to the Environmental Contractor within the specified turnaround time. Data archiving forms will be generated and affixed to each laboratory report received per Sample Delivery Group (SDG) for cataloguing, tracking, and archiving purposes.

Hard copy data and SNEDDs will be reviewed to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 10% comparison between the hard copy and SNEDD content will be conducted to ensure consistency, resolve discrepancies, and document data error issues (for example, EDD re-submissions, turnaround time problems, hard copy incompleteness). All detected errors should be resolved with the laboratory.

These checks ensure the consistency and the validity of the SNEDD and hardcopy content before the data are reported in preliminary tables or sent for validation. The objective of using the SNEDD-QC-Tool is to ensure that the validation process is performed on consistently high-quality data and minimize the chance of finding data errors later in the validation process, which would require the laboratory to resend corrected data and start the validation process over again.

Preliminary raw and detects tables will be generated from data reported in the SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4 Data Validation

Once the preliminary data verification is complete, the PC is notified by the EIS that the data is available for validation. The PC will notify the data validator in advance of when to expect data and of any samples or analyses that should not be validated (i.e. grain size should not be validated). For internal data validation, the EIS will notify the PC of data availability, and provide the hardcopy data and a QC Association Table.

Upon receipt of data from CH2M HILL, data validation will be performed in accordance with the Data Validation SOW, UFP SAP, and any other documents required. Generally, questions or noted inconsistencies identified by the validator should be addressed directly to laboratory, with the PC notified of issues and resolutions identified.

4.4.1 External Data Validation

For external data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the data validator. The PC will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

Data Validators will provide the following materials to the PC within the required turn around time:

- Hardcopy Data Validation Report
- Validated Version of the SNEDD (external validation)

Once returned to CH2M HILL, the SNEDD will be run through the SNEDD-QC-Tool, which includes automated diagnostic checks for validated data to verify format and content compliance with SNEDD validation specifications. The PC will review the validated data to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the SNEDD. All detected errors should be resolved with the data validator.

Data archiving forms will be generated and affixed to each Data Validation Report per SDG received for cataloguing, tracking, and archiving purposes.

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.2 Internal Data Validation

For internal data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the PC.

The PC will evaluate QC information, associated validation logic, and apply qualifiers to data in the SNEDD and on the laboratory Form Is when QC criteria are not achieved. Qualifier criteria will be based on the Quality Assurance Project Plan. A hardcopy data validation report will be generated. Data archiving forms will be generated and affixed to each Data Validation Report per SDG validated for cataloguing, tracking, and archiving purposes

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.3 Unvalidated Data Preload Check

Occasionally, unvalidated data will need to be loaded into the database. Although the data will not be validated, it will undergo a basic Preload Check by the PC to ensure laboratory compliance with project guidelines and determine results to be reported as the best result where multiple runs were conducted for a given sample/analysis. The PCL will provide input and oversight to ensure that data flags are applied correctly by the PC.

4.4.4 Senior Review

The PCL will verify that the final SNEDD and hardcopy data are complete and acceptable. Any identified discrepancies will be resolved with the assistance of the PC, EIS, laboratory, or validator as needed.

4.5 Data Preparation and Loading

Once the data are considered final and approved by the PCL, they are exported from the SNEDD to the project Data Warehouse. Field and laboratory data are merged into a format that is amenable to the warehouse. The backbone is a SQL-server-based data warehouse.

4.5.1 Data Preparation

As part of the normal process of loading data into the warehouse, data standardization tasks must be completed. A Database Specialist (DBS) will load data into the warehouse using the following three programs: SNEDD-QC-Tool, SVMTool and CH-IMPTool.

A final QC of the data reported in the SNEDD is conducted with the SNEDD-QC-Tool. Any identified discrepancies will be resolved with the assistance of the PCL, PC, or EIS as needed. SNEDDs that pass all of the QA/QC checks in the SNEDD-QC-Tool are then processed with the SVMTool.

The SVMTool links the field data contained in the FDETool to the analytical data contained in the SNEDD. A series of logical QC checks are run to ensure that all data links correctly minimum data requirements are met. The tool then merges the data into a format compatible with the data warehouse structure.

4.5.2 Data Loading

CH2M HILL Loading

The CH-IMPTool runs an additional series of QC checks and adds project-specific formatting, and loads the data into the warehouse. The following tasks need to be completed to load the data for project use:

- **Unit Standardization:** Analytical units and the associated results, reporting limits, and method detection limits will need to be converted to a consistent set of units as required by the project.
- **Resolve Reanalysis and Dilutions:** All samples that had an associated reanalysis or dilution run by the laboratory must have all of the excluded or rejected results marked as not the best result for reporting.
- **Resolve Analytical Overlap and Split Samples:** Analytical overlap occurs when a sample is analyzed by two or more methods that report the same analyte. To resolve any issues not previously resolved, the following logic is used to select the usable result:
  - If the overlapping results are all non-detections, the lowest non-detection result is selected.
  - If the overlapping results are all detected, the highest detected result is selected.
  - If the overlapping results consist of a mixture of detections and non-detections, the highest detected result is selected.

When data are loaded into the warehouse, an automated script will run to identify the “best” result when more than one analytical result exists.

NIRIS Loading

All Navy CLEAN and Joint Venture data must be loaded into NIRIS. Following the successful loading of data into the data warehouse, the DBS will use the FDETool and ALPTool to generate project NIRIS Electronic Data Deliverables (NEDD) files. Field-related NEDDs will be generated from the final version of the FDETool. The final version of the project SNEDD will be processed through the ALPTool to generate the analytical NEDD.

The DBS will use NIRIS's Data Checker Loader Tool to QC and submit the project NEDD files into NIRIS. The NIRIS Regional Database Manager (RDM) will load the data into NIRIS, and will work with the DBS to resolve any potential issue that may arise during loading. Following notification of successful data loading from the RDM, the DBS will query the data from NIRIS for review to ensure data integrity and accuracy.

4.5.3 Data Warehouse

The data warehouse is a Microsoft SQL Server 2005 relational database. This database, and all other "CH" tools used, has a data structure designed to achieve compliance with the Environmental Restoration Program Information Management System (ERPIMS) standard specified by Air Force Center for Engineering and the Environment (AFCEE). ERPIMS is an effective, comprehensive standard for environmental management.

The warehouse will use valid value tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, analyte names, units. These reference tables are critical for maintaining the completeness and accuracy of data sets and are essential for accurate querying of the data.

Data are loaded and stored so that relationships among categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and collection, analysis, and reporting tools used in the DBMS are designed to enforce, for any project data record, entries in fields that refer to other types of data as required by the overall data model.

4.6 Data Reporting

Data reporting includes the following tasks:

- Retrieving data from the data warehouse for project deliverables, data visualization, or consumption by third parties
- Reviewing initial data and producing data queries and draft reports to dissect and disassemble the data
- Producing any requested client and regulatory agency data deliverables

Data for project deliverables, data visualization, or consumption by third parties will be retrieved from the warehouse, and will be equivalent to the real-time state of the project repository database. PMs and GIS Analysts (GAs) will work with the EIS and PCL for quality queries and data for reports.

4.6.1 Tables, Figures, and Diagrams

Once the data have been sufficiently analyzed, the list of requested data reports (tables, figures, diagrams) can be developed and finalized by the project team and submitted to the PCL and PM for review.

All requests for figures or graphics are to be directed to the GA assigned as the Point of Contact (POC) for that particular Navy installation. All requests for analytical data (crosstab tables, data dumps, third party deliverables etc) should be directed to the EIS assigned as the POC for that particular Navy installation. The EIS will generate a data deliverable from the data warehouse

or NIRIS (as needed) suitable for end use and will provide data support to the end user. All requests for data statistics and calculations should be directed to the Risk Assessor assigned to the project.

4.6.2 GIS

The Navy CLEAN program will utilize ESRI's suite of GIS software for the majority of GIS-related tasks. The GIS data model will consist of one or more geodatabases (GDBs) per installation. Each installation will maintain one common installation GDB, which will store the common infrastructure data such as buildings, roads, topography, hyrdography, utilities, etc. The common installation GDB should adhere, as much as possible, to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) data model. All project specific GDBs shall be developed and named for ease of interpretation by the GA.

All station location information for each installation will be pulled directly from the data warehouse and stored in the common installation GDB as a data table. The data warehouse must contain valid coordinate information for the locations to be displayed correctly. Valid coordinate information will be maintained in the data warehouse by the EIS, and updated as necessary by the DBS.

ESRI's ArcMap 9.3 (or the latest version available) will be utilized for spatially displaying the environmental data within maps and figures, as well as for spatial analysis. The GA will need to coordinate efforts with the EIS on all requests that require the display of environmental sample data on a map to ensure that the appropriate data is queried from the data warehouse and linked to the appropriate station location table within the GIS.

4.6.3 Site Information Management System

This is currently not being used on the Navy CLEAN and Joint Venture Programs.

SIMS is a tool for publishing data of sufficient quality from the project. However, the project data warehouse will remain the database of record for the project.

SIMS provides many standard report formats, all of which are used in conjunction with the Query Tool feature, to isolate and retrieve information. Users can generate and save their queries using a graphical point-and-click tool. Reports in a wide variety of formats also can be requested and produced.

4.6.4 Legacy Data

Legacy data are those collected from any contractor other than CH2M HILL and data collected by CH2M HILL that have not been managed in accordance with Navy CLEAN and Joint Venture Program requirements. Legacy data are commonly compiled from various electronic and hard copy sources including spreadsheets, databases, technical reports, and laboratory hard copy data reports. When working with legacy data, usability assessment must be completed for the project team to be able to use the data with confidence. In order to assess the data properly, the legacy data needs to be evaluated by skilled professionals that are familiar with the type of data being evaluated so that any errors identified in the data can be corrected when possible or qualified in a manner to reflect the limitations of the data's use.

The PM has overall responsibility for the selection for inclusion of legacy data into the data management process. The PDL and PCL will work with the PM to establish the data review

and import process, compile a comprehensive data inventory, and identify staff to facilitate data review.

The PDL and PCL will work with the EIS to determine the appropriate intermediary files and tools used to collect the data. The PDL and PCL will oversee the data review and flagging process and approve the data for upload into the Data Warehouse. The EIS is responsible for assembling the field and laboratory data in formats that facilitate data review, aid the PDL and PCL in overseeing the data review and flagging process, schedule, conversion of the data to the proper data warehouse format, and then loading the data into the Data Warehouse after approval by the PDL and PCL.

The GA, PDL, PCL, and PM have the primary responsibility for reviewing the data in their area of expertise and providing the PCL with data usability flags to be associated with each record.

SECTION 5

Project Closeout

The project completion/closeout phase includes the following:

- Archive hard copy and electronic documents
- Conduct project closeout meeting

5.1 Archive Procedures

A large variety of technical data will be generated during the field investigations. The EIS and PC will collect all hard copy and electronic data they are responsible for and verify that the incoming records are legible and in suitable condition for storage. Record storage will be performed in two stages:

- Storage during the project
- Permanent storage following project completion

During the project, CH2M HILL will store data hardcopy reports in CH2M HILL offices. Physical records will be secured in steel file cabinets or shelves, and labelled with the appropriate project identification. Electronic data will be maintained on CH2M HILL's corporate local area network servers.

Information generated from field activities will be documented on appropriate forms and will be maintained in the project file. These include COC records, field logbooks, well construction forms, boring logs, location sketches, and site photographs. In addition, notes from project meetings and telephone conversations will be filed.

Following project completion, both hard copy and electronic data deliverables will be archived. Team staff will provide all hard copies of laboratory and validation reports to the Data Closeout Coordinator to be prepped and shipped to Stone Mountain for archiving. Final laboratory SNEDDs and loading files will be provided to the PDL, to be archived on CH2M HILL's corporate local area network servers.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

5.2 Invoice Review and Approval

The EIS is responsible for tracking all data deliverables throughout the data management process to ensure that the project schedule is maintained, subcontractors comply with all required turn around times, and data provided are complete and acceptable. Following project completion, EISs are to review and provide comments on all laboratory and data validator invoices regarding data quality and schedule compliance prior to approval by the PM.

5.3 Project Closeout

At the end of each project, the PM will notify team staff of project closeout. The PM will coordinate and verify that all pertinent data has been archived. The PM may also review lessons learned, suggest process improvements, or revisions to the DMP and other project documentation as deemed necessary.

Appendix A
Environmental Data Management Work Process

Environmental Data Management Work Process

1.0 Project Planning & Setup	2.0 Sample Collection & Management	3.0 Lab Analysis	4.0 Data Validation	5.0 Data Management	6.0 Data Evaluation & Reporting
1.1 Project Setup	2.1 Sample Management	3.1 Sample Analysis	4.1 Internal Chemical Data Validation	5.1 CH2M HILL Data	6.1 Data Prep & Processing for Reporting
1.2 QAPP, SAP, DMP, DQOs Integration	2.2 Sample Collection	3.2 EDD Management	4.2 External Chemical Data Validation	5.2 Other Contractor & Legacy Data	6.2 Tabular Data Queries & Reports
1.3 Laboratory Setup	2.3 Sample Data Management	3.3 Hard Copy Management	4.3 Senior Review of Validated Data	5.3 Database Maintenance & Administration	6.3 Field Logs and Graphs
1.4 Database Setup					6.4 GIS Queries and Maps

Appendix B
Life of a Sample

A Sample's Life

Step-by-Step Outline of Navy CLEAN and JV Data Management Process, and Roles & Responsibilities

Step 1

Planning Phase

- Staffing Schedules
- Kickoff Meeting – Include the EIS & PC
- Project Instructions (PIs)
  - Sample Nomenclature provided in table
  - Reviewed by DMC (Chelsea Bennet) or Database Specialist

Step 2A

Sample Collection

- Daily collection and shipments of samples
- One COC/cooler; One FedEx slip/cooler
- Coordinate w/ EIS for tracking & Lab notification
- GPS conducted (if applicable)

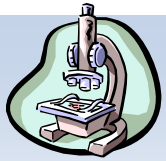
Step 2B

Sample Tracking

- EIS cross checks COC against PIs
- Also reviews lab confirmation sheets to verify all samples were received and in appropriate condition

Step 3

Lab Analysis



- Standard 28-day unless otherwise arranged
- EIS reviews data for accuracy and works with lab to resolve discrepancies
- EIS tracks schedule and keeps PM informed
- EIS inputs STSP information from Log Books
- EIS can generate Unvalidated Raw and Detects Data Tables

Step 4

Data Validation

- PC reviews all data for accuracy against the PIs
- PC sends data from lab to Data Validator
- Delays may occur if there is missing data or data is late from the lab\
- EIS can generate Validated Raw and Detects Data Tables

Step 5

Data Load

- PCL sends data to Database Specialist to be loaded into the Data Warehouse (DW)
- (Sometimes this involves assistance from PM, FTL, PC, and/or EIS)

Step 6

Quality Assurance/ Quality Control

- EIS & PC are notified that data is loaded
- EIS verifies info loaded is correct (Sample, Station, Analyses, Result)
- EIS then helps decide whether info needs to be updated or not
- File and archive all Lab and DV deliverables

Step 7

Report Generation

- Raw, Detects, Exceedance Reports
- Data Requests
- Exceedance Reports (criteria needed prior to this step and selected by PM)
- Human Health Risk Assessment
- Eco Risk Assessment

End of our Sample's Life?

- Data may be used in reports, posted on web, put into GIS, etc
- In that regard, a sample's life doesn't really ever end!
- Hopefully our sample had no exceedances and everyone is happy.

Appendix C
Standard Operating Procedures

Checklist – Archive and NIRIS Load Prep

Checklist – Data QC

Checklist - EIS Project Start-up Questions

Checklist - Generating RDE Tables

Checklist - Historic Data Cleanup

Checklist - SNEDD DM Process

Roles – Data Management Coordinator

Roles – EIS

Roles – Project Manager

Template – STS & QC Association Table

SOP-114 - CHIMPTool

SOP-126 - XTab Reports Tool

SOP - Access to NIRIS

SOP - Cherry Point Exceedance Formatting Wizard

SOP – CLEAN SNEDD Loading with CHIMPTool

SOP - Corrections to File

SOP - Data Archiving Procedures

SOP - Data Shipping

SOP – FDET

SOP – FDET Setup

SOP – NIRIS Importer Validator Tool

SOP – SVMTool

SOP – Valid Value Setup

Appendix D
Electronic Data Deliverable Specifications

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office, not including dashes. Found on Statement of Work. (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012, TO-54 = TO54)
Phase	A8	NR	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)
Installation_ID	A20*	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20*	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15*	R	NIRIS code for the analytical method category (e.g. PCHAR)
Lab_Code	A10*	R	CH2M HILL Code assigned to the laboratory (e.g. COMP)
Lab_Name	A50*	R	The name of the laboratory that conducted the analysis, in all CAPS.
Leachate_Method	A16*	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	R	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)
Extraction_Method	A16*	RA	Code for the extraction method used on sample. (e.g. FLTRES)
Result_Type	A16*	R	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	R	Code for Laboratory Sample (MS, MSD, LBLK, LCS)
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)
QC_Level	A16*	R	QC Level of data package : EPA levels I to IV. (e.g. 3)
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/2007 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab (in 10 characters). (e.g. 03/24/2007)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. Req'd if sample was leached and/or Leachate Method provided. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock, with 8 characters. (e.g. 14:30:05). Req'd if sample was leached and/or Leachate Method provided.
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample. Req'd if Extraction Method provided.
Extraction_Time	HH:MM:SS	RA	Time of day lab extracted the sample. Use 24 hour clock, with 8 characters. Req'd if Extraction Method provided. (e.g. 02:15:00)
Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock, with 8 characters.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Dilution	N10,2	R	Dilution factor used. Default value is 1 (e.g. 10)
Run_Number	N4	R	Number distinguishing multiple or repeat analyses by the same method (incl. RA, RE, DL, etc). Must be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A55*	R	The name of the compound being analyzed.
Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)
Lab_Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.
Validator_Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.
Analysis_Result_Type	A4*	R	Type of analysis performed (allowed: SURR or TRG).
Result_Narrative	A120	RA	Additional information or comments associated with the result.
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria and upper/lower accuracy included. (e.g. CLPA)
QC_Accuracy_Upper	N6,3	RA	Upper QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 25.45)
QC_Accuracy_Lower	N6,3	RA	Lower QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 10.15)
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.
QC_Narrative	A120	RA	Leave blank for Validator. Enter DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit
Detection_Limit	N18,7	RA	Reported Detection Limit
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.
Validator_Name	A50*	R	Leave Blank. Name of Validator in all CAPS. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.

Appendix C
Laboratory DoD ELAP Certificates

PJLA

November 30, 2011

Ms. Lisa Reyes
Columbia Analytical Services, Inc.
1 Mustard St. Suite 250
Rochester, NY 14609

Dear Ms. Reyes:

Congratulations! This letter is to inform you that your assessment to ISO/IEC 17025: 2005, DoD Elap, with PJLA assessors Doug Berg and Maurice Downer, was completed October 17, 2011. Upon finalization of all information, Mr. Berg and Mr. Downer will complete the accreditation process by recommending you for final accreditation.

The following items are in the process of being added to your scope: GEN-AVS, HPLC-8330B, HPLC-METACID, SMO-MIS. Our Executive Committee, will then review the assessment material. Upon their agreement with Mr. Berg's recommendation, your final accreditation will be granted. A draft certificate will then be prepared for your review.

On behalf of the PJLA staff, I would like to commend you on your superior management system and demonstrated commitment to quality. If we can be of any further assistance to you, please feel free to contact me directly. Thank you for selecting Perry Johnson Laboratory Accreditation, Inc.

Cordially,

Tracy Szerszen
President/Operations Manager

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc., has assessed the Laboratory of:

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the DoD Quality Systems Manual for Environmental Laboratories Version 4.2 (November 15, 2010) and is accredited in accordance with the**:**

United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Environmental Testing
(As detailed in the supplement)

Such testing shall only be offered at or from the address given above. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation Body's duty to observe and comply with the said rules.

For PJLA:

The validity of this certificate is mandated through ongoing surveillance.

Tracy Szerszen
President/Operations Manager
Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Ste 1325
Troy, Michigan 48084

Initial Accreditation Date:	Issue Date:	Revision Date:	Expiration Date:
January 22, 2010	January 22, 2010	August 2, 2011	May 21, 2012

Accreditation No:	Certificate No:	Page No:
65817	L10-9-R3	Page 1 of 19

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous	(CAS SOP) GEN-TICW	UV-VIS	Total inorganic carbon
Aqueous	EPA 1631	CVAFS	Mercury
Aqueous	EPA 1664A	Gravimetric	Oil and grease
Aqueous	EPA 1664A	Gravimetric	Total petroleum hydrocarbons
Aqueous	EPA 218.6	IC-UV	Chromium, Hexavalent
Aqueous	EPA 245.1	CVAA	Mercury
Aqueous	EPA 300.0	IC	Chloride
Aqueous	EPA 300.0	IC	Fluoride
Aqueous	EPA 300.0	IC	Nitrate
Aqueous	EPA 300.0	IC	Sulfate
Aqueous	EPA 351.2	UV-VIS	Nitrogen, total Kjeldahl
Aqueous	EPA 353.2	UV-VIS	Nitrite as N
Aqueous	EPA 410.4	UV-VIS	Chemical oxygen demand
Aqueous	EPA 7470A	CVAA	Mercury
Aqueous	EPA 8151A	GC-ECD	Dinoseb
Aqueous	EPA 8260C	GC-MS-SIM	1,1-Dichloroethene
Aqueous	EPA 8260C	GC-MS-SIM	1,2-Dichlorobenzene
Aqueous	EPA 8260C	GC-MS-SIM	1,2-Dichloroethane
Aqueous	EPA 8260C	GC-MS-SIM	1,4-Dioxane
Aqueous	EPA 8260C	GC-MS-SIM	Carbon tetrachloride
Aqueous	EPA 8260C	GC-MS-SIM	Dichloromethane
Aqueous	EPA 8260C	GC-MS-SIM	Ethylbenzene
Aqueous	EPA 8260C	GC-MS-SIM	m- + p-Xylene
Aqueous	EPA 8260C	GC-MS-SIM	o-Xylene
Aqueous	EPA 8260C	GC-MS-SIM	Tetrachloroethene
Aqueous	EPA 8260C	GC-MS-SIM	Trichloroethene
Aqueous	EPA 8260C	GC-MS-SIM	Vinyl chloride
Aqueous	EPA 8260C	GC-MS-SIM	Xylenes, total
Aqueous	EPA 8310	HPLC-UV/FLUOR	Acenaphthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Acenaphthylene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Anthracene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(a)antracene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(a)pyrene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(b)fluoranthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(g,h,i)perylene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(k)fluoranthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Chrysene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Dibenzo(a,h)anthracene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Fluoranthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Fluorene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Indeno(1,2,3-cd)pyrene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Naphthalene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Phenanthrene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Pyrene
Aqueous	EPA 9040B, C	POT	pH
Aqueous	EPA 9060, A	UV-VIS	Total organic carbon
Aqueous	EPA 9066	UV-VIS	Phenolics, total
Aqueous	RSK-175	GC-FID	Ethane
Aqueous	RSK-175	GC-FID	Ethylene
Aqueous	RSK-175	GC-FID	Methane
Aqueous	RSK-175	GC-FID	Propane
Aqueous	RSK-175	GC-FID	Acetylene
Aqueous	SM 2320B	Titration	Alkalinity, total, carbonate, and bicarbonate
Aqueous	SM 2340C	Titration	Hardness, total
Solids	(CAS SOP) GEN-351.2	UV-VIS	Nitrogen, total Kjeldahl
Solids	(CAS SOP) GEN-420.4/9066	UV-VIS	Phenolics, total
Solids	EPA Lloyd Kahn	UV-VIS	Total organic carbon
Solids	EPA 300.0	IC	Chloride
Solids	EPA 300.0	IC	Fluoride
Solids	EPA 300.0	IC	Nitrate
Solids	EPA 300.0	IC	Sulfate
Solids	EPA 7471B	CVAA	Mercury
Solids	EPA 8330A	HPLC-UV	1,3,5-Trinitrobenzene
Solids	EPA 8330A	HPLC-UV	1,3-Dinitrobenzene
Solids	EPA 8330A	HPLC-UV	2,4,6-Trinitrotoluene
Solids	EPA 8330A	HPLC-UV	2,4-Dinitrotoluene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Solids	EPA 8330A	HPLC-UV	2,6-Dinitrotoluene
Solids	EPA 8330A	HPLC-UV	2-Amino-4,6-dinitrotoluene
Solids	EPA 8330A	HPLC-UV	2-Nitrotoluene
Solids	EPA 8330A	HPLC-UV	3-Nitrotoluene
Solids	EPA 8330A	HPLC-UV	4-Amino-2,6-dinitrotoluene
Solids	EPA 8330A	HPLC-UV	4-Nitrotoluene
Solids	EPA 8330A	HPLC-UV	HMX
Solids	EPA 8330A	HPLC-UV	Nitrobenzene
Solids	EPA 8330A	HPLC-UV	RDX
Solids	EPA 8330A	HPLC-UV	Tetryl
Solids	EPA 9045C, D	POT	pH
Solids	SM 5220B	Titration	Chemical oxygen demand
Aqueous/Solids	EPA 1010A	Pensky Martin	Ignitability
Aqueous/Solids	EPA 353.2	UV-VIS	Nitrate/nitrite as N
Aqueous/Solids	EPA 6010C	ICP-AES	Aluminum
Aqueous/Solids	EPA 6010C	ICP-AES	Antimony
Aqueous/Solids	EPA 6010C	ICP-AES	Arsenic
Aqueous/Solids	EPA 6010C	ICP-AES	Barium
Aqueous/Solids	EPA 6010C	ICP-AES	Beryllium
Aqueous/Solids	EPA 6010C	ICP-AES	Boron
Aqueous/Solids	EPA 6010C	ICP-AES	Cadmium
Aqueous/Solids	EPA 6010C	ICP-AES	Calcium
Aqueous/Solids	EPA 6010C	ICP-AES	Chromium
Aqueous/Solids	EPA 6010C	ICP-AES	Cobalt
Aqueous/Solids	EPA 6010C	ICP-AES	Copper
Aqueous/Solids	EPA 6010C	ICP-AES	Iron
Aqueous/Solids	EPA 6010C	ICP-AES	Lead
Aqueous/Solids	EPA 6010C	ICP-AES	Magnesium
Aqueous/Solids	EPA 6010C	ICP-AES	Manganese
Aqueous/Solids	EPA 6010C	ICP-AES	Nickel
Aqueous/Solids	EPA 6010C	ICP-AES	Potassium
Aqueous/Solids	EPA 6010C	ICP-AES	Selenium
Aqueous/Solids	EPA 6010C	ICP-AES	Silver

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 6010C	ICP-AES	Sodium
Aqueous/Solids	EPA 6010C	ICP-AES	Thallium
Aqueous/Solids	EPA 6010C	ICP-AES	Tin
Aqueous/Solids	EPA 6010C	ICP-AES	Vanadium
Aqueous/Solids	EPA 6010C	ICP-AES	Zinc
Aqueous/Solids	EPA 6020A	ICP-MS	Arsenic
Aqueous/Solids	EPA 6020A	ICP-MS	Antimony
Aqueous/Solids	EPA 6020A	ICP-MS	Barium
Aqueous/Solids	EPA 6020A	ICP-MS	Beryllium
Aqueous/Solids	EPA 6020A	ICP-MS	Cadmium
Aqueous/Solids	EPA 6020A	ICP-MS	Chromium
Aqueous/Solids	EPA 6020A	ICP-MS	Cobalt
Aqueous/Solids	EPA 6020A	ICP-MS	Copper
Aqueous/Solids	EPA 6020A	ICP-MS	Lead
Aqueous/Solids	EPA 6020A	ICP-MS	Manganese
Aqueous/Solids	EPA 6020A	ICP-MS	Nickel
Aqueous/Solids	EPA 6020A	ICP-MS	Selenium
Aqueous/Solids	EPA 6020A	ICP-MS	Silver
Aqueous/Solids	EPA 6020A	ICP-MS	Thallium
Aqueous/Solids	EPA 6020A	ICP-MS	Vanadium
Aqueous/Solids	EPA 6020A	ICP-MS	Zinc
Aqueous/Solids	EPA 680	GC-MS	Monochlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Dichlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Trichlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Tetrachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Pentachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Hexachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Heptachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Octachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Nonachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Decachlorobiphenyls, Total
Aqueous/Solids	EPA 6850	HPLC-MS	Perchlorate

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1 Mustard Street, Suite #250
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Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 7196A	UV-VIS	Chromium, hexavalent
Aqueous/Solids	EPA 7199	IC-UV	Chromium, hexavalent
Aqueous/Solids	EPA 8015C	GC-FID	Gasoline range organics
Aqueous/Solids	EPA 8015C	GC-FID	Diesel range organics
Aqueous/Solids	EPA 8081B	GC-ECD	4,4'-DDD
Aqueous/Solids	EPA 8081B	GC-ECD	4,4'-DDE
Aqueous/Solids	EPA 8081B	GC-ECD	4,4'-DDT
Aqueous/Solids	EPA 8081B	GC-ECD	Aldrin
Aqueous/Solids	EPA 8081B	GC-ECD	α-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Alpha-chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	β-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Chlordane, technical
Aqueous/Solids	EPA 8081B	GC-ECD	δ-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Dieldrin
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan I
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan II
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan sulfate
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin aldehyde
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin ketone
Aqueous/Solids	EPA 8081B	GC-ECD	γ-BHC (Lindane)
Aqueous/Solids	EPA 8081B	GC-ECD	γ-Chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	Heptachlor
Aqueous/Solids	EPA 8081B	GC-ECD	Heptachlor epoxide
Aqueous/Solids	EPA 8081B	GC-ECD	Hexachlorobenzene
Aqueous/Solids	EPA 8081B	GC-ECD	Methoxychlor
Aqueous/Solids	EPA 8081B	GC-ECD	Toxaphene
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1016
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1221
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1232
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1242
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1248
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1254

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ISO/IEC 17025:2005 and DoD-ELAP

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1 Mustard Street, Suite #250
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Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1260
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1268
Aqueous/Solids	EPA 8151A	GC-ECD	2,4-D
Aqueous/Solids	EPA 8151A	GC-ECD	Dicamba
Aqueous/Solids	EPA 8151A	GC-ECD	2,4,5-T
Aqueous/Solids	EPA 8151A	GC-ECD	2,4,5-TP
Aqueous/Solids	EPA 8151A	GC-ECD	Pentachlorophenol (PCP)
Aqueous/Solids	EPA 8260C	GC-MS	1,1,1,2-Tetrachloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1,1-Trichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
Aqueous/Solids	EPA 8260C	GC-MS	1,1,2-Trichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1-Dichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1-Dichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	1,1-Dichloropropene
Aqueous/Solids	EPA 8260C	GC-MS	1,2,3-Trichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2,3-Trichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2,4-Trimethylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dibromo-3-chloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dibromoethane
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloro-1,1,2-trifluoroethane (Freon 123a)
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloroethene, total
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,3,5-Trimethylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,3-Dichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,3-Dichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,4-Dichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,4-Dioxane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8260C	GC-MS	2,2-Dichloro-1,1,1-trifluoroethane (Freon 123)
Aqueous/Solids	EPA 8260C	GC-MS	2,2-Dichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	2-Butanone (MEK)
Aqueous/Solids	EPA 8260C	GC-MS	2-Chloro-1,3-butadiene
Aqueous/Solids	EPA 8260C	GC-MS	2-Chloroethylvinyl ether
Aqueous/Solids	EPA 8260C	GC-MS	2-Chlorotoluene
Aqueous/Solids	EPA 8260C	GC-MS	2-Hexanone
Aqueous/Solids	EPA 8260C	GC-MS	2-Methyl-1-propanol (Isobutlyl alcohol)
Aqueous/Solids	EPA 8260C	GC-MS	2-Methyl-2-propanol (Tertbutyl alcohol)
Aqueous/Solids	EPA 8260C	GC-MS	2-Nitropropane
Aqueous/Solids	EPA 8260C	GC-MS	2-Propanol
Aqueous/Solids	EPA 8260C	GC-MS	3-Chloro-1-propene (Allyl chloride)
Aqueous/Solids	EPA 8260C	GC-MS	4-Chlorotoluene
Aqueous/Solids	EPA 8260C	GC-MS	4-Ethyltoluene
Aqueous/Solids	EPA 8260C	GC-MS	4-Isopropyltoluene
Aqueous/Solids	EPA 8260C	GC-MS	4-Methyl-2-pentanone (MIBK)
Aqueous/Solids	EPA 8260C	GC-MS	Acetone
Aqueous/Solids	EPA 8260C	GC-MS	Acetonitrile
Aqueous/Solids	EPA 8260C	GC-MS	Acrolein
Aqueous/Solids	EPA 8260C	GC-MS	Acrylonitrile
Aqueous/Solids	EPA 8260C	GC-MS	Benzene
Aqueous/Solids	EPA 8260C	GC-MS	Benzyl chloride
Aqueous/Solids	EPA 8260C	GC-MS	Bromobenzene
Aqueous/Solids	EPA 8260C	GC-MS	Bromochloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Bromodichloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Bromoform
Aqueous/Solids	EPA 8260C	GC-MS	Bromomethane
Aqueous/Solids	EPA 8260C	GC-MS	Carbon disulfide
Aqueous/Solids	EPA 8260C	GC-MS	Carbon tetrachloride
Aqueous/Solids	EPA 8260C	GC-MS	Chlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	Chloroethane
Aqueous/Solids	EPA 8260C	GC-MS	Chloroform
Aqueous/Solids	EPA 8260C	GC-MS	Chloromethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8260C	GC-MS	cis-1,2-Dichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	cis-1,3-Dichloropropene
Aqueous/Solids	EPA 8260C	GC-MS	Cyclohexane
Aqueous/Solids	EPA 8260C	GC-MS	Cyclohexanone
Aqueous/Solids	EPA 8260C	GC-MS	Dibromochloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Dibromomethane
Aqueous/Solids	EPA 8260C	GC-MS	Dichlorodifluoromethane (Freon 12)
Aqueous/Solids	EPA 8260C	GC-MS	Dichlorofluoromethane (Freon 21)
Aqueous/Solids	EPA 8260C	GC-MS	Dichloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Diethyl ether
Aqueous/Solids	EPA 8260C	GC-MS	Diisopropyl ether
Aqueous/Solids	EPA 8260C	GC-MS	Ethyl methacrylate
Aqueous/Solids	EPA 8260C	GC-MS	Ethyl tert-butyl ether
Aqueous/Solids	EPA 8260C	GC-MS	Ethylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8260C	GC-MS	Iodomethane
Aqueous/Solids	EPA 8260C	GC-MS	Isopropylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	m- + p-Xylene
Aqueous/Solids	EPA 8260C	GC-MS	Methacrylonitrile
Aqueous/Solids	EPA 8260C	GC-MS	Methyl acetate
Aqueous/Solids	EPA 8260C	GC-MS	Methyl methacrylate
Aqueous/Solids	EPA 8260C	GC-MS	Methylcyclohexane
Aqueous/Solids	EPA 8260C	GC-MS	Methyl-tert-butyl ether (MTBE)
Aqueous/Solids	EPA 8260C	GC-MS	Napthalene
Aqueous/Solids	EPA 8260C	GC-MS	N-butylacetate
Aqueous/Solids	EPA 8260C	GC-MS	N-butylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	N-heptane
Aqueous/Solids	EPA 8260C	GC-MS	N-propylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	o-Xylene
Aqueous/Solids	EPA 8260C	GC-MS	Propionitrile
Aqueous/Solids	EPA 8260C	GC-MS	sec-butylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	Styrene
Aqueous/Solids	EPA 8260C	GC-MS	tert-amyl methyl ether

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8260C	GC-MS	tert-butylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	Tetra hydrofuran
Aqueous/Solids	EPA 8260C	GC-MS	Tetrachloroethene
Aqueous/Solids	EPA 8260C	GC-MS	Toluene
Aqueous/Solids	EPA 8260C	GC-MS	trans-1,2-Dichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	trans-1,3-Dichloropropene
Aqueous/Solids	EPA 8260C	GC-MS	trans-1,4-Dichloro-2-butene
Aqueous/Solids	EPA 8260C	GC-MS	Trichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	Trichlorofluoromethane (Freon 11)
Aqueous/Solids	EPA 8260C	GC-MS	Vinyl acetate
Aqueous/Solids	EPA 8260C	GC-MS	Vinyl chloride
Aqueous/Solids	EPA 8260C	GC-MS	Xylenes, total
Aqueous/Solids	EPA 8270D	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2-Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2-Diphenylhydrazine
Aqueous/Solids	EPA 8270D	GC-MS	1,3,5-Trinitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,3-Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,3-Dinitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,4-Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,4-Dioxane
Aqueous/Solids	EPA 8270D	GC-MS	1,4-Naphthoquinone
Aqueous/Solids	EPA 8270D	GC-MS	1-Methyl-2-pyrrolidinone
Aqueous/Solids	EPA 8270D	GC-MS	1-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	1-Naphthylamine
Aqueous/Solids	EPA 8270D	GC-MS	2,3,4,6-Tetrachlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4,5-Trichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4,6-Trichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dimethylphenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dinitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dinitrotoluene
Aqueous/Solids	EPA 8270D	GC-MS	2,6-Dichlorophenol

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

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1 Mustard Street, Suite #250
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Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	2,6-Dinitrotoluene
Aqueous/Solids	EPA 8270D	GC-MS	2-Acetylaminofluorene
Aqueous/Solids	EPA 8270D	GC-MS	2-Chloronaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2-Chlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Methyl-5-nitroaniline (5-Nitro-o-toluidine)
Aqueous/Solids	EPA 8270D	GC-MS	2-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2-Methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Naphthylamine
Aqueous/Solids	EPA 8270D	GC-MS	2-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	2-Nitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Picoline
Aqueous/Solids	EPA 8270D	GC-MS	3,3'-Dichlorobenzidine
Aqueous/Solids	EPA 8270D	GC-MS	3,3'-Dimethylbenzidine
Aqueous/Solids	EPA 8270D	GC-MS	3+4-Methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	3-Methylcholanthrene
Aqueous/Solids	EPA 8270D	GC-MS	3-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4,6-Dinitro-2-methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Aminobiphenyl
Aqueous/Solids	EPA 8270D	GC-MS	4-Bromophenyl-phenylether
Aqueous/Solids	EPA 8270D	GC-MS	4-Chloro-3-methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Chloroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Chlorophenyl-phenylether
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitroquinoline-1-oxide
Aqueous/Solids	EPA 8270D	GC-MS	7,12-Dimethylbenz(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	α,α-Dimethylphenethylamine
Aqueous/Solids	EPA 8270D	GC-MS	Acenaphthene
Aqueous/Solids	EPA 8270D	GC-MS	Acenaphthylene
Aqueous/Solids	EPA 8270D	GC-MS	Acetophenone
Aqueous/Solids	EPA 8270D	GC-MS	Aniline
Aqueous/Solids	EPA 8270D	GC-MS	Anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Aramite

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Atrazine
Aqueous/Solids	EPA 8270D	GC-MS	Benzaldehyde
Aqueous/Solids	EPA 8270D	GC-MS	Benzidine
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(a)pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Benzoic acid
Aqueous/Solids	EPA 8270D	GC-MS	Benzyl alcohol
Aqueous/Solids	EPA 8270D	GC-MS	Biphenyl
Aqueous/Solids	EPA 8270D	GC-MS	Bis(1-chloroisopropyl)ether
Aqueous/Solids	EPA 8270D	GC-MS	Bis(-2-chloroethoxy)methane
Aqueous/Solids	EPA 8270D	GC-MS	Bis(2-chloroethyl)ether
Aqueous/Solids	EPA 8270D	GC-MS	Bis(2-ethylhexyl)phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Caprolactam
Aqueous/Solids	EPA 8270D	GC-MS	Carbazole
Aqueous/Solids	EPA 8270D	GC-MS	Chlorobenzilate
Aqueous/Solids	EPA 8270D	GC-MS	Chrysene
Aqueous/Solids	EPA 8270D	GC-MS	Cyclohexane, isothiocyanato-
Aqueous/Solids	EPA 8270D	GC-MS	Diallate
Aqueous/Solids	EPA 8270D	GC-MS	Dibenzo(a,h)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Dibenzofuran
Aqueous/Solids	EPA 8270D	GC-MS	Diethylphthalate
Aqueous/Solids	EPA 8270D	GC-MS	Dimethoate
Aqueous/Solids	EPA 8270D	GC-MS	Dimethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Di-n-butylphthalate
Aqueous/Solids	EPA 8270D	GC-MS	Di-n-octyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Dinoseb
Aqueous/Solids	EPA 8270D	GC-MS	Diphenylamine
Aqueous/Solids	EPA 8270D	GC-MS	Disulfoton
Aqueous/Solids	EPA 8270D	GC-MS	Ethyl methanesulfonate

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

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Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Fluorene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorocyclopentadiene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachloroethane
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorophene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachloropropene
Aqueous/Solids	EPA 8270D	GC-MS	Indeno(1,2,3-cd)pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Isodrin
Aqueous/Solids	EPA 8270D	GC-MS	Isophorone
Aqueous/Solids	EPA 8270D	GC-MS	Isosafrole
Aqueous/Solids	EPA 8270D	GC-MS	Methapyrilene
Aqueous/Solids	EPA 8270D	GC-MS	Methyl methanesulfonate
Aqueous/Solids	EPA 8270D	GC-MS	Methyl parathion
Aqueous/Solids	EPA 8270D	GC-MS	Naphthalene
Aqueous/Solids	EPA 8270D	GC-MS	Nitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodiethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodimethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodi-n-butylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitroso-di-n-propylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodiphenylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosomethylethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosomorpholine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosopiperidine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosopyrolidine
Aqueous/Solids	EPA 8270D	GC-MS	Octachlorostyrene
Aqueous/Solids	EPA 8270D	GC-MS	o,o,o-triethyl phosphorothioate
Aqueous/Solids	EPA 8270D	GC-MS	o-toluidine
Aqueous/Solids	EPA 8270D	GC-MS	Parathion (ethyl)
Aqueous/Solids	EPA 8270D	GC-MS	p-dimethylaminoazobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachloroethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Pentachloronitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	Phenacetin
Aqueous/Solids	EPA 8270D	GC-MS	Phenanthrene
Aqueous/Solids	EPA 8270D	GC-MS	Phenol
Aqueous/Solids	EPA 8270D	GC-MS	Phorate
Aqueous/Solids	EPA 8270D	GC-MS	Phthalimide
Aqueous/Solids	EPA 8270D	GC-MS	Pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Pyridine
Aqueous/Solids	EPA 8270D	GC-MS	Safrole
Aqueous/Solids	EPA 8270D	GC-MS	Sulfotepp
Aqueous/Solids	EPA 8270D	GC-MS	Thionazin
Aqueous/Solids	EPA 8270D	GC-MS-LL	1,4-Dioxane
Aqueous/Solids	EPA 8270D	GC-MS-LL	1-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS-LL	2-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Acenaphthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Acenaphthylene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Anthracene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(a)pyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Bis(2-ethylhexyl)phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Carbazole
Aqueous/Solids	EPA 8270D	GC-MS-LL	Chrysene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Dibenzo(a,h)anthracene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Dibenzofuran
Aqueous/Solids	EPA 8270D	GC-MS-LL	Diethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Dimethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Di-n-butyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Di-n-octyl phthalate

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

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1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS-LL	Fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Fluorene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Hexachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Indeno(1,2,3-cd)pyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Naphthalene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Nitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Octachlorostyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Phenanthrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Pyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Pyridine
Aqueous/Solids	EPA 9012A, B	UV-VIS	Cyanide, total
Aqueous/Solids	EPA 9034	Titration	Sulfide, acid soluble
Aqueous/Solids	EPA 9056A	IC	Bromide
Aqueous/Solids	EPA 9056A	IC	Chloride
Aqueous/Solids	EPA 9056A	IC	Fluoride
Aqueous/Solids	EPA 9056A	IC	Nitrate as Nitrogen
Aqueous/Solids	EPA 9056A	IC	Nitrite as Nitrogen
Aqueous/Solids	EPA 9056A	IC	Sulfate
Aqueous/Solids	ILM05.3	UV-VIS	Cyanide, total
Aqueous/Solids	ILM05.3	ICP-AES	Aluminum
Aqueous/Solids	ILM05.3	ICP-AES	Antimony
Aqueous/Solids	ILM05.3	ICP-AES	Arsenic
Aqueous/Solids	ILM05.3	ICP-AES	Barium
Aqueous/Solids	ILM05.3	ICP-AES	Beryllium
Aqueous/Solids	ILM05.3	ICP-AES	Cadmium
Aqueous/Solids	ILM05.3	ICP-AES	Calcium
Aqueous/Solids	ILM05.3	ICP-AES	Chromium
Aqueous/Solids	ILM05.3	ICP-AES	Cobalt
Aqueous/Solids	ILM05.3	ICP-AES	Copper
Aqueous/Solids	ILM05.3	ICP-AES	Iron
Aqueous/Solids	ILM05.3	ICP-AES	Lead
Aqueous/Solids	ILM05.3	ICP-AES	Magnesium
Aqueous/Solids	ILM05.3	ICP-AES	Manganese

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	ILM05.3	ICP-AES	Nickel
Aqueous/Solids	ILM05.3	ICP-AES	Potassium
Aqueous/Solids	ILM05.3	ICP-AES	Selenium
Aqueous/Solids	ILM05.3	ICP-AES	Silver
Aqueous/Solids	ILM05.3	ICP-AES	Sodium
Aqueous/Solids	ILM05.3	ICP-AES	Thallium
Aqueous/Solids	ILM05.3	ICP-AES	Vanadium
Aqueous/Solids	ILM05.3	ICP-AES	Zinc
Aqueous/Solids	OLC03.2	GC-MS	1,1,1-Trichloroethane
Aqueous/Solids	OLC03.2	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous/Solids	OLC03.2	GC-MS	1,1,2-Trichloroethane
Aqueous/Solids	OLC03.2	GC-MS	1,1-Dichloroethane
Aqueous/Solids	OLC03.2	GC-MS	1,1-Dichloroethene
Aqueous/Solids	OLC03.2	GC-MS	1,2,3-Trichlorobenzene
Aqueous/Solids	OLC03.2	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	OLC03.2	GC-MS	1,2-Dibromo-3-chloropropane
Aqueous/Solids	OLC03.2	GC-MS	1,2-Dibromoethane
Aqueous/Solids	OLC03.2	GC-MS	1,2-Dichlorobenzene
Aqueous/Solids	OLC03.2	GC-MS	1,2-Dichloroethane
Aqueous/Solids	OLC03.2	GC-MS	1,2-Dichloropropane
Aqueous/Solids	OLC03.2	GC-MS	1,3-Dichlorobenzene
Aqueous/Solids	OLC03.2	GC-MS	1,4-Dichlorobenzene
Aqueous/Solids	OLC03.2	GC-MS	2-Butanone
Aqueous/Solids	OLC03.2	GC-MS	2-Hexanone
Aqueous/Solids	OLC03.2	GC-MS	4-Methyl-2-pentanone
Aqueous/Solids	OLC03.2	GC-MS	Acetone
Aqueous/Solids	OLC03.2	GC-MS	Benzene
Aqueous/Solids	OLC03.2	GC-MS	Bromochloromethane
Aqueous/Solids	OLC03.2	GC-MS	Bromodichloromethane
Aqueous/Solids	OLC03.2	GC-MS	Bromoform
Aqueous/Solids	OLC03.2	GC-MS	Bromomethane
Aqueous/Solids	OLC03.2	GC-MS	Carbon disulfide
Aqueous/Solids	OLC03.2	GC-MS	Carbon tetrachloride

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	OLC03.2	GC-MS	Chlorobenzene
Aqueous/Solids	OLC03.2	GC-MS	Chloroethane
Aqueous/Solids	OLC03.2	GC-MS	Chloroform
Aqueous/Solids	OLC03.2	GC-MS	Chloromethane
Aqueous/Solids	OLC03.2	GC-MS	cis-1,2-Dichloroethene
Aqueous/Solids	OLC03.2	GC-MS	cis-1,3-Dichloropropene
Aqueous/Solids	OLC03.2	GC-MS	Cyclohexane
Aqueous/Solids	OLC03.2	GC-MS	Dibromochloromethane
Aqueous/Solids	OLC03.2	GC-MS	Dichlorodifluoromethane
Aqueous/Solids	OLC03.2	GC-MS	Ethylbenzene
Aqueous/Solids	OLC03.2	GC-MS	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
Aqueous/Solids	OLC03.2	GC-MS	Isopropylbenzene
Aqueous/Solids	OLC03.2	GC-MS	Methyl acetate
Aqueous/Solids	OLC03.2	GC-MS	Methylcyclohexane
Aqueous/Solids	OLC03.2	GC-MS	Methylene chloride
Aqueous/Solids	OLC03.2	GC-MS	Methyl-t-butyl ether
Aqueous/Solids	OLC03.2	GC-MS	m- + p-Xylene
Aqueous/Solids	OLC03.2	GC-MS	o-Xylene
Aqueous/Solids	OLC03.2	GC-MS	Styrene
Aqueous/Solids	OLC03.2	GC-MS	Tetrachloroethene
Aqueous/Solids	OLC03.2	GC-MS	Toluene
Aqueous/Solids	OLC03.2	GC-MS	trans-1,2-Dichloroethene
Aqueous/Solids	OLC03.2	GC-MS	trans-1,3-Dichloropropene
Aqueous/Solids	OLC03.2	GC-MS	Trichloroethene
Aqueous/Solids	OLC03.2	GC-MS	Trichlorofluoromethane
Aqueous/Solids	OLC03.2	GC-MS	Vinyl chloride
Aqueous/Solids	OLM04.3	GC-MS	1,1,1-Trichloroethane
Aqueous/Solids	OLM04.3	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous/Solids	OLM04.3	GC-MS	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
Aqueous/Solids	OLM04.3	GC-MS	1,1,2-Trichloroethane
Aqueous/Solids	OLM04.3	GC-MS	1,1-Dichloroethane
Aqueous/Solids	OLM04.3	GC-MS	1,1-Dichloroethene
Aqueous/Solids	OLM04.3	GC-MS	1,2,4-Trichlorobenzene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	OLM04.3	GC-MS	1,2-Dibromo-3-chloropropane
Aqueous/Solids	OLM04.3	GC-MS	1,2-Dibromoethane
Aqueous/Solids	OLM04.3	GC-MS	1,2-Dichlorobenzene
Aqueous/Solids	OLM04.3	GC-MS	1,2-Dichloroethane
Aqueous/Solids	OLM04.3	GC-MS	1,2-Dichloropropane
Aqueous/Solids	OLM04.3	GC-MS	1,3-Dichlorobenzene
Aqueous/Solids	OLM04.3	GC-MS	1,4-Dichlorobenzene
Aqueous/Solids	OLM04.3	GC-MS	2-Butanone
Aqueous/Solids	OLM04.3	GC-MS	2-Hexanone
Aqueous/Solids	OLM04.3	GC-MS	4-Methyl-2-pentanone
Aqueous/Solids	OLM04.3	GC-MS	Acetone
Aqueous/Solids	OLM04.3	GC-MS	Benzene
Aqueous/Solids	OLM04.3	GC-MS	Bromodichloromethane
Aqueous/Solids	OLM04.3	GC-MS	Bromoform
Aqueous/Solids	OLM04.3	GC-MS	Bromomethane
Aqueous/Solids	OLM04.3	GC-MS	Carbon disulfide
Aqueous/Solids	OLM04.3	GC-MS	Carbon tetrachloride
Aqueous/Solids	OLM04.3	GC-MS	Chlorobenzene
Aqueous/Solids	OLM04.3	GC-MS	Chlorodifluoromethane
Aqueous/Solids	OLM04.3	GC-MS	Chloroethane
Aqueous/Solids	OLM04.3	GC-MS	Chloroform
Aqueous/Solids	OLM04.3	GC-MS	Chloromethane
Aqueous/Solids	OLM04.3	GC-MS	cis-1,2-Dichloroethene
Aqueous/Solids	OLM04.3	GC-MS	cis-1,3-Dichloropropene
Aqueous/Solids	OLM04.3	GC-MS	Cyclohexane
Aqueous/Solids	OLM04.3	GC-MS	Dibromochloromethane
Aqueous/Solids	OLM04.3	GC-MS	Dichlorodifluoromethane
Aqueous/Solids	OLM04.3	GC-MS	Ethylbenzene
Aqueous/Solids	OLM04.3	GC-MS	Isopropylbenzene
Aqueous/Solids	OLM04.3	GC-MS	m- + p-Xylene
Aqueous/Solids	OLM04.3	GC-MS	Methyl acetate
Aqueous/Solids	OLM04.3	GC-MS	Methyl tert-butyl ether
Aqueous/Solids	OLM04.3	GC-MS	Methylcyclohexane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services, Inc.
1 Mustard Street, Suite #250
Rochester, NY 14609

Accreditation is granted to this facility to perform the following testing:

Matrix	Standard / Method	Technology	Analyte
Aqueous/Solids	OLM04.3	GC-MS	Methylene chloride
Aqueous/Solids	OLM04.3	GC-MS	o-Xylene
Aqueous/Solids	OLM04.3	GC-MS	Styrene
Aqueous/Solids	OLM04.3	GC-MS	Tetrachloroethene
Aqueous/Solids	OLM04.3	GC-MS	Toluene
Aqueous/Solids	OLM04.3	GC-MS	trans-1,2-Dichloroethene
Aqueous/Solids	OLM04.3	GC-MS	trans-1,3-Dichloropropene
Aqueous/Solids	OLM04.3	GC-MS	Trichloroethene
Aqueous/Solids	OLM04.3	GC-MS	Trichlorofluoromethane
Aqueous/Solids	OLM04.3	GC-MS	Vinyl chloride

Matrix	Standard / Method	Technology	Analyte
Aqueous	EPA 3010A	Acid Digestion	Metals prep
Aqueous	EPA 3510C	SF Extraction	Semivolatiles, pesticides, PCBs, DRO
Aqueous	EPA 5030B	P&T	Volatiles
Solids	EPA 3050B	Acid Digestion	Metals prep
Solids	EPA 3060A	Digestion	Hexavalent chromium digestion
Solids	EPA 3541	SOX Extraction	Semivolatiles, pesticides, PCBs, DRO
Solids	EPA 5035	P&T closed	Volatiles
Aqueous/Solids	EPA 1311	TCLP	Physical Extraction
Aqueous/Solids	EPA 1312	SPLP	Physical Extraction
Aqueous/Solids	EPA 3620B	Florisil Cleanup	Semivolatiles, pesticides, PCBs
Aqueous/Solids	EPA 3660B	Sulfur Cleanup	Semivolatiles, pesticides, PCBs
Aqueous/Solids	EPA 3665A	Sulfuric Acid Cleanup	PCBs
Aqueous/Solids	EPA 9012A, B	Distillation	Cyanide
Aqueous/Solids	EPA 9030B	Distillation	Sulfide, acid soluble

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ENVIRONMENTAL CONSERVATION LABORATORIES – ORLANDO
10775 Central Port Drive
Orlando, FL 32824
Lori Mangrum Phone: 407 826 5314
lmangrum@encolabs.com

ENVIRONMENTAL

Valid To: June 30, 2012 Certificate Number: 3000.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Metals	EPA 6020A/200.8	EPA 6020A
Aluminum	EPA 6020A/200.8	EPA 6020A
Antimony	EPA 6020A/200.8	EPA 6020A
Arsenic	EPA 6020A/200.8	EPA 6020A
Barium	EPA 6020A/200.8	EPA 6020A
Beryllium	EPA 6020A/200.8	EPA 6020A
Cadmium	EPA 6020A/200.8	EPA 6020A
Calcium	EPA 6020A/200.8	EPA 6020A
Chromium	EPA 6020A/200.8	EPA 6020A
Cobalt	EPA 6020A/200.8	EPA 6020A
Copper	EPA 6020A/200.8	EPA 6020A
Hardness	SM 2340 B	----------
Iron	EPA 6020A/200.8	EPA 6020A
Lead	EPA 6020A/200.8	EPA 6020A
Magnesium	EPA 6020A/200.8	EPA 6020A
Manganese	EPA 6020A/200.8	EPA 6020A
Mercury	EPA 245.1/7470A	EPA 7471B
Molybdenum	EPA 6020A/200.8	EPA 6020A
Nickel	EPA 6020A/200.8	EPA 6020A
Potassium	EPA 6020A/200.8	EPA 6020A
Selenium	EPA 6020A/200.8	EPA 6020A
Silver	EPA 6020A/200.8	EPA 6020A
Sodium	EPA 6020A/200.8	EPA 6020A
Thallium	EPA 6020A/200.8	EPA 6020A
Tin	EPA 6020A/200.8	EPA 6020A

5301 Buckeystown Pike, Suite 350 | Frederick, Maryland 21704-8373 | Phone: 301 644 3248 | Fax: 301 662 2974 | www.A2LA.org

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Titanium	EPA 6020A/200.8	EPA 6020A
Vanadium	EPA 6020A/200.8	EPA 6020A
Zinc	EPA 6020A/200.8	EPA 6020A
Microbiology		
Total Coliforms	SM 9222B	----------
Fecal Coliforms	SM 9222D	----------
General Chemistry		
Acidity, as $CaC0_3$	EPA 305.1/SM 2310 B (4A)	----------
Alkalinity as $CaC0_3$	EPA 310.1/SM 2320 B	EPA 310.1/SM 2320 B
Alkalinity as $CaC0_4$	EPA 310.2	EPA 310.2
Ammonia as N	----------	EPA 350.1
Biochemical oxygen demand	EPA 405.1/SM 5210 B	----------
Bromide	EPA 300.0/9056A	EPA 9056A
Carbonaceous BOD (CBOD)	SM 5210 B	----------
Chemical oxygen demand	EPA 410.4	----------
Chloride	EPA 300.0/9056A	EPA 9056A
Chromium VI	EPA 7196/ SM 3500-Cr D	EPA 7196
Conductivity	EPA 120.1	----------
Cyanide	EPA 335.2/SM 4500-CN E	EPA 9014
Ferric iron (calculated)	SM 3500-Fe D	----------
Ferrous iron	SM 3500-Fe D	----------
Fluoride	EPA 300.0/9056A	EPA 9056A
Hardness	EPA 130.2/SM 2340 C	----------
Kjeldahl nitrogen -total	EPA 351.2	EPA351.2
Nitrate as N	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrate-nitrite	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrite as N	EPA 300.0/354.1/9056A/SM 4500-NO_2 B	EPA 9056A/ SM 4500-NO_2 B
Organic nitrogen	EPA 351.2/350.1	EPA 351.2/350.1
Orthophosphate as P	EPA 365.1	----------
Orthophosphate as P	EPA 365.3	----------
pH	EPA 150.1/9040C/SM 4500-H^+-B	EPA 9040C
Phosphorus, total	EPA 365.4	EPA 365.4
Residue-filterable (TDS)	SM 2540 C	----------
Residue-nonfilterable (TSS)	SM 2540 D	----------
Residue-total	SM 2540 B/SM 2540 G/EPA 160.3	SM 2540G/EPA 160.3
Residue-volatile	EPA 160.4	EPA 160.4
Sulfate	EPA 300.0/9056A	EPA 9056A
Sulfide	EPA 376.1/SM 4500-S E	----------
Surfactants -MBAS	SM 5540 C	----------
Total nitrate-nitrite	EPA 9056 A/SM 4500-$N0_3$ H	EPA 9056 A/SM 4500-$N0_3$ H
Total cyanide	EPA 9014	EPA 9014
Total nitrogen	TKN + Total nitrate-nitrite	TKN + Total nitrate-nitrite
Total Organic Carbon	EPA 9060A/SM 5310B	TOC Walkley Black
Total phenolics	EPA 420.1	EPA 420.1
Total, fixed, and volatile residue	SM 2540 G	SM 2540 G
Turbidity	EPA 180.1	----------
Un-ionized ammonia	DEP SOP 10/03/83	DEP SOP 10/03/83
Extractable Organics		

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
1,2,4-Trichlorobenzene	EPA 8270D/625	EPA 8270D
1,2,4,5-Tetrachlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Diphenylhydrazine	EPA 8270D/625	EPA 8270D
1,3-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,4-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1- Methylnaphthalene	EPA 8270D/625/ Scan-Sim	EPA 8270D/ Scan-Sim
2,3,4,6-Tetrachlorophenol	EPA 8270D/625	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dimethylphenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrophenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D/625/ Scan-Sim	EPA 8270D
2,6-Dichlorophenon	EPA 8270D/625	EPA 8270D
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D/625	EPA 8270D
2-Chloronaphthalene	EPA 8270D/625	EPA 8270D
2-Chlorophenol	EPA 8270D/625	EPA 8270D
2·Methyl-4,6-dinitrophenol	EPA 8270D/625	EPA 8270D
2-Methylnaphthalene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
2-Methylphenol (o-Cresol)	EPA 8270D/625	EPA 8270D
2-Nitroaniline	EPA 8270D/625	EPA 8270D
2-Nitrophenol	EPA 8270D/625	EPA 8270D
3,3'-Dichlorobenzidine	EPA 8270D/625	EPA 8270D
3/4-Methylphenols (m/p-Cresols)	EPA 8270D/625	EPA 8270D
3-Nitroaniline	EPA 8270D/625	EPA 8270D
4-Bromophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D/625	EPA 8270D
4-Chloroaniline	EPA 8270D/625	EPA 8270D
4-Chlorophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Nitrophenol	EPA 8270D/625	EPA 8270D
Acenaphthene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Acenaphthylene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
4-Melhylphenol (p-Cresol)	EPA 8270D/625	EPA 8270D
4-Nitroaniline	EPA 8270D/625	EPA 8270D
Acetophenone	EPA 8270D/625	EPA 8270D
Anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan Sim
Atrazine	EPA 8270D/625	EPA 8270D
Benzaldehyde	EPA 8270D/625	EPA 8270D
Benzidine	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(a)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(a)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(b)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(g,h,i)perylene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(k)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzyl alcohol	EPA 8270D/625	EPA 8270D
1,1-Biphenyl	EPA 8270D/625	EPA 8270D
bis(2-Chloroethoxy) methane	EPA 8270D/625	EPA 8270D
bis(2-Chloroethyl) ether	EPA 8270D/625	EPA 8270D
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270D/625	EPA 8270D

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270D/625	EPA 8270D
Butyl benzyl phthalate	EPA 8270D/625	EPA 8270D
Caprolactam	EPA 8270D/625	EPA 8270D
Carbazole	EPA 8270D/625	EPA 8270D
Chrysene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Dibenz(a,h)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Dibenzofuran	EPA 8270D/625	EPA 8270D
Diethyl phthalate	EPA 8270D/625	EPA 8270D
Dimethyl phthalate	EPA 8270D/625/ Scan-Sim	EPA 8270D
Di-n-butyl phthalate	EPA 8270D/625	EPA 8270D
Di-n-octyl phthalate	EPA 8270D/625	EPA 8270D
Fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Fluorene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Hexachlorobenzene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorobutadiene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D/625	EPA 8270D
Hexachloroethane	EPA 8270D/625	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Isodrin	EPA 8270D/625	EPA 8270D
Isophorone	EPA 8270D/625	EPA 8270D
Naphthalene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Nitrobenzene	EPA 8270D/625	EPA 8270D
n-Nitrosodimethylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodiphenylamine	EPA 8270D/625	EPA 8270D
n-Nitrosopyrrolidine	EPA 8270D/625	EPA 8270D
Pentachlorophenol	EPA 8270D/625/ Scan-Sim	EPA 8270D
Phenanthrene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Phenol	EPA 8270D/625	EPA 8270D
Pyrene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Total Petroleum Hydrocarbons (TPH)	FL·PRO	FL·PRO
Volatile Organics		
1,1,1,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethene	EPA 8260B/624	EPA 8260B
1,1-Dichloropropene	EPA 8260B/624	EPA 8260B
1,2,3-Trichlorobenzene	EPA 504.1/8260B/624	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B/624	EPA 8260B
1,2,4-Trichlorobenzene	EPA 8260B/624	EPA 8260B
1,2,4-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504 /504.1/8011/8260B	EPA 8260B
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504 /504.1/8011/8260B	EPA 8260B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
1,2-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,2-Dichloroethane	EPA 8260B/624	EPA 8260B
1,2-Dichloropropane	EPA 8260B/624	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,3-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,3-Dichloropropane	EPA 8260B/624	EPA 8260B
1,4-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,4-Dioxane (1,4-Diethylencoxide)	EPA 8260B/8260C SIM/624	EPA 8260B/8260C SIM
2,2-Dichloropropane	EPA 8260B/624	EPA 8260B
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B/624	EPA 8260B
2-Chloroethyl vinyl ether	EPA 8260B/624	EPA 8260B
2-Chlorotoluene	EPA 8260B/624	EPA 8260B
2-Hexanone	EPA 8260B/624	EPA 8260B
4-Chlorotoluene	EPA 8260B/624	EPA 8260B
4-Methyl-2-pentanone (MIBK)	EPA 8260B/624	EPA 8260B
Acetone	EPA 8260B/624	EPA 8260B
Acetonitrile	EPA 8260B/624	EPA 8260B
Acrolein (Propenal)	EPA 8260B/624	EPA 8260B
Acrylonitrile	EPA 8260B/624	EPA 8260B
Allyl chloride (3-Chloropropene)	EPA 8260B/624	EPA 8260B
Benzene	EPA 8260B/624	EPA 8260B
Bromobenzene	EPA 8260B/624	EPA 8260B
Bromochloromethane	EPA 8260B/624	EPA 8260B
Bromodichloromethane	EPA 8260B/624	EPA 8260B
Bromoform	EPA 8260B/624	EPA 8260B
Carbon tetrachloride	EPA 8260B/624	EPA 8260B
Carbon disulfide	EPA 8260B/624	EPA 8260B
Chlorobenzene	EPA 8260B/624	EPA 8260B
Chloroethane	EPA 8260B/624	EPA 8260B
Chloroform	EPA 8260B/624	EPA 8260B
Chloroprene	EPA 8260B/624	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
Cyclohexane	EPA 8260B/624	EPA 8260B
Dibromochloromethane	EPA 8260B/624	EPA 8260B
Dibromomethane	EPA 8260B/624	EPA 8260B
Dichlorodifluoromethane	EPA 8260B/624	EPA 8260B
Ethyl methacrylate	EPA 8260B/624	EPA 8260B
Hexachlorobutadiene	EPA 8260B/624	EPA 8260B
Ethylbenzene	EPA 8260B/624	EPA 8260B
Iodomethane (Methyl iodide)	EPA 8260B/624	EPA 8260B
Isobutyl alcohol (2-Methyl-l-propanol)	EPA 8260B/624	EPA 8260B
Isopropylbenzene	EPA 8260B/624	EPA 8260B
m+p-Xylenes	EPA 8260B/624	EPA 8260B
Methacrylonitrile	EPA 8260B/624	EPA 8260B
Methyl acetate	EPA 8260B/624	EPA 8260B
Methyl bromide (Bromomethane)	EPA 8260B/624	EPA 8260B
Methyl chloride (Chloromethane)	EPA 8260B/624	EPA 8260B
Methyl methacrylate	EPA 8260B/624	EPA 8260B
Methyl tert-butyl ether (MTBE)	EPA 8260B/624	EPA 8260B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Methylcyclohexane	EPA 8260B/624	EPA 8260B
Methylene chloride	EPA 8260B/624	EPA 8260B
Naphthalene	EPA 8260B/624	EPA 8260B
n-Butylbenzene	EPA 8260B/624	EPA 8260B
n-Propylbenzene	EPA 8260B/624	EPA 8260B
o-Xylene	EPA 8260B/624	EPA 8260B
Pentachloroethane	EPA 8260B/624	EPA 8260B
p-Isopropyltoluene	EPA 8260B/624	EPA 8260B
Propionitrile (Ethyl cyanide)	EPA 8260B/624	EPA 8260B
sec-Butylbenzene	EPA 8260B/624	EPA 8260B
Styrene	EPA 8260B/624	EPA 8260B
tert-Butylbenzene	EPA 8260B/624	EPA 8260B
Tetrachloroethene (Perchloroethylene)	EPA 8260B/624	EPA 8260B
Toluene	EPA 8260B/624	EPA 8260B
trans-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
trans-1,4-Dichloro-2-butene	EPA 8260B/624	EPA 8260B
Trichloroethene (Trichloroethylene)	EPA 8260B/624	EPA 8260B
Trichlorofluoromethane	EPA 8260B/624	EPA 8260B
Vinyl acetate	EPA 8260B/624	EPA 8260B
Vinyl chloride	EPA 8260B/624	EPA 8260B
Xylene (total)	EPA 8260B/624	EPA 8260B
Pesticides-Herbicides-PCBs		
2,4,5-T	EPA 8151A /615	EPA 8151A
2,4-D	EPA 8151A /615	EPA 8151A
2,4-DB	EPA 8151A /615	EPA 8151A
3,5-Dichlorobenzoic acid	EPA 8151A /615	EPA 8151A
4.4'-DDD	EPA 8081B/608	EPA 8081B
4.4'-DDE	EPA 8081B/608	EPA 8081B
4,4'·DDT	EPA 8081B/608	EPA 8081B
4-Nitrophenol	EPA 8151A/615	EPA 8151A
Acifluorfen	EPA 8151A/615	EPA 8151A
Aldrin	EPA 8081B/608	EPA 8081B
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
alpha-Chlordane	EPA 8081B/608	EPA 8081B
Aroclor-1016(PCB-1016)	EPA 8082A/608	EPA 8082A
Aroclor-1221 (PCB-1221)	EPA 8082A/608	EPA 8082A
Aroclor-1232 (PCB-1232)	EPA 8082A/608	EPA 8082A
Aroclor-1242 (PCB-1242)	EPA 8082A/608	EPA 8082A
Aroclor-1248 (PCB-1248)	EPA 8082A/608	EPA 8082A
Aroclor-1254 (PCB-1254)	EPA 8082A/608	EPA 8082A
Aroclor-1260 (PCB-1260)	EPA 8082A/608	EPA 8082A
Aroclor-1262 (PCB-1262)	EPA 8082A/608	EPA 8082A
Aroclor-1268 (PCB-1268)	EPA 8082A/608	EPA 8082A
Azinphos-methyl (Guthion)	EPA 8141B/614	EPA 8141B
Bentazon	EPA 8151A/615	EPA 8151A
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
Bolstar (Sulprofos)	EPA 8141B/614	EPA 8141B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Chloramben	EPA 8151A/615	EPA 8151A
Chlordane (tech.)	EPA 8081B/608	EPA 8081B
Chlorpynfos	EPA 8141B/614	EPA 8141B
Coumaphos	EPA 8141B/614	EPA 8141B
Dacthal (DCPA)	EPA 8151A/615	EPA 8151A
Dalapon	EPA 8151A/615	EPA 8151A
delta-BHC	EPA 8081B/608	EPA 8081B
Demeton-o	EPA 8141B/614	EPA 8141B
Demeton-s	EPA 8141B/614	EPA 8141B
Diazinon	EPA 8141B/614	EPA 8141B
Dicamba	EPA 8151A/615	EPA 8151A
Dichlorofenthion	EPA 8141B/614	EPA 8141B
Dichloroprop (Dichlorprop)	EPA 8151A/615	EPA 8151A
Dlchlorovos (DDVP, Dichtorvos)	EPA 8141B/614	EPA 8141B
Dieldrin	EPA 8081B/608	EPA 8081B
Dimethoate	EPA 8141B/614	EPA 8141B
Dinoseb (2-sec-buty1-4 ,6-dinilrophenol, DNB P)	EPA 8151A/615	EPA 8151A
Disulfoton	EPA 8141B/614	EPA 8141B
Endosulfan I	EPA 8081B/608	EPA 8081B
Endosulfan II	EPA 8081B/608	EPA 8081B
Endosulfan sulfate	EPA 8081B/608	EPA 8081B
Endrin	EPA 8081B/608	EPA 8081B
Endrin aldehyde	EPA 8081B/608	EPA 8081B
Endrin ketone	EPA 8081B/608	EPA 8081B
EPN	EPA 8141B/614	EPA 8141B
Ethion	EPA 8141B/614	EPA 8141B
Ethoprop	EPA 8141B/614	EPA 8141B
fensulfothion	EPA 8141B/614	EPA 8141B
fenthion	EPA 8141B/614	EPA 8141B
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
gamma-Chlordane	EPA 8081B/608	EPA 8081B
Heptachlor	EPA 8081B/608	EPA 8081B
Heptachlor epoxide	EPA 8081B/608	EPA 8081B
Isodrin	EPA 8081B/608	EPA 8081B
Malathion	EPA 8141B/614	EPA 8141B
MCPA	EPA 8151A/615	EPA 8151A
MCPP	EPA 8151A/615	EPA 8151A
Merphos	EPA 8141B/614	EPA 8141B
Methoxychlor	EPA 8081B/608	EPA 8081B
Methyl parathion (Parathion. methyl)	EPA 8141B/614	EPA 8141B
Mevinphos	EPA 8141B/614	EPA 8141B
Mirex	EPA 8081B/608	EPA 8081B
Monocrotophos	EPA 8141B/614	EPA 8141B
Naled	EPA 8141B/614	EPA 8141B
Parathion, ethyl	EPA 8141B/614	EPA 8141B
Pentachlorophenol	EPA 8151A/615	EPA 8151A
Phorate	EPA 8141B/614	EPA 8141B
Picloram	EPA 8151A/615	EPA 8151A
Ronnel	EPA 8141B/614	EPA 8141B
Silvex (2A.5-TP)	EPA 8151B/615	EPA 8151B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Stirofos	EPA 8141B/614	EPA 8141B
Sulfotepp	EPA 8141B/614	EPA 8141B
Tetraethyl pyrophosphate (TEPP)	EPA 8141B/614	EPA 8141B
Tokuthion (Prothiophos)	EPA 8141B/614	EPA 8141B
Toxaphene (Chlorinated camphene)	EPA 8081B/608	EPA 8081B
Trichloronate	EPA 8141B/614	EPA 8141B

Preparation Methods

Fraction	Analytical Method	Preparation Method
Cyanide	EPA 9014 EPA 335.2 /SM 4500-CN E	EPA 9010C
TX	EPA 9056A	EPA 5050
Metal water prep	EPA 6020A/200.8	EPA 3005A
Metals soil prep	EPA 6020A	EPA 3050B
Metals TCLP prep	EPA 6020A/200.8	EPA 3010A
Extractable organics and Pesticides water prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3510C
Extractable organics and Pesticides waste prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3580A
Extractable organics and Pesticides soil prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3550C
Organics water and mid-level soil prep	EPA 8260B/624	EPA 5030B
Organics low-level soil prep	EPA 8260B/624	EPA 5035
Soil/water leachate	Wets	ENCO WETS-88
SPLP	Wets, Organics, and Metals	EPA 1312
TCLP	Wets, Organics, and Metals	EPA 1311

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

ENVIRONMENTAL CONSERVATION LABORATORIES - ORLANDO

Orlando, FL

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
CORPORATE SEAL 1978
DISTRICT OF COLUMBIA
A2LA

Presented this 29h day of March 2010.

President & CEO
For the Accreditation Council
Certificate Number 3000.01
Valid to June 30, 2012
Revised March 16, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

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GEL LABORATORIES, LLC

Charleston, SC

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Presented this 22nd day of August 2011.

President & CEO
For the Accreditation Council
Certificate Number 2567.01
Valid to June 30, 2013

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

Joint IAF-ILAC-ISO Communiqué
on the
Management Systems Requirements of ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories

A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and **management system requirements** that are necessary for it to consistently deliver technically valid test results and calibrations. The **management system requirements** in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 **Quality Management Systems — Requirements** and are aligned with its pertinent requirements.

IAF Chair	**ILAC Chair**	**ISO Secretary General**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

GEL LABORATORIES, LLC
2040 Savage Road
Charleston, SC 29414
Robert L. Pullano Phone: (843) 556-8171
rlp@gel.com

ENVIRONMENTAL

Valid To: June 30, 2013 Certificate Number: 2567.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1)) accreditation is granted to this laboratory to perform the following radiochemical tests in various matrices, including soils, drinking water, wastewater, groundwater, fiber air filters, vegetation, animal tissues and milk.

	Preparation SOP	Analytical SOP
Alpha Spectrometry: Alpha: Am-241, Am-243, Cf-252, Cm-242, Cm-243/244, Cm-245/246, Np-237, Po-208, Po-209, Po-210, Pu-236, Pu-238, Pu-239/240, Pu-242, Pu-244, Th-228, Th-229, Th-230, Th-232, U-232, U-233/234, U-235/236, U-238	GL-RAD-A-011, GL-RAD-A-016, GL-RAD-A-032, GL-RAD-A-036, GL-RAD-A-038	GL-RAD-I-009
Radon Emanation: Ra-226	GL-RAD-A-008, GL-RAD-A-028	GL-RAD-I-007
Gamma Spectrometry: Gamma: 46 to 1836 keV, I-129, I-131, Ni-59	GL-RAD-A-006, GL-RAD-A-013, GL-RAD-A-022	GL-RAD-I-001
Kinetic Phosphorescence Analyzer Total Uranium	GL-RAD-A-023	GL-RAD-B-018

5301 Buckeystown Pike, Suite 350 | Frederick, Maryland 21704-8373 | Phone: 301 644 3248 | Fax: 301 662 2974 | www.A2LA.org

	Preparation SOP	Analytical SOP
Gas Flow Proportional Counting: Beta: Cl-36, I-131, Pb-210, Ra-228, Sr-89, Sr-90, Total Radium	GL-RAD-A-004, GL-RAD-A-009, GL-RAD-A-010, GL-RAD-A-017, GL-RAD-A-018, GL-RAD-A-029, GL-RAD-A-030, GL-RAD-A-033, GL-RAD-A-044, GL-RAD-A-054	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
Gross Alpha/Gross Beta:	GL-RAD-A-001, GL-RAD-A-001B, GL-RAD-A-001C, GL-RAD-A-056	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
48 hour Gross Alpha	GL-RAD-A-047	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
Liquid Scintillation Spectrometry: Beta: C-14, Ca-45, Fe-55, H-3, Ni-63, P-32, Pm-147, Pu-241, S-35, Se-79, Tc-99 Alpha: Rn-222	GL-RAD-A-002, GL-RAD-A-003, GL-RAD-A-005, GL-RAD-A-007, GL-RAD-A-019, GL-RAD-A-020, GL-RAD-A-022, GL-RAD-A-031, GL-RAD-A-035, GL-RAD-A-040, GL-RAD-A-048, GL-RAD-A-049, GL-RAD-A-050	GL-RAD-I-004, GL-RAD-I-014, GL-RAD-I-017
ICP-MS Uranium Isotopes Tc-99	 GL-MA-E-008 GL-RAD-A-005, GL-RAD-A-055	 GL-MA-E-014 GL-RAD-B-034

Additionally, in recognition of the successful completion of the A2LA evaluation process, including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1), accreditation is granted to this laboratory to perform recognized EPA, Standard Methods for the Examination of Water and Wastewater, ASTM, Department of Energy (DOE), California and Connecticut test methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP/MS, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Methylene Blue Active Substances, Misc.- Electronic Probes (pH, O_2), Oxygen Demand, Hazardous Waste Characteristics Tests, Spectrophotometry (Visible), Spectrophotometry (Automated), IR Spectrometry, Titrimetry, Total Organic Carbon, Total Organic Halide, Turbidity, Liquid Chromatography/Mass Spectrometer/Mass Spectrometer and Various Radiochemistry Techniques

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Metals		
Aluminum	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Antimony	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C
Arsenic	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Barium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Beryllium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Boron	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Cadmium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Calcium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Chromium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Cobalt	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Copper	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Iron	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Lead	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Lithium	EPA 200.8/6020/6020A	EPA 6020/6020A
Magnesium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Manganese	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Mercury	EPA 1631E/7470/7470A/245.1/245.2	EPA 7470/7470A/7471A/7471B
Molybdenum	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Nickel	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Phosphorous	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Potassium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Selenium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Silicon[1]	EPA 200.7/6010B/6010C modified	EPA 6010B/6010C modified
Silica as SiO2	EPA 200.7/6010B/6010C	EPA 6010B/6010C
Silver	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C
Sodium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Strontium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Thallium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Tin	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C
Titanium	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Tungsten	----------	EPA 6020/6020A
Vanadium	EPA 200.7/6010B/6010C	EPA 6010B/6010C
Zinc	EPA 200.7/200.8/6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
General Chemistry		
Acidity	SM 2310 B/EPA 305.1	----------
Adsorbable Organic Halogens (AOX)	EPA 1650	----------
Alkalinity	SM 2320B/EPA 310.1	----------
Ammenable Cyanide	EPA 9012A/9012B/EPA 335.1	EPA 9012A/9012B
Ammonia Nitrogen	EPA 350.1	----------
Biochemical oxygen demand	SM 5210 B/EPA 405.1	----------
Bromide	EPA 9056A/EPA 300.0	EPA 9056A[3]
Carbonaceous BOD	SM 5210 B	----------
Chemical Oxygen Demand (COD)	EPA 410.4	----------
Chloride	EPA 9056A/EPA 300.0	EPA 9056A[3]
Chlorine (residual)	SM 4500Cl-G/EPA 330.5	----------
Chromium VI	EPA 7196A/SM 3500Cr-B	EPA 7196A
Color	SM 2120B/EPA 110.2	----------
Corrosivity toward Steel	----------	EPA 1110/1110A
Cyanide	EPA 9012A/9012B/335.3/335.4	EPA 9012A/9012B
Density	----------	ASTM D 5057
Extractable Organic Halides (EOX)	----------	EPA 9023
Filterable residue	SM 2540C	----------
Fluoride	EPA 9056A/EPA 300.0	EPA 9056A[3]
Ignitability	EPA 1010/1020A/1020B	EPA 1010/1020A/1020B
Hardness	SM 2340B/SM 2340C/EPA 130.2	----------
Kjeldahl Nitrogen	EPA 351.2	----------
MBAS/Surfactants	SM 5540C/EPA 425.1	----------
Nitrate (as N)	EPA 9056A/EPA 300.0	EPA 9056A[3]
Nitrate-nitrite (as N)	EPA 9056A/EPA 300.0	EPA 9056A[3]

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Nitrite (as N)	EPA 9056A/EPA 300.0	EPA 9056A[3]
Nonfilterable residue	SM 2540D	----------
Oil & Grease	EPA 1664A	EPA 1664A
Organic Nitrogen	TKN – Ammonia EPA 351.2 – EPA 350.1	----------
Orthophosphate (as P)	EPA 9056A/EPA 300.0	EPA 9056A[3]
Paint Filter Liquids Test	----------	EPA 9095A/9095B
Perchlorate	EPA 314.0/6850	EPA 6850
pH	SM 4500-H^+ B/ EPA 9040B /9040C/9041A/ EPA 150.1	EPA 9040B/9040C/9045C/9045D
Reactive Cyanide	Sec 7.3.3 SW846	Sec 7.3.3 SW846
Reactive Sulfide	Sec 7.3.4 SW846	Sec 7.3.4 SW846
Residue-Volatile	SM 2540E/EPA 160.4	----------
Residue-Settleable	SM 2540F	----------
Specific conductance	EPA 9050A/EPA 120.1	----------
Sulfate	EPA 9056A/EPA 300.0	EPA 9056A[3]
Sulfite	SM 4500-SO3 B	----------
Sulfide	EPA 9030B/9034	EPA 9030B/9034
Total, fixed, and volatile residue	SM 2540G	----------
Total Nitrate-Nitrite	EPA 353.2	----------
Total Organic Carbon (TOC)	EPA 9060/9060A/ SM 5310D/415.1	EPA 9060/9060A[2]
Total Organic Halides (TOX)	EPA 9020B	EPA 9020B[2]
Total Petroleum Hydrocarbons	EPA 1664A	EPA 1664A
Total Phenolics	EPA 9066/EPA 420.4	----------
Total Phosphorous	EPA 365.4	----------
Total residue	SM 2540B	----------
Turbidity	EPA 180.1/SM 2130	EPA 180.1/SM 2130
Organic Analytes		
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1/8011/8260B	EPA 8260B
1,2 Dibromoethane (EDB)	EPA 504.1/8011/8260B	EPA 8260B
Purgeable Organics (Volatiles)		
Acetone	EPA 624/8260B	EPA 8260B
Acetonitrile	EPA 624/8260B	EPA 8260B
Acrolein (Propenal)	EPA 624/8260B	EPA 8260B
Acrylonitrile	EPA 624/8260B	EPA 8260B
Allyl Chloride	EPA 624/8260B	EPA 8260B
Benzene	EPA 624/8260B	EPA 8260B
Benzyl chloride	EPA 624/8260B	EPA 8260B
Bromobenzene	EPA 624/8260B	EPA 8260B
Bromochloromethane	EPA 624/8260B	EPA 8260B
Bromodichloromethane	EPA 624/8260B	EPA 8260B
Bromoform	EPA 624/8260B	EPA 8260B
Bromomethane	EPA 624/8260B	EPA 8260B
2-Butanone (Methyl Ethyl Ketone)	EPA 8015B/8015C/624/8260B	EPA 8260B

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
n-Butyl alcohol	EPA 8015B/8015C/624/8260B	EPA 8260B
n-Butylbenzene	EPA 624/8260B	EPA 8260B
Sec-Butylbenzene	EPA 624/8260B	EPA 8260B
Tert-Butylbenzene	EPA 624/8260B	EPA 8260B
Carbon disulfide	EPA 624/8260B	EPA 8260B
Carbon tetrachloride	EPA 624/8260B	EPA 8260B
Chlorobenzene	EPA 624/8260B	EPA 8260B
Chloroethane	EPA 624/8260B	EPA 8260B
2-Chloroethyl vinyl ether	EPA 624/8260B	EPA 8260B
Chloroform	EPA 624/8260B	EPA 8260B
Chloromethane	EPA 624/8260B	EPA 8260B
Chloroprene	EPA 624/8260B	EPA 8260B
2-Chlorotoluene	EPA 624/8260B	EPA 8260B
4-Chlorotoluene	EPA 624/8260B	EPA 8260B
Dibromochloromethane	EPA 624/8260B	EPA 8260B
Dibromomethane	EPA 624/8260B	EPA 8260B
1,2-Dichlorobenzene	EPA 624/8260/625/8270C/8270D	EPA 8260/8270C/8270D
1,3-Dichlorobenzene	EPA 624/8260/625/8270C/8270D	EPA 8260/8270C/8270D
1,4-Dichlorobenzene	EPA 624/8260/625/8270C/8270D	EPA 8260/8270C/8270D
Dichlorodifluoromethane	EPA 624/8260B	EPA 8260B
1,1-Dichloroethane	EPA 624/8260B	EPA 8260B
1,2-Dichloroethane	EPA 624/8260B	EPA 8260B
1,1-Dichloroethene	EPA 624/8260B	EPA 8260B
cis-1,2-Dichloroethene	EPA 624/8260B	EPA 8260B
trans-1,2-Dichloroethene	EPA 624/8260B	EPA 8260B
1,2-Dichloropropane	EPA 624/8260B	EPA 8260B
1,3-Dichloropropane	EPA 624/8260B	EPA 8260B
2,2-Dichloropropane	EPA 624/8260B	EPA 8260B
1,1-Dichloropropene	EPA 624/8260B	EPA 8260B
cis-1,3-Dichloropropene	EPA 624/8260B	EPA 8260B
trans-1,3-Dichloropropene	EPA 624/8260B	EPA 8260B
cis-1,4-Dichloro-2-butene	EPA 624/8260B	EPA 8260B
trans-1,4-Dichloro-2-butene	EPA 624/8260B	EPA 8260B
Diethyl ether	EPA 624/8260B	EPA 8260B
1,4-Dioxane	EPA 624/8260B	EPA 8260B
Ethyl Acetate	EPA 8015B/8015C/624/8260B	EPA 8015B/8015C/8260B
Ethyl Benzene	EPA 624/8260B	EPA 8260B
Ethyl methacrylate	EPA 624/8260B	EPA 8260B
2-Hexanone	EPA 624/8260B	EPA 8260B
Hexachlorobutadiene	EPA 624/8260/625/8270C/8270D	EPA 8260/8270C/8270D
Isopropylbenzene	EPA 624/8260B	EPA 8260B
4-Isopropyltoluene	EPA 624/8260B	EPA 8260B
Iodomethane	EPA 624/8260B	EPA 8260B
Isobutyl Alcohol	EPA 8015B/8015C/624/8260B	EPA 8260B
Methacrylonitrile	EPA 624/8260B	EPA 8260B
Methylene chloride	EPA 624/8260B	EPA 8260B
Methyl methyacrylate	EPA 624/8260B	EPA 8260B
4-Methyl-2-pentanone	EPA 624/8260B	EPA 8260B
Methyl tert butyl ether (MTBE)	EPA 624/8260B	EPA 8260B
Naphthalene	EPA 624/8260B/625/8270C/8270D/8310	EPA 8260B/8270C/8270D/8310

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
2-Nitropropane	EPA 624/8260B	EPA 8260B
n-Propylbenzene	EPA 624/8260B	EPA 8260B
Pentachloroethane	EPA 624/8260B	EPA 8260B
Propionitrile	EPA 624/8260B	EPA 8260B
Styrene	EPA 624/8260B	EPA 8260B
1,1,1,2-Tetrachloroethane	EPA 624/8260B	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 624/8260B	EPA 8260B
Tetrachloroethene	EPA 624/8260B	EPA 8260B
Toluene	EPA 624/8260B	EPA 8260B
1,1,1-Trichloroethane	EPA 624/8260B	EPA 8260B
1,1,2-Trichloroethane	EPA 624/8260B	EPA 8260B
Trichloroethene	EPA 624/8260B	EPA 8260B
Trichlorofluoromethane	EPA 624/8260B	EPA 8260B
1,2,3-Trichlorobenzene	EPA 624/8260B	EPA 8260B
1,2,3-Trichloropropane	EPA 624/8260B	EPA 8260B
1,2,4-Trichlorobenzene	EPA 624/8260B/625/8270C/8270D	EPA 8260B/8270C/8270D
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 624/8260B	----------
1,2,4-Trimethylbenzene	EPA 624/8260B	EPA 8260B
1,3,5-Trimethylbenzene	EPA 624/8260B	EPA 8260B
Trihalomethanes	EPA 624/8260B	EPA 8260B
Vinyl acetate	EPA 624/8260B	EPA 8260B
Vinyl chloride	EPA 624/8260B	EPA 8260B
Xylenes, total	EPA 624/8260B	EPA 8260B
o-Xylene	EPA 624/8260B	EPA 8260B
m+p-Xylene	EPA 624/8260B	EPA 8260B
Semivolatile Compounds		
Acenaphthene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Acenaphthylene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Acetophenone	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Acetylaminofluorene	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Aminobiphenyl	EPA 625/8270C/8270D	EPA 8270C/8270D
Aniline	EPA 625/8270C/8270D	EPA 8270C/8270D
Anthracene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Aramite	EPA 625/8270C/8270D	EPA 8270C/8270D
Atrazine	EPA 625/8270C/8270D	EPA 8270C/8270D
Benzidine	EPA 625/8270C/8270D	EPA 8270C/8270D
Benzoic acid	EPA 625/8270C/8270D	EPA 8270C/8270D
Benzo (a) anthracene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (b) fluoranthene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (k) fluoranthene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (ghi) perylene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (a) pyrene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
p-Benzoquinone	EPA 625/8270C/8270D	EPA 8270C/8270D
Benzyl alcohol	EPA 625/8270C/8270D	EPA 8270C/8270D
Bis (2-chloroethoxy) methane	EPA 625/8270C/8270D	EPA 8270C/8270D
Bis (2-chloroethyl) ether	EPA 625/8270C/8270D	EPA 8270C/8270D
Bis (2-chloroisopropyl) ether	EPA 625/8270C/8270D	EPA 8270C/8270D
Bis (2-ethylhexyl) phthalate	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Bromophenyl phenyl ether	EPA 625/8270C/8270D	EPA 8270C/8270D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Butyl benzyl phthalate	EPA 625/8270C/8270D	EPA 8270C/8270D
Carbazole	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Chloroaniline	EPA 625/8270C/8270D	EPA 8270C/8270D
Chlorobenzilate	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Chloro-3-methylphenol	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Chloronaphthalene	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Chlorophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Chlorophenyl phenyl ether	EPA 625/8270C/8270D	EPA 8270C/8270D
Chrysene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
n-Decane	EPA 625/8270C/8270D	----------
Diallate	EPA 625/8270C/8270D	EPA 8270C/8270D
Dibenzo (a,h) anthracene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Dibenzofuran	EPA 625/8270C/8270D	EPA 8270C/8270D
Dibenzo (a,e) pyrene	EPA 625/8270C/8270D	EPA 8270C/8270D
1,2-Dichlorobenzene	EPA 624/8260B/625/8270C/8270D	EPA 8260B/8270C/8270D
1,3-Dichlorobenzene	EPA 624/8260B/625/8270C/8270D	EPA 8260B/8270C/8270D
1,4-Dichlorobenzene	EPA 624/8260B/625/8270C/8270D	EPA 8260B/8270C/8270D
3,3'-Dichlorobenzidine	EPA 625/8270C/8270D	EPA 8270C/8270D
2,4-Dichlorophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
2,6-Dichlorophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
3,3'-Dimethylbenzidine	EPA 625/8270C/8270D	EPA 8270C/8270D
Diethyl phthalate	EPA 625/8270C/8270D	EPA 8270C/8270D
Dimethoate	EPA 625/8270C/8270D	EPA 8270C/8270D
1,3-Dinitrobenzene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
1,4-Dinitrobenzene	EPA 625/8270C/8270D	EPA 8270C/8270D
Disulfoton	EPA 625/8270C/8270D	EPA 8270C/8270D
p-Dimethylaminoazobenzene	EPA 625/8270C/8270D	EPA 8270C/8270D
7,12-Dimethylbenz(a)anthracene	EPA 625/8270C/8270D	EPA 8270C/8270D
Alpha-,alpha-Dimethylphenethylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
2,4-Dimethylphenol	EPA 625/8270C/8270D	EPA 8270C/8270D
Dimethyl phthalate	EPA 625/8270C/8270D	EPA 8270C/8270D
Di-n-butyl phthalate	EPA 625/8270C/8270D	EPA 8270C/8270D
Di-n-octyl phthalate	EPA 625/8270C/8270D	EPA 8270C/8270D
2,4-Dinitrophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
2,4-Dinitrotoluene	EPA 625/8270/8330A/8330B	EPA 8270/8330A/8330B
2,6-Dinitrotoluene	EPA 625/8270/8330A/8330B	EPA 8270/8330A/8330B
Diphenylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
1,2-Diphenylhydrazine	EPA 625/8270C/8270D	EPA 8270C/8270D
Ethyl methanesulfonate	EPA 625/8270C/8270D	EPA 8270C/8270D
Famphur	EPA 625/8270C/8270D	EPA 8270C/8270D
Fluoroanthene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Fluorene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Hexachlorobenzene	EPA 625/8270C/8270D	EPA 8270C/8270D
Hexachlorobutadiene	EPA 624/8260B/625/8270C/8270D	EPA 8260B/8270C/8270D
Hexachlorophene	EPA 625/8270C/8270D	EPA 8270C/8270D
Hexachloropropene	EPA 625/8270C/8270D	EPA 8270C/8270D
Hexachlorocyclopentadiene	EPA 625/8270C/8270D	EPA 8270C/8270D
Hexachloroethane	EPA 625/8270C/8270D	EPA 8270C/8270D
Indeno (1,2,3-cd) pyrene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Isodrin	EPA 625/8270C/8270D	EPA 8270C/8270D
Isophorone	EPA 625/8270C/8270D	EPA 8270C/8270D
Isosafrole	EPA 625/8270C/8270D	EPA 8270C/8270D
Kepone	EPA 625/8270C/8270D	EPA 8270C/8270D
Methapyrilene	EPA 625/8270C/8270D	EPA 8270C/8270D
3-Methylcholanthrene	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Methyl-4,6-Dinitrophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
Methyl methanesulfonate	EPA 625/8270C/8270D	EPA 8270C/8270D
1-Methylnaphthalene	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Methylnaphthalene	EPA 625/8270C/8270D	EPA 8270C/8270D
Methyl Parathion	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Methylphenol (o-cresol)	EPA 625/8270C/8270D	EPA 8270C/8270D
3/4-Methylphenols(m/p cresols)	EPA 625/8270C/8270D	EPA 8270C/8270D
Naphthalene	EPA 624/8260B/625/8270C/8270D/8310	EPA8260B/8270C/8270D/8310
1,4-Naphthoquinone	EPA 625/8270C/8270D	----------
1-Naphthylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Naphthylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Nitroaniline	EPA 625/8270C/8270D	EPA 8270C/8270D
3-Nitroaniline	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Nitroaniline	EPA 625/8270C/8270D	EPA 8270C/8270D
Nitrobenzene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
5-Nitro-o-toluidine	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Nitrophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
4-Nitrophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
Nitroquinoline-1-oxide	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosodietheylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosodimethylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosodi-n-butylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosodi-n-propylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosodiphenylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosodimethylethylamine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosomorpholine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosopiperidine	EPA 625/8270C/8270D	EPA 8270C/8270D
N-Nitrosopyrrolidine	EPA 625/8270C/8270D	EPA 8270C/8270D
n-Octadecane	----------	EPA 8270C/8270D
o,o,o-Triethyl phosphorothioate	EPA 625/8270C/8270D	EPA 8270C/8270D
o-Toluidine	EPA 625/8270C/8270D	EPA 8270C/8270D
Parathion, ethyl	EPA 625/8270C/8270D	EPA 8270C/8270D
Pentachlorobenzene	EPA 625/8270C/8270D	EPA 8270C/8270D
Pentachloronitrobenzene	EPA 625/8270C/8270D	EPA 8270C/8270D
Pentachlorophenol	EPA 8270C/8270D/8151A	EPA 8270C/8270D/8151A
Phenacetin	EPA 625/8270C/8270D	EPA 8270C/8270D
Phenanthrene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Phenol	EPA 625/8270C/8270D	EPA 8270C/8270D
1,4-Phenylenediamine	EPA 625/8270C/8270D	----------
Phorate	EPA 625/8270C/8270D	EPA 8270C/8270D
2-Picoline (2-Methylpyridine)	EPA 625/8270C/8270D	EPA 8270C/8270D
Pronamide (Kerb)	EPA 625/8270C/8270D	EPA 8270C/8270D
Pyrene	EPA 625/8270C/8270D/8310	EPA 8270C/8270D/8310
Pyridine	EPA 625/8270C/8270D	EPA 8270C/8270D
Safrole	EPA 625/8270C/8270D	EPA 8270C/8270D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Sulfotepp	EPA 625/8270C/8270D	EPA 8270C/8270D
1,2,4,5-Tetrachlorobenzene	EPA 625/8270C/8270D	EPA 8270C/8270D
2,3,4,6-Tetrachlorophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
Thionazin (Zinophos)	EPA 625/8270C/8270D	EPA 8270C/8270D
1,2,4-Trichlorobenzene	EPA 624/8260B/625/8270C/8270D	EPA 8260B/8270C/8270D
2,4,5-Trichlorophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
2,4,6-Trichlorophenol	EPA 625/8270C/8270D	EPA 8270C/8270D
1,3,5-Trinitrobenzene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
Pesticides & PCBs		
Aldrin	EPA 608/8081A/8081B	EPA 8081A/8081B
alpha-BHC	EPA 608/8081A/8081B	EPA 8081A/8081B
alpha-Chlordane	EPA 608/8081A/8081B	EPA 8081A/8081B
beta-BHC	EPA 608/8081A/8081B	EPA 8081A/8081B
Chlordane (technical)	EPA 608/8081A/8081B	EPA 8081A/8081B
delta-BHC	EPA 608/8081A/8081B	EPA 8081A/8081B
gamma-BHC	EPA 608/8081A/8081B	EPA 8081A/8081B
gamma-Chlordane	EPA 608/8081A/8081B	EPA 8081A/8081B
4,4'-DDD	EPA 608/8081A/8081B	EPA 8081A/8081B
4,4'-DDE	EPA 608/8081A/8081B	EPA 8081A/8081B
4,4'-DDT	EPA 608/8081A/8081B	EPA 8081A/8081B
Dieldrin	EPA 608/8081A/8081B	EPA 8081A/8081B
Endosulfan I	EPA 608/8081A/8081B	EPA 8081A/8081B
Endosulfan II	EPA 608/8081A/8081B	EPA 8081A/8081B
Endonsulfan sulfate	EPA 608/8081A/8081B	EPA 8081A/8081B
Endrin	EPA 608/8081A/8081B	EPA 8081A/8081B
Endrin aldehyde	EPA 608/8081A/8081B	EPA 8081A/8081B
Endrin ketone	EPA 608/8081A/8081B	EPA 8081A/8081B
Heptachlor	EPA 608/8081A/8081B	EPA 8081A/8081B
Heptachlor epoxide	EPA 608/8081A/8081B	EPA 8081A/8081B
Methoxychlor	EPA 608/8081A/8081B	EPA 8081A/8081B
Toxaphene	EPA 608/8081A/8081B	EPA 8081A/8081B
PCB-1016 (Aroclor)	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1221	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1232	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1242	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1248	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1254	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1260	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1262	EPA 608/8082/8082A	EPA 8082/8082A
PCB-1268	EPA 608/8082/8082A	EPA 8082/8082A
Total Aroclors	EPA 608/8082/8082A	EPA 8082/8082A
FID Compounds		
Ethyl acetate	EPA 8015B/8015C/624/8260B	EPA 8015B/8015C/8260B
Ethylene Glycol	EPA 8015B/8015C	EPA 8015B/8015C
Isobutyl Alcohol	EPA 8015B/8015C/624/8260B	EPA 8260B
Isopropyl Alcohol (2-Propanol)	EPA 8015B/8015C	----------
Methanol	EPA 8015B/8015C	EPA 8015B/8015C
Diesel Range Organics (DRO)	EPA 8015B/8015C/CA-LUFT/ CT-ETPH	EPA 8015B/8015C/CA-LUFT/ CT-ETPH

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Gas Range Organics (GRO)	EPA 8015B/8015C/CA-LUFT	EPA 8015B/8015C/CA-LUFT
Herbicides		
2,4-D	EPA 8151A	EPA 8151A
2,4-DB	EPA 8151A	EPA 8151A
Dalapon	EPA 8151A	EPA 8151A
Dicamba	EPA 8151A	EPA 8151A
Dichloroprop	EPA 8151A	EPA 8151A
Dinoseb	EPA 8151A	EPA 8151A
MCPA	EPA 8151A	EPA 8151A
MCPP	EPA 8151A	EPA 8151A
2,4,5-T	EPA 8151A	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A	EPA 8151A
Pentachlorophenol	EPA 8151A	EPA 8151A
Nitrosamines, Nitroaromatics		
1,3-Dinitrobenzene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
2,4-Dinitrotoluene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
2,6-Dinitrotoluene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
2,4,6-Trinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
2-Amino-4,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
2-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
3-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
3,5-Dinitroaniline		EPA 8330B (Solids Only)
4-Amino-2,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
4-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
Nitrobenzene	EPA 625/8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
Nitroglycerine	EPA 8330A/8330B	EPA 8330A/8330B
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330A/8330B	EPA 8330A/8330B
Pentaerythritoltetranitrate (PETN)	EPA 8330A/8330B	EPA 8330A/8330B
hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	EPA 8330A/8330B	EPA 8330A/8330B
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330A/8330B	EPA 8330/8330B
Radiochemistry		
Barium 133	DOE 4.5.2.3	DOE 4.5.2.3
Cesium 134	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Cesium 137	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Cobalt-60	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Gamma Emitters	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Gross Alpha	EPA 900.0/9310	EPA 9310
Gross Beta	EPA 900.0/9310	EPA 9310
Radioactive Iodine	DOE 4.5.2.3/EPA 901.1/902.0	DOE 4.5.2.3
Radium-226	EPA 903.1/DOE Ra-04	DOE Ra-04
Radium-228	EPA 904.0/9320/DOE 4.5.2.3	DOE 4.5.2.3/EPA9320
Total Radium	EPA 9315	EPA 9315
Radon	SM7500 Rn-B	----------
Strontium-89	EPA 905.0	DOE Sr-01
Strontium-90	EPA 905.0/DOE Sr-02	DOE Sr-02

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Thorium	EMSL-LV	EMSL-LV
Tritium	EPA 906.0	----------
Uranium	ASTM D5174-02/D5174-97/DOE U-02/EPA 6020/6020A	DOE U-02/EPA 6020/6020A
Zinc-65	EPA 901.1/DOE 4.5.2.3	DOE 4.5.2.3
Preparatory and Clean-up Methods		
Toxicity Characteristic Leaching Procedure (Inorganics, Extractable Organics, Volatile Organics)	----------	EPA 1311
Synthetic Precipitation Leaching Procedure	----------	EPA 1312
Waste Extraction Test (W.E.T.)	----------	CCR Chapter 11, Article 5, Appendix II
Anion Preparation	----------	EPA 9056A[3]
Cyanide Distillation	EPA 9010B/9010C	EPA 9010B/9010C[3]
Sulfide Distillation	EPA 9030B	EPA 9030B
Metals Digestion	EPA 200.2, 3005A, 3010A	EPA 3050B
Alkaline Digestion for Hexavalent Chromium	----------	EPA 3060A
Bomb Preparation for Solid Waste	----------	EPA 5050
Mercury Preparation	EPA 245.1/245.2/7470/7470A	EPA 7471A/7471B
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	----------
Continuous Liquid-Liquid Extraction	EPA 3520C	----------
Solid Phase Extraction	EPA 3535A	----------
Automated Soxhlet Extraction	----------	EPA 3541
Ultrasonic Extraction	----------	EPA 3550C
Waste Dilution	----------	EPA 3580A
Waste Dilution for Volatile Organics	----------	EPA 3585
Purge and Trap for Volatile Organics	EPA 5030A/5030B/5030C	EPA 5035/5035A
Alumina Clean-up	----------	EPA 3610B/3611B
Florisil Clean-up	----------	EPA 3620B/3620C
Silica Gel Clean-up	----------	EPA 3630C
Gel Permeation Clean-up	----------	EPA 3640A
Sulfur Clean-up	----------	EPA 3660B
Sulfuric Acid/Permanganate Clean-up	----------	EPA 3665A

Additionally, in recognition of the successful completion of the A2LA evaluation process (including an assessment of the laboratory's compliance with the 2003 NELAC Chapter 5 Requirements), accreditation is granted to this laboratory to perform the following bioassay analyses on bone, tissue, urine, fecal, and nasal swabs.

Bioassy Analysis		
Alpha Spectrometry: Alpha: Am-241, Cm-242, Cm-243/244, Cm 245/246,Cf-252, Np-237, Po-208, Po- 209, Po-210, Pu-236, Pu-238, Pu-239/240, Pu-242, Pu-244, Th-228, Th-229, Th-230, Th-232, U-232, U-233/234, U-235/236, U-238	GL-RAD-B-001, GL-RAD-B-002, GL-RAD-B-003, GL-RAD-B-010, GL-RAD-B-012, GL-RAD-B-013, GL-RAD-B-017	GL-RAD-B-009
Liquid Scintillation Spectrometry: C-14, Gross Alpha, H-3, Ni-63, Pu-241, Tc-99	GL-RAD-B-001, GL-RAD-B-008, GL-RAD-B-011, GL-RAD-B-012, GL-RAD-B-013, GL-RAD-B-016, GL-RAD-B-020, GL-RAD-B-023	GL-RAD-I-004, GL-RAD-I-014, GL-RAD-I-017
Gas Flow Proportional Counting: Beta: Sr-90	GL-RAD-B-001	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
Gross Alpha/Gross Beta	GL-RAD-B-022	GL-RAD-I-006
Kinetic Phosphorescence Analyzer Total Uranium	GL-RAD-B-019	GL-RAD-B-018
Radon Emanation: Ra-226	GL-RAD-B-002	GL-RAD-I-007
Refractometer Specific Gravity	GL-RAD-B-027	GL-RAD-B-027
ICP-MS Uranium Isotopes	GL-RAD-B-035	GL-RAD-B-027
Gamma Spectrometry: Gamma: Ni-59, 46 to 1836 keV	GL-RAD-B-020, GL-RAD-A-013	GL-RAD-I-001

Finally, accreditation is also granted to this laboratory to perform the following tests on children's toys:

Chemical	
Lead in Paint by ICP	16 CFR part 1303 (using GL-MA-E-009 and GL-MA-E-013)

[1] - Calculated from silica determination

[2] – Applicable only to liquid 'Solid Hazardous Waste', where liquids may include aqueous, non-aqueous, and oily wastes. Solids may include soils, sediments, sludges, tissues, filters and any matrix deemed non-liquid.

[3] – The referenced method is modified to include a simple prep for non-aqueous and/or solid matrix samples.

LABORATORY
ACCREDITATION
BUREAU

Certificate Number L2223

Certificate of Accreditation

Accredited to DoD ELAP and ISO/IEC 17025:2005

Katahdin Analytical Services, Inc.

600 Technology Way
Scarborough, ME 04074

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

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

Accreditation Granted through: November 4, 2012

R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 4th of November, 2009

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements
Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

LABORATORY ACCREDITATION BUREAU

Certificate # L2223

Scope of Accreditation For Katahdin Analytical Services, Inc.

600 Technology Way
Scarborough, ME 04074
Leslie Dimond
207-874-2400

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.2) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Katahdin Analytical Services to perform the following tests:

Accreditation granted through: **November 4, 2012**

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	2, 4`-DDD
GC/ECD	EPA 8081B	2, 4`-DDE
GC/ECD	EPA 8081B	2, 4`-DDT
GC/ECD	EPA 608 / 8081B	4, 4`-DDD
GC/ECD	EPA 608 / 8081B	4, 4`-DDE
GC/ECD	EPA 608 / 8081B	4, 4`-DDT
GC/ECD	EPA 608 / 8081B	Aldrin
GC/ECD	EPA 608 / 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Alpha-Chlordane
GC/ECD	EPA 608 / 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Cis-Nonaclor
GC/ECD	EPA 608 / 8081B	Chlordane (tech.)
GC/ECD	EPA 608 / 8081B	delta-BHC
GC/ECD	EPA 608 / 8081B	Dieldrin
GC/ECD	EPA 608 / 8081B	Endosulfan I
GC/ECD	EPA 608 / 8081B	Endosulfan II

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 608 / 8081B	Endosulfan sulfate
GC/ECD	EPA 608 / 8081B	Endrin
GC/ECD	EPA 608 / 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin Ketone
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 608 / 8081B	Heptachlor
GC/ECD	EPA 608 / 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Hexachlorobenzene
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 8081B	Mirex
GC/ECD	EPA 8081B	Oxychlordane
GC/ECD	EPA 608 / 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8081B	trans-Nonachlor
GC/ECD	EPA 608 / 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 608 / 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 608 / 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 608 / 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 608 / 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 608 / 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 608 / 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A MOD	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A MOD	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)
GC/ECD	EPA 8082A	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 180)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5', 6-Heptachlorobiphenyl (BZ 183)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5-Hexachlorobiphenyl (BZ 138)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 6, 6'-Heptachlorobiphenyl (BZ 184)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	2, 2', 3, 4', 5, 5', 6-Heptachlorobiphenyl (BZ 187)
GC/ECD	EPA 8082A	2, 2', 3, 4, 5'-Pentachlorobiphenyl (BZ 87)
GC/ECD	EPA 8082A	2, 2', 3, 5'-Tetrachlorobiphenyl (BZ 44)
GC/ECD	EPA 8082A	2, 2', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 153)
GC/ECD	EPA 8082A	2, 2', 4, 5, 5'-Pentachlorobiphenyl (BZ 101)
GC/ECD	EPA 8082A	2, 2', 4, 5-Tetrachlorobiphenyl (BZ 48)
GC/ECD	EPA 8082A	2, 2', 4, 5'-Tetrachlorobiphenyl (BZ 49)
GC/ECD	EPA 8082A	2, 2', 5, 5'-Tetrachlorobiphenyl (BZ 52)
GC/ECD	EPA 8082A	2, 2', 5-Trichlorobiphenyl (BZ 18)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5-Hexachlorobiphenyl (BZ 156)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5'-Hexachlorobiphenyl (BZ 157)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4'-Pentachlorobiphenyl (BZ 105)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 189)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 167)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 118)
GC/ECD	EPA 8082A	2, 3', 4, 4',5'-Pentachlorobiphenyl (BZ 123)
GC/ECD	EPA 8082A	2, 3', 4, 4'-Tetrachlorobiphenyl (BZ 66)
GC/ECD	EPA 8082A	2, 3, 4, 4', 5-Pentachlorobiphenyl (BZ 114)
GC/ECD	EPA 8082A	2, 4, 4'-Trichlorobiphenyl (BZ 28)
GC/ECD	EPA 8082A	2, 4'-Dichlorobiphenyl (BZ 8)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 169)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 126)
GC/ECD	EPA 8082A	3, 3', 4, 4'-Tetrachlorobiphenyl (BZ 77)
GC/ECD	EPA 8082A	3, 4, 4', 5-Tetrachlorobiphenyl (BZ 81)
GC/ECD	EPA 8082A	Decachlorobiphenyl (BZ 209)
GC/ECD	EPA 8151A	2, 4, 5-T
GC/ECD	EPA 8151A	2, 4-D
GC/ECD	EPA 8151A	2, 4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2, 4, 5-TP)
GC/FID	EPA 8015C/D MOD	Diesel range organics (DRO)
GC/FID	EPA 8015C/D MOD	Total Petroleum Hydrocarbon (TPH)
GC/FID	EPA 8015C/D MOD	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable Petroleum Hydrocarbons
GC/FID	CT ETPH	Total Petroleum Hydrocarbons
GC/FID	TNRCC Method 1005	Total Petroleum Hydrocarbons
GC/FID	FL-PRO	Petroleum Range Organics
GC/ECD	EPA 8011 / 504	1, 2-Dibromoethane (EDB)
GC/ECD	EPA 8011 / 504	1, 2-Dibromo-3-chloropropane
GC/FID	RSK-175	Methane Ethane Ethene
GC/MS	EPA 8260B,C / 524.2	1, 1, 1, 2-Tetrachloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1, 1-Trichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1, 2-Trichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1-Dichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1-Dichloroethene
GC/MS	EPA 8260B,C / 524.2	1, 1-Dichloropropene
GC/MS	EPA 8260B,C / 524.2	1, 2, 3-Trichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 2, 3-Trichloropropane
GC/MS	EPA 8260B,C	1,2,3-Trimethylbenzene
GC/MS	EPA 8260B,C / 524.2	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 2, 4-Trimethylbenzene
GC/MS	EPA 8260B,C / 524.2	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B,C / 524.2	1, 2-Dibromoethane (EDB)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624 / 8260B,C / 524.2	1, 2-Dichlorobenzene
GC/MS	EPA 624 / 8260B,C / 524.2	1, 2-Dichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 2-Dichloropropane
GC/MS	EPA 8260B,C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 3, 5-Trimethylbenzene
GC/MS	EPA 624 / 8260B,C / 524.2	1, 3-Dichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 3-Dichloropropane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 4-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 4-Dioxane
GC/MS	EPA 8260B,C	1-Chlorohexane
GC/MS	EPA 8260B,C / 524.2	2, 2-Dichloropropane
GC/MS	EPA 8260B,C / 524.2	2-Butanone
GC/MS	EPA 624 / 8260B,C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B,C / 524.2	2-Chlorotoluene
GC/MS	EPA 8260B,C / 524.2	2-Hexanone
GC/MS	EPA 8260B,C / 524.2	4-Chlorotoluene
GC/MS	EPA 8260B,C / 524.2	4-Methyl-2-pentanone
GC/MS	EPA 8260B,C / 524.2	Acetone
GC/MS	EPA 8260B,C	Acetonitrile
GC/MS	EPA 624 / 8260B,C	Acrolein
GC/MS	EPA 624 / 8260B,C / 524.2	Acrylonitrile
GC/MS	EPA 8260B,C / 524.2	Allyl chloride
GC/MS	EPA 624 / 8260B,C / 524.2	Benzene
GC/MS	EPA 8260B,C	Benzyl chloride
GC/MS	EPA 8260B,C / 524.2	Bromobenzene
GC/MS	EPA 8260B,C / 524.2	Bromochloromethane
GC/MS	EPA 624 / 8260B,C / 524.2	Bromodichloromethane
GC/MS	EPA 624 / 8260B,C / 524.2	Bromoform
GC/MS	EPA 8260B,C / 524.2	Carbon disulfide
GC/MS	EPA 624 / 8260B,C / 524.2	Carbon tetrachloride
GC/MS	EPA 624 / 8260B,C / 524.2	Chlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624 / 8260B,C / 524.2	Chloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	Chloroform
GC/MS	EPA 8260B,C	Chloroprene
GC/MS	EPA 8260B,C / 524.2	cis-1, 2-Dichloroethene
GC/MS	EPA 624 / 8260B,C / 524.2	cis-1, 3-Dichloropropene
GC/MS	EPA 8260B,C	Cis-1,4-Dichloro-2-butene
GC/MS	EPA 8260B,C	Cyclohexane
GC/MS	EPA 624 / 8260B,C / 524.2	Dibromochloromethane
GC/MS	EPA 8260B,C / 524.2	Dibromomethane
GC/MS	EPA 624 / 8260B,C / 524.2	Dichlorodifluoromethane
GC/MS	EPA 8260B,C / 524.2	Diethyl ether
GC/MS	EPA 8260B,C	Di-isopropylether
GC/MS	EPA 8260B,C / 524.2	Ethyl methacrylate
GC/MS	EPA 624 / 8260B,C / 524.2	Ethylbenzene
GC/MS	EPA 8260B,C	Ethyl-t-butylether
GC/MS	EPA 8260B,C / 524.2	Hexachlorobutadiene
GC/MS	EPA 8260B,C	Iodomethane
GC/MS	EPA 8260B,C	Isobutyl alcohol
GC/MS	EPA 8260B,C	Isopropyl alcohol
GC/MS	EPA 8260B,C / 524.2	Isopropyl benzene
GC/MS	EPA 8260B,C / 524.2	m p-xylenes
GC/MS	EPA 8260B, C	Methyl acetate
GC/MS	EPA 8260B,C / 524.2	Methacrylonitrile
GC/MS	EPA 624 / 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 624 / 8260B,C / 524.2	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B,C / 524.2	Methyl methacrylate
GC/MS	EPA 8260B,C / 524.2	Methyl tert-butyl ether
GC/MS	EPA 8260B,C	Methylcyclohexane
GC/MS	EPA 624 / 8260B,C / 524.2	Methylene chloride
GC/MS	EPA 8260B,C / 524.2	Naphthalene
GC/MS	EPA 8260B,C / 524.2	n-Butylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C / 524.2	n-Propylbenzene
GC/MS	EPA 8260B,C / 524.2	o-Xylene
GC/MS	EPA 8260B,C	Pentachloroethane
GC/MS	EPA 8260B,C / 524.2	p-Isopropyltoluene
GC/MS	EPA 8260B,C / 524.2	Propionitrile
GC/MS	EPA 8260B,C / 524.2	sec-butylbenzene
GC/MS	EPA 8260B,C / 524.2	Styrene
GC/MS	EPA 8260B,C	t-Amylmethylether
GC/MS	EPA 8260B,C / 524.2	tert-Butyl alcohol
GC/MS	EPA 8260B,C	tert-Butylbenzene
GC/MS	EPA 624 / 8260B,C / 524.2	Tetrachloroethene (Perchloroethylene)
GC/MS	EPA 8260B,C / 524.2	Tetrahydrofuran
GC/MS	EPA 624 / 8260B,C / 524.2	Toluene
GC/MS	EPA 624 / 8260B,C / 524.2	trans-1, 2-Dichloroethylene
GC/MS	EPA 624 / 8260B,C / 524.2	trans-1, 3-Dichloropropylene
GC/MS	EPA 8260B,C / 524.2	trans-1, 4-Dichloro-2-butuene
GC/MS	EPA 624 / 8260B,C / 524.2	Trichloroethene (Trichloroethylene)
GC/MS	EPA 624 / 8260B,C / 524.2	Trichlorofluoromethane
GC/MS	EPA 8260B,C	Vinyl acetate
GC/MS	EPA 624 / 8260B,C / 524.2	Vinyl chloride
GC/MS	EPA 624 / 8260B,C	Xylene
GC/MS	EPA 8270C,D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 625 / 8270C,D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 625 / 8270C,D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 2-Diphenylhydrazine
GC/MS	EPA 8270C,D	1, 3, 5-Trinitrobenzene
GC/MS	EPA 625 / 8270C,D	1, 3-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 3-Dinitrobenzene
GC/MS	EPA 625 / 8270C,D	1, 4-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 4-Dioxane
GC/MS	EPA 8270C,D	1, 4-Naphthoquinone

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	1, 4-Phenylenediamine
GC/MS	EPA 8270C,D	1-Chloronaphthalene
GC/MS	EPA 8270C,D	1-Methylnaphthalene
GC/MS	EPA 8270C,D	1-Naphthylamine
GC/MS	EPA 8270C,D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C,D	2, 4, 5-Trochlorophenol
GC/MS	EPA 625 / 8270C,D	2, 4, 6-Trichlorophenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dichlorophenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dimethylphenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dinitrophenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dinitrotoluene (2, 4-DNT)
GC/MS	EPA 8270C,D	2, 6-Dichlorophenol
GC/MS	EPA 625 / 8270C,D	2, 6-Dinitrotoluene (2, 6-DNT)
GC/MS	EPA 8270C,D	2-Acetylaminofluorene
GC/MS	EPA 625 / 8270C,D	2-Chloronaphthalene
GC/MS	EPA 625 / 8270C,D	2-Chlorophenol
GC/MS	EPA 625 / 8270C,D	2-Methyl-4 6-dinitrophenol
GC/MS	EPA 8270C,D	2-Methylnaphthalene
GC/MS	EPA 8270C,D	2-Methylphenol
GC/MS	EPA 8270C,D	2-Naphthylamine
GC/MS	EPA 8270C,D	2-Nitroaniline
GC/MS	EPA 625 / 8270C,D	2-Nitrophenol
GC/MS	EPA 8270C,D	2-Picoline
GC/MS	EPA 8270C,D	3-Methylcholanthrene
GC/MS	EPA 8270C,D	3-Nitroaniline
GC/MS	EPA 8270C,D	4-Aminobiphenyl
GC/MS	EPA 625 / 8270C,D	4-Bromophenyl phenyl ether
GC/MS	EPA 625 / 8270C,D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C,D	4-Chloroaniline
GC/MS	EPA 625 / 8270C,D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C,D	4-Dimethyl aminoazobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	3, 4-Methylphenol
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 625 / 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C,D	5-Nitro-o-toluidine
GC/MS	EPA 8270C,D	7, 12-DimethylphenethylamineDimethylbenz(a)anthracene
GC/MS	EPA 8270C,D	a a-Dimethylphenethylamine
GC/MS	EPA 625 / 8270C,D	Acenaphthene
GC/MS	EPA 625 / 8270C,D	Acenaphthylene
GC/MS	EPA 8270C,D	Acetophenone
GC/MS	EPA 8270C,D	Aniline
GC/MS	EPA 625 / 8270C,D	Anthracene
GC/MS	EPA 8270C,D	Aramite
GC/MS	EPA 8270C,D	Atrazine
GC/MS	EPA 8270C,D	Azobenzene
GC/MS	EPA 8270C,D	Benzaldehyde
GC/MS	EPA 625 / 8270C,D	Benzidine
GC/MS	EPA 625 / 8270C,D	Benzo(a)anthracene
GC/MS	EPA 625 / 8270C,D	Benzo(a)pyrene
GC/MS	EPA 625 / 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 625 / 8270C,D	Benzo(g h i)perylene
GC/MS	EPA 625 / 8270C,D	Benzo(k)fluoranthene
GC/MS	EPA 8270C,D	Benzoic Acid
GC/MS	EPA 8270C,D	Benzyl alcohol
GC/MS	EPA 8270C,D	1,1-Biphenyl
GC/MS	EPA 625 / 8270C,D	bis(2-Chloroethoxy)methane
GC/MS	EPA 625 / 8270C,D	bis(2-Chloroethyl) ether
GC/MS	EPA 625 / 8270C,D	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane))
GC/MS	EPA 625 / 8270C,D	bis(2-Ethylhexyl)adipate
GC/MS	EPA 625 / 8270C,D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 625 / 8270C,D	Butyl benzyl phthalate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Caprolactam
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chlorobenzilate
GC/MS	EPA 625 / 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Diallate
GC/MS	EPA 8270C,D	Dibenzo(a,j)acridine
GC/MS	EPA 625 / 8270C,D	Dibenz(a h)anthracene
GC/MS	EPA 8270C,D	Dibenzofuran
GC/MS	EPA 8270C,D	Diethyladipate
GC/MS	EPA 625 / 8270C,D	Diethyl phthalate
GC/MS	EPA 8270C,D	Dimethoate
GC/MS	EPA 625 / 8270C,D	Dimethyl phthalate
GC/MS	EPA 625 / 8270C,D	Di-n-butyl phthalate
GC/MS	EPA 625 / 8270C,D	Di-n-octyl phthalate
GC/MS	EPA 8270C,D	Dinoseb
GC/MS	EPA 8270C,D	Disulfoton
GC/MS	EPA 8270C,D	Ethyl methanesulfonate
GC/MS	EPA 8270C,D	Ethyl parathion
GC/MS	EPA 8270C,D	Ethyl methacrylate
GC/MS	EPA 8270C,D	Famfur
GC/MS	EPA 625 / 8270C,D	Fluoranthene
GC/MS	EPA 625 / 8270C,D	Fluorene
GC/MS	EPA 625 / 8270C,D	Hexachlorobenzene
GC/MS	EPA 625 / 8270C,D	Hexachlorobutadiene
GC/MS	EPA 625 / 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 625 / 8270C,D	Hexachloroethane
GC/MS	EPA 8270C,D	Hexachlorophene
GC/MS	EPA 8270C,D	Hexachloropropene
GC/MS	EPA 625 / 8270C,D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C,D	Isodrin
GC/MS	EPA 625 / 8270C,D	Isophorone

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Isosafrole
GC/MS	EPA 8270C,D	Kepone
GC/MS	EPA 8270C,D	Methapyriline
GC/MS	EPA 8270C,D	Methy methanesulfonate
GC/MS	EPA 8270C,D	Methyl parathion
GC/MS	EPA 625 / 8270C,D	Naphthalene
GC/MS	EPA 625 / 8270C,D	Nitrobenzene
GC/MS	EPA 8270C,D	Nitroquinoline-1-oxide
GC/MS	EPA 8270C,D	n-Nitrosodiethylamine
GC/MS	EPA 625 / 8270C,D	n-Nitrosodimethylamine
GC/MS	EPA 8270C,D	n-Nitroso-di-n-butylamine
GC/MS	EPA 625 / 8270C,D	n-Nitrosodi-n-propylamine
GC/MS	EPA 625 / 8270C,D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C,D	n-Nitrosomethylethylamine
GC/MS	EPA 8270C,D	n-Nitrosomorpholine
GC/MS	EPA 8270C,D	n-Nitrosopiperidine
GC/MS	EPA 8270C,D	n-Nitrosopyrrolidine
GC/MS	EPA 8270C,D	o,O o, o-Triethyl phosphorothioate
GC/MS	EPA 8270C,D	o,o-Diethyl o-pyrazinyl phosphorothiote
GC/MS	EPA 8270C,D	o-Toluidine
GC/MS	EPA 8270C,D	Pentachlorobenzene
GC/MS	EPA 8270C,D	Pentachloronitrobenzene
GC/MS	EPA 625 / 8270C,D	Pentachlorophenol
GC/MS	EPA 8270C,D	Phenacetin
GC/MS	EPA 625 / 8270C,D	Phenanthrene
GC/MS	EPA 625 / 8270C,D	Phenol
GC/MS	EPA 8270C,D	Phorate
GC/MS	EPA 8270C,D	Pronamide
GC/MS	EPA 625 / 8270C,D	Pyrene
GC/MS	EPA 8270C,D	Pyrididne
GC/MS	EPA 8270C,D	Safrole

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Sulfotepp
GC/MS	EPA 8270C,D	Thionazin
GC/MS	EPA 625 / 8270C,D	3, 3'-Dichlorobenzidine
GC/MS	EPA 8270C,D	3, 3'-Dimethylbenzidine
HPLC/UV	EPA 8330A/8330B	1, 3, 5-Trinitrobenzene
HPLC/UV	EPA 8330A/8330B	1, 3-Dinitrobenzene
HPLC/UV	EPA 8330A/8330B	2, 4, 6-Trinitrotoluene
HPLC/UV	EPA 8330A/8330B	2, 4-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2-Amino-4, 6 -Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2-Nitrotoluene
HPLC/UV	EPA 8330A/8330B	3-Nitrotoluene
HPLC/UV	EPA 8330A/8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/8330B	4-Amino-2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	4-Nitrotoluene
HPLC/UV	EPA 8330A/8330B	Ethylene glycol dinitrate (EGDN)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	EPA 8330A/8330B	Nitrobenzene
HPLC/UV	EPA 8330A MOD	Nitroglycerin
HPLC/UV	EPA 8330B	Nitroglycerin
HPLC/UV	EPA 8330A/8330B	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	EPA 8330A/8330B	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	EPA 8330A/8330B	Tetryl
CVAA	EPA 245.1 / 7470A	Mercury
CVAF	EPA 1631E	Low Level Mercury
ICP/AES	EPA 200.7 / 6010B,C	Aluminum
ICP/AES	EPA 200.7 / 6010B,C	Antimony
ICP/AES	EPA 200.7 / 6010B,C	Arsenic
ICP/AES	EPA 200.7 / 6010B,C	Barium
ICP/AES	EPA 200.7 / 6010B,C	Beryllium
ICP/AES	EPA 200.7 / 6010B,C	Boron

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/AES	EPA 200.7 / 6010B,C	Cadmium
ICP/AES	EPA 200.7 / 6010B,C	Calcium
ICP/AES	EPA 200.7 / 6010B,C	Chromium
ICP/AES	EPA 200.7 / 6010B,C	Cobalt
ICP/AES	EPA 200.7 / 6010B,C	Copper
ICP/AES	EPA 200.7 / 6010B,C	Iron
ICP/AES	EPA 200.7 / 6010B,C	Lead
ICP/AES	EPA 200.7 / 6010B,C	Magnesium
ICP/AES	EPA 200.7 / 6010B,C	Manganese
ICP/AES	EPA 200.7 / 6010B,C	Molybdenum
ICP/AES	EPA 200.7 / 6010B,C	Nickel
ICP/AES	EPA 200.7 / 6010B,C	Potassium
ICP/AES	EPA 200.7 / 6010B,C	Selenium
ICP/AES	EPA 200.7	Silicon
ICP/AES	EPA 200.7 / 6010B,C	Silver
ICP/AES	EPA 200.7 / 6010B,C	Sodium
ICP/AES	EPA 6010B,C	Strontium
ICP/AES	EPA 200.7 / 6010B,C	Thallium
ICP/AES	EPA 200.7 / 6010B,C	Tin
ICP/AES	EPA 200.7 / 6010B,C	Titanium
ICP/AES	EPA 200.7 / 6010B,C	Vanadium
ICP/AES	EPA 200.7 / 6010B,C	Zinc
ICP/MS	EPA 200.8 / 6020A	Aluminum
ICP/MS	EPA 200.8 / 6020A	Antimony
ICP/MS	EPA 200.8 / 6020A	Arsenic
ICP/MS	EPA 200.8 / 6020A	Barium
ICP/MS	EPA 200.8 / 6020A	Beryllium
ICP/MS	EPA 200.8 / 6020A	Boron
ICP/MS	EPA 200.8 / 6020A	Cadmium
ICP/MS	EPA 200.8 / 6020A	Calcium
ICP/MS	EPA 200.8 / 6020A	Chromium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/MS	EPA 200.8 / 6020A	Cobalt
ICP/MS	EPA 200.8 / 6020A	Copper
ICP/MS	EPA 200.8 / 6020A	Iron
ICP/MS	EPA 200.8 / 6020A	Lead
ICP/MS	EPA 200.8 / 6020A	Magnesium
ICP/MS	EPA 200.8 / 6020A	Manganese
ICP/MS	EPA 200.8 / 6020A	Molybdenum
ICP/MS	EPA 200.8 / 6020A	Nickel
ICP/MS	EPA 200.8 / 6020A	Potassium
ICP/MS	EPA 200.8 / 6020A	Selenium
ICP/MS	EPA 200.8 / 6020A	Silicon
ICP/MS	EPA 200.8 / 6020A	Silver
ICP/MS	EPA 200.8 / 6020A	Sodium
ICP/MS	EPA 6020A	Strontium
ICP/MS	EPA 200.8 / 6020A	Thallium
ICP/MS	EPA 200.8 / 6020A	Tin
ICP/MS	EPA 200.8 / 6020A	Titanium
ICP/MS	EPA 200.8 / 6020A	Tungsten
ICP/MS	EPA 200.8	Uranium
ICP/MS	EPA 200.8 / 6020A	Vanadium
ICP/MS	EPA 200.8 / 6020A	Zinc
IC	EPA 300.0 / 9056A	Bromide
IC	EPA 300.0 / 9056A	Chloride
IC	EPA 300.0 / 9056A	Fluoride
IC	EPA 300.0 / 9056A	Nitrate as N
IC	EPA 300.0 / 9056A	Nitrite as N
IC	EPA 300.0 / 9056A	Nitrate + Nitrite
IC	EPA 300.0 / 9056A	Orthophosphate as P
IC	EPA 300.0 / 9056A	Sulfate
Titration	EPA 310.1 / SM 2320B	Alkalinity
Caculation	SM 2340B	Hardness

Non-Potable Water		
Technology	**Method**	**Analyte**
Gravimetric	EPA 1664A / EPA 9070A	Oil and Grease, Oil and Grease with SGT
Gravimetric	SM 2540B,C,D	Solids
ISE	EPA 120.1 / SM 2510B	Conductivity
ISE	SM 2520B	Practical Salinity
ISE	SM 4500F- C	Fluoride
ISE	SM 4500H+ B	pH
ISE	SM 5210B	TBOD / CBOD
Physical	EPA 1010A	Ignitability
Physical	EPA 9040C	pH
Titration	SM 2340C	Hardness
Titration	SM 4500SO_3 B	Sulfite
Titration	EPA 9034 / SM 4500S^{2-} F	Sulfide
Titration	Chap. 7.3.4	Reactive Sulfide
IR	EPA 9060A / SM 5310B	Total organic carbon
Turbidimetric	EPA 180.1 / SM 2130B	Turbidity
Turbidimetric	EPA 9038 / ASTM 516-02	Sulfate
UV/VIS	EPA 335.4 / EPA 9012B / SM 4500-CN G	Amenable cyanide
UV/VIS	EPA 350.1 / SM 4500NH3 H	Ammonia as N
UV/VIS	SM 3500Fe D	Ferrous Iron
UV/VIS	EPA 351.2	Kjeldahl nitrogen - total
UV/VIS	EPA 353.2 / SM 4500NO3 F	Nitrate + Nitrite
UV/VIS	EPA 353.2 / SM 4500NO3 F	Nitrate as N
UV/VIS	EPA 353.2 / SM 4500NO3 F	Nitrite as N
UV/VIS	EPA 365.2 / SM 4500P E	Orthophosphate as P
UV/VIS	EPA 365.4	Phosphorus total
UV/VIS	EPA 376.3	AVS-SEM
UV/VIS	EPA 410.4	COD
UV/VIS	EPA 420.1 / 9065	Total Phenolics
UV/VIS	SM 4500Cl G	Total Residual Chlorine

Non-Potable Water		
Technology	**Method**	**Analyte**
UV/VIS	SM 5540C	MBAS
UV/VIS	EPA 7196A / SM 3500-Cr D	Chromium VI
UV/VIS	EPA 9012B / 335.4	Total Cyanide
UV/VIS	EPA 9251 / SM 4500Cl E	Chloride
UV/VIS	Chap. 7.3.4	Reactive Cyanide
Preparation	**Method**	**Type**
Cleanup Methods	EPA 3640A	Gel Permeation Clean-up
Cleanup Methods	EPA 3630C	Silica Gel
Cleanup Methods	EPA 3660B	Sulfur Clean-Up
Cleanup Methods	EPA 3665A	Sulfuric Acid Clean-Up
Organic Preparation	EPA 3510C	Separatory Funnel Extraction
Organic Preparation	EPA 3520C	Continuous Liquid-Liquid Extraction
Inorganic Preparation	EPA 3010A	Hotblock
Volatile Organic Preparation	EPA 5030C	Purge and Trap

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	8081B	2,4`-DDD
GC/ECD	8081B	2,4`-DDE
GC/ECD	8081B	2,4`-DDT
GC/ECD	EPA 8081B	4, 4`-DDD
GC/ECD	EPA 8081B	4, 4`-DDE
GC/ECD	EPA 8081B	4, 4`-DDT
GC/ECD	EPA 8081B	Aldrin
GC/ECD	EPA 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Alpha-Chlordane

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 608 / 8081B	Chlordane (tech.)
GC/ECD	8081B	Cis-Nonachlor
GC/ECD	EPA 8081B	delta-BHC
GC/ECD	EPA 8081B	Dieldrin
GC/ECD	EPA 8081B	Endosulfan I
GC/ECD	EPA 8081B	Endosulfan II
GC/ECD	EPA 8081B	Endosulfan sulfate
GC/ECD	EPA 8081B	Endrin
GC/ECD	EPA 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin Ketone
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 8081B	Heptachlor
GC/ECD	EPA 8081B	Heptachlor epoxide
GC/ECD	8081B	Hexachlorobenzene
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	8081B	Mirex
GC/ECD	8081B	Oxychlordane
GC/ECD	EPA 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	8081B	Trans-Nonachlor
GC/ECD	EPA 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A MOD	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A MOD	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5, 5', 6-Nonachlorobiphenyl (BZ 206)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5, 6-Octachlorobiphenyl (BZ 195)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5-Heptachlorobiphenyl (BZ 170)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4'-Hexachlorobiphenyl (BZ 128)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 180)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5', 6-Heptachlorobiphenyl (BZ 183)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5-Hexachlorobiphenyl (BZ 138)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 6, 6'-Heptachlorobiphenyl (BZ 184)
GC/ECD	EPA 8082A	2, 2', 3, 4', 5, 5', 6-Heptachlorobiphenyl (BZ 187)
GC/ECD	EPA 8082A	2, 2', 3, 4, 5'-Pentachlorobiphenyl (BZ 87)
GC/ECD	EPA 8082A	2, 2', 3, 5'-Tetrachlorobiphenyl (BZ 44)
GC/ECD	EPA 8082A	2, 2', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 153)
GC/ECD	EPA 8082A	2, 2', 4, 5, 5'-Pentachlorobiphenyl (BZ 101)
GC/ECD	EPA 8082A	2, 2', 4, 5-Tetrachlorobiphenyl (BZ 48)
GC/ECD	EPA 8082A	2, 2', 4, 5'-Tetrachlorobiphenyl (BZ 49)
GC/ECD	EPA 8082A	2, 2', 5, 5'-Tetrachlorobiphenyl (BZ 52)
GC/ECD	EPA 8082A	2, 2', 5-Trichlorobiphenyl (BZ 18)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5-Hexachlorobiphenyl (BZ 156)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5'-Hexachlorobiphenyl (BZ 157)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4'-Pentachlorobiphenyl (BZ 105)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 189)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 167)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 118)
GC/ECD	EPA 8082A	2, 3', 4, 4',5'-Pentachlorobiphenyl (BZ 123)
GC/ECD	EPA 8082A	2, 3', 4, 4'-Tetrachlorobiphenyl (BZ 66)
GC/ECD	EPA 8082A	2, 3, 4, 4', 5-Pentachlorobiphenyl (BZ 114)
GC/ECD	EPA 8082A	2, 4, 4'-Trichlorobiphenyl (BZ 28)
GC/ECD	EPA 8082A	2, 4'-Dichlorobiphenyl (BZ 8)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 169)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 126)
GC/ECD	EPA 8082A	3, 3', 4, 4'-Tetrachlorobiphenyl (BZ 77)
GC/ECD	EPA 8082A	3, 4, 4', 5-Tetrachlorobiphenyl (BZ 81)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	Decachlorobiphenyl (BZ 209)
GC/ECD	EPA 8151A	2, 4, 5-T
GC/ECD	EPA 8151A	2, 4-D
GC/ECD	EPA 8151A	2, 4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2, 4, 5-TP)
GC/FID	EPA 8015C/D	Diesel range organics (DRO)
GC/FID	EPA 8015C/D	Total Petroleum Hydrocarbons (TPH)
GC/FID	EPA 8015C/D	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable Petroleum Hydrocarbons
GC/FID	CT-ETPH	Total Petroleum Hydrocarbons
GC/FID	TNRCC Method 1005	Total Petroleum Hydrocarbons
GC/FID	FL-PRO	Petroleum Range Organics
GC/ECD	EPA 8011	1, 2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B,C	1, 1, 1, 2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B,C	1, 1, 1-Trichloroethane
GC/MS	EPA 8260B,C	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA 8260B,C	1, 1, 2-Trichloroethane
GC/MS	EPA 8260B,C	1, 1-Dichloroethane
GC/MS	EPA 8260B,C	1, 1-Dichloroethylene
GC/MS	EPA 8260B,C	1, 1-Dichloropropene
GC/MS	EPA 8260B,C	1, 2, 3-Trichlorobenzene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	1, 2, 3-Trichloropropane
GC/MS	EPA 8260B,C	1,2,3-Trimethylbenzene
GC/MS	EPA 8260B,C	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8260B,C	1, 2, 4-Trimethylbenzene
GC/MS	EPA 8260B,C	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B,C	1, 2-Dibromoethane
GC/MS	EPA 8260B,C	1, 2-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 2-Dichloroethane
GC/MS	EPA 8260B,C	1, 2-Dichloropropane
GC/MS	EPA 8260B,C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B,C	1, 3, 5-Trimethylbenzene
GC/MS	EPA 8260B,C	1, 3-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 3-Dichloropropane
GC/MS	EPA 8260B,C	1, 4-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 4-Dioxane
GC/MS	EPA 8260B,C	2, 2-Dichloropropane
GC/MS	EPA 8260B,C	2-Butanone
GC/MS	EPA 8260B,C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B,C	2-Chlorotoluene
GC/MS	EPA 8260B,C	2-Hexanone
GC/MS	EPA 8260B,C	4-Chlorotoluene
GC/MS	EPA 8260B,C	4-Methyl-2-pentanone
GC/MS	EPA 8260B,C	Acetone
GC/MS	EPA 8260B,C	Acetonitrile
GC/MS	EPA 8260B,C	Acrolein
GC/MS	EPA 8260B,C	Acrylonitrile
GC/MS	EPA 8260B,C	Allyl chloride
GC/MS	EPA 8260B,C	Benzene
GC/MS	EPA 8260B,C	Benzyl chloride
GC/MS	EPA 8260B,C	Bromobenzene
GC/MS	EPA 8260B,C	Bromochloromethane

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	Bromodichloromethane
GC/MS	EPA 8260B,C	Bromoform
GC/MS	EPA 8260B,C	Carbon disulfide
GC/MS	EPA 8260B,C	Carbon tetrachloride
GC/MS	EPA 8260B,C	Chlorobenzene
GC/MS	EPA 8260B,C	Chloroethane
GC/MS	EPA 8260B,C	Chloroform
GC/MS	EPA 8260B,C	Chloroprene
GC/MS	EPA 8260B,C	cis-1, 2-Dichloroethene
GC/MS	EPA 8260B,C	cis-1, 3-Dichloropropene
GC/MS	EPA 8260B,C	cis-1,3-Dichloro-2-butene
GC/MS	EPA 8260B,C	Cyclohexane
GC/MS	EPA 8260B,C	Dibromochloromethane
GC/MS	EPA 8260B,C	Dibromomethane
GC/MS	EPA 8260B,C	Dichlorodifluoromethane
GC/MS	EPA 8260B,C	Diethyl ether
GC/MS	EPA 8260B,C	Di-isopropylether
GC/MS	EPA 8260B,C	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B,C	Ethyl methacrylate
GC/MS	EPA 8260B,C	Ethylbenzene
GC/MS	EPA 8260B,C	Ethyl-t-butylether
GC/MS	EPA 8260B,C	Hexachlorobutadiene
GC/MS	EPA 8260B,C	Iodomethane
GC/MS	EPA 8260B,C	Isobutyl alcohol
GC/MS	EPA 8260B,C	Isopropyl alcohol
GC/MS	EPA 8260B,C	Isopropyl benzene
GC/MS	EPA 8260B,C	m p-xylenes
GC/MS	EPA 8260B, C	Methyl acetate
GC/MS	EPA 8260B,C	Methacrylonitrile
GC/MS	EPA 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 8260B,C	Methyl chloride (Chloromethane)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	Methyl methacrylate
GC/MS	EPA 8260B,C	Methyl tert-butyl ether
GC/MS	EPA 8260B,C	Methylcyclohexane
GC/MS	EPA 8260B,C	Methylene chloride
GC/MS	EPA 8260B,C	Naphthalene
GC/MS	EPA 8260B,C	n-Butylbenzene
GC/MS	EPA 8260B,C	n-proplybenzene
GC/MS	EPA 8260B,C	o-Xylene
GC/MS	EPA 8260B,C	pentachloroethane
GC/MS	EPA 8260B,C	p-Isopropyltoluene
GC/MS	EPA 8260B,C	Propionitrile
GC/MS	EPA 8260B,C	sec-butylbenzene
GC/MS	EPA 8260B,C	Styrene
GC/MS	EPA 8260B,C	t-Amylmethylether
GC/MS	EPA 8260B,C	tert-Butyl alcohol
GC/MS	EPA 8260B,C	tert-Butylbenzene
GC/MS	EPA 8260B,C	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B,C	Tetrahydrofuran
GC/MS	EPA 8260B,C	Toluene
GC/MS	EPA 8260B,C	trans-1, 2-Dichloroethylene
GC/MS	EPA 8260B,C	trans-1, 3-Dichloropropylene
GC/MS	EPA 8260B,C	Trans-1, 4-Dichloro-2-butuene
GC/MS	EPA 8260B,C	Trichloroethene (Trichloroethylene)
GC/MS	EPA 8260B,C	Trichlorofluoromethane
GC/MS	EPA 8260B,C	Vinyl acetate
GC/MS	EPA 8260B,C	Vinyl chloride
GC/MS	EPA 8260B,C	Xylene
GC/MS	EPA 8270C,D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 8270C,D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8270C,D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 2-Diphenylhydrazine

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	1, 3, 5-Trinitrobenzene
GC/MS	EPA 8270C,D	1, 3-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 3-Dinitrobenzene
GC/MS	EPA 8270C,D	1, 4-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 4-Dioxane
GC/MS	EPA 8270C,D	1, 4-Naphthoquinone
GC/MS	EPA 8270C,D	1, 4-Phenylenediamine
GC/MS	EPA 8270C,D	1,1-Biphenyl
GC/MS	EPA 8270C,D	1-Chlorohexane
GC/MS	EPA 8270C,D	1-Chloronaphthalene
GC/MS	EPA 8270C,D	1-Methylnaphthalene
GC/MS	EPA 8270C,D	1-Naphthylamine
GC/MS	EPA 8270C,D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C,D	2, 4, 5-Trochlorophenol
GC/MS	EPA 8270C,D	2, 4, 6-Trichlorophenol
GC/MS	EPA 8270C,D	2, 4-Dichlorophenol
GC/MS	EPA 8270C,D	2, 4-Dimethylphenol
GC/MS	EPA 8270C,D	2, 4-Dinitrophenol
GC/MS	EPA 8270C,D	2, 4-Dinitrotoluene (2 4-DNT)
GC/MS	EPA 8270C,D	2, 6-Dichlorophenol
GC/MS	EPA 8270C,D	2, 6-Dinitrotoluene (2 6-DNT)
GC/MS	EPA 8270C,D	2-Acetylaminofluorene
GC/MS	EPA 8270C,D	2-Chloronaphthalene
GC/MS	EPA 8270C,D	2-Chlorophenol
GC/MS	EPA 8270C,D	2-Methyl-4, 6-dinitrophenol
GC/MS	EPA 8270C,D	2-Methylnaphthalene
GC/MS	EPA 8270C,D	2-Methylphenol
GC/MS	EPA 8270C,D	2-Naphthylamine
GC/MS	EPA 8270C,D	2-Nitroaniline
GC/MS	EPA 8270C,D	2-Nitrophenol
GC/MS	EPA 8270C,D	2-Picoline

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	3, 3`-Dichlorobenzidine
GC/MS	EPA 8270C,D	3, 3'-Dimethylbenzidine
GC/MS	EPA 8270C,D	3,4-Methylphenol
GC/MS	EPA 8270C,D	3-Methylcholanthrene
GC/MS	EPA 8270C,D	3-Nitroaniline
GC/MS	EPA 8270C,D	4-Aminobiphenyl
GC/MS	EPA 8270C,D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C,D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C,D	4-Chloroaniline
GC/MS	EPA 8270C,D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C,D	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C,D	5-Nitro-o-toluidine
GC/MS	EPA 8270C,D	7,12-7,12-Dimethylbenz(a)anthraceneDimethylphenethylamine
GC/MS	EPA 8270C,D	a a-Dimethylphenethylamine
GC/MS	EPA 8270C,D	Acenaphthene
GC/MS	EPA 8270C,D	Acenaphthylene
GC/MS	EPA 8270C,D	Acetophenone
GC/MS	EPA 8270C,D	Aniline
GC/MS	EPA 8270C,D	Anthracene
GC/MS	EPA 8270C,D	Aramite
GC/MS	EPA 8270C,D	Atrazine
GC/MS	EPA 8270C,D	Azobenzene
GC/MS	EPA 8270C,D	Benzaldehyde
GC/MS	EPA 8270C,D	Benzidine
GC/MS	EPA 8270C,D	Benzo(a)anthracene
GC/MS	EPA 8270C,D	Benzo(a)pyrene
GC/MS	EPA 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 8270C,D	Benzo(g h i)perylene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Benzo(k)fluoranthene
GC/MS	EPA 8270C,D	Benzoic Acid
GC/MS	EPA 8270C,D	Benzyl alcohol
GC/MS	EPA 8270C,D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C,D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C,D	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane))
GC/MS	EPA 8270C,D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 625 / 8270C,D	Bis(2-Ethylhexyl)adipate
GC/MS	EPA 8270C,D	Butyl benzyl phthalate
GC/MS	EPA 8270C,D	Caprolactam
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chlorobenzilate
GC/MS	EPA 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Diallate
GC/MS	EPA 8270C,D	Dibenz(a h)anthracene
GC/MS	EPA 8270C,D	Dibenzo(a,j)acridine
GC/MS	EPA 8270C,D	Dibenzofuran
GC/MS	EPA 8270C,D	Diethyl phthalate
GC/MS	EPA 8270C,D	Diethyladipate
GC/MS	EPA 8270C,D	Dimethoate
GC/MS	EPA 8270C,D	Dimethyl phthalate
GC/MS	EPA 8270C,D	Di-n-butyl phthalate
GC/MS	EPA 8270C,D	Di-n-octyl phthalate
GC/MS	EPA 8270C,D	Disulfoton
GC/MS	EPA 8270C,D	Ethyl methacrylate
GC/MS	EPA 8270C,D	Ethyl methanesulfonate
GC/MS	EPA 8270C,D	Ethyl parathion
GC/MS	EPA 8270C,D	Famfur
GC/MS	EPA 8270C,D	Fluoranthene
GC/MS	EPA 8270C,D	Fluorene
GC/MS	EPA 8270C,D	Hexachlorobenzene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Hexachlorobutadiene
GC/MS	EPA 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C,D	Hexachloroethane
GC/MS	EPA 8270C,D	Hexachlorophene
GC/MS	EPA 8270C,D	Hexachloropropene
GC/MS	EPA 8270C,D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C,D	Isodrin
GC/MS	EPA 8270C,D	Isophorone
GC/MS	EPA 8270C,D	Isosafrole
GC/MS	EPA 8270C,D	Kepone
GC/MS	EPA 8270C,D	Methapyriline
GC/MS	EPA 8270C,D	Methyl methanesulfonate
GC/MS	EPA 8270C,D	Methyl parathion
GC/MS	EPA 8270C,D	Naphthalene
GC/MS	EPA 8270C,D	Nitrobenzene
GC/MS	EPA 8270C,D	n-Nitrosodiethylamine
GC/MS	EPA 8270C,D	n-Nitrosodimethylamine
GC/MS	EPA 8270C,D	n-Nitroso-di-n-butylamine
GC/MS	EPA 8270C,D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C,D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C,D	n-Nitrosomethylethylamine
GC/MS	EPA 8270C,D	n-Nitrosomorpholine
GC/MS	EPA 8270C,D	n-Nitrosopiperidine
GC/MS	EPA 8270C,D	n-Nitrosopyrrolidine
GC/MS	EPA 8270C,D	o,O o, o-Triethyl phosphorothioate
GC/MS	EPA 8270C,D	o,o-Diethyl o-pyrazinyl phosphorothiote
GC/MS	EPA 8270C,D	o-Toluidine
GC/MS	EPA 8270C,D	Pentachlorobenzene
GC/MS	EPA 8270C,D	Pentachloronitrobenzene
GC/MS	EPA 8270C,D	Pentachlorophenol
GC/MS	EPA 8270C,D	Phenacetin

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Phenanthrene
GC/MS	EPA 8270C,D	Phenol
GC/MS	EPA 8270C,D	Phorate
GC/MS	EPA 8270C,D	Pronamide
GC/MS	EPA 8270C,D	Pyrene
GC/MS	EPA 8270C,D	Pyrididne
GC/MS	EPA 8270C,D	Safrole
GC/MS	EPA 8270C,D	Sulfotepp
GC/MS	EPA 8270C,D	Thionazin
HPLC/UV	EPA 8330A	1 ,3, 5-Trinitrobenzene
HPLC/UV	EPA 8330A	1, 3-Dinitrobenzene
HPLC/UV	EPA 8330A	2, 4, 6-Trinitrotoluene
HPLC/UV	EPA 8330A	2, 4-Dinitrotoluene
HPLC/UV	EPA 8330A	2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A	2-Amino-4, 6-dinitrotoluene
HPLC/UV	EPA 8330A	2-Nitrotoluene
HPLC/UV	EPA 8330A	3-Nitrotoluene
HPLC/UV	EPA 8330A	3,5-Dinitroaniline
HPLC/UV	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A	4-Nitrotoluene
HPLC/UV	EPA 8330A	Ethylene glycol dinitrate (EGDN)
HPLC/UV	EPA 8330A	Hexahydr-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	EPA 8330A	Nitrobenzene
HPLC/UV	EPA 8330A MOD	Nitroglycerin
HPLC/UV	EPA 8330A	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	EPA 8330A	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	EPA 8330A	Tetryl
HPLC/UV	8330B (W/O Soil Grinding)	1, 3, 5-Trinitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	1, 3-Dinitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	2, 4, 6-Trinitrotoluene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
HPLC/UV	8330B (W/O Soil Grinding)	2, 4-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2, 6-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2-Amino-4, 6 -Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	3-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	3,5-Dinitroaniline
HPLC/UV	8330B (W/O Soil Grinding)	4-Amino-2,3-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	4-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	Ethylene glycol dinitrate (EGDN)
HPLC/UV	8330B (W/O Soil Grinding)	Hexahydr-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	8330B (W/O Soil Grinding)	Nitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	Nitroglycerin
HPLC/UV	8330B (W/O Soil Grinding)	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	8330B (W/O Soil Grinding)	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	8330B (W/O Soil Grinding)	Tetryl
CVAA	EPA 7471B	Mercury
CVAF	EPA 1631E	Low Level Mercury
ICP/AES	EPA 6010B,C	Aluminum
ICP/AES	EPA 6010B,C	Antimony
ICP/AES	EPA 6010B,C	Arsenic
ICP/AES	EPA 6010B,C	Barium
ICP/AES	EPA 6010B,C	Beryllium
ICP/AES	EPA 6010B,C	Boron
ICP/AES	EPA 6010B,C	Cadmium
ICP/AES	EPA 6010B,C	Calcium

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/AES	EPA 6010B,C	Chromium
ICP/AES	EPA 6010B,C	Cobalt
ICP/AES	EPA 6010B,C	Copper
ICP/AES	EPA 6010B,C	Iron
ICP/AES	EPA 6010B,C	Lead
ICP/AES	EPA 6010B,C	Magnesium
ICP/AES	EPA 6010B,C	Manganese
ICP/AES	EPA 6010B,C	Molybdenum
ICP/AES	EPA 6010B,C	Nickel
ICP/AES	EPA 6010B,C	Potassium
ICP/AES	EPA 6010B,C	Selenium
ICP/AES	EPA 200.7	Silicon
ICP/AES	EPA 6010B,C	Silver
ICP/AES	EPA 6010B,C	Sodium
ICP/AES	EPA 6010B,C	Strontium
ICP/AES	EPA 6010B,C	Thallium
ICP/AES	EPA 6010B,C	Tin
ICP/AES	EPA 6010B,C	Titanium
ICP/AES	EPA 6010B,C	Vanadium
ICP/AES	EPA 6010B,C	Zinc
ICP/MS	EPA 6020A	Aluminum
ICP/MS	EPA 6020A	Antimony
ICP/MS	EPA 6020A	Arsenic
ICP/MS	EPA 6020A	Barium
ICP/MS	EPA 6020A	Beryllium
ICP/MS	EPA 6020A	Boron
ICP/MS	EPA 6020A	Cadmium
ICP/MS	EPA 6020A	Calcium
ICP/MS	EPA 6020A	Chromium
ICP/MS	EPA 6020A	Cobalt
ICP/MS	EPA 6020A	Copper

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/MS	EPA 6020A	Iron
ICP/MS	EPA 6020A	Lead
ICP/MS	EPA 6020A	Magnesium
ICP/MS	EPA 6020A	Manganese
ICP/MS	EPA 6020A	Molybdenum
ICP/MS	EPA 6020A	Nickel
ICP/MS	EPA 6020A	Potassium
ICP/MS	EPA 6020A	Selenium
ICP/MS	EPA 6020A	Silver
ICP/MS	EPA 6020A	Sodium
ICP/MS	EPA 6020A	Strontium
ICP/MS	EPA 6020A	Thallium
ICP/MS	EPA 6020A	Tin
ICP/MS	EPA 6020A	Titanium
ICP/MS	EPA 6020A	Tungsten
ICP/MS	EPA 6020A	Vanadium
ICP/MS	EPA 6020A	Zinc
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate as N
IC	EPA 9056A	Nitrite as N
IC	EPA 9056A	Orthophosphate
IC	EPA 9056A	Sulfate
Gravimetric	EPA 9071A / 9071B	Oil and Grease, Oil and Grease with SGT
Physical	EPA 1010A	Ignitability
Physical	EPA 9045D	pH
Titration	Chap 7.3.4	Reactive Sulfide
IR	Lloyd Kahn	Total organic carbon
Turbidimetric	EPA 9038 / ASTM 516-02	Sulfate
UV/VIS	EPA 350.1 / SM 4500NH3 H	Ammonia as N
UV/VIS	EPA 9251 / SM 4500Cl E	Chloride

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
UV/VIS	Chap. 7.3.4	Reactive Cyanide
UV/VIS	EPA 376.3	AVS-SEM
UV/VIS	SM 3500Fe D	Ferrous Iron
Cleanup Methods	EPA 3630C	Silica Gel
UV/VIS	EPA 7196	Chromium VI
UV/VIS	EPA 7196A	Chromium VI
UV/VIS	EPA 9012B	Total cyanide
Preparation	**Method**	**Type**
Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure
Preparation	EPA 1312	Synthetic Precipitation Leaching Procedure
Cleanup Methods	EPA 3660B	Sulfur Clean-up
Cleanup Methods	EPA 3620C	Florsil Clean-up
Cleanup Methods	EPA 3630C	Silica Gel Clean-up
Cleanup Methods	EPA 3640A	GPC Clean-up
Organic Preparation	EPA 3540C	Soxhlet Extraction
Organic Preparation	EPA 3545A	Pressurized Fluid Extraction
Organic Preparation	EPA 3550C	Sonication
Inorganics Preparation	EPA 3050B	Hotblock
Inorganics Preparation	EPA 3060A	Alkaline Digestion
Volatile Organics Preparation	EPA 5035/5035A	Closed System Purge and Trap

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	Propene
GC/MS	EPA TO-15	1, 1, 1-Trichloroethane
GC/MS	EPA TO-15	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA TO-15	1, 1, 2-Trichloroethane

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	1, 1-Dichloroethane
GC/MS	EPA TO-15	1, 1-Dichloroethylene
GC/MS	EPA TO-15	1, 2, 4-Trichlorobenzene
GC/MS	EPA TO-15	1, 2, 4-Trimethylbenzene
GC/MS	EPA TO-15	1, 2-Dibromoethane (EDB)
GC/MS	EPA TO-15	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)
GC/MS	EPA TO-15	1, 2-Dichlorobenzene
GC/MS	EPA TO-15	1, 2-Dichloroethane
GC/MS	EPA TO-15	1, 2-Dichloroethenes (Total)
GC/MS	EPA TO-15	1, 2-Dichloropropane
GC/MS	EPA TO-15	1, 3, 5-Trimethylbenzene
GC/MS	EPA TO-15	1, 3-Butadiene
GC/MS	EPA TO-15	1, 3-Dichlorobenzene
GC/MS	EPA TO-15	1, 4-Dichlorobenzene
GC/MS	EPA TO-15	1,4-Difluorobenzene
GC/MS	EPA TO-15	1, 4-Dioxane
GC/MS	EPA TO-15	2-Butanone
GC/MS	EPA TO-15	2-Hexanone
GC/MS	EPA TO-15	2-Propanol
GC/MS	EPA TO-15	4-Ethyltoluene
GC/MS	EPA TO-15	4-Methyl-2-pentanone
GC/MS	EPA TO-15	Acetone
GC/MS	EPA TO-15	Acrolein
GC/MS	EPA TO-15	Benzene
GC/MS	EPA TO-15	Benzyl chloride
GC/MS	EPA TO-15	Bromochloromethane
GC/MS	EPA TO-15	Bromodichloromethane
GC/MS	EPA TO-15	Bromoform
GC/MS	EPA TO-15	Carbon disulfide
GC/MS	EPA TO-15	Carbon tetrachloride
GC/MS	EPA TO-15	Chlorobenzene

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	Chloroethane
GC/MS	EPA TO-15	Chloroform
GC/MS	EPA TO-15	Cis-1, 2-Dichloroethene
GC/MS	EPA TO-15	Cis-1, 3-Dichloropropene
GC/MS	EPA TO-15	Cyclohexane
GC/MS	EPA TO-15	Dibromochloromethane
GC/MS	EPA TO-15	Dichlorodifluoromethane (Freon 12)
GC/MS	EPA TO-15	Ethanol
GC/MS	EPA TO-15	Ethyl acetate
GC/MS	EPA TO-15	Ethylbenzene
GC/MS	EPA TO-15	Hexachlorobutadiene
GC/MS	EPA TO-15	Isopropyl alcohol
GC/MS	EPA TO-15	m, p-Xylene
GC/MS	EPA TO-15	Methyl bromide (Bromomethane)
GC/MS	EPA TO-15	Methyl chloride (Chloromethane)
GC/MS	EPA TO-15	Methyl methacrylate
GC/MS	EPA TO-15	Methyl tert-butyl ether
GC/MS	EPA TO-15	Methylene chloride
GC/MS	EPA TO-15	Naphthalene
GC/MS	EPA TO-15	n-Heptane
GC/MS	EPA TO-15	n-Hexane
GC/MS	EPA TO-15	o-Xylene
GC/MS	EPA TO-15	Styrene
GC/MS	EPA TO-15	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA TO-15	Tetrahydrofuran
GC/MS	EPA TO-15	Toluene
GC/MS	EPA TO-15	trans-1, 2-Dichloroethylene
GC/MS	EPA TO-15	trans-1, 3-Dichloropropylene
GC/MS	EPA TO-15	Trichloroethene (Trichloroethylene)
GC/MS	EPA TO-15	Trichlorofluoromethane (Freon 11)
GC/MS	EPA TO-15	Trichlorotrifluoroethane (Freon 113)

LABORATORY ACCREDITATION BUREAU

Certificate # L2223

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	Vinyl acetate
GC/MS	EPA TO-15	Vinyl chloride
GC/MS	EPA TO-15	Xylenes (Total)

Notes:

1) This laboratory offers commercial testing service.

Approved by: _____ Date: February 10, 2012

R. Douglas Leonard
Chief Technical Officer

Issued: 11/04/09 Revised: 01/11/10 Revised: 04/06/10 Revised: 9/9/10 Revised: 10/13/10
Revised: 1/20/11 Revised: 4/13/11 Revised: 5/26/11 Revised: 2/10/12

TestAmerica West Sacramento requests the following exceptions to DOD QSM Version 4.2

1.0 Common Laboratory Contaminants

The concentrations of common laboratory contaminants in the method blank shall not exceed the reporting limit. When determining whether a blank is contaminated the LOQ will be used rather than ½ the LOQ.

The common laboratory contaminants for TestAmerica West Sacramento comprise the following:

Method	Analytes
PCBs 1668	PCB-118

2.0 ***Dilutions for Organic Analyte***s

TestAmerica West Sacramento often uses screening techniques to determine appropriate dilution levels. Screening can include visual observation of the samples or sample extracts in instances where high concentrations of organic compounds are evident (e.g., non-aqueous liquid phase).
If the dilution is overestimated by the screening technique (i.e., peak/signal is too low), the lab will conduct additional analyses to produce lower detection limits.
The laboratory may not be able to analyze less dilute samples if significant levels of non-target and/or target compounds are present at concentrations high enough to prevent further dilutions.
In order to protect our instruments from failure and contamination, initial analysis of sample dilutions based on screening data will be used to document any samples containing concentrations high enough to prevent further dilutions.
Screening data will be included in the data package.
TestAmerica West Sacramento will make every attempt to minimize dilutions and to analyze extracts without dilution if it can be done without damaging the analytical equipment.

3.0 HIGH RESOLUTION MS ISOTOPE DILUTION METHODS

When reporting data below the LOQ for methods 8290, 1668 , 1698 and 1699 results will be “J” flagged down to the estimated detection limit (EDL) rather than the LOD.

High resolution MS instruments have the capability and method requirement that the EDLs be calculated. These EDLs are analyte and sample specific estimates of detection sensitivity produced during the actual instrumental analysis. As such the EDL is a better estimate of analyte sensitivity in a specific sample than are the statistically derived LOD or MDL.

4.0 PCB CONGENERS BY ISOTOPE DILUTION – METHOD 1668A

PCB congeners will be reported only to the LOQ.
PCBs are common trace laboratory contaminants at levels < ½ the LOQ. TestAmerica will analyze and report to the estimated detection limit (EDL) if requested but this will often result in many trace

"J" value hits in samples and method blanks that are well below the LOQ and are not necessarily characteristic of the site being studied.

The 5-point Initial Calibration for the PCB congeners will be carried out only for the congeners required by EPA Method 1668. As per the method, all other congeners will be calculated off a 1-point calibration. Second source samples will only be controlled off the congeners that have a 5-point calibration.

The Laboratory Control Sample (LCS) will be required to be spiked and controlled only with the congeners that have a 5-point calibration.

SCOPE OF ACCREDITATION TO ISO/IEC 17025-2005

TESTAMERICA LABORATORIES WEST SACRAMENTO
880 Riverside Parkway
West Sacramento, CA 95605
Douglas Weir Phone: 916 3744 389

ENVIRONMENTAL

Valid To: April 30, 2012 Certificate Number: 2928.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Inductively Coupled Plasma (ICP), ICP-Mass Spectroscopy, Atomic Absorption Spectroscopy (flame), Gas Chromatography(GC), GC- Mass Spectroscopy, High Resolution Gas Chromatography/High Resolution Mass Spectroscopy, Liquid Chromatography(LC),LC- Mass Spectroscopy, Ion Chromatography, Spectrophotometry, Misc.- Electronic Probes

Parameter/Analyte	**Non potable Water**	**Solid Hazardous Waste**	**Air**	**Associated Prep Methods**
Metals				
Aluminum	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Antimony	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Arsenic	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Barium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Beryllium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Cadmium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Calcium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Chromium (Total)	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Chromium (Hexavalent)	EPA 7196A	EPA 7196A	-------	EPA 3005A/3010A/3050A
Cobalt	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Copper	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Iron	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Lead	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Magnesium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A

5301 Buckeystown Pike, Suite 350 | Frederick, Maryland 21704-8373 | Phone: 301 644 3248 | Fax: 301 662 2974 | www.A2LA.org

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Manganese	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Mercury	EPA 7470A	EPA 7471A	-------	EPA 3005A/3010A/3050A
Molybdenum	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Nickel	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Potassium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Selenium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Silver	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Sodium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Thallium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Vanadium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Zinc	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Nutrients				
Nitrate	EPA 353.2/9056A/300.0	EPA 353.2/9056A/300.0	-------	----------
Nitrate-nitrite	EPA 353.2/ SM4500-NO3 F	EPA 353.2	-------	----------
Nitrite	EPA 353.2/9056A/300.0	EPA 353.2/9056A/300.0	-------	----------
Orthophosphate	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
Wet Chemistry				
Oil and Grease	EPA 1664/9070	EPA 1664/9071	-------	----------
Nitrocellulose	WS-WC-0050	WS-WC-0050	-------	----------
Perchlorate	EPA 6850	EPA 6850	-------	----------
Chloride	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
Fluoride	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
Sulfate	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
			-------	----------
Hazardous Waste Characteristics				
TCLP Extractables	----------	EPA 1311		
TCLP Inorganics	----------	EPA 1311	-------	----------
			-------	----------
Purgeable Organics				
(volatiles)				
Acetone	EPA 8260B	EPA 8260B		
Acrylonitrile	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Benzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromochloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromodichloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromoform	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromomethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Carbon disulfide	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Carbon tetrachloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2-Chloroethyl vinyl ether	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chloroform	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Chloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Dibromochloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dibromo-3-chloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dibromoethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Dibromomethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,3-Dichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,4-Dichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Dichlorodifluoromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1-Dichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1-Dichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
trans-1,2-Dichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
cis-1,2-Dichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,3-Dichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2,2-Dichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1-Dichloropropene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
cis-1,3-Dichloropropene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
trans-1,3-Dichloropropene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,4-Dioxane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Ethylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Hexachlorobutadiene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2-Hexanone (MBK)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methyl tert-butyl ether (MTBE)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methylene chloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methyl ethyl ketone	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
4-Methyl-2-pentanone (MIBK)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Naphthalene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,1,2-Tetrachloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,2,2-Tetrachloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Tetrachloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Toluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,3-Trichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,4-Trichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,1-Trichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,2-Trichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Trichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Trichlorofluoromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,3-Trichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Vinyl acetate	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Vinyl chloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
m & p xylene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
o-xylene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Xylenes, Total	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
tert-amyl methyl ether (TAME)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
tert-butyl alcohol (TBA)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Ethyl tert-butyl ether (ETBE)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
n-Butylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
sec-Butylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
tert-Butylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2-Chlorotoluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
4-Chlorotoluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Isopropylbenzene	EPA 8260B	----------	-------	EPA 5030A/5030B/5035/5035A
n-Propylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Styrene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,4-Trimethylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,3,5-Trimethylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Oxygenates	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Gasoline Range Organics (GRO)	EPA 8260B/AK101	EPA 8260B/AK101	-------	EPA 5030A/5030B/5035/5035A
p-Isopropyltoluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
			-------	EPA 5030A/5030B/5035/5035A
Extractable Organics				
(semivolatiles)				
Acenaphthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008		
Acenaphthylene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Aniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Anthracene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/3580A
Benzidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Benzo(a)anthracene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/3580A
Benzo(b)fluoranthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(k)fluoranthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(g,h,i)perylene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(a)pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(e)pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzoic acid	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzyl alcohol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Benzyl butyl phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Bis(2-chloroethoxy) Methane	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Bis(2-chloroethyl) ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Bis(2-chloroisopropyl) ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Di(2-ethylhexyl) phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Bromophenyl phenyl ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Carbazole	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Chloroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Chloro-3-methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Chloronaphthalene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Chlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Chlorophenyl phenyl ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Chrysene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A
Dibenz(a,h)anthracene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A
Dibenzofuran	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
1,2-Dichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,3-Dichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,4-Dichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
3,3'-Dichlorobenzidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Diethyl Phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dimethylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Dimethyl Phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Di-n-butyl phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Di-n-octyl phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4,6-Dinitro-2-methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dinitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dinitrotoluene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,6-Dinitrotoluene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
1,4-Dioxane	WS-MS-0011	WS-MS-0011	-------	EPA 3500B/3510C/3550B/ 3580A
1,2-Diphenylhydrazine (as Azobenzene)	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Fluoranthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A
Fluorene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Hexachlorobenzene	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Hexachlorobutadiene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Hexachlorocyclopentadiene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Hexachloroethane	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Indeno(1,2,3-c,d)pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A
Isophorone	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
2-Methylnaphthalene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A
2-Methylphenol	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
3-Methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/
Naphthalene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A
2-Nitroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
3-Nitroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Nitroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Nitrobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Nitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Nitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodimethylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodi-n-propylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodiphenylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Pentachlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Phenanthrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/ 3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Phenol	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	-------	EPA 3500B/3510C/3550B/3580A
Pyridine	EPA 8270C	EPA 8270C	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
1,2,4-Trichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
2,4,5-Trichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
2,4,6-Trichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Diesel Range Organics (DRO)	EPA 8015B/AK102	EPA 8015B/AK102	-------	EPA 3500B/3510C/3550B/3580A
Residual Range Organics	AK103	AK103	-------	EPA 3500B/3510C/3550B/3580A
			-------	EPA 3500B/3510C/3550B/3580A
Dioxins				
2,3,7,8-TeCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B		
1,2,3,7,8-PeCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,7,8-HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,6,7,8-HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8,9-HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,6,7,8-HpCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
OCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
2,3,7,8-TeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8-PeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
2,3,4,7,8-PeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,7,8-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,6,7,8-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8,9-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
2,3,4,6,7,8-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,6,7,8-HpCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,7,8,9-HpCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
OCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total TCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total PeCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HeptaCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total TCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total PeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HpCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Chemical Warfare Degradates				
1,4-Dithiane	WS-MS-0003	WS-MS-0003	-------	----------
Benzothiazole	WS-MS-0003	WS-MS-0003	-------	----------
p-Chlorophenyl methylsulfide	WS-MS-0003	WS-MS-0003	-------	----------
p-Chlorophenyl methylsulfoxide	WS-MS-0003	WS-MS-0003	-------	----------
p-Chlorophenyl methylsulfone	WS-MS-0003	WS-MS-0003	-------	----------
Chloropicrin	WS-MS-0003	WS-MS-0003	-------	----------
Acetophenone	WS-MS-0003	WS-MS-0003	-------	----------
2-Chloroacetophenone	WS-MS-0003	WS-MS-0003	-------	----------
1,4-Oxathiane	WS-MS-0003	WS-MS-0003	-------	----------
Dimethyl Disulfide	WS-MS-0003	WS-MS-0003	-------	----------
Diisopropylmethylphosphate (DIMP)	WS-LC-0004	WS-LC-0004	-------	----------
Dimethylmethylphosphonate (DMMP)	WS-LC-0004	WS-LC-0004	-------	----------
Ethyl methylphosphonic acid (EMPA)	WS-LC-0004	WS-LC-0004	-------	----------
Isopropyl methylphosphonic acid (IMPA)	WS-LC-0004	WS-LC-0004	-------	----------
Methylphosphonic acid (MPA)	WS-LC-0004	WS-LC-0004	-------	----------
Thiodiglycol (2,2'-Thiodiethanol) (TDG)	WS-LC-0004	WS-LC-0004	-------	----------
Nitroaromatics				
2-Amino-4,6-dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
4-Amino-2,6-dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
3,5-Dinitroaniline	EPA 8330B	EPA 8330B	-------	----------
1,3-Dinitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2,4-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Ethylene glycol dinitrate	EPA 8330B	EPA 8330B	-------	----------
Glycerol trinitrate (Nitroglycerin)	EPA 8330B	EPA 8330B	-------	----------
Hexahydro-1,3,5-trinitro-1,3,5-triazine (Hexogen)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Nitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2-Nitrotoluene (o-Nitrotoluene)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
3-Nitrotoluene (m-Nitrotoluene)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
4-Nitrotoluene (p-Nitrotoluene)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Octahydro-1,3,5,7-tetranitro1,3,5,7-tetracine (Octogen)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Picric acid	EPA 8330B	EPA 8330B	-------	----------
Pentaerythritol tetranitrate	EPA 8330B	EPA 8330B	-------	----------
1,3,5-Trinitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2,4,6-Trinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Nitroguanidine	WS-LC-0010	WS-LC-0010	-------	----------
Nitrosamines				
N-Nitrosodimethylamine (NDMA)	WS-MS-0012	WS-MS-0012	-------	----------
Perfluoro Compounds				
Perfluorooctanoic acid	WS-LC-0020	WS-LC-0020	-------	----------
Perfluorooctane sulfonate	WS-LC-0020	WS-LC-0020	-------	----------
Pesticides/PCBs				
Aldrin	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
a-BHC	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
b-BHC	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
d-BHC	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
g-BHC (Lindane)	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
a-Chlordane	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
g-Chlordane	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Oxy-Chlordane	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A
4,4'-DDD	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
2,4’-DDD	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A
4,4'-DDE	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
2,4’-DDE	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
4,4'-DDT	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
2,4'-DDT	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A
Dieldrin	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endosulfan I	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endosulfan II	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endosulfan sulfate	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endrin	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endrin aldehyde	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endrin ketone	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Heptachlor	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Heptachlor epoxide	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Hexachlorobenzene	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A
Methoxychlor	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Cis-Nonachlor	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A
Trans-Nonachlor	EPA 1699	EPA 1699		EPA 3500B/3510C/3550B/3620B/ 3660A
Toxaphene	EPA 8081A/EPA 1699	EPA 8081A/EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Mirex	EPA 1699	EPA 1699	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Chlordane (technical)	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
PCB (Aroclors)				

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB-1016	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1221	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1232	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1242	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1248	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1254	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1260	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1262	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB-1268	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A
PCB (congeners)				
PCB 1 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 2 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 3 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 4 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 5 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 6 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 7 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 8 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 9 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 10 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 11 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 12 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 13 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 14 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 15 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 16 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 17 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 18 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 19 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 20 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 21 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 22 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 23 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 24 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 25 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 26 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 27 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 28 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 29 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 30 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 32 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 31 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 33 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 34 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 35 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 36 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 37 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 38 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 39 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 40 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 41 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 42 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 43 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 44 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 45 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 46 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 47 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 48 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 49 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 50 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 51 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 52 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 53 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 54 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 55 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 56 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 57 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 58 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 59 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 60 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 61 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 62 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 63 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 64 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 65 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 66 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 67 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 68 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 69 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 70 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 71 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 72 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 73 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 74 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 75 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 76 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 77 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 78 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 79 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 80 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 81 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 82 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 83 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 84 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 85 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 86 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 87 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 88 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 89 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 90 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 91 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 92 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 93 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 94 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 95 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 96 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 97 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 98 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 99 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 100 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 101 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 102 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 103 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 104 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 105 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 106 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 108 (BZ)/107 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 109 (BZ)/108 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 107 (BZ)/109 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 110 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 111 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 112 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 113 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 114 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 115 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 116 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 117 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 118 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 119 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 120 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 121 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 122 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 123 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 124 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 125 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 126 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 127 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 128 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 129 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 130 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 131 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 132 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 133 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 134 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 135 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 136 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 137 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 138 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 139 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 140 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 141 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 142 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 143 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 144 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 145 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 146 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 147 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 148 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 149 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 150 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 151 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 152 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 153 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 154 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 155 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 156 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 157 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 158 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 159 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 160 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 161 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 162 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 163 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 164 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 165 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 166 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 167 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 168 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 169 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 170 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 171 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 172 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 173 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 174 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 175 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 176 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 177 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 178 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 179 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 180 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 181 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 182 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 183 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 184 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 185 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 186 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 187 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 188 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 189 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 190 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 191 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 192 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 193 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 194 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 195 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 196 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 197 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 198 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 201 (BZ)/199 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 199 (BZ)/200 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 200 (BZ)/201 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 202 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 203 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 204 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 205 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 206 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 207 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 208 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 209 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
Hormones,Steroids, Pharmaceuticals and Disinfection Byproducts				
Acetominophen	WS-LC-0024	----------	-------	----------
Atenolol	WS-LC-0024	----------	-------	----------
Azithromycin	WS-LC-0024	----------		
Carbadox	WS-LC-0024	----------	-------	----------
Carbamazepine	WS-LC-0024	----------	-------	----------
Clarithromycin	WS-LC-0024	----------		
Diazepam	WS-LC-0024	----------	-------	----------
Digoxigenin	WS-LC-0024	----------	-------	----------
Digoxin	WS-LC-0024	----------		
Diphenylhydramine	WS-LC-0024	----------	-------	----------
Fluoxetine	WS-LC-0024	----------		
Flumequine	WS-LC-0024	----------	-------	----------
Gemfibrozil	WS-LC-0024	----------		
Ibuprofen	WS-LC-0024	----------	-------	----------
Naproxen	WS-LC-0024	----------	-------	----------
Ormetoprim	WS-LC-0024	----------	-------	----------
Penicillin G	WS-LC-0024	----------		

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Sulfachloropyridazine	WS-LC-0024	----------	-------	----------
Sulfadiazine	WS-LC-0024	----------	-------	----------
Sulfamethizole	WS-LC-0024	----------	-------	----------
Sulfamethoxazole	WS-LC-0024	----------	-------	----------
Sulfathiazole	WS-LC-0024	----------	-------	----------
Thiabendazole	WS-LC-0024	----------		
Trimethoprim	WS-LC-0024	----------		
Tris (2-chloro-2-propyl)phosphate (TCPP)	WS-LC-0024	----------	-------	----------
Warfarin	WS-LC-0024	----------	-------	----------

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

TESTAMERICA LABORATORIES
WEST SACRAMENTO

West Sacramento, CA

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
CORPORATE SEAL 1978
DISTRICT OF COLUMBIA
A2LA

Presented this 15th day of December 2009.

President & CEO
For the Accreditation Council
Certificate Number 2928.01
Valid to April 30, 2012
Revised March 16, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

LABORATORY ACCREDITATION BUREAU

Certificate of Accreditation

ISO/IEC 17025:2005 ***Certificate Number L2226***

Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228

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

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

Accreditation Granted through: November 30, 2012

R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 30th of November 2009

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements
Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

LABORATORY ACCREDITATION BUREAU

Certificate # L2226

Scope of Accreditation For Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228
Marcia K. McGinnity
1-877-345-1113

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Empirical Laboratories, LLC to perform the following tests:

Accreditation granted through: **November 30, 2012**

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trimethylbenzene
GC/MS	8260B	1,3,5-Trimethylbenzene
GC/MS	8260B	1,2-Dibromoethane (EDB)
GC/MS	8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane (EDC)
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Benzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Carbon Disulfide
GC/MS	8260B	Carbon Tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Isopropylbenzene (Cumene)
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methylene Chloride, or Dichloromethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	Tetrachloroethene (PCE; PERC)
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene (TCE)
GC/MS	8260B	Trichlorofluoromethane (CFC-11)
GC/MS	8260B	Vinyl Chloride (VC)
GC/MS	8260B	Xylenes (Total)
GC/MS	8260B	Acrolein
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Di-isopropyl ether
GC/MS	8260B	ETBE
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Iodomethane
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	t-Butyl alcohol
GC/MS	8260B	tert-Amyl methyl ether
GC/MS	8260B	2-Chloroethyl vinyl ether
GC/MS	8260B	1-Chlorohexane
GC/MS	8260B	Tetrahydrofuran
GC/MS	8260B	Vinyl acetate
GC/MS	8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	8270C/D	1,2-Dichlorobenzene
GC/MS	8270C/D	1,3-Dichlorobenzene
GC/MS	8270C/D	1,4-Dichlorobenzene
GC/MS	8270C/D	2,4,5-Trichlorophenol
GC/MS	8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	8270C/D	2,4-Dimethylphenol
GC/MS	8270C/D	2,4-Dinitrophenol
GC/MS	8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	8270C/D	2,6-Dichlorophenol
GC/MS	8270C/D	2,6-Dinitrotoluene
GC/MS	8270C/D	1,2-Diphenylhydrazine
GC/MS	8270C/D	2-Chloronaphthalene
GC/MS	8270C/D	2-Chlorophenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	2-Methylnaphthalene
GC/MS	8270C/D	2-Methylphenol (o-Cresol)
GC/MS	8270C/D	2-Nitroaniline
GC/MS	8270C/D	2-Nitrophenol (ONP)
GC/MS	8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	8270C/D	3-Methylphenol
GC/MS	8270C/D	3-Nitroaniline
GC/MS	8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	8270C/D	4-Bromophenyl phenyl ether
GC/MS	8270C/D	4-Chloro-3-methylphenol
GC/MS	8270C/D	4-Chloroaniline
GC/MS	8270C/D	4-Chlorophenyl phenyl ether
GC/MS	8270C/D	4-Methylphenol (p-Cresol)
GC/MS	8270C/D	4-Nitroaniline (PNA)
GC/MS	8270C/D	4-Nitrophenol (PNP)
GC/MS	8270C/D	Acenaphthene
GC/MS	8270C/D	Acenaphthylene
GC/MS	8270C/D	Acetaphenone
GC/MS	8270C/D	Anthracene
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)pyrene
GC/MS	8270C/D	Benzo(b)fluoranthene
GC/MS	8270C/D	Benzo(g,h,i)perylene
GC/MS	8270C/D	Benzo(k)fluoranthene
GC/MS	8270C/D	Benzyl alcohol
GC/MS	8270C/D	Benzoic Acid
GC/MS	8270C/D	bis(2-Chloroethoxy)methane
GC/MS	8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	8270C/D	Carbazole
GC/MS	8270C/D	Chrysene
GC/MS	8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	8270C/D	Dibenz(a,h)anthracene
GC/MS	8270C/D	Dibenzofuran (DBF)
GC/MS	8270C/D	Diethyl phthalate (DEP)
GC/MS	8270C/D	Dimethyl phthalate (DMP)
GC/MS	8270C/D	Fluoranthene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	Fluorene
GC/MS	8270C/D	Hexachlorobenzene (HCB)
GC/MS	8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	8270C/D	Hexachloroethane (HCE)
GC/MS	8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	8270C/D	Isophorone
GC/MS	8270C/D	N-Nitrosodimethylamine
GC/MS	8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	8270C/D	Naphthalene
GC/MS	8270C/D	Nitrobenzene
GC/MS	8270C/D	Pentachlorophenol
GC/MS	8270C/D	Phenanthrene
GC/MS	8270C/D	Phenol
GC/MS	8270C/D	Pyrene
GC/MS	8270C/D	Pyridine
GC/MS	8270C/D	1,2,4-Trichlorobenzene
GC/MS	8270C/D	1,1'-Biphenyl
GC/MS	8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	8270C/D	1,4-Dioxane
GC/MS	8270C/D	1-Methylnaphthalene
GC/MS	8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	8270C/D	Aniline
GC/MS	8270C/D	Atrazine
GC/MS	8270C/D	Benzaldehyde
GC/MS	8270C/D	Benzidine
GC/MS	8270C/D	7,12-Dimethylbenz(a)anthracene
GC/MS	8270C/D	Caprolactam
GC/ECD	8081A/B	4,4'-DDD
GC/ECD	8081A/B	4,4'-DDE
GC/ECD	8081A/B	4,4'-DDT
GC/ECD	8081A/B	Aldrin
GC/ECD	8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	8081A/B	alpha-Chlordane
GC/ECD	8081A/B	beta-BHC (beta-HCH)
GC/ECD	8081A/B	delta-BHC (delta-HCH)
GC/ECD	8081A/B	Dieldrin
GC/ECD	8081A/B	Endosulfan I

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	8081A/B	Endosulfan II
GC/ECD	8081A/B	Endosulfan sulfate
GC/ECD	8081A/B	Endrin
GC/ECD	8081A/B	Endrin aldehyde
GC/ECD	8081A/B	Endrin ketone
GC/ECD	8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	8081A/B	gamma-Chlordane
GC/ECD	8081A/B	Heptachlor
GC/ECD	8081A/B	Heptachlor epoxide
GC/ECD	8081A/B	Methoxychlor
GC/ECD	8081A/B	Chlordane
GC/ECD	8081A/B	Toxaphene
GC/ECD	8082 /A	Aroclor-1016
GC/ECD	8082 /A	Aroclor-1221
GC/ECD	8082 /A	Aroclor-1232
GC/ECD	8082 /A	Aroclor-1242
GC/ECD	8082 /A	Aroclor-1248
GC/ECD	8082 /A	Aroclor-1254
GC/ECD	8082 /A	Aroclor-1260
GC/ECD	8151A	2,4,5-T
GC/ECD	8151A	2,4,5-TP (Silvex)
GC/ECD	8151A	2,4-D
GC/ECD	8151A	2,4-DB
GC/ECD	8151A	Dalapon
GC/ECD	8151A	Dicamba
GC/ECD	8151A	Dichlorprop
GC/ECD	8151A	Dinoseb
GC/ECD	8151A	MCPA
GC/ECD	8151A	MCPP (Mecoprop)
HPLC/UV	8330A	1,3,5-Trinitrobenzene
HPLC/UV	8330A	1,3-Dinitrobenzene
HPLC/UV	8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330A	2,6-Dinitrotoluene
HPLC/UV	8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330A	2-Nitrotoluene (ONT)
HPLC/UV	8330A	3-Nitrotoluene
HPLC/UV	8330A	4-Amino-2,6-dinitrotoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC/UV	8330A	4-Nitrotoluene (PNT)
HPLC/UV	8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330A	Nitroglycerin
HPLC/UV	8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330A	3,5-Dinitroaniline
HPLC/UV	8330A	Nitrobenzene
HPLC/UV	8330A	PETN
HPLC/UV	8330A	Nitroguanidine
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	8015B	TPH DRO
GC/FID	8015B	TPH GRO
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/ECD	8011	1,2-Dibromoethane (EDB)
GC/ECD	8011	1,2-Dibromo-3-chloropropane (DBCP)
HPLC/MS	6850	Perchlorate
ICP	6010B/C	Aluminum
ICP	6010B/C	Antimony
ICP	6010B/C	Arsenic
ICP	6010B/C	Barium
ICP	6010B/C	Beryllium
ICP	6010B/C	Cadmium
ICP	6010B/C	Calcium
ICP	6010B/C	Chromium, total
ICP	6010B/C	Cobalt
ICP	6010B/C	Copper
ICP	6010B/C	Iron
ICP	6010B/C	Lead
ICP	6010B/C	Magnesium
ICP	6010B/C	Manganese
CVAA	7470A	Mercury
ICP	6010B/C	Nickel
ICP	6010B/C	Potassium
ICP	6010B/C	Selenium
ICP	6010B/C	Silver
ICP	6010B/C	Sodium
ICP	6010B/C	Thallium
ICP	6010B/C	Vanadium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP	6010B/C	Zinc
ICP	6010B/C	Molybdenum
ICP	6010B/C	Tin
ICP	6010B/C	Strontium
ICP	6010B/C	Titanium
IC	300.0	Chloride
IC	300.0	Fluoride
IC	300.0	Nitrate
IC	300.0	Nitrite
IC	300.0	Sulfate
IC	9056A	Chloride
IC	9056A	Fluoride
IC	9056A	Nitrate
IC	9056A	Nitrite
IC	9056A	Sulfate
Titration	SM 2320B 20th ed.	Alkalinity
ISE	SM 4500 B, D, 20th ed.	Ammonia
UV/Vis	7196A	Hexavalent Chromium
Colorimetric	353.2	Nitrocellulose
Colorimetric	353.2	Nitrate/Nitrite
Titration	Chap.7, Sect. 7.3 Mod.	Reactive Sulfide
Titration	SM 4500 S-2CF, 20th edition	Sulfide
UV/Vis	SM 4500 P B5, E, 20th edition	Total Phosphorus (as P)
UV/Vis	SM 4500 PE, 20th edition	Ortho-Phosphate (as P)
TOC	9060A/SM5310C, 20th edition	Total Organic Carbon
Gravimetric	SM 2540C, 20th edition	TDS
Colorimetric	9012A/B	Cyanide
Physical	1010A	Ignitability
Physical	9095B	Paint Filter
Probe	9040B/C	pH
Preparation	**Method**	**Type**
Preparation	1311	TCLP
Preparation	3005A	Metals digestion
Preparation	3010A	Metals digestion
Preparation	3510C	Organics Liquid Extraction
Preparation	5030A/B	Purge and Trap Water

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trimethylbenzene
GC/MS	8260B	1,3,5-Trimethylbenzene
GC/MS	8260B	1,2-Dibromoethane (EDB)
GC/MS	8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane (EDC)
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3-Dichlorobenzene
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Benzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Carbon Disulfide
GC/MS	8260B	Carbon Tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Isopropylbenzene (Cumene)
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methylene Chloride, or Dichloromethane
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	Tetrachloroethene (PCE; PERC)
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene (TCE)
GC/MS	8260B	Trichlorofluoromethane (CFC-11)
GC/MS	8260B	Vinyl Chloride (VC)
GC/MS	8260B	Xylenes (Total)
GC/MS	8260B	Acrolein
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Iodomethane
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	Vinyl acetate
GC/MS	8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	8270C/D	1,2-Dichlorobenzene
GC/MS	8270C/D	1,3-Dichlorobenzene
GC/MS	8270C/D	1,4-Dichlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	2,4,5-Trichlorophenol
GC/MS	8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	8270C/D	2,4-Dimethylphenol
GC/MS	8270C/D	2,4-Dinitrophenol
GC/MS	8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	8270C/D	2,6-Dichlorophenol
GC/MS	8270C/D	2,6-Dinitrotoluene
GC/MS	8270C/D	1,2-Diphenylhydrazine
GC/MS	8270C/D	2-Chloronaphthalene
GC/MS	8270C/D	2-Chlorophenol
GC/MS	8270C/D	2-Methylnaphthalene
GC/MS	8270C/D	2-Methylphenol (o-Cresol)
GC/MS	8270C/D	2-Nitroaniline
GC/MS	8270C/D	2-Nitrophenol (ONP)
GC/MS	8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	8270C/D	3-Methylphenol
GC/MS	8270C/D	3-Nitroaniline
GC/MS	8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	8270C/D	4-Bromophenyl phenyl ether
GC/MS	8270C/D	4-Chloro-3-methylphenol
GC/MS	8270C/D	4-Chloroaniline
GC/MS	8270C/D	4-Chlorophenyl phenyl ether
GC/MS	8270C/D	4-Methylphenol (p-Cresol)
GC/MS	8270C/D	4-Nitroaniline (PNA)
GC/MS	8270C/D	4-Nitrophenol (PNP)
GC/MS	8270C/D	Acenaphthene
GC/MS	8270C/D	Acenaphthylene
GC/MS	8270C/D	Acetaphenone
GC/MS	8270C/D	Anthracene
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)pyrene
GC/MS	8270C/D	Benzo(b)fluoranthene
GC/MS	8270C/D	Benzo(g,h,i)perylene
GC/MS	8270C/D	Benzo(k)fluoranthene
GC/MS	8270C/D	Benzyl alcohol
GC/MS	8270C/D	Benzoic Acid
GC/MS	8270C/D	bis(2-Chloroethoxy)methane
GC/MS	8270C/D	bis(2-Chloroethyl)ether (BCEE)

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	8270C/D	Carbazole
GC/MS	8270C/D	Chrysene
GC/MS	8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	8270C/D	Dibenz(a,h)anthracene
GC/MS	8270C/D	Dibenzofuran (DBF)
GC/MS	8270C/D	Diethyl phthalate (DEP)
GC/MS	8270C/D	Dimethyl phthalate (DMP)
GC/MS	8270C/D	Fluoranthene
GC/MS	8270C/D	Fluorene
GC/MS	8270C/D	Hexachlorobenzene (HCB)
GC/MS	8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	8270C/D	Hexachloroethane (HCE)
GC/MS	8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	8270C/D	Isophorone
GC/MS	8270C/D	N-Nitrosodimethylamine
GC/MS	8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	8270C/D	Naphthalene
GC/MS	8270C/D	Nitrobenzene
GC/MS	8270C/D	Pentachlorophenol
GC/MS	8270C/D	Phenanthrene
GC/MS	8270C/D	Phenol
GC/MS	8270C/D	Pyrene
GC/MS	8270C/D	Pyridine
GC/MS	8270C/D	1,2,4-Trichlorobenzene
GC/MS	8270C/D	1,1'-Biphenyl
GC/MS	8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	8270C/D	1,4-Dioxane
GC/MS	8270C/D	1-Methylnaphthalene
GC/MS	8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	8270C/D	Aniline
GC/MS	8270C/D	Atrazine
GC/MS	8270C/D	Benzaldehyde
GC/MS	8270C/D	Benzidine
GC/MS	8270C/D	Benzo(a)anthracene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	Caprolactam
GC/ECD	8081A/B	4,4'-DDD
GC/ECD	8081A/B	4,4'-DDE
GC/ECD	8081A/B	4,4'-DDT
GC/ECD	8081A/B	Aldrin
GC/ECD	8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	8081A/B	alpha-Chlordane
GC/ECD	8081A/B	beta-BHC (beta-HCH)
GC/ECD	8081A/B	delta-BHC (delta-HCH)
GC/ECD	8081A/B	Dieldrin
GC/ECD	8081A/B	Endosulfan I
GC/ECD	8081A/B	Endosulfan II
GC/ECD	8081A/B	Endosulfan sulfate
GC/ECD	8081A/B	Endrin
GC/ECD	8081A/B	Endrin aldehyde
GC/ECD	8081A/B	Endrin ketone
GC/ECD	8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	8081A/B	gamma-Chlordane
GC/ECD	8081A/B	Heptachlor
GC/ECD	8081A/B	Heptachlor epoxide
GC/ECD	8081A/B	Methoxychlor
GC/ECD	8081A/B	Chlordane
GC/ECD	8081A/B	Toxaphene
GC/ECD	8082 /A	Aroclor-1016
GC/ECD	8082 /A	Aroclor-1221
GC/ECD	8082 /A	Aroclor-1232
GC/ECD	8082 /A	Aroclor-1242
GC/ECD	8082 /A	Aroclor-1248
GC/ECD	8082 /A	Aroclor-1254
GC/ECD	8082 /A	Aroclor-1260
GC/ECD	8151A	2,4,5-T
GC/ECD	8151A	2,4,5-TP (Silvex)
GC/ECD	8151A	2,4-D
GC/ECD	8151A	2,4-DB
GC/ECD	8151A	Dalapon
GC/ECD	8151A	Dicamba
GC/ECD	8151A	Dichlorprop
GC/ECD	8151A	Dinoseb
GC/ECD	8151A	MCPA

Solid and Chemical Materials

Technology	Method	Analyte
GC/ECD	8151A	MCPP (Mecoprop)
HPLC/UV	8330A	1,3,5-Trinitrobenzene
HPLC/UV	8330A	1,3-Dinitrobenzene
HPLC/UV	8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330A	2,6-Dinitrotoluene
HPLC/UV	8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330A	2-Nitrotoluene (ONT)
HPLC/UV	8330A	3-Nitrotoluene
HPLC/UV	8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	8330A	4-Nitrotoluene (PNT)
HPLC/UV	8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330A	Nitroglycerin
HPLC/UV	8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330A	Nitrobenzene
HPLC/UV	8330A	PETN
HPLC/UV	8330A	Nitroguanidine
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	8015B	TPH DRO
GC/FID	8015B	TPH GRO
HPLC/MS	6850	Perchlorate
ICP	6010B/C	Aluminum
ICP	6010B/C	Antimony
ICP	6010B/C	Arsenic
ICP	6010B/C	Barium
ICP	6010B/C	Beryllium
ICP	6010B/C	Cadmium
ICP	6010B/C	Calcium
ICP	6010B/C	Chromium, total
ICP	6010B/C	Cobalt
ICP	6010B/C	Copper
ICP	6010B/C	Iron
ICP	6010B/C	Lead
ICP	6010B/C	Magnesium
ICP	6010B/C	Manganese
CVAA	7471A/B	Mercury
ICP	6010B/C	Nickel
ICP	6010B/C	Potassium

LABORATORY ACCREDITATION BUREAU

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP	6010B/C	Selenium
ICP	6010B/C	Silver
ICP	6010B/C	Sodium
ICP	6010B/C	Thallium
ICP	6010B/C	Vanadium
ICP	6010B/C	Zinc
ICP	6010B/C	Molybdenum
ICP	6010B/C	Tin
ICP	6010B/C	Strontium
ICP	6010B/C	Titanium
UV/Vis	7196A	Hexavalent Chromium
TOC	Lloyd Kahn	Total Organic Carbon
Colorimetric	353.2	Nitrocellulose
Colorimetric	9012A/B	Cyanide
Titration	Chap.7, Sect. 7.3 Mod.	Reactive Sulfide
Titration	9034	Sulfide
Probe	9045D	pH
Preparation	**Method**	**Type**
Preparation	1311	TCLP
Preparation	1312	SPLP
Preparation	NJ Modified 3060A	Hexavalent Chromium
Preparation	3050B	Metals Digestion
Preparation	3546	Organics Microwave Extraction
Preparation	3541	Organics Soxhlet Extraction
Preparation	3550B	Organics Sonication
Preparation	SM 2540B 20th edition	Percent Solids (Percent Moisture)
Preparation	5035 /A	Purge and Trap Solid

Notes:

1) This laboratory offers commercial testing service.

Approved By: _____ Date: March 31, 2010

R. Douglas Leonard
Chief Technical Officer

Issued: 11/30/09 Revised: 2/9/10 Revised: 3/31/10

Appendix D
Ecological Screening Values

APPENDIX D

References for Ecological Screening Values

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Appendix D
Ecological Screening Values (ESVs) for Soil

Analytical Group	Chemical	ESV	Units	Reference	Comments
Explosives	1,3,5-Trinitrobenzene	NSV	--	--	
Explosives	1,3-Dinitrobenzene	NSV	--	--	
Explosives	2,4,6-Trinitrotoluene	10,000	ug/kg	Talmage et al. 1999	Plant
Explosives	2,4-Dinitrotoluene	11,000	ug/kg	NRCC 2006	Plant/Invertebrate
Explosives	2,6-Dinitrotoluene	8,500	ug/kg	NRCC 2006	Plant/Invertebrate
Explosives	2-Amino-4,6-dinitrotoluene	80,000	ug/kg	Talmage et al. 1999	Plant
Explosives	2-Nitrotoluene	NSV	--	--	
Explosives	3,5-Dinitroaniline	NSV	--	--	
Explosives	3-Nitrotoluene	NSV	--	--	
Explosives	4-Amino-2,6-dinitrotoluene	80,000	ug/kg	2-Amino-4,6-dinitrotoluene	Plant
Explosives	4-Nitrotoluene	NSV	--	--	
Explosives	HMX	10,000	ug/kg	Talmage et al. 1999	Invertebrate
Explosives	Nitrobenzene	2,260	ug/kg	Efroymson et al. 1997b	LC50 of 226,000; UF of 100
Explosives	Nitroglycerine	NSV	--	--	
Explosives	Nitroguanidine	NSV	--	--	
Explosives	PETN	NSV	--	--	
Explosives	RDX	10,000	ug/kg	Talmage et al. 1999	Invertebrate
Explosives	Tetryl	10,000	ug/kg	Talmage et al. 1999	Plant
Inorganics	Aluminum	pH < 5.5	--	USEPA 2003a	Eco-SSL
Inorganics	Antimony	78.0	mg/kg	USEPA 2005a	Eco-SSL - Invertebrate
Inorganics	Arsenic	18.0	mg/kg	USEPA 2005b	Eco-SSL - Plant
Inorganics	Barium	330	mg/kg	USEPA 2005c	Eco-SSL - Invertebrate
Inorganics	Beryllium	40.0	mg/kg	USEPA 2005d	Eco-SSL - Invertebrate
Inorganics	Cadmium	32.0	mg/kg	USEPA 2005e	Eco-SSL - Plant
Inorganics	Calcium	NSV	--	--	
Inorganics	Chromium	64.0	mg/kg	CCME 2007	Soil Quality Guideline
Inorganics	Cobalt	13.0	mg/kg	USEPA 2005f	Eco-SSL - Plant
Inorganics	Copper	70.0	mg/kg	USEPA 2007a	Eco-SSL - Plant
Inorganics	Cyanide	15.8	mg/kg	MHSPE 2000	Geomean of target/intervention - complex
Inorganics	Iron	5 < pH > 8	--	USEPA 2003b	Eco-SSL
Inorganics	Lead	120	mg/kg	USEPA 2005g	Eco-SSL - Plant
Inorganics	Magnesium	NSV	--	--	

Appendix D
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Analytical Group	Chemical	ESV	Units	Reference	Comments
Inorganics	Manganese	220	mg/kg	USEPA 2007b	Eco-SSL - Plant
Inorganics	Mercury	0.10	mg/kg	Efroymson et al. 1997b	Invertebrate
Inorganics	Nickel	38.0	mg/kg	USEPA 2007c	Eco-SSL - Plant
Inorganics	Potassium	NSV	--	--	
Inorganics	Selenium	0.52	mg/kg	USEPA 2007d	Eco-SSL - Plant
Inorganics	Silver	560	mg/kg	USEPA 2006a	Eco-SSL - Plant
Inorganics	Sodium	NSV	--	--	
Inorganics	Thallium	1.00	mg/kg	Efroymson et al. 1997a	Plant
Inorganics	Vanadium	130	mg/kg	CCME 2007	Soil Quality Guideline
Inorganics	Zinc	120	mg/kg	USEPA 2007e	Eco-SSL - Invertebrate
Pesticides	4,4'-DDD	583	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	4,4'-DDE	114	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	4,4'-DDT	100	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	Aldrin	3.63	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	alpha-BHC	226	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	alpha-Chlordane	11.0	ug/kg	MHSPE 2000	Geomean of target/intervention
Pesticides	beta-BHC	342	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	delta-BHC	226	ug/kg	alpha-BHC	
Pesticides	Dieldrin	10.5	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	Endosulfan I	6.32	ug/kg	MHSPE 2000	Geomean of target/intervention
Pesticides	Endosulfan II	6.32	ug/kg	MHSPE 2000	Geomean of target/intervention
Pesticides	Endosulfan sulfate	6.32	ug/kg	Endosulfan	
Pesticides	Endrin	1.95	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	Endrin aldehyde	1.95	ug/kg	Endrin	
Pesticides	Endrin ketone	1.95	ug/kg	Endrin	
Pesticides	gamma-BHC (Lindane)	7.75	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
Pesticides	gamma-Chlordane	11.0	ug/kg	MHSPE 2000	Geomean of target/intervention
Pesticides	Heptachlor	52.9	ug/kg	MHSPE 2000	Geomean of target/intervention
Pesticides	Heptachlor epoxide	52.9	ug/kg	Heptachlor	
Pesticides	Methoxychlor	500	ug/kg	Beyer 1990	B value
Pesticides	Toxaphene	500	ug/kg	Beyer 1990	B value
PCBs	Aroclor-1016	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5

Appendix D
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Analytical Group	Chemical	ESV	Units	Reference	Comments
PCBs	Aroclor-1221	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5
PCBs	Aroclor-1232	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5
PCBs	Aroclor-1242	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5
PCBs	Aroclor-1248	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5
PCBs	Aroclor-1254	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5
PCBs	Aroclor-1260	8,000	ug/kg	Efroymson et al. 1997a	Lowest EC50 (40,000); UF of 5
SVOCs	1,1-Biphenyl	13,600	ug/kg	Efroymson et al. 1997a	EC50 (68,000); UF of 5
SVOCs	1,2,4,5-Tetrachlorobenzene	1,000	ug/kg	Beyer 1990	B value
SVOCs	1,2,3-Trichlorobenzene	1,150	ug/kg	Efroymson et al. 1997b	LC50 of 115,000; UF of 100
SVOCs	1,2,4-Trichlorobenzene	1,270	ug/kg	Efroymson et al. 1997b	LC50 of 127,000; UF of 100
SVOCs	1,2-Dichlorobenzene	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	1,3-Dichlorobenzene	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	1,4-Dichlorobenzene	1,280	ug/kg	Efroymson et al. 1997b	LC50 of 128,000; UF of 100
SVOCs	2,2'-Oxybis(1-chloropropane)	NSV	--	--	
SVOCs	2,3,4,6-Tetrachlorophenol	500	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	2,4,5-Trichlorophenol	1,350	ug/kg	Efroymson et al. 1997a	Plant NOEC
SVOCs	2,4,6-Trichlorophenol	580	ug/kg	Efroymson et al. 1997b	LC50 of 58,000; UF of 100
SVOCs	2,4-Dichlorophenol	500	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	2,4-Dimethylphenol	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	2,4-Dinitrophenol	20,000	ug/kg	Efroymson et al. 1997a	Plant NOEC
SVOCs	2,4-Dinitrotoluene	11,000	ug/kg	NRCC 2006	Plant/Invertebrate
SVOCs	2,6-Dinitrotoluene	8,500	ug/kg	NRCC 2006	Plant/Invertebrate
SVOCs	2-Chloronaphthalene	PAH	--	--	
SVOCs	2-Chlorophenol	500	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	2-Methylnaphthalene	PAH	--	--	
SVOCs	2-Methylphenol	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	2-Nitroaniline	NSV	--	--	
SVOCs	2-Nitrophenol	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	3- and 4-Methylphenol	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	3,3'-Dichlorobenzidine	NSV	--	--	
SVOCs	3-Nitroaniline	NSV	--	--	
SVOCs	4,6-Dinitro-2-methylphenol	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC

Appendix D
Ecological Screening Values (ESVs) for Soil

Analytical Group	Chemical	ESV	Units	Reference	Comments
SVOCs	4-Bromophenyl-phenylether	NSV	--	--	
SVOCs	4-Chloro-3-methylphenol	500	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	4-Chloroaniline	500	ug/kg	MHSPE 2000	Geomean of target/intervention
SVOCs	4-Chlorophenyl-phenylether	NSV	--	--	
SVOCs	4-Methylphenol	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
SVOCs	4-Nitroaniline	NSV	--	--	
SVOCs	4-Nitrophenol	380	ug/kg	Efroymson et al. 1997b	LC50 of 38,000; UF of 100
SVOCs	Acenaphthene	PAH	--	--	
SVOCs	Acenaphthylene	PAH	--	--	
SVOCs	Acetophenone	NSV	--	--	
SVOCs	Anthracene	PAH	--	--	
SVOCs	Atrazine	11.9	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
SVOCs	Benzaldehyde	NSV	--	--	
SVOCs	Benzo(a)anthracene	PAH	--	--	
SVOCs	Benzo(a)pyrene	PAH	--	--	
SVOCs	Benzo(b)fluoranthene	PAH	--	--	
SVOCs	Benzo(g,h,i)perylene	PAH	--	--	
SVOCs	Benzo(k)fluoranthene	PAH	--	--	
SVOCs	Benzoic acid	NSV	--	--	
SVOCs	Benzyl alcohol	NSV	--	--	
SVOCs	bis(2-Chloroethoxy)methane	NSV	--	--	
SVOCs	bis(2-Chloroethyl)ether	NSV	--	--	
SVOCs	bis(2-Ethylhexyl)phthalate	30,000	ug/kg	CCME 2007	Plant; IRC
SVOCs	Butylbenzylphthalate	30,000	ug/kg	CCME 2007	Plant; IRC
SVOCs	Caprolactam	NSV	--	--	
SVOCs	Carbazole	NSV	--	--	
SVOCs	Chrysene	PAH	--	--	
SVOCs	Dibenz(a,h)anthracene	PAH	--	--	
SVOCs	Dibenzofuran	NSV	--	--	
SVOCs	Diethylphthalate	26,800	ug/kg	Efroymson et al. 1997a	EC50 (134,000); UF of 5
SVOCs	Dimethyl phthalate	10,640	ug/kg	Efroymson et al. 1997b	LC50 of 1,064,000; UF of 100
SVOCs	Di-n-butylphthalate	40,000	ug/kg	Efroymson et al. 1997a	LOEC (200,000); UF of 5

Appendix D
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Analytical Group	Chemical	ESV	Units	Reference	Comments
SVOCs	Di-n-octylphthalate	30,000	ug/kg	CCME 2007	Plant; IRC
SVOCs	Fluoranthene	PAH	--	--	
SVOCs	Fluorene	PAH	--	--	
SVOCs	Hexachlorobenzene	1,000	ug/kg	Beyer 1990	B value
SVOCs	Hexachlorobutadiene	NSV	--	--	
SVOCs	Hexachlorocyclopentadiene	2,000	ug/kg	Efroymson et al. 1997a	LOEC (10,000); UF of 5
SVOCs	Hexachloroethane	NSV	--	--	
SVOCs	Indeno(1,2,3-cd)pyrene	PAH	--	--	
SVOCs	Isophorone	NSV	--	--	
SVOCs	Naphthalene	PAH	--	--	
SVOCs	Nitrobenzene	2,260	ug/kg	Efroymson et al. 1997b	LC50 of 226,000; UF of 100
SVOCs	n-Nitroso-di-n-propylamine	NSV	--	--	
SVOCs	n-Nitrosodiphenylamine	1,090	ug/kg	Efroymson et al. 1997b	LC50 of 109,000; UF of 100
SVOCs	PAH (HMW)	18,000	ug/kg	USEPA 2007f	Eco-SSL - Invertebrate
SVOCs	PAH (LMW)	29,000	ug/kg	USEPA 2007f	Eco-SSL - Invertebrate
SVOCs	Pentachlorophenol	5,000	ug/kg	USEPA 2007f	Eco-SSL - Plant
SVOCs	Phenanthrene	PAH	--	--	
SVOCs	Phenol	1,880	ug/kg	Efroymson et al. 1997b	LC50 of 188,000; UF of 100
SVOCs	Pyrene	PAH	--	--	
VOCs	1,1,1-Trichloroethane	1,025	ug/kg	MHSPE 2000	Geomean of target/intervention
VOCs	1,1,2,2-Tetrachloroethane	5,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	NSV	--	--	
VOCs	1,1,2-Trichloroethane	2,000	ug/kg	MHSPE 2000	Geomean of target/intervention
VOCs	1,1-Dichloroethane	548	ug/kg	MHSPE 2000	Geomean of target/intervention
VOCs	1,1-Dichloroethene	173	ug/kg	MHSPE 2000	Geomean of target/intervention
VOCs	1,2,3-Trichlorobenzene	1,150	ug/kg	Efroymson et al. 1997b	LC50 of 115,000; UF of 100
VOCs	1,2,4-Trichlorobenzene	1,270	ug/kg	Efroymson et al. 1997b	LC50 of 127,000; UF of 100
VOCs	1,2-Dibromo-3-chloropropane	NSV	--	--	
VOCs	1,2-Dibromoethane	300	ug/kg	CCME 2007	IRC
VOCs	1,2-Dichlorobenzene	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
VOCs	1,2-Dichloroethane	2,190	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	1,2-Dichloropropane	38,800	ug/kg	Efroymson et al. 1997b	LC50 of 3,880,000; UF of 100

Appendix D
Ecological Screening Values (ESVs) for Soil

Analytical Group	Chemical	ESV	Units	Reference	Comments
VOCs	1,3-Dichlorobenzene	1,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
VOCs	1,4-Dichlorobenzene	1,280	ug/kg	Efroymson et al. 1997b	LC50 of 128,000; UF of 100
VOCs	2-Butanone	NSV	--	--	
VOCs	2-Hexanone	NSV	--	--	
VOCs	4-Methyl-2-pentanone	NSV	--	--	
VOCs	Acetone	NSV	--	--	
VOCs	Benzene	1,140	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Bromochloromethane	NSV	--	--	
VOCs	Bromodichloromethane	NSV	--	--	
VOCs	Bromoform	300	ug/kg	CCME 2007	Plant; IRC
VOCs	Bromomethane	NSV	--	--	
VOCs	Carbon disulfide	NSV	--	--	
VOCs	Carbon tetrachloride	3,400	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Chlorobenzene	2,400	ug/kg	Efroymson et al. 1997b	LC50 of 240,000; UF of 100
VOCs	Chloroethane	5,000	ug/kg	CCME 2007	IRC
VOCs	Chloroform	1,844	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Chloromethane	5,000	ug/kg	CCME 2007	IRC
VOCs	cis-1,2-Dichloroethene	447	ug/kg	MHSPE 2000	Geomean of target/intervention
VOCs	cis-1,3-Dichloropropene	5,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
VOCs	Cyclohexane	6,000	ug/kg	Beyer 1990	B value
VOCs	Dibromochloromethane	NSV	--	--	
VOCs	Dichlorodifluoromethane(Freon-12)	NSV	--	--	
VOCs	Ethylbenzene	1,815	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Isopropylbenzene	NSV	--	--	
VOCs	m- and p-Xylene	1,300	ug/kg	Total xylenes	
VOCs	Methyl acetate	NSV	--	--	
VOCs	Methylcyclohexane	NSV	--	--	
VOCs	Methylene chloride	1,250	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Methyl-tert-butyl ether (MTBE)	NSV	--	--	
VOCs	o-Xylene	1,300	ug/kg	Total xylenes	
VOCs	Styrene	64,000	ug/kg	Efroymson et al. 1997a	EC50 (320,000); UF of 5
VOCs	Tetrachloroethene	179	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC

Appendix D
Ecological Screening Values (ESVs) for Soil

Analytical Group	Chemical	ESV	Units	Reference	Comments
VOCs	Toluene	40,000	ug/kg	Efroymson et al. 1997a	EC50 (200,000); UF of 5
VOCs	trans-1,2-Dichloroethene	447	ug/kg	MHSPE 2000	Geomean of target/intervention
VOCs	trans-1,3-Dichloropropene	5,000	ug/kg	Beyer 1990; CCME 2007	B value; IRC
VOCs	Trichloroethene	500	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Trichlorofluoromethane(Freon-11)	NSV	--	--	
VOCs	Vinyl chloride	412	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC
VOCs	Xylene, total	1,300	ug/kg	MHSPE 2000; 2001	Geomean of target/SRC

NSV - No Screening Value

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
Explosives	1,3,5-Trinitrobenzene	Freshwater	2.40	ug/kg	1	Talmage et al. 1999	
Explosives	1,3-Dinitrobenzene	Freshwater	6.70	ug/kg	1	Talmage et al. 1999	
Explosives	2,4,6-Trinitrotoluene	Freshwater	92.0	ug/kg	1	Talmage et al. 1999	
Explosives	2,4-Dinitrotoluene	Freshwater	41.6	ug/kg	1	USEPA 2006b	
Explosives	2,6-Dinitrotoluene	Freshwater	NSV	--		--	
Explosives	2-Amino-4,6-dinitrotoluene	Freshwater	13.2	ug/kg	1	NAVFAC 2007	
Explosives	2-Nitrotoluene	Freshwater	6,204	ug/kg	1	NAVFAC 2007	
Explosives	3,5-Dinitroaniline	Freshwater	NSV	--		--	
Explosives	3-Nitrotoluene	Freshwater	1,922	ug/kg	1	NAVFAC 2007	
Explosives	4-Amino-2,6-dinitrotoluene	Freshwater	23.2	ug/kg	1	NAVFAC 2007	
Explosives	4-Nitrotoluene	Freshwater	4,062	ug/kg	1	USEPA 2006b	
Explosives	HMX	Freshwater	4.74	ug/kg	1	Talmage et al. 1999	
Explosives	Nitrobenzene	Freshwater	1,779	ug/kg	1	NAVFAC 2007	
Explosives	Nitroglycerine	Freshwater	NSV	--		--	
Explosives	Nitroguanidine	Freshwater	NSV	--		--	
Explosives	PETN	Freshwater	NSV	--		--	
Explosives	RDX	Freshwater	12.7	ug/kg	1	Talmage et al. 1999	
Explosives	Tetryl	Freshwater	NSV	--		--	
Inorganics	Aluminum	Freshwater	25,500	mg/kg		Buchman 2008	ARCS TEL
Inorganics	Antimony	Freshwater	3.00	mg/kg		Buchman 2008	UET
Inorganics	Arsenic	Freshwater	9.79	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Barium	Freshwater	20.0	mg/kg		MacDonald et al. 2003	TEC
Inorganics	Beryllium	Freshwater	NSV	--		--	
Inorganics	Cadmium	Freshwater	0.99	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Calcium	Freshwater	NSV	--		--	
Inorganics	Chromium	Freshwater	43.4	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Cobalt	Freshwater	50.0	mg/kg		Persuad et al. 1993	OWDG
Inorganics	Copper	Freshwater	31.6	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Cyanide	Freshwater	NSV	--		--	
Inorganics	Iron	Freshwater	20,000	mg/kg		Persuad et al. 1993	LEL
Inorganics	Lead	Freshwater	35.8	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Magnesium	Freshwater	NSV	--		--	

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
Inorganics	Manganese	Freshwater	460	mg/kg		Persuad et al. 1993	LEL
Inorganics	Mercury	Freshwater	0.18	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Nickel	Freshwater	22.7	mg/kg		MacDonald et al. 2000a	TEC
Inorganics	Potassium	Freshwater	NSV	--		--	
Inorganics	Selenium	Freshwater	2.00	mg/kg		USEPA 2006b	
Inorganics	Silver	Freshwater	1.00	mg/kg		MacDonald et al. 2003	TEC
Inorganics	Sodium	Freshwater	NSV	--		--	
Inorganics	Thallium	Freshwater	NSV	--		--	
Inorganics	Vanadium	Freshwater	NSV	--		--	
Inorganics	Zinc	Freshwater	121	mg/kg		MacDonald et al. 2000a	TEC
Pesticides	4,4'-DDD	Freshwater	4.88	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	4,4'-DDE	Freshwater	3.16	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	4,4'-DDT	Freshwater	4.16	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	Aldrin	Freshwater	2.00	ug/kg		Persuad et al. 1993	LEL
Pesticides	alpha-BHC	Freshwater	6.00	ug/kg		Persuad et al. 1993	LEL
Pesticides	alpha-Chlordane	Freshwater	3.24	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	beta-BHC	Freshwater	5.00	ug/kg		Persuad et al. 1993	LEL
Pesticides	delta-BHC	Freshwater	3.00	ug/kg		Persuad et al. 1993	LEL
Pesticides	Dieldrin	Freshwater	1.90	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	Endosulfan I	Freshwater	2.90	ug/kg	1	USEPA 1996	
Pesticides	Endosulfan II	Freshwater	14.0	ug/kg	1	USEPA 1996	
Pesticides	Endosulfan sulfate	Freshwater	5.40	ug/kg	1	USEPA 1996	
Pesticides	Endrin	Freshwater	2.22	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	Endrin aldehyde	Freshwater	2.22	ug/kg		Endrin	
Pesticides	Endrin ketone	Freshwater	2.22	ug/kg		Endrin	
Pesticides	gamma-BHC (Lindane)	Freshwater	2.37	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	gamma-Chlordane	Freshwater	3.24	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	Heptachlor	Freshwater	68.0	ug/kg	1	Jones et al. 1997	
Pesticides	Heptachlor epoxide	Freshwater	2.47	ug/kg		MacDonald et al. 2000a	TEC
Pesticides	Methoxychlor	Freshwater	19.0	ug/kg	1	USEPA 1996	
Pesticides	Toxaphene	Freshwater	28.0	ug/kg	1	USEPA 1996	
PCBs	Aroclor-1016	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
PCBs	Aroclor-1221	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC
PCBs	Aroclor-1232	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC
PCBs	Aroclor-1242	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC
PCBs	Aroclor-1248	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC
PCBs	Aroclor-1254	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC
PCBs	Aroclor-1260	Freshwater	59.8	ug/kg		MacDonald et al. 2000b	TEC
SVOCs	1,1-Biphenyl	Freshwater	1,100	ug/kg	1	USEPA 1996	
SVOCs	1,2,4,5-Tetrachlorobenzene	Freshwater	1,093	ug/kg	1	USEPA 2006b	
SVOCs	1,2,3-Trichlorobenzene	Freshwater	858	ug/kg	1	USEPA 2006b	
SVOCs	1,2,4-Trichlorobenzene	Freshwater	9,200	ug/kg	1	USEPA 1996	
SVOCs	1,2-Dichlorobenzene	Freshwater	340	ug/kg	1	USEPA 1996	
SVOCs	1,3-Dichlorobenzene	Freshwater	1,700	ug/kg	1	USEPA 1996	
SVOCs	1,4-Dichlorobenzene	Freshwater	350	ug/kg	1	USEPA 1996	
SVOCs	2,2'-Oxybis(1-chloropropane)	Freshwater	NSV	--		--	
SVOCs	2,3,4,6-Tetrachlorophenol	Freshwater	284	ug/kg	1	USEPA 2006b	
SVOCs	2,4,5-Trichlorophenol	Freshwater	NSV	--		--	
SVOCs	2,4,6-Trichlorophenol	Freshwater	213	ug/kg	1	USEPA 2006b	
SVOCs	2,4-Dichlorophenol	Freshwater	117	ug/kg	1	USEPA 2006b	
SVOCs	2,4-Dimethylphenol	Freshwater	NSV	--		--	
SVOCs	2,4-Dinitrophenol	Freshwater	NSV	--		--	
SVOCs	2,4-Dinitrotoluene	Freshwater	41.6	ug/kg	1	USEPA 2006b	
SVOCs	2,6-Dinitrotoluene	Freshwater	NSV	--		--	
SVOCs	2-Chloronaphthalene	Freshwater	NSV	--		--	
SVOCs	2-Chlorophenol	Freshwater	31.2	ug/kg	1	USEPA 2006b	
SVOCs	2-Methylnaphthalene	Freshwater	NSV	--		--	
SVOCs	2-Methylphenol	Freshwater	NSV	--		--	
SVOCs	2-Nitroaniline	Freshwater	NSV	--		--	
SVOCs	2-Nitrophenol	Freshwater	NSV	--		--	
SVOCs	3- and 4-Methylphenol	Freshwater	NSV	--		--	
SVOCs	3,3'-Dichlorobenzidine	Freshwater	127	ug/kg	1	USEPA 2006b	
SVOCs	3-Nitroaniline	Freshwater	NSV	--		--	
SVOCs	4,6-Dinitro-2-methylphenol	Freshwater	NSV	--		--	

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
SVOCs	4-Bromophenyl-phenylether	Freshwater	1,300	ug/kg	1	USEPA 1996	
SVOCs	4-Chloro-3-methylphenol	Freshwater	NSV	--		--	
SVOCs	4-Chloroaniline	Freshwater	NSV	--		--	
SVOCs	4-Chlorophenyl-phenylether	Freshwater	NSV	--		--	
SVOCs	4-Methylphenol	Freshwater	NSV	--		--	
SVOCs	4-Nitroaniline	Freshwater	NSV	--		--	
SVOCs	4-Nitrophenol	Freshwater	NSV	--		--	
SVOCs	Acenaphthene	Freshwater	290	ug/kg		Buchman 2008	UET
SVOCs	Acenaphthylene	Freshwater	160	ug/kg		Buchman 2008	UET
SVOCs	Acetophenone	Freshwater	NSV	--		--	
SVOCs	Anthracene	Freshwater	57.2	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Atrazine	Freshwater	6.62	ug/kg	1	USEPA 2006b	
SVOCs	Benzaldehyde	Freshwater	NSV	--		--	
SVOCs	Benzo(a)anthracene	Freshwater	108	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Benzo(a)pyrene	Freshwater	150	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Benzo(b)fluoranthene	Freshwater	240	ug/kg		Benzo(k)fluoanthene value	
SVOCs	Benzo(g,h,i)perylene	Freshwater	170	ug/kg		Persuad et al. 1993	LEL
SVOCs	Benzo(k)fluoranthene	Freshwater	240	ug/kg		Persuad et al. 1993	LEL
SVOCs	Benzoic acid	Freshwater	NSV	--		--	
SVOCs	Benzyl alcohol	Freshwater	NSV	--		--	
SVOCs	bis(2-Chloroethoxy)methane	Freshwater	NSV	--		--	
SVOCs	bis(2-Chloroethyl)ether	Freshwater	NSV	--		--	
SVOCs	bis(2-Ethylhexyl)phthalate	Freshwater	750	ug/kg		Buchman 2008	UET
SVOCs	Butylbenzylphthalate	Freshwater	11,000	ug/kg	1	USEPA 1996	
SVOCs	Caprolactam	Freshwater	NSV	--		--	
SVOCs	Carbazole	Freshwater	NSV	--		--	
SVOCs	Chrysene	Freshwater	166	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Dibenz(a,h)anthracene	Freshwater	33.0	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Dibenzofuran	Freshwater	5,100	ug/kg		Buchman 2008	UET
SVOCs	Diethylphthalate	Freshwater	630	ug/kg		MacDonald et al. 2003	TEC
SVOCs	Dimethyl phthalate	Freshwater	NSV	--		--	
SVOCs	Di-n-butylphthalate	Freshwater	110	ug/kg		Buchman 2008	UET

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
SVOCs	Di-n-octylphthalate	Freshwater	NSV	--		--	
SVOCs	Fluoranthene	Freshwater	423	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Fluorene	Freshwater	77.4	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Hexachlorobenzene	Freshwater	20.0	ug/kg		Persuad et al. 1993	LEL
SVOCs	Hexachlorobutadiene	Freshwater	550	ug/kg	1	MacDonald et al. 2003	
SVOCs	Hexachlorocyclopentadiene	Freshwater	NSV	--		--	
SVOCs	Hexachloroethane	Freshwater	1,000	ug/kg	1	USEPA 1996	
SVOCs	Indeno(1,2,3-cd)pyrene	Freshwater	200	ug/kg		Persuad et al. 1993	LEL
SVOCs	Isophorone	Freshwater	NSV	--		--	
SVOCs	Naphthalene	Freshwater	176	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Nitrobenzene	Freshwater	1,779	ug/kg	1	NAVFAC 2007	
SVOCs	n-Nitroso-di-n-propylamine	Freshwater	NSV	--		--	
SVOCs	n-Nitrosodiphenylamine	Freshwater	2,684	ug/kg	1	USEPA 2006b	
SVOCs	PAH (total)	Freshwater	3,553	ug/kg		Jones et al. 1997	ARCS TEC
SVOCs	PAH (HMW)	Freshwater	2,900	ug/kg		Jones et al. 1997	ARCS TEC
SVOCs	PAH (LMW)	Freshwater	786	ug/kg		Jones et al. 1997	ARCS TEC
SVOCs	Pentachlorophenol	Freshwater	504	ug/kg	1	USEPA 2006b	
SVOCs	Phenanthrene	Freshwater	204	ug/kg		MacDonald et al. 2000a	TEC
SVOCs	Phenol	Freshwater	48.0	ug/kg		Buchman 2008	UET
SVOCs	Pyrene	Freshwater	195	ug/kg		MacDonald et al. 2000a	TEC
VOCs	1,1,1-Trichloroethane	Freshwater	170	ug/kg	1	USEPA 1996	
VOCs	1,1,2,2-Tetrachloroethane	Freshwater	940	ug/kg	1	USEPA 1996	
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	Freshwater	NSV	--		--	
VOCs	1,1,2-Trichloroethane	Freshwater	1,200	ug/kg	1	Jones et al. 1997	
VOCs	1,1-Dichloroethane	Freshwater	27.0	ug/kg	1	Jones et al. 1997	
VOCs	1,1-Dichloroethene	Freshwater	31.0	ug/kg	1	Jones et al. 1997	
VOCs	1,2,3-Trichlorobenzene	Freshwater	858	ug/kg	1	USEPA 2006b	
VOCs	1,2,4-Trichlorobenzene	Freshwater	9,200	ug/kg	1	USEPA 1996	
VOCs	1,2-Dibromo-3-chloropropane	Freshwater	NSV	--		--	
VOCs	1,2-Dibromoethane	Freshwater	NSV	--		--	
VOCs	1,2-Dichlorobenzene	Freshwater	340	ug/kg	1	USEPA 1996	
VOCs	1,2-Dichloroethane	Freshwater	250	ug/kg	1	Jones et al. 1997	

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
VOCs	1,2-Dichloropropane	Freshwater	NSV	--		--	
VOCs	1,3-Dichlorobenzene	Freshwater	1,700	ug/kg	1	USEPA 1996	
VOCs	1,4-Dichlorobenzene	Freshwater	350	ug/kg	1	USEPA 1996	
VOCs	2-Butanone	Freshwater	NSV	--		--	
VOCs	2-Hexanone	Freshwater	NSV	--		--	
VOCs	4-Methyl-2-pentanone	Freshwater	NSV	--		--	
VOCs	Acetone	Freshwater	NSV	--		--	
VOCs	Benzene	Freshwater	57.0	ug/kg	1	USEPA 1996	
VOCs	Bromochloromethane	Freshwater	NSV	--		--	
VOCs	Bromodichloromethane	Freshwater	NSV	--		--	
VOCs	Bromoform	Freshwater	650	ug/kg	1	USEPA 1996	
VOCs	Bromomethane	Freshwater	NSV	--		--	
VOCs	Carbon disulfide	Freshwater	0.85	ug/kg	1	Jones et al. 1997	
VOCs	Carbon tetrachloride	Freshwater	1,200	ug/kg	1	USEPA 1996	
VOCs	Chlorobenzene	Freshwater	820	ug/kg	1	USEPA 1996	
VOCs	Chloroethane	Freshwater	NSV	--		--	
VOCs	Chloroform	Freshwater	22.0	ug/kg	1	Jones et al. 1997	
VOCs	Chloromethane	Freshwater	NSV	--		--	
VOCs	cis-1,2-Dichloroethene	Freshwater	400	ug/kg	1	Jones et al. 1997	
VOCs	cis-1,3-Dichloropropene	Freshwater	0.051	ug/kg	1	Jones et al. 1997	
VOCs	Cyclohexane	Freshwater	NSV	--		--	
VOCs	Dibromochloromethane	Freshwater	NSV	--		--	
VOCs	Dichlorodifluoromethane(Freon-12)	Freshwater	NSV	--		--	
VOCs	Ethylbenzene	Freshwater	3,600	ug/kg	1	USEPA 1996	
VOCs	Isopropylbenzene (Cumene)	Freshwater	86.0	ug/kg	1	USEPA 2006b	
VOCs	m- and p-Xylene	Freshwater	160	ug/kg	1	Jones et al. 1997	Total xylenes
VOCs	Methyl acetate	Freshwater	NSV	--		--	
VOCs	Methylcyclohexane	Freshwater	NSV	--		--	
VOCs	Methylene chloride	Freshwater	370	ug/kg	1	Jones et al. 1997	
VOCs	Methyl-tert-butyl ether (MTBE)	Freshwater	NSV	--		--	
VOCs	o-Xylene	Freshwater	160	ug/kg	1	Jones et al. 1997	Total xylenes
VOCs	Styrene	Freshwater	559	ug/kg	1	USEPA 2006b	

Appendix D
Ecological Screening Values (ESVs) for Freshwater Sediment

Analytical Group	Chemical	Type	ESV	Units	TOC (%)	Reference	Comment
VOCs	Tetrachloroethene	Freshwater	530	ug/kg	1	USEPA 1996	
VOCs	Toluene	Freshwater	670	ug/kg	1	USEPA 1996	
VOCs	trans-1,2-Dichloroethene	Freshwater	400	ug/kg	1	Jones et al. 1997	
VOCs	trans-1,3-Dichloropropene	Freshwater	0.051	ug/kg	1	Jones et al. 1997	
VOCs	Trichloroethene	Freshwater	1,600	ug/kg	1	USEPA 1996	
VOCs	Trichlorofluoromethane(Freon-11)	Freshwater	NSV	--		--	
VOCs	Vinyl chloride	Freshwater	NSV	--		--	
VOCs	Xylene, total	Freshwater	160	ug/kg	1	Jones et al. 1997	

NSV - No Screening Value

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
Explosives	1,3,5-Trinitrobenzene	Freshwater	11.0	ug/L			Talmage et al. 1999	SCV
Explosives	1,3-Dinitrobenzene	Freshwater	17.0	ug/L			Talmage et al. 1999	SCV
Explosives	2,4,6-Trinitrotoluene	Freshwater	93.0	ug/L			Talmage et al. 1999	SCV
Explosives	2,4-Dinitrotoluene	Freshwater	44.0	ug/L			USEPA 2006b	SCV
Explosives	2,6-Dinitrotoluene	Freshwater	81.0	ug/L			USEPA 2006b	SCV
Explosives	2-Amino-4,6-dinitrotoluene	Freshwater	19.0	ug/L			Talmage et al. 1999	SCV
Explosives	2-Nitrotoluene	Freshwater	3,400	ug/L			NAVFAC 2007	
Explosives	3,5-Dinitroaniline	Freshwater	59.0	ug/L			Talmage et al. 1999	SCV
Explosives	3-Nitrotoluene	Freshwater	750	ug/L			USEPA 2006b	
Explosives	4-Amino-2,6-dinitrotoluene	Freshwater	19.0	ug/L			2-Amino-4,6-dinitrotoluene	
Explosives	4-Nitrotoluene	Freshwater	1,900	ug/L			USEPA 2006b	
Explosives	HMX	Freshwater	330	ug/L			Talmage et al. 1999	SCV
Explosives	Nitrobenzene	Freshwater	270	ug/L			USEPA 2001	Acute/10
Explosives	Nitroglycerine	Freshwater	138	ug/L			USEPA 2006b	
Explosives	Nitroguanidine	Freshwater	220	ug/L			NAVFAC 2007	NOEC
Explosives	PETN	Freshwater	85,000	ug/L			USEPA 2006b	
Explosives	RDX	Freshwater	186	ug/L			Talmage et al. 1999	SCV
Explosives	Tetryl	Freshwater	NSV	--			--	
Filtered Metals	Aluminum	Freshwater	87.0	ug/L			USEPA 2009	AWQC
Filtered Metals	Antimony	Freshwater	30.0	ug/L			Suter and Tsao 1996	FCV
Filtered Metals	Arsenic	Freshwater	150	ug/L			USEPA 2009	AWQC
Filtered Metals	Barium	Freshwater	4.00	ug/L			Suter and Tsao 1996	SCV
Filtered Metals	Beryllium	Freshwater	0.66	ug/L			Suter and Tsao 1996	SCV
Filtered Metals	Cadmium	Freshwater	0.25	ug/L	100		USEPA 2009	AWQC
Filtered Metals	Calcium	Freshwater	NSV	--			--	
Filtered Metals	Chromium	Freshwater	11.0	ug/L			USEPA 2009	AWQC
Filtered Metals	Cobalt	Freshwater	23.0	ug/L			Suter and Tsao 1996	SCV
Filtered Metals	Copper	Freshwater	8.96	ug/L	100		USEPA 2006c	AWQC
Filtered Metals	Iron	Freshwater	1,000	ug/L			USEPA 2009	AWQC
Filtered Metals	Lead	Freshwater	2.52	ug/L	100		USEPA 2009	AWQC
Filtered Metals	Magnesium	Freshwater	NSV	--			--	
Filtered Metals	Manganese	Freshwater	120	ug/L			Suter and Tsao 1996	SCV

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
Filtered Metals	Mercury	Freshwater	0.77	ug/L			USEPA 2009	AWQC
Filtered Metals	Nickel	Freshwater	52.0	ug/L	100		USEPA 2009	AWQC
Filtered Metals	Potassium	Freshwater	NSV	--			--	
Filtered Metals	Selenium	Freshwater	4.61	ug/L			USEPA 2009	AWQC
Filtered Metals	Silver	Freshwater	0.36	ug/L			Suter and Tsao 1996	SCV
Filtered Metals	Sodium	Freshwater	NSV	--			--	
Filtered Metals	Thallium	Freshwater	12.0	ug/L			Suter and Tsao 1996	SCV
Filtered Metals	Vanadium	Freshwater	20.0	ug/L			Suter and Tsao 1996	SCV
Filtered Metals	Zinc	Freshwater	118	ug/L	100		USEPA 2009	AWQC
Inorganics	Aluminum	Freshwater	87.0	ug/L			USEPA 2009	AWQC
Inorganics	Antimony	Freshwater	30.0	ug/L			Suter and Tsao 1996	FCV
Inorganics	Arsenic	Freshwater	150	ug/L			USEPA 2009	AWQC
Inorganics	Barium	Freshwater	4.00	ug/L			Suter and Tsao 1996	SCV
Inorganics	Beryllium	Freshwater	0.66	ug/L			Suter and Tsao 1996	SCV
Inorganics	Cadmium	Freshwater	0.27	ug/L	100		USEPA 2009	AWQC
Inorganics	Calcium	Freshwater	NSV	--			--	
Inorganics	Chromium	Freshwater	11.4	ug/L			USEPA 2009	AWQC
Inorganics	Cobalt	Freshwater	23.0	ug/L			Suter and Tsao 1996	SCV
Inorganics	Copper	Freshwater	9.33	ug/L	100		USEPA 2006c	AWQC
Inorganics	Cyanide	Freshwater	5.20	ug/L			USEPA 2009	AWQC
Inorganics	Iron	Freshwater	1,000	ug/L			USEPA 2009	AWQC
Inorganics	Lead	Freshwater	3.18	ug/L	100		USEPA 2009	AWQC
Inorganics	Magnesium	Freshwater	NSV	--			--	
Inorganics	Manganese	Freshwater	120	ug/L			Suter and Tsao 1996	SCV
Inorganics	Mercury	Freshwater	0.91	ug/L			USEPA 2009	AWQC
Inorganics	Nickel	Freshwater	52.2	ug/L	100		USEPA 2009	AWQC
Inorganics	Potassium	Freshwater	NSV	--			--	
Inorganics	Selenium	Freshwater	5.00	ug/L			USEPA 2009	AWQC
Inorganics	Silver	Freshwater	0.36	ug/L			Suter and Tsao 1996	SCV
Inorganics	Sodium	Freshwater	NSV	--			--	
Inorganics	Thallium	Freshwater	12.0	ug/L			Suter and Tsao 1996	SCV
Inorganics	Vanadium	Freshwater	20.0	ug/L			Suter and Tsao 1996	SCV

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
Inorganics	Zinc	Freshwater	120	ug/L	100		USEPA 2009	AWQC
Pesticides	4,4'-DDD	Freshwater	0.011	ug/L			Suter and Tsao 1996	SCV
Pesticides	4,4'-DDE	Freshwater	0.013	ug/L			DDT value	
Pesticides	4,4'-DDT	Freshwater	0.013	ug/L			USEPA 1996	SCV
Pesticides	Aldrin	Freshwater	0.30	ug/L			USEPA 2001	Acute AWQC / 10
Pesticides	alpha-BHC	Freshwater	2.20	ug/L			Suter and Tsao 1996	SCV
Pesticides	alpha-Chlordane	Freshwater	0.17	ug/L			Suter and Tsao 1996	SCV
Pesticides	beta-BHC	Freshwater	2.20	ug/L			Suter and Tsao 1996	SCV
Pesticides	delta-BHC	Freshwater	2.20	ug/L			Suter and Tsao 1996	SCV
Pesticides	Dieldrin	Freshwater	0.056	ug/L			USEPA 2009	AWQC - FCV
Pesticides	Endosulfan I	Freshwater	0.056	ug/L			USEPA 2009	AWQC
Pesticides	Endosulfan II	Freshwater	0.056	ug/L			USEPA 2009	AWQC
Pesticides	Endosulfan sulfate	Freshwater	0.056	ug/L			Endosulfan value	
Pesticides	Endrin	Freshwater	0.036	ug/L			USEPA 2009	AWQC - FCV
Pesticides	Endrin aldehyde	Freshwater	0.15	ug/L			Buchman 2008	
Pesticides	Endrin ketone	Freshwater	0.15	ug/L			Endrin aldehyde value	
Pesticides	gamma-BHC (Lindane)	Freshwater	0.08	ug/L			USEPA 1996	FCV
Pesticides	gamma-Chlordane	Freshwater	0.17	ug/L			Suter and Tsao 1996	SCV
Pesticides	Heptachlor	Freshwater	0.0069	ug/L			USEPA 1996	SCV
Pesticides	Heptachlor epoxide	Freshwater	0.0069	ug/L			Heptachlor value	
Pesticides	Methoxychlor	Freshwater	0.03	ug/L			USEPA 2009	AWQC
Pesticides	Toxaphene	Freshwater	0.011	ug/L			USEPA 1996	SCV
PCBs	Aroclor-1016	Freshwater	0.14	ug/L			Suter and Tsao 1996	SCV
PCBs	Aroclor-1221	Freshwater	0.28	ug/L			Suter and Tsao 1996	SCV
PCBs	Aroclor-1232	Freshwater	0.58	ug/L			Suter and Tsao 1996	SCV
PCBs	Aroclor-1242	Freshwater	0.053	ug/L			Suter and Tsao 1996	SCV
PCBs	Aroclor-1248	Freshwater	0.081	ug/L			Suter and Tsao 1996	SCV
PCBs	Aroclor-1254	Freshwater	0.033	ug/L			Suter and Tsao 1996	SCV
PCBs	Aroclor-1260	Freshwater	0.14	ug/L			Suter and Tsao 1996	SCV
SVOCs	1,1-Biphenyl	Freshwater	14.0	ug/L			USEPA 1996	SCV
SVOCs	1,2,4,5-Tetrachlorobenzene	Freshwater	3.00	ug/L			USEPA 2003c	Tier II SCV
SVOCs	1,2,3-Trichlorobenzene	Freshwater	8.00	ug/L			USEPA 2006b	

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
SVOCs	1,2,4-Trichlorobenzene	Freshwater	110	ug/L			Suter and Tsao 1996	SCV
SVOCs	1,2-Dichlorobenzene	Freshwater	14.0	ug/L			USEPA 1996	SCV
SVOCs	1,3-Dichlorobenzene	Freshwater	71.0	ug/L			USEPA 1996	SCV
SVOCs	1,4-Dichlorobenzene	Freshwater	15.0	ug/L			USEPA 1996	SCV
SVOCs	2,2'-Oxybis(1-chloropropane)	Freshwater	NSV	--			--	
SVOCs	2,3,4,6-Tetrachlorophenol	Freshwater	1.20	ug/L			USEPA 2003c	Tier II SCV
SVOCs	2,4,5-Trichlorophenol	Freshwater	63.0	ug/L			Buchman 2008	
SVOCs	2,4,6-Trichlorophenol	Freshwater	4.90	ug/L			Buchman 2008	
SVOCs	2,4-Dichlorophenol	Freshwater	11.0	ug/L			USEPA 2006b	SCV
SVOCs	2,4-Dimethylphenol	Freshwater	100	ug/L			Buchman 2008	
SVOCs	2,4-Dinitrophenol	Freshwater	19.0	ug/L			Buchman 2008	
SVOCs	2,4-Dinitrotoluene	Freshwater	44.0	ug/L			USEPA 2006b	SCV
SVOCs	2,6-Dinitrotoluene	Freshwater	81.0	ug/L			USEPA 2006b	SCV
SVOCs	2-Chloronaphthalene	Freshwater	0.40	ug/L			Buchman 2008	
SVOCs	2-Chlorophenol	Freshwater	24.0	ug/L			USEPA 2006b	FCV
SVOCs	2-Methylnaphthalene	Freshwater	330	ug/L			Buchman 2008	
SVOCs	2-Methylphenol	Freshwater	13.0	ug/L			Suter and Tsao 1996	SCV
SVOCs	2-Nitroaniline	Freshwater	NSV	--			--	
SVOCs	2-Nitrophenol	Freshwater	1,920	ug/L			USEPA 2006b	
SVOCs	3- and 4-Methylphenol	Freshwater	543	ug/L			USEPA 2006b	4-Methylphenol
SVOCs	3,3'-Dichlorobenzidine	Freshwater	4.50	ug/L			USEPA 2006b	FCV
SVOCs	3-Nitroaniline	Freshwater	NSV	--			--	
SVOCs	4,6-Dinitro-2-methylphenol	Freshwater	2.30	ug/L			USEPA 2001	
SVOCs	4-Bromophenyl-phenylether	Freshwater	1.50	ug/L			USEPA 1996	SCV
SVOCs	4-Chloro-3-methylphenol	Freshwater	0.30	ug/L			USEPA 2001	
SVOCs	4-Chloroaniline	Freshwater	232	ug/L			USEPA 2006b	
SVOCs	4-Chlorophenyl-phenylether	Freshwater	NSV	--			--	
SVOCs	4-Methylphenol	Freshwater	543	ug/L			USEPA 2006b	
SVOCs	4-Nitroaniline	Freshwater	NSV	--			--	
SVOCs	4-Nitrophenol	Freshwater	300	ug/L			Suter and Tsao 1996	SCV
SVOCs	Acenaphthene	Freshwater	23.0	ug/L			USEPA 1996	FCV
SVOCs	Acenaphthylene	Freshwater	4,840	ug/L			Buchman 2008	

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
SVOCs	Acetophenone	Freshwater	NSV	--			--	
SVOCs	Anthracene	Freshwater	0.73	ug/L			Suter and Tsao 1996	SCV
SVOCs	Atrazine	Freshwater	1.80	ug/L			USEPA 2006b	
SVOCs	Benzaldehyde	Freshwater	NSV	--			--	
SVOCs	Benzo(a)anthracene	Freshwater	0.027	ug/L			Suter and Tsao 1996	SCV
SVOCs	Benzo(a)pyrene	Freshwater	0.014	ug/L			Suter and Tsao 1996	SCV
SVOCs	Benzo(b)fluoranthene	Freshwater	9.07	ug/L			Buchman 2008	
SVOCs	Benzo(g,h,i)perylene	Freshwater	7.64	ug/L			Buchman 2008	
SVOCs	Benzo(k)fluoranthene	Freshwater	9.07	ug/L			Benzo(b)fluoranthene value	
SVOCs	Benzoic acid	Freshwater	42.0	ug/L			Suter and Tsao 1996	SCV
SVOCs	Benzyl alcohol	Freshwater	8.60	ug/L			Suter and Tsao 1996	SCV
SVOCs	bis(2-Chloroethoxy)methane	Freshwater	NSV	--			--	
SVOCs	bis(2-Chloroethyl)ether	Freshwater	1,900	ug/L			Buchman 2008	
SVOCs	bis(2-Ethylhexyl)phthalate	Freshwater	32.0	ug/L			USEPA 1996	SCV
SVOCs	Butylbenzylphthalate	Freshwater	19.0	ug/L			USEPA 1996	SCV
SVOCs	Caprolactam	Freshwater	NSV	--			--	
SVOCs	Carbazole	Freshwater	NSV	--			--	
SVOCs	Chrysene	Freshwater	NSV	--			--	
SVOCs	Dibenz(a,h)anthracene	Freshwater	NSV	--			--	
SVOCs	Dibenzofuran	Freshwater	3.70	ug/L			Suter and Tsao 1996	SCV
SVOCs	Diethylphthalate	Freshwater	270	ug/L			USEPA 2008	SCV
SVOCs	Dimethyl phthalate	Freshwater	330	ug/L			USEPA 2001	
SVOCs	Di-n-butylphthalate	Freshwater	35.0	ug/L			Suter and Tsao 1996	SCV
SVOCs	Di-n-octylphthalate	Freshwater	22.0	ug/L			USEPA 2006b	
SVOCs	Fluoranthene	Freshwater	8.10	ug/L			USEPA 1996	FCV
SVOCs	Fluorene	Freshwater	3.90	ug/L			USEPA 1996	SCV
SVOCs	Hexachlorobenzene	Freshwater	3.68	ug/L			Buchman 2008	Proposed AWQC
SVOCs	Hexachlorobutadiene	Freshwater	1.30	ug/L			USEPA 2006b	
SVOCs	Hexachlorocyclopentadiene	Freshwater	1.04	ug/L			Buchman 2008	LOEL/5
SVOCs	Hexachloroethane	Freshwater	12.0	ug/L			USEPA 1996	SCV
SVOCs	Indeno(1,2,3-cd)pyrene	Freshwater	4.31	ug/L			Buchman 2008	
SVOCs	Isophorone	Freshwater	1,170	ug/L			USEPA 2001	

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
SVOCs	Naphthalene	Freshwater	12.0	ug/L			Suter and Tsao 1996	SCV
SVOCs	Nitrobenzene	Freshwater	270	ug/L			USEPA 2001	Acute/10
SVOCs	n-Nitroso-di-n-propylamine	Freshwater	NSV	--			--	
SVOCs	n-Nitrosodiphenylamine	Freshwater	210	ug/L			Suter and Tsao 1996	SCV
SVOCs	Pentachlorophenol	Freshwater	15.0	ug/L		7.8	USEPA 2009	AWQC
SVOCs	Phenanthrene	Freshwater	6.30	ug/L			USEPA 1996	FCV
SVOCs	Phenol	Freshwater	110	ug/L			Suter and Tsao 1996	SCV
SVOCs	Pyrene	Freshwater	0.025	ug/L			USEPA 2006b	
VOCs	1,1,1-Trichloroethane	Freshwater	11.0	ug/L			Suter and Tsao 1996	SCV
VOCs	1,1,2,2-Tetrachloroethane	Freshwater	610	ug/L			Suter and Tsao 1996	SCV
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	Freshwater	NSV	--			--	
VOCs	1,1,2-Trichloroethane	Freshwater	1,200	ug/L			Suter and Tsao 1996	SCV
VOCs	1,1-Dichloroethane	Freshwater	47.0	ug/L			Suter and Tsao 1996	SCV
VOCs	1,1-Dichloroethene	Freshwater	25.0	ug/L			Suter and Tsao 1996	SCV
VOCs	1,2,3-Trichlorobenzene	Freshwater	8.00	ug/L			USEPA 2006b	
VOCs	1,2,4-Trichlorobenzene	Freshwater	110	ug/L			Suter and Tsao 1996	SCV
VOCs	1,2-Dibromo-3-chloropropane	Freshwater	NSV	--			--	
VOCs	1,2-Dibromoethane	Freshwater	NSV	--			--	
VOCs	1,2-Dichlorobenzene	Freshwater	14.0	ug/L			USEPA 1996	SCV
VOCs	1,2-Dichloroethane	Freshwater	910	ug/L			Suter and Tsao 1996	SCV
VOCs	1,2-Dichloropropane	Freshwater	525	ug/L			USEPA 2001	
VOCs	1,3-Dichlorobenzene	Freshwater	71.0	ug/L			USEPA 1996	SCV
VOCs	1,4-Dichlorobenzene	Freshwater	15.0	ug/L			USEPA 1996	SCV
VOCs	2-Butanone	Freshwater	14,000	ug/L			Suter and Tsao 1996	SCV
VOCs	2-Hexanone	Freshwater	99.0	ug/L			Suter and Tsao 1996	SCV
VOCs	4-Methyl-2-pentanone	Freshwater	170	ug/L			Suter and Tsao 1996	SCV
VOCs	Acetone	Freshwater	1,500	ug/L			Suter and Tsao 1996	SCV
VOCs	Benzene	Freshwater	130	ug/L			Suter and Tsao 1996	SCV
VOCs	Bromochloromethane	Freshwater	NSV	--			--	
VOCs	Bromodichloromethane	Freshwater	NSV	--			--	
VOCs	Bromoform	Freshwater	320	ug/L			USEPA 1996	SCV
VOCs	Bromomethane	Freshwater	110	ug/L			USEPA 2001	

Appendix D
Ecological Screening Values (ESVs) for Freshwater

Analytical Group	Chemical	Type	ESV	Units	Hardness (mg/L)	pH	Reference	Comments
VOCs	Carbon disulfide	Freshwater	0.92	ug/L			Suter and Tsao 1996	SCV
VOCs	Carbon tetrachloride	Freshwater	240	ug/L			USEPA 1996	SCV
VOCs	Chlorobenzene	Freshwater	64.0	ug/L			Suter and Tsao 1996	SCV
VOCs	Chloroethane	Freshwater	NSV	--			--	
VOCs	Chloroform	Freshwater	28.0	ug/L			Suter and Tsao 1996	SCV
VOCs	Chloromethane	Freshwater	5,500	ug/L			USEPA 2001	
VOCs	cis-1,2-Dichloroethene	Freshwater	590	ug/L			Suter and Tsao 1996	SCV
VOCs	cis-1,3-Dichloropropene	Freshwater	24.4	ug/L			USEPA 2001	
VOCs	Cyclohexane	Freshwater	NSV	--			--	
VOCs	Dibromochloromethane	Freshwater	NSV	--			--	
VOCs	Dichlorodifluoromethane(Freon-12)	Freshwater	NSV	--			--	
VOCs	Ethylbenzene	Freshwater	290	ug/L			USEPA 1996	SCV
VOCs	Isopropylbenzene (Cumene)	Freshwater	2.60	ug/L			USEPA 2006b	
VOCs	m- and p-Xylene	Freshwater	13.0	ug/L			Suter and Tsao 1996	Total xylenes
VOCs	Methyl acetate	Freshwater	NSV	--			--	
VOCs	Methylcyclohexane	Freshwater	NSV	--			--	
VOCs	Methylene chloride	Freshwater	2,200	ug/L			Suter and Tsao 1996	SCV
VOCs	Methyl-tert-butyl ether (MTBE)	Freshwater	11,070	ug/L			USEPA 2006b	
VOCs	o-Xylene	Freshwater	13.0	ug/L			Suter and Tsao 1996	Total xylenes
VOCs	Styrene	Freshwater	72.0	ug/L			USEPA 2006b	
VOCs	Tetrachloroethene	Freshwater	98.0	ug/L			Suter and Tsao 1996	SCV
VOCs	Toluene	Freshwater	9.80	ug/L			Suter and Tsao 1996	SCV
VOCs	trans-1,2-Dichloroethene	Freshwater	590	ug/L			Suter and Tsao 1996	SCV
VOCs	trans-1,3-Dichloropropene	Freshwater	24.4	ug/L			USEPA 2001	
VOCs	Trichloroethene	Freshwater	47.0	ug/L			Suter and Tsao 1996	SCV
VOCs	Trichlorofluoromethane(Freon-11)	Freshwater	NSV	--			--	
VOCs	Vinyl chloride	Freshwater	930	ug/L			USEPA 2006b	FCV
VOCs	Xylene, total	Freshwater	13.0	ug/L			Suter and Tsao 1996	SCV

NSV - No Screening Value

Response to Comments

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

August 1, 2012

Mr. Scott Park
NAVFAC MIDLANT, Building N-26, Room 3208
Attention: Code OPHE3, Mr. Scott Park
9742 Maryland Avenue
Norfolk, VA 23511-3095

Subject: Draft Remedial Investigation Sampling and Analysis Plan, Youth Pond, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia, June 2012

Mr. Park:

Thank you for the opportunity to review the subject document. EPA would like to provide the following comments at this time.

1. On page 6, the objectives of the RI are listed. The fourth bullet in this paragraph should be clarified to indicate that potential risks associated with fish consumption will be assessed.

2. Groundwater flow has been estimated to be north-northeast towards Upstream Pond. If correct, Youth Pond which is north east of Upstream Pond lies in the direct path of the groundwater flow. It is unclear to the reviewer why ground water sampling is not a part of this SAP. The six proposed ground water monitoring wells, mentioned in the Tier II Sampling and Analysis Plan Site 4 - Remediation Investigation, should be drilled and sampled during this investigation. Groundwater contamination can be a good indicator of buried contamination. Considering the size of the area with its heavily wooded surroundings, groundwater sampling and analysis would be a key component in the complete characterization of the site and would provide a more comprehensive approach to identifying the source of contamination at Youth Pond. It is recommended that ground water be analyzed for the full suite of contaminants during this investigation.

3. If any samples are to be split between laboratories, then it is recommended that the procedure for split sample comparability on page 49 of the Uniform Federal Policy for Quality Assurance Project Plans (UFP) be followed with the exception of having each laboratory use the same method, not equivalent methods.

4. Worksheet #10 on page 38 states that if the data collected to fulfill the objectives of this RI indicate that additional sampling (i.e., York River surface water/sediment samples) is needed, a SAP addendum to collect and evaluate the additional data will be submitted under a separate cover. This document does not adequately address why the York River is not being sampled along with Youth Pond as part of the current investigation. Given the distribution of contaminants throughout the pond based on historical sampling, there is sufficient information available to support that sampling is needed in the York River. At a minimum, sampling should occur in depositional areas of the river where the pipe discharges. Sampling can be deferred to a later investigation, however, the recommendation to sample in the river is unlikely to change based on the existing data.

5. Worksheet #10 on page 38 states that in addition to the collection of sediment and surface water samples, fish tissue will also be collected to support the ecological and human health risk assessments. Because of the shallow nature of the pond, frogs should also be collected from the pond for tissue analysis, as they are likely an important food resource for birds and mammals that feed in the pond and may accumulate higher levels of contaminants than small fish based on their trophic position.

6. Worksheet #10 on page 39 states that twelve surface sediment (0-4 inches), five subsurface sediment (4-8 inches) and five surface water samples will be collected from within Youth Pond. It is unclear why subsurface sediment and surface water samples are not proposed at all locations. The variability among samples can be high and 12 samples would give a better estimate of both the mean and range of contaminant concentrations. Because of the historical nature of the potential release, subsurface sediment may have higher concentrations of contaminants. Therefore, surface and subsurface sediment and surface water should be collected at all twelve sediment locations shown in Figure 4.

7. Worksheet #10 on page 39 states that two of the five co-located surface and subsurface sediment/surface water locations (SD/SW-09 and SD/SW-11) will be collected at the approximate locations of the 2000 Pond Study samples (00-Pond-SD/SW08 and 00-Pond-SD/SW09). These samples will be used to compare current constituent concentrations with historical concentrations at these approximate locations. Given the limited historical data set and the potentially high variability in some medium, it is not clear if comparison of current data with historical data will be meaningful. Given the limited historical data, a specific explanation for this comparison should be provided.

8. Worksheet #10 on page 40 states that following a biological survey, three fish tissue samples, of the most appropriate species for human exposures, will be collected. The human health fish tissue samples will be filleted and analyzed for contaminants. The offal of these fish should also be analyzed so that a whole body concentration of large fish can be estimated and risk to birds (e.g., bald eagle [*Haliaeetus leucocephalus*] and osprey [*Pandion haliaetus*]) that eat larger fish can be evaluated.

9. Worksheet #10 on page 40 states that following a biological survey, three composite fish tissue samples will be collected for evaluation of ecological risk. Depending on the

number of fish species found in the pond, their size range, and life history, it is not clear that three fish tissue samples will be adequate to assess risk to the fish and upper trophic levels in Youth Pond. Justification for this low sample size should be provided.

10. Worksheet #11 on page 43 states that contaminant concentrations in surface soil, sediment, subsurface sediment, and surface water will be compared to literature based ecological screening values. These literature based ecological screening values need to be identified along with their sources and provided to BTAG for review. Obviously Region 3 BTAG screening values need to be used when available, as should the EPA Eco-SSLs. The guidance on screening values on EPA Region 3's website should be followed.

11. Worksheet #11 on page 43 states that fish PALs will also consider literature based tissue effect levels. These literature based tissue effect levels need to be identified along with their sources and provided to BTAG for review.

12. Worksheet #11 on page 43 states that site concentrations for fish tissue will also be compared with concentrations from reference areas (to be collected separately as part of the Site 4 RI). Specific information should be provided on the reference tissue samples including the quantity and locations of reference samples and how they will be used. This information is needed to ensure that these reference tissue samples are applicable to the site.

13. Worksheet #11 on page 46 states that fish tissue will be analyzed for metals and PCBs only. It is unclear why analysis is being limited at this point in the investigation with such limited historical sampling. Any other bioaccumulative chemicals detected in sediment must also be analyzed in fish tissue to assess the potential for ecological risk.

14. Worksheet #11 on page 47 states that if organic constituent concentrations are below method detection limits, it will be assumed that soil and sediment from the sampled locations are not a source of contamination to Youth Pond. The Navy needs to discuss the result if the method detection limits are greater than the screening criteria.

15. Worksheet #11 on page 49 provides the process for evaluating risk to ecological receptors. Because of their limited mobility, maximum contaminant concentrations need to be used to assess risk to plants and invertebrates.

16. Worksheet #14 on page 60 states that a reconnaissance-level biological survey of fish will be conducted in Youth Pond to determine the presence and type of aquatic community that exists within this water body. The results of this survey will be used to characterize the ecological receptors that are present and to guide the collection of fish tissue samples. Specific information on how the results of the aquatic biological survey will be used to determine which fish species will be collected for tissue analysis should be provided. The presence and relative abundance of frogs should also be noted. As

stated previously, if they are present in sufficient numbers to constitute an important food source for birds and mammals, frogs should also be collected for tissue analysis.

17. Worksheet #14 on page 61 states that whole-body fish tissue samples of an appropriate size range for piscivorous wildlife (4 to 12 cm based upon the size range of possible receptors such as great blue heron, belted kingfisher, and mink) will be collected from Youth Pond. Larger and older fish will generally have higher concentrations of contaminants. Fish species from all age/size classes need to be included in tissue sampling to ensure ecological exposure is fully characterized.

18. Worksheet #14 on page 61 discusses the decontamination procedure for equipment. The specific procedure is in Appendix A. For equipment where sampling for metal analysis will be performed, the procedure should include a step to rinse equipment with a nitric acid solution to prevent cross contamination of samples.

19. Worksheet #17 on page 91 states that surface water samples will be collected just below the water surface. Depending on the depth of the pond, it is unlikely that this single sample will be sufficient. Provide support for selecting this sampling depth.

20. Figure 4 shows the proposed and previous sampling locations at Youth Pond. Sample locations SD08 and SD09 are shown as proposed sediment locations (orange circles). However, results for these locations are shown, which seems to indicate that they were previous sample locations and should be shown as red circles. The figure also shows that SD-14 would be collected in the storm water line between the pond and the river. The document should clarify if this is an open ditch or closed pipe, and if an outfall pipe extends all the way to the river. It also appears that SD-13 is not in the water and is on the land between the pond and river. These issues should be clarified.

If you have any questions, please contact me at 215-814-3394.

Sincerely,

Susanne Haug

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

cc: Wade Smith, VDEQ

From: Sawyer, Stephanie/VBO
Sent: Monday, September 10, 2012 8:00 AM
To: Haug.Susanne@epamail.epa.gov; Smith, Wade (DEQ)
Cc: Park, Scott R CIV NAVFAC MIDLANT, EV; Ivester, Marlene/VBO; Sawyer, Stephanie/VBO
Subject: Response to EPA Comments on the Draft Youth Pond RI UFP-SAP
Attachments: Draft Youth Pond RI SAP EPA RTCs_Aug 12.pdf; Draft Youth Pond RI SAP DEQ RTCs_Aug 12.pdf; Figure 3 - Surface Features Locations.pdf; Figure 4 - Proposed and Previous Sampling Locations.pdf; Appendix D.pdf; Draft Final UFP-SAP_CAX Youth Pond_redline_rev.docx

Sue and Wade,

Attached are the Navy's responses to both the EPA's and DEQ's comments on the Draft Youth Pond RI UFP-SAP. The USEPA comments were received via email on August 1, 2012 and the DEQ's comments were received via email on July 17, 2012. We will be discussing these RTCs at our partnering meeting next week so we can get consensus on the responses and mobilize to the field at the beginning of October.

In addition, in order to expedite finalizing this document, I've attached the draft final redline word version of the UFP-SAP, the revised Figures 3 and 4 (revised as a result of the RTCs), and the revised Appendix D (also revised as a result of the RTCs). If you have any questions prior to the meeting please let us know.

Thanks,
Stephanie

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Response to Comments
Remedial Investigation
Sampling and Analysis Plan
Youth Pond
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, VA
September 7, 2012

Comments received by email on August 1, 2012 from Sue Haug, Environmental Protection Agency, Region 3.

EPA Comment 1: On page 6, the objectives of the RI are listed. The fourth bullet in this paragraph should be clarified to indicate that potential risks associated with fish consumption will be assessed.

Response: Agreed. The fourth bullet under the objectives of the RI was revised (as shown below) to include fish (and frogs as discussed in the response to EPA Comment 5 below) as a medium being used to assess potential human health and ecological risks:

- Assess potential human health and ecological risks associated with fish/frog tissue, surface water, sediment, and soil.

EPA Comment 2: Groundwater flow has been estimated to be north-northeast towards Upstream Pond. If correct, Youth Pond which is north east of Upstream Pond lies in the direct path of the groundwater flow. It is unclear to the reviewer why ground water sampling is not a part of this SAP. The six proposed ground water monitoring wells, mentioned in the Tier II Sampling and Analysis Plan Site 4 - Remediation Investigation, should be drilled and sampled during this investigation. Groundwater contamination can be a good indicator of buried contamination. Considering the size of the area with its heavily wooded surroundings, groundwater sampling and analysis would be a key component in the complete characterization of the site and would provide a more comprehensive approach to identifying the source of contamination at Youth Pond. It is recommended that ground water be analyzed for the full suite of contaminants during this investigation.

Response: Groundwater sampling is not included as part of this SAP because, as stated in the SAP, the primary objective of this project is to determine the source of VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in the surface water and sediment samples during the 2000 Pond Study (SAP Project Statement and Objectives; Worksheet #10). The evidence to date indicates that Youth Pond itself is not the source area of contamination within the pond, but rather the body of water that received contaminants from another source or sources. Depending on the nature of the source or sources that are ultimately determined to have impacted Youth Pond, groundwater sampling may be necessary to complete the characterization of the source area(s). However, given that at the present time the source or sources of these contaminants have not been identified, groundwater sampling is premature. It should be noted, the Partnering Team has agreed that Site 4 is one potential source of contamination into Youth Pond, and groundwater samples will be collected and analyzed as part of the Site 4 investigation.

EPA Comment 3: If any samples are to be split between laboratories, then it is recommended that the procedure for split sample comparability on page 49 of the Uniform Federal Policy for Quality Assurance Project Plans (UFP) be followed with the exception of having each laboratory use the same method, not equivalent methods.

Response: Split sampling is not proposed as part of the Youth Pond investigation. As outlined in Worksheet #27, all surface water, sediment, and soil samples will be shipped to ENCO Labs in Orlando, FL, with the exception of hexavalent chromium samples. ENCO will send samples for explosives analysis to GEL Labs in Charleston, SC and will send samples for AVS/SEM to CAS-Rochester. All hexavalent chromium samples will be shipped directly to CAS-Rochester due to the short hold time. All tissue samples will be shipped to Katahdin in Scarborough, ME. Katahdin will fillet fish tissue samples (if applicable) and homogenize samples. Katahdin will send homogenized aliquots for PCB congener analysis to TestAmerica in West Sacramento, CA. There will be no duplication of analytical results between the respective laboratories. No changes were made to the SAP.

EPA Comment 4: Worksheet #10 on page 38 states that if the data collected to fulfill the objectives of this RI indicate that additional sampling (i.e., York River surface water/sediment samples) is needed, a SAP addendum to collect and evaluate the additional data will be submitted under a separate cover. This document does not adequately address why the York River is

not being sampled along with Youth Pond as part of the current investigation. Given the distribution of contaminants throughout the pond based on historical sampling, there is sufficient information available to support that sampling is needed in the York River. At a minimum, sampling should occur in depositional areas of the river where the pipe discharges. Sampling can be deferred to a later investigation, however, the recommendation to sample in the river is unlikely to change based on the existing data.

Response: As described in the response to EPA Comment 2, the primary objective of this project is to determine the source of VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in the surface water and sediment samples within Youth Pond during the 2000 Pond Study. While the results of the 2000 Pond Study indicate that VOCs, SVOCs, pesticides, PCBs, explosives, and metals are present in Youth Pond, the results are from only two samples. Thus, there is no information at this time to support the premise that these contaminants are located throughout the pond or are potentially discharging to the York River. Sampling is proposed from the depositional area at the outlet of Youth Pond (SD14). The SAP was revised to clarify that proposed sediment sample SD14 will be collected from this depositional area. During the June 2012 Partnering Meeting, the Team was informed that the investigation of Youth Pond will likely be conducted in two phases. During this phase (Phase 1), the focus of the project (and SAP) is on identifying all potential sources of contamination (including Site 4 and surface features identified during the October 2011 site visit) and what the current constituent concentrations and risks are in Youth Pond.

The Navy understands the EPA's request to sample the York River is unlikely to change; however, the potential clearly exists for non-site-related and non-Navy sources of similar contamination to have impacted the York River. As a result, it would be extremely difficult to determine if any identified York River contamination originated at Site 4 and/or the surface features identified during the October 2011 site visit and was transported through Youth Pond. The Navy is preparing a Watershed Contaminated Source Document (WCSD) to help identify other potential sources of contamination in the York River, which will be completed before any sampling of the York River occurs and may assist with future risk management decisions.

EPA Comment 5: Worksheet #10 on page 38 states that in addition to the collection of sediment and surface water samples, fish tissue will also be collected to support the ecological and human health risk assessments. Because of the shallow nature of the pond, frogs should also be collected from the pond for tissue analysis, as they are likely an important food resource for birds and mammals that feed in the pond and may accumulate higher levels of contaminants than small fish based on their trophic position.

Response: This comment was discussed during the August 21, 2012 Partnering Team and technical support conference call, with agreement by all participating parties to add three whole-body frog tissue samples. The frog tissue samples will be analyzed for the same analytes as those proposed for the whole-body fish tissue samples (metals, the 12 dioxin-like congeners, PCB homologues, percent moisture, and percent lipids). The SAP was revised to add the frog samples and include the conference call as an additional scoping session.

EPA Comment 6: Worksheet #10 on page 39 states that twelve surface sediment (0-4 inches), five subsurface sediment (4-8 inches) and five surface water samples will be collected from within Youth Pond. It is unclear why subsurface sediment and surface water samples are not proposed at all locations. The variability among samples can be high and 12 samples would give a better estimate of both the mean and range of contaminant concentrations. Because of the historical nature of the potential release, subsurface sediment may have higher concentrations of contaminants. Therefore, surface and subsurface sediment and surface water should be collected at all twelve sediment locations shown in Figure 4.

Response: During the August 21, 2012 conference call, the CAX Partnering Team discussed this issue and agreed to collect subsurface sediment samples at all 12 locations, co-located with the proposed surface sediment samples. In addition, the one Youth Pond sample location originally proposed as part of the Site 4 RI was removed from the Site 4 SAP and added to the Youth Pond SAP. Therefore, a total of 13 surface sediment and 13 subsurface sediment samples will be collected from within Youth Pond.

Surface water samples will not be collected from all sediment locations because the size of the pond does not warrant a similar sampling density to that used for sediments, as the water column will mix throughout the pond on a regular basis. Thus, as discussed during the August 21,2012 conference call, surface water samples are proposed at five of the sediment locations, placed at all known inflow and outflow locations, plus within the deeper portions of the pond. One surface water sample will also be collected from the one Youth Pond sample location originally proposed as part of the Site 4 RI (see above). Therefore, a total of six surface water samples will be collected from within Youth Pond.

The SAP was revised to add these samples and include the conference call as an additional scoping session.

EPA Comment 7: Worksheet #10 on page 39 states that two of the five co-located surface and subsurface sediment/surface water locations (SD/SW-09 and SD/SW-11) will be collected at the approximate locations of the 2000 Pond Study samples (00-Pond-SD/SW08 and 00-Pond-SD/SW09). These samples will be used to compare current constituent concentrations with historical concentrations at these approximate locations. Given the limited historical data set and the potentially high variability in some medium, it is not clear if comparison of current data with historical data will be meaningful. Given the limited historical data, a specific explanation for this comparison should be provided.

Response: The two historical samples from the Pond Study were placed at logical locations within the pond to characterize potential contamination. Thus, these two locations also warrant sampling as part of this larger and more recent sampling effort due simply to their location within the pond and would also, incidentally, allow for a comparison of current with historical concentrations. Given the small Youth Pond sample size in the Pond Study (n = 2) and the difficulty in sampling the exact same location, the comparison will be qualitative in nature and will be included in the discussion of nature and extent. The earlier Pond Study data will not be used in the risk assessments.

EPA Comment 8: Worksheet #10 on page 40 states that following a biological survey, three fish tissue samples, of the most appropriate species for human exposures, will be collected. The human health fish tissue samples will be filleted and analyzed for contaminants. The offal of these fish should also be analyzed so that a whole body concentration of large fish can be estimated and risk to birds (e.g., bald eagle [Haliaeetus leucocephalus] and osprey [Pandion haliaetus]) that eat larger fish can be evaluated.

Response: The main purpose of the Phase 1 biological survey and fish tissue sampling is to characterize the fishery that is present within the pond and to obtain an initial estimate of chemical concentrations within key components of this fishery that may be utilized by key human and ecological receptors. Larger bird species such as the bald eagle and osprey are less likely to regularly use smaller ponds such as Youth Pond relative to larger water bodies such as Penniman Lake, Cheatham Pond, and the York River. Thus, while the Navy does not object to the approach proposed in the comment in principle, the collection of these samples is of lesser importance for a Phase 1 study at Youth Pond given the lower exposure potential of these potential receptors. The limited resources available in Phase 1 are better spent characterizing other receptors, such as the addition of three frog tissue samples to the Phase 1 sampling (please see the response to EPA Comment 5).

EPA Comment 9: Worksheet #10 on page 40 states that following a biological survey, three composite fish tissue samples will be collected for evaluation of ecological risk. Depending on the number of fish species found in the pond, their size range, and life history, it is not clear that three fish tissue samples will be adequate to assess risk to the fish and upper trophic levels in Youth Pond. Justification for this low sample size should be provided.

Response: Please see the responses to EPA Comments 5 and 8. Three additional tissue samples (frogs) were added to the Phase 1 sampling to support the ecological evaluation.

EPA Comment 10: Worksheet #11 on page 43 states that contaminant concentrations in surface soil, sediment, subsurface sediment, and surface water will be compared to literature based ecological screening values. These literature based ecological screening values need to be identified along with their sources and provided to BTAG for review. Obviously Region 3 BTAG screening values need to be used when available, as should the EPA Eco-SSLs. The guidance on screening values on EPA Region 3's website should be followed.

Response: The numerical literature-based screening values are listed in Worksheet #15 which is also referenced on Worksheet #11 (page 43). The source of each of these values has been included as an appendix to the SAP.

EPA Comment 11: Worksheet #11 on page 43 states that fish PALs will also consider literature based tissue effect levels. These literature based tissue effect levels need to be identified along with their sources and provided to BTAG for review.

Response: The numerical values are listed in Worksheet #15, which is also referenced on Worksheet #11 (page 43). The source of these values (other than the values derived from back-calculating using the food web models from the Site 4 SI) are Jarvinen and Ankley (1999; *linkage of effects to tissue residues: development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals)* and the Army Corp of Engineers *Residue-Effects Database*. These references have been added the Project Action Limits section of Worksheet #11.

EPA Comment 12: Worksheet #11 on page 43 states that site concentrations for fish tissue will also be compared with concentrations from reference areas (to be collected separately as part of the Site 4 RI). Specific information should be provided on the reference tissue samples including the quantity and locations of reference samples and how they will be used. This information is needed to ensure that these reference tissue samples are applicable to the site.

Response: For planning purposes, the addition of three filet fish tissue, three whole body fish tissue, and three frog tissue samples from the reference pond was added to the SAP. However, the specific number and type of reference tissue samples that will be collected and used for the Youth Pond evaluation will depend upon the results of the biological survey since reference tissue samples will be collected to as closely as possible match the type of tissue samples that will be collected in Youth Pond (e.g., type of organism, species, etc.).

Cheatham Pond is the preferred choice for the reference area since it is more likely to provide areas with similar habitats for all of the site evaluations (Site 4, Youth Pond, and Penniman Lake). The results of the 2000 Pond Study indicate that very few organic constituents were detected in Cheatham Pond sediments (eight samples); a comparison of detected organic constituent concentrations with ecological sediment screening values indicate that none of the existing screening values were exceeded (see attached table). While several detected metals (e.g., arsenic, barium, and iron) exceeded ecological sediment screening values in one or more samples, the relatively small range in the detected concentrations do not suggest that they are the result of a release. It is the Navy's position that the Pond Study sediment data do not preclude the use of Cheatham Pond as a potential reference area, particularly since the Pond Study sampling was biased toward portions of the pond nearest known source areas (sites); there are large, un-sampled areas within the pond that are not near any known Navy source areas.

EPA Comment 13: Worksheet #11 on page 46 states that fish tissue will be analyzed for metals and PCBs only. It is unclear why analysis is being limited at this point in the investigation with such limited historical sampling. Any other bioaccumulative chemicals detected in sediment must also be analyzed in fish tissue to assess the potential for ecological risk.

Response: These constituent groups were the risk drivers from the Site 4 SI for aquatic habitats. Since Site 4 is the most likely source area to Youth Pond, these were the most logical groups to include in the Phase 1 sampling for Youth Pond. If any other bioaccumulative chemicals are detected in sediment, they will be evaluated through food web modeling. This comment was discussed during the August 21, 2012 Partnering Team and technical support conference call, and the Team agreed this approach was acceptable.

EPA Comment 14: Worksheet #11 on page 47 states that if organic constituent concentrations are below method detection limits, it will be assumed that soil and sediment from the sampled locations are not a source of contamination to Youth Pond. The Navy needs to discuss the result if the method detection limits are greater than the screening criteria.

Response: Should this occur, it will be discussed in the uncertainty section of the risk assessments.

EPA Comment 15: Worksheet #11 on page 49 provides the process for evaluating risk to ecological receptors. Because of their limited mobility, maximum contaminant concentrations need to be used to assess risk to plants and invertebrates.

Response: Maximum concentrations will be included as one of the exposure point concentrations used to characterize the range of potential ecological risks at the site. The Ecological Risk Decision Logic section of Worksheet #11 was revised to include this information.

EPA Comment 16: Worksheet #14 on page 60 states that a reconnaissance-level biological survey of fish will be conducted in Youth Pond to determine the presence and type of aquatic community that exists within this water body. The results of this survey will be used to characterize the ecological receptors that are present and to guide the collection of fish tissue samples. Specific information on how the results of the aquatic biological survey will be used to determine which fish species will be collected for tissue analysis should be provided. The presence and relative abundance of frogs should also be noted. As stated previously, if they are present in sufficient numbers to constitute an important food source for birds and mammals, frogs should also be collected for tissue analysis.

Response: The decision to sample frog tissue, which will be made in the field, will be based on the professional judgment of the senior aquatic field biologist conducting the sampling, in consultation with the risk assessors and Partnering Team, and will be based upon such factors as relative abundance, size range available, and trophic level. Frog tissue samples have been added to the SAP for possible collection (please see the response to EPA Comment 5).

EPA Comment 17: Worksheet #14 on page 61 states that whole-body fish tissue samples of an appropriate size range for piscivorous wildlife (4 to 12 cm based upon the size range of possible receptors such as great blue heron, belted kingfisher, and mink) will be collected from Youth Pond. Larger and older fish will generally have higher concentrations of contaminants. Fish species from all age/size classes need to be included in tissue sampling to ensure ecological exposure is fully characterized.

Response: Please see the response to EPA Comment 8.

EPA Comment 18: Worksheet #14 on page 61 discusses the decontamination procedure for equipment. The specific procedure is in Appendix A. For equipment where sampling for metal analysis will be performed, the procedure should include a step to rinse equipment with a nitric acid solution to prevent cross contamination of samples.

Response: The EPA's concern regarding cross-contamination among samples is noted. There are some circumstances in which a nitric acid rinse would be of greater importance, such as analysis for trace metals or mercury speciation; however, those circumstances don't apply to the work being proposed in these SAPs. The proposed work includes the standard metals analysis, not trace metals analysis or any type of mercury speciation. Most cross-contamination would typically come from poor scrubbing procedures during decontamination, not a lack of nitric acid rinsing. Equipment blanks will be collected each day which would identify any possible cross-contamination from poor or inadequate decontamination procedures. In addition, when possible, disposable equipment will be used and sample collection will proceed from areas of suspected lowest concentrations to areas of suspected highest concentrations. This comment was discussed during the August 21, 2012 Partnering Team and technical support conference call, and all participating parties agreed the nitric rinse was not necessary for this investigation.

EPA Comment 19: Worksheet #17 on page 91 states that surface water samples will be collected just below the water surface. Depending on the depth of the pond, it is unlikely that this single sample will be sufficient. Provide support for selecting this sampling depth.

Response: The proposed sampling methodology for these samples followed the same procedures used for the Site 4 SI sampling. However, for the Youth Pond investigation, if the water depth exceeds 4 feet at a sampling location, the sample will be collected at mid-depth in the water column. Worksheet #11, Worksheet #14, and Worksheet #17 were revised to include this information.

EPA Comment 20: Figure 4 shows the proposed and previous sampling locations at Youth Pond. Sample locations SD08 and SD09 are shown as proposed sediment locations (orange circles). However, results for these locations are shown, which seems to indicate that they were previous sample locations and should be shown as red circles. The figure also shows that SD-14 would be collected in the storm water line between the pond and the river. The document should clarify if this is an open ditch or closed pipe, and if an outfall pipe extends all the way to the river. It also appears that SD-13 is not in the water and is on the land between the pond and river. These issues should be clarified.

Response: During the June 2012 Partnering Meeting, the CAX Partnering Team identified and discussed the SD08 and SD09 symbol errors listed above. As a result, Figure 4 was revised and resubmitted to the team on July 2, 2012 with a request that the revised figure be used to replace the one included in the draft SAP. The revised figure is also attached here. Regarding the SD14 sediment location, the text in Worksheet #10 (Conceptual Site Model; Physical Characteristics) was revised to clarify that the culvert is an underground pipe that leads to a depositional area just short of the York River shoreline. While SD13 appears to be located on land between the pond and the river, it only appears this way because of the nature of the aerial photograph used. The actual perimeter of the pond is indicated by the blue boundary, labeled Youth Pond Study Area; therefore, SD13 is located in the water and not on open land between the pond and river.

Table 1
Exceedances - Cheatham Pond Surface Sediment - Pond Study
Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia

Station ID	**Sediment ESV**	Cheatham Pond-SD02		Cheatham Pond-SD03	Cheatham Pond-SD04	Cheatham Pond-SD05	Cheatham Pond-SD06	Cheatham Pond-SD07	Cheatham Pond-SD18	Cheatham Pond-SD19
Sample ID		CP-00-POND-SD02-0300	CP-00-POND-SD02D-0300	CP-00-POND-SD03-0300	CP-00-POND-SD04-0300	CP-00-POND-SD05-0300	CP-00-POND-SD06-0300	CP-00-POND-SD07-0300	CP-00-POND-SD18-0300	CP-00-POND-SD19-0300
Sample Date		03/30/00	03/30/00	03/30/00	03/30/00	03/31/00	03/31/00	03/31/00	03/30/00	03/30/00
Volatile Organic Compounds (UG/KG)										
Acetone	NSV	210 B	110 U	310 B	180 B	65 U	**780**	**1,500**	320 B	540 B
Toluene	4,194	110 U	110 U	85 U	**11 J**	65 U	79 U	**32 J**	82 U	60 U
Semivolatile Organic Compounds (UG/KG)										
bis(2-Ethylhexyl)phthalate	750	220 B	3,600 U	**260 J**	2,600 U	120 B	2,600 U	180 B	2,700 U	2,000 U
Diethylphthalate	630	3,600 U	3,600 U	2,900 U	**370 J**	2,100 U	2,600 U	2,900 U	2,700 U	2,000 U
Nitrobenzene	11,137	3,600 U	3,600 U	2,900 U	2,600 U	2,100 U	2,600 U	**69 J**	2,700 U	2,000 U
Pesticide/Polychlorinated Biphenyls (UG/KG)										
No Detections	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides (UG/KG)										
Diquat	NSV	NA	NA	NA	NA	NA	NA	NA	**110,000**	**48,000**
Explosives (UG/KG)										
4-Amino-2,6-dinitrotoluene	145	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ	**96 J**	250 UJ
Inorganics (MG/KG)										
Aluminum	25,500	**8,710**	**9,400**	**10,100**	**12,400**	**10,900**	**12,200**	**7,990**	**10,300**	**4,880**
Arsenic	9.79	**63.6**	**65.3**	**75.2**	**58.5**	**50.3**	**45.4**	**51.1**	**61.6**	**36.5**
Barium	20	**59**	**56.9**	**69.9**	**61.8**	**67.8**	**66**	**57.6**	**56.7**	**46.2**
Beryllium	NSV	**1.2**	1.15 U	**0.53**	0.851 U	**0.4**	**0.54**	**0.29**	**1.2**	**1.1**
Calcium	--	**177,000**	**172,000**	**65,700**	**79,600**	**180,000**	**66,700**	**150,000**	**128,000**	**189,000**
Chromium	43.4	**22.9**	**31.3**	**25.7**	**38**	**21.2**	**26.5**	**17.2**	**29.1**	**9**
Cobalt	50	**8**	**12.7**	**4.5**	**9.4**	**2.7**	**3.8**	**3.4**	**6.3**	**5.4**
Copper	31.6	**19.5**	**19.1**	**15.6**	**20.2**	**11.6**	**13.3**	**12.5**	**20.8**	**10**
Iron	20,000	**24,100**	**23,800**	**35,800**	**32,800**	**20,300**	**28,600**	**16,300**	**22,600**	**11,000**
Lead	35.8	**27**	**27.4**	**31.3**	**29.6**	**23.6**	**29.1**	**26.2**	**29.2**	**13.8**
Magnesium	--	**1,660**	**1,780**	**2,300**	**2,650**	**2,340**	**1,950**	**1,730**	**2,110**	**1,450**
Manganese	460	**221**	**222**	**300**	**292**	**186**	**179**	**129**	**244**	**141**
Mercury	0.18	**0.15**	**0.13**	**0.18**	**0.18**	**0.12**	**0.17**	**0.13**	**0.24**	**0.08**
Nickel	22.7	22.2 U	24.4 U	**13.2**	18.1 U	**9.5**	**10.3**	**7.1**	16.3 U	11.7 U
Potassium	--	**1,600**	**2,090**	**2,080**	**2,440**	**1,510**	**1,870**	**1,490**	**1,670**	**1,020**
Sodium	--	**308**	**329**	**343**	**349**	**344**	**344**	**341**	**519**	**212**
Thallium	NSV	5.90 U	6.72 U	5.61 U	**6.5**	4.02 U	4.95 U	5.34 U	4.51 U	3.23 U
Vanadium	57	**27**	**33**	**36.9**	**41.1**	**30.9**	**39.1**	**28.2**	**35.2**	**17.5**
Zinc	121	**76.9**	**79.2**	**77.1**	**91.1**	**51.4**	**58.3**	**45.6**	**61.1**	**30.4**
Other Parameters (various units)										
pH (PH)	--	**7.6**	**7.7**	**8**	**7.8**	**7.7**	**7.9**	**7.3**	**7.7**	**7.8**
Total organic carbon (TOC) (MG/KG)	--	**43,200**	**60,800**	**108,000**	**29,500**	**46,700**	**78,300**	**12,700**	**96,500**	**68,500**

Notes:

Grey highlighting indicates value greater than screening value

Yellow highlighting indicates value equal to screening value

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

BJ

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

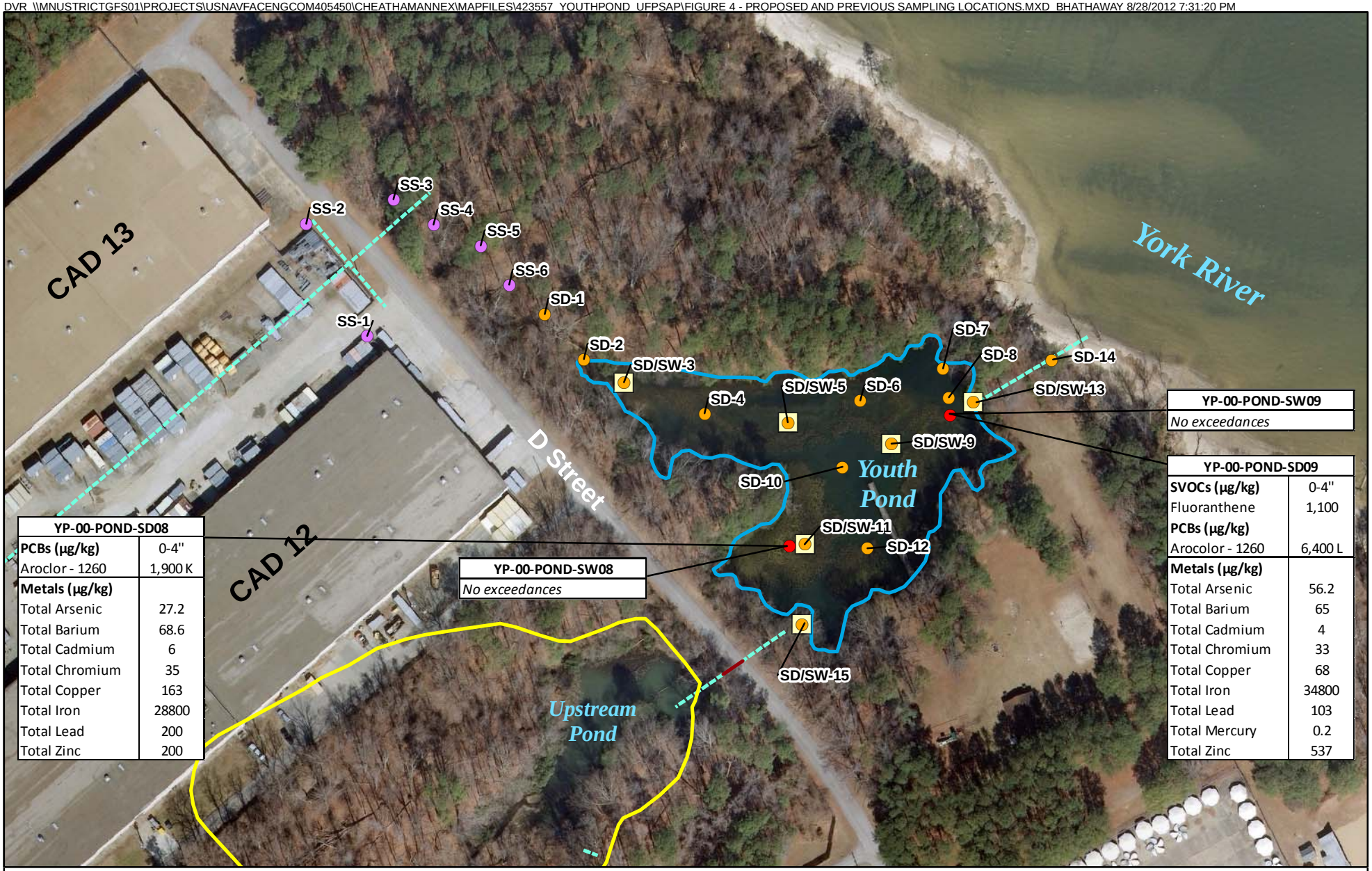
UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHEATHAMANNEX\MAPFILES\423557_YOUTHPOND_UFPSAP\FIGURE 4 - PROPOSED AND PREVIOUS SAMPLING LOCATIONS.MXD BHATHAWAY 8/28/2012 7:31:20 PM



YP-00-POND-SD08	
PCBs (µg/kg)	0-4"
Aroclor - 1260	1,900 K
Metals (µg/kg)	
Total Arsenic	27.2
Total Barium	68.6
Total Cadmium	6
Total Chromium	35
Total Copper	163
Total Iron	28800
Total Lead	200
Total Zinc	200

YP-00-POND-SW08
No exceedances

YP-00-POND-SW09
No exceedances

YP-00-POND-SD09	
SVOCs (µg/kg)	0-4"
Fluoranthene	1,100
PCBs (µg/kg)	
Arocolor - 1260	6,400 L
Metals (µg/kg)	
Total Arsenic	56.2
Total Barium	65
Total Cadmium	4
Total Chromium	33
Total Copper	68
Total Iron	34800
Total Lead	103
Total Mercury	0.2
Total Zinc	537

Legend

- Proposed Sediment Sample Location
- Proposed Sediment/Surface Water Sample Location
- Proposed Surface Soil Sample Location
- Previous Sample Locations
- Culvert
- Storm Water Line
- Site 4 Boundary
- Youth Pond Study Area Boundary

N W E S

0 75 150 Feet

Figure 4
Proposed and Previous Sampling Locations
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

From: Smith, Wade (DEQ) [Wade.Smith@deq.virginia.gov]
Sent: Tuesday, July 17, 2012 10:14 AM
To: scott.park@navy.mil
Cc: Ivester, Marlene/VBO; Sawyer, Stephanie/VBO; Haug.Susanne@epamail.epa.gov; Newman, Kyle (DEQ)
Subject: CAX: Youth Pond SAP - DEQ Comments
Attachments: Draft UFP-SAP_CAX Youth Pond_for_team(DEQ).docx

Follow Up Flag: Follow up
Flag Status: Completed

Thank you for giving the DEQ the opportunity to comment on the June 2012 Remedial Investigation Sampling and Analysis Plan for the Youth Pond site at CAX.

The SAP was received by the DEQ on June 8, 2012.

The DEQ's comments are attached (track changes via Word).

Please let me know if you have any questions.

Thanks,
wade

Wade M. Smith
Remediation Project Manager
Virginia Department of Environmental Quality
Office of Remediation Programs
Phone: (804) 698-4125
wade.smith@deq.virginia.gov

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	D	DF	F
Scott Park	Remedial Project Manager (RPM) for CAX	NAVFAC Mid-Atlantic	(757) 341-0481	scott.park@navy.mil	A	CL	A
John Burchette	RPM	USEPA Region 3	(215) 814-3378	Burchette.John@epamail.epa.gov	A	CL	A
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.Smith@deq.virginia.gov	A	CL	A
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785	Bonnie.Capito@navy.mil			A
Marlene Ivester	Activity Manager (AM) for CAX	CH2M HILL	(757) 873-1442, x41634	Marlene.Ivester@ch2m.com			A
Stephanie Sawyer	Deputy AM for CAX and Project Manager (PM)		(757) 671-6273	Stephanie.Sawyer@ch2m.com	A	A	A
Toby Stewart	Field Team Leader (FTL)		(757) 419-0430	Toby.Stewart@ch2m.com			A
Doug Bitterman	Senior Technical Consultant (STC) and Activity Quality Manager (AQM)		(757) 671-6209	Doug.Bitterman@ch2m.com			A
Marcia Colon	Laboratory PM	ENCO Labs (ENCO)	(407) 826-5314	mcolon@encolabs.com			HC
Jennifer Obrin	Laboratory PM	Katahdin Analytical Services, Inc. (KAS)	(207) 874-2400	jorbin@katahdinlab.com			HC
Herb Kelly	Validator	CH2M HILL	(352) 384-7100	herb.kelly@ch2m.com			CD

Notes:

A = All, CD = Compact Disc, CL = Cover Letter, D = Draft, DF = Draft Final, HC = Hard Copy, F = Final;

Document Control Number: An administrative record number will be assigned when the final document is being prepared.

Comment [WS1]: Replace with Susanne Haug, EPA RPM, throughout document as appropriate

SAP Worksheet #9a—Project Scoping Session Participants Sheet

Project Name: Youth Pond RI **Projected Date(s) of Sampling:** September 2012 **PM:** Stephanie Sawyer	**Site Name:** Youth Pond **Site Location:** CAX, Williamsburg, VA

Date of Session: December 21, 2011 (via conference call)

Scoping Session Purpose: Team discussion and agreement on the sample locations, analytic parameters, and objectives for the Youth Pond RI.

Name	Title	Affiliation	Phone #	E-mail Address
Krista Parra	RPM	Navy	(757) 341-0395	Krista.Parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 873-1442, x41634	Marlene.Ivester@ch2m.com
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.smith@deq.virginia.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	Stephanie.Sawyer@ch2m.com
Ngozi Ibe	Site Manager	CH2M HILL	(703) 376-5017	Ngozi.Ibe@ch2m.com
John Burchette	RPM	USEPA Region 3	(215) 814-3378	Burchette.John@epamail.epa.gov

Comments/Decisions

Comment [WS2]: It would be nice to have additional scoping session details to include: Comments/Decisions, Action Items, and Consensus Decisions, as in the Draft SAP for Penniman Lake.

The Team held a Partnering conference call and discussed the path forward for the Youth Pond Remedial Investigation (RI). The Team agreed on the objectives of the RI, sample media, number and locations of samples, analytical parameters, and environmental questions that needed to be answered by the RI.

It was agreed that 6 surface soil samples (0-6 inches) and 14 surface sediment samples (0-4 inches) would be collected from select locations and analyzed for volatile organic compounds (VOCs), SVOCs, PCBs, pesticides, metals plus cyanide, and explosives. Subsurface sediment (4-8 inches) and surface water samples would also be collected at 5 of the 14 surface sediment sample locations and analyzed for VOCs, SVOCs, PCBs, pesticides, metals plus cyanide, and explosives.

The team also agreed that 3 fish tissue samples would be collected and analyzed for PCBs and metals. There was some discussion regarding analyzing fish tissue samples for PCB congeners as well; however, the team decided to look into this further before making a final decision.

If results of the agreed upon sampling were sufficient to adequately characterize the nature and extent of contamination, then an RI report would be prepared. If results warranted further action, then a SAP addendum proposing additional work would be submitted under a separate cover.

Wrap-Up/Action Item

1. Krista will look into what storm event data are available and will report back to the Team. *Krista informed the team on 12/29/11 that regulated outfalls (002, 017, and 033, none of which discharge to or from Youth Pond) are sampled monthly and visually inspected quarterly*.
2. Wade will check with his risk assessor to verify if PCB congener analysis is preferred and make sure it doesn't conflict with EPA requirements. *The team held a conference call to discuss the PCB congener analysis as described in* ***Worksheet #9b***.

SAP Worksheet #9b—Project Scoping Session Participants Sheet

Project Name: Youth Pond RI **Projected Date(s) of Sampling**: September 2012 **PM:** Stephanie Sawyer	**Site Name:** Youth Pond **Site Location:** CAX, Williamsburg, VA

Date of Session: February 1, 2012 (via conference call)

Scoping Session Purpose: Discuss and agree on path forward for PCB Congener Analysis

Name	Title	Affiliation	Phone #	E-mail Address
John Burchette	RPM	USEPA Region 3	(215) 814-3378	burchette.john@epa.gov
Wade Smith	RPM	VDEQ	(804) 698-4125	wade.smith@deq.virginia.gov
Krista Parra	RPM	NAVFAC Mid-Atlantic	(757)-341-0395	krista.parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 671-1634	marlene.ivester@ch2m.com
Stephanie Sawyer	Deputy AM/PM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com
Jennifer Corrack	Human Health Risk Assessor (RA)	Navy Marine Corps Health Center	(757) 953-0950	Jennifer.Corack@med.navy.mil
Jennifer Wright	Ecological RA	NAVFAC Atlantic	(757) 322-8428	jennifer.h.wright@navy.mil
Dave Barclift	Ecological RA	NAVFAC Atlantic	(215) 897-4913	david.barclift@navy.mil
John McCloskey	Ecological RA	USEPA Region 3	(804) 693-6694 X116	John_McCloskey@fws.gov
Dawn ~~Loven~~Ioven	Toxicologist	USEPA Region 3	(215) 814-3320	ioven.dawn@epa.gov
Kyle Newman	RA	VDEQ	(804) 698-4452	kyle.newman@deq.virginia.gov
William Kappleman	Ecological RA	CH2M HILL	(703) 376-5152	William.kappleman@ch2m.com
Roni Warren	Human Health RA	CH2M HILL	(814) 364-2454	Roni.warren@ch2m.com
Anita Dodson	Chemist	CH2M HILL	(757) 671-6218	Anita.dodson@ch2m.com

Comments/Decisions

Comment [WS3]: See previous comment

The team held a conference call to discuss whether PCB congener analysis should be added to the fish tissue samples being collected at Youth Pond (and additional sites at CAX). John Burchette asked the EPA ecological and human health risk assessors whether they would be comfortable making decisions on PCBs using only Aroclor data, especially for human health assessment. Dawn ~~Loven~~Ioven replied that dioxin-like congener data would be good to have to conduct risk; however, the tests are expensive. She recommended analyzing a percentage of samples for dioxin-like congeners.

The team discussed the sampling parameters further and agreed that sediment samples would be analyzed for Aroclors only. Human health risk animal tissue samples would be analyzed for the 12 dioxin-like congeners and Aroclors, and ecological risk tissue samples would be analyzed for the 12 dioxin-like congeners and homologues (unless the cost to do this was greater than or equal to full congener analysis, in which case analysis for the full 209 congeners would be performed). This would apply to all tissue samples, not a select percentage of samples as previously recommended by Dawn ~~Loven~~Ioven. In addition, if necessary, the team agreed that tissue samples could be frozen for potential later analysis for up to one year.

Response to Comments
Remedial Investigation
Sampling and Analysis Plan
Youth Pond
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, VA
September 7, 2012

Comments received by email on July 17, 2012 from Wade Smith, Virginia Department of Environmental Quality.

VDEQ Comment 1: Embedded comment on Worksheet #3: Replace with Susanne Haug, EPA RPM, throughout document as appropriate

Response: The UFP-SAP was revised to reference Sue Haug (as opposed to John Burchette) as the EPA RPM where applicable.

VDEQ Comments 2, 4, 5, 6, and 8 through 11: Editorial changes.

Response: Editorial and/or text updates have been incorporated into the UFP-SAP.

VDEQ Comment 3 and 7: It would be nice to have additional scoping session details to include: Comments/Decisions, Action Items, and Consensus Decisions, as in the Draft SAP for Penniman Lake.

Response: As recommended by the DEQ, Worksheets #9a and #9b were updated to include Comments/Decisions, Action Items, and Consensus Decision sections.

From: Sawyer, Stephanie/VBO
Sent: Wednesday, September 26, 2012 8:13 AM
To: Haug.Susanne@epamail.epa.gov; Smith, Wade (DEQ)
Cc: Park, Scott R CIV NAVFAC MIDLANT, EV; Ivester, Marlene/VBO; Sawyer, Stephanie/VBO
Subject: RE: Response to EPA Comments on the Draft Youth Pond RI UFP-SAP
Attachments: Draft Youth Pond RI SAP EPA RTCs_Aug 12_rev1.pdf

To All:

Based on our partnering meeting discussion of the Youth Pond RTCs, I have reviewed the RTCs we sent to address the EPAs comments on the UFP-SAP. We discussed making sure the RTC text says that while we will not be conducting some of the EPA suggested sampling at this time (specifically groundwater, York River, and fish offal sampling), this sampling is not completely off the table for potential future phases of the investigation.

I've attached revised RTCs for your review.

I feel the highlighted text in the response to EPA Comment 2 (re: groundwater sampling) already conveys that we are not disagreeing with the EPAs suggestion, but would rather complete the current phase of the investigation before we discuss any additional sampling, including groundwater. Sue, do you agree? In addition, I have made redline edits to the responses to the York River and fish offal sampling (responses to EPA Comments 4 and 8, respectively) to more clearly state that we are not disagreeing with the EPAs suggestion, but again would rather complete this phase of the investigation before we discuss any additional sampling.

If you have any questions or comments about the attached revised RTCs, please let Marlene and I know.

Thanks,
Stephanie

From: Sawyer, Stephanie/VBO
Sent: Monday, September 10, 2012 8:00 AM
To: Haug.Susanne@epamail.epa.gov; Smith, Wade (DEQ)
Cc: Park, Scott R CIV NAVFAC MIDLANT, EV; Ivester, Marlene/VBO; Sawyer, Stephanie/VBO
Subject: Response to EPA Comments on the Draft Youth Pond RI UFP-SAP

Sue and Wade,

Attached are the Navy's responses to both the EPA's and DEQ's comments on the Draft Youth Pond RI UFP-SAP. The USEPA comments were received via email on August 1, 2012 and the DEQ's comments were received via email on July 17, 2012. We will be discussing these RTCs at our partnering meeting next week so we can get consensus on the responses and mobilize to the field at the beginning of October.

In addition, in order to expedite finalizing this document, I've attached the draft final redline word version of the UFP-SAP, the revised Figures 3 and 4 (revised as a result of the RTCs), and the revised Appendix D (also revised as a result of the RTCs). If you have any questions prior to the meeting please let us know.

Thanks,
Stephanie

Stephanie Sawyer
Associate Scientist
CH2M HILL
5701 Cleveland Street, Suite 200
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Phone: 757-671-6273
Fax: 757-497-6885
stephanie.sawyer@ch2m.com

Revised Response to Comments
Remedial Investigation
Sampling and Analysis Plan
Youth Pond
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, VA
September ~~7~~25, 2012

Comments received by email on August 1, 2012 from Sue Haug, Environmental Protection Agency, Region 3.

EPA Comment 1: On page 6, the objectives of the RI are listed. The fourth bullet in this paragraph should be clarified to indicate that potential risks associated with fish consumption will be assessed.

Response: Agreed. The fourth bullet under the objectives of the RI was revised (as shown below) to include fish (and frogs as discussed in the response to EPA Comment 5 below) as a medium being used to assess potential human health and ecological risks:

- Assess potential human health and ecological risks associated with fish/frog tissue, surface water, sediment, and soil.

EPA Comment 2: Groundwater flow has been estimated to be north-northeast towards Upstream Pond. If correct, Youth Pond which is north east of Upstream Pond lies in the direct path of the groundwater flow. It is unclear to the reviewer why ground water sampling is not a part of this SAP. The six proposed ground water monitoring wells, mentioned in the Tier II Sampling and Analysis Plan Site 4 - Remediation Investigation, should be drilled and sampled during this investigation. Groundwater contamination can be a good indicator of buried contamination. Considering the size of the area with its heavily wooded surroundings, groundwater sampling and analysis would be a key component in the complete characterization of the site and would provide a more comprehensive approach to identifying the source of contamination at Youth Pond. It is recommended that ground water be analyzed for the full suite of contaminants during this investigation.

Response: Groundwater sampling is not included as part of this SAP because, as stated in the SAP, the primary objective of this project is to determine the source of VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in the surface water and sediment samples during the 2000 Pond Study (SAP Project Statement and Objectives; Worksheet #10). The evidence to date indicates that Youth Pond itself is not the source area of contamination within the pond, but rather the body of water that received contaminants from another source or sources. Depending on the nature of the source or sources that are ultimately determined to have impacted Youth Pond, groundwater sampling may be necessary to complete the characterization of the source area(s). However, given that at the present time the source or sources of these contaminants have not been identified, groundwater sampling is premature. It should be noted, the Partnering Team has agreed that Site 4 is one potential source of contamination into Youth Pond, and groundwater samples will be collected and analyzed as part of the Site 4 investigation.

EPA Comment 3: If any samples are to be split between laboratories, then it is recommended that the procedure for split sample comparability on page 49 of the Uniform Federal Policy for Quality Assurance Project Plans (UFP) be followed with the exception of having each laboratory use the same method, not equivalent methods.

Response: Split sampling is not proposed as part of the Youth Pond investigation. As outlined in Worksheet #27, all surface water, sediment, and soil samples will be shipped to ENCO Labs in Orlando, FL, with the exception of hexavalent chromium samples. ENCO will send samples for explosives analysis to GEL Labs in Charleston, SC and will send samples for AVS/SEM to CAS-Rochester. All hexavalent chromium samples will be shipped directly to CAS-Rochester due to the short hold time. All tissue samples will be shipped to Katahdin in Scarborough, ME. Katahdin will fillet fish tissue samples (if applicable) and homogenize samples. Katahdin will send homogenized aliquots for PCB congener analysis to TestAmerica in West Sacramento, CA. There will be no duplication of analytical results between the respective laboratories. No changes were made to the SAP.

EPA Comment 4: Worksheet #10 on page 38 states that if the data collected to fulfill the objectives of this RI indicate that additional sampling (i.e., York River surface water/sediment samples) is needed, a SAP addendum to collect and evaluate the additional data will be submitted under a separate cover. This document does not adequately address why the York River is

not being sampled along with Youth Pond as part of the current investigation. Given the distribution of contaminants throughout the pond based on historical sampling, there is sufficient information available to support that sampling is needed in the York River. At a minimum, sampling should occur in depositional areas of the river where the pipe discharges. Sampling can be deferred to a later investigation, however, the recommendation to sample in the river is unlikely to change based on the existing data.

Response: As described in the response to EPA Comment 2, the primary objective of this project is to determine the source of VOCs, SVOCs, pesticides, PCBs, explosives, and metals detected in the surface water and sediment samples within Youth Pond during the 2000 Pond Study. While the results of the 2000 Pond Study indicate that VOCs, SVOCs, pesticides, PCBs, explosives, and metals are present in Youth Pond, the results are from only two samples. Thus, there is no information at this time to support the premise that these contaminants are located throughout the pond or are potentially discharging to the York River. Sampling is proposed from the depositional area at the outlet of Youth Pond (SD14) that drains into the York River. The SAP was revised to clarify that proposed sediment sample SD14 will be collected from this depositional area. ~~During the June 2012 Partnering Meeting, the Team was informed that the investigation of Youth Pond will likely be conducted in two phases. During this phase (Phase 1), the focus of the project (and SAP) is on identifying all potential sources of contamination (including Site 4 and surface features identified during the October 2011 site visit) and what the current constituent concentrations and risks are in Youth Pond.~~

The Navy understands the EPA's request to sample the York River is unlikely to change; however, the potential clearly exists for non-site-related and non-Navy sources of similar contamination to have impacted the York River. As a result, it would be extremely difficult to determine if any identified York River contamination originated at Site 4 and/or the surface features identified during the October 2011 site visit and was transported through Youth Pond. The Navy is preparing a Watershed Contaminated Source Document (WCSD) to help identify other potential sources of contamination in the York River, which will be completed before any sampling of the York River occurs and may assist with future risk management decisions. If the data suggest a second phase is needed, the team will discuss the need to collect samples from the York River. During the June 2012 Partnering Meeting, the Team was informed that the investigation of Youth Pond will likely be conducted in two phases. During this phase (Phase 1), the focus of the project (and SAP) is on identifying all potential sources of contamination (including Site 4 and surface features identified during the October 2011 site visit) and what the current constituent concentrations and risks are in Youth Pond.

EPA Comment 5: Worksheet #10 on page 38 states that in addition to the collection of sediment and surface water samples, fish tissue will also be collected to support the ecological and human health risk assessments. Because of the shallow nature of the pond, frogs should also be collected from the pond for tissue analysis, as they are likely an important food resource for birds and mammals that feed in the pond and may accumulate higher levels of contaminants than small fish based on their trophic position.

Response: This comment was discussed during the August 21, 2012 Partnering Team and technical support conference call, with agreement by all participating parties to add three whole-body frog tissue samples. The frog tissue samples will be analyzed for the same analytes as those proposed for the whole-body fish tissue samples (metals, the 12 dioxin-like congeners, PCB homologues, percent moisture, and percent lipids). The SAP was revised to add the frog samples and include the conference call as an additional scoping session.

EPA Comment 6: Worksheet #10 on page 39 states that twelve surface sediment (0-4 inches), five subsurface sediment (4-8 inches) and five surface water samples will be collected from within Youth Pond. It is unclear why subsurface sediment and surface water samples are not proposed at all locations. The variability among samples can be high and 12 samples would give a better estimate of both the mean and range of contaminant concentrations. Because of the historical nature of the potential release, subsurface sediment may have higher concentrations of contaminants. Therefore, surface and subsurface sediment and surface water should be collected at all twelve sediment locations shown in Figure 4.

Response: During the August 21, 2012 conference call, the CAX Partnering Team discussed this issue and agreed to collect subsurface sediment samples at all 12 locations, co-located with the proposed surface sediment samples. In addition, the one Youth Pond sample location originally proposed as part of the Site 4 RI was removed from the Site 4 SAP and added to the Youth Pond SAP. Therefore, a total of 13 surface sediment and 13 subsurface sediment samples will be collected from within Youth Pond.

Surface water samples will not be collected from all sediment locations because the size of the pond does not warrant a similar sampling density to that used for sediments, as the water column will mix throughout the pond on a regular basis. Thus, as discussed during the August 21,2012 conference call, surface water samples are proposed at five of the sediment locations, placed at all known inflow and outflow locations, plus within the deeper portions of the pond. One surface water

sample will also be collected from the one Youth Pond sample location originally proposed as part of the Site 4 RI (see above). Therefore, a total of six surface water samples will be collected from within Youth Pond.

The SAP was revised to add these samples and include the conference call as an additional scoping session.

EPA Comment 7: Worksheet #10 on page 39 states that two of the five co-located surface and subsurface sediment/surface water locations (SD/SW-09 and SD/SW-11) will be collected at the approximate locations of the 2000 Pond Study samples (00-Pond-SD/SW08 and 00-Pond-SD/SW09). These samples will be used to compare current constituent concentrations with historical concentrations at these approximate locations. Given the limited historical data set and the potentially high variability in some medium, it is not clear if comparison of current data with historical data will be meaningful. Given the limited historical data, a specific explanation for this comparison should be provided.

Response: The two historical samples from the Pond Study were placed at logical locations within the pond to characterize potential contamination. Thus, these two locations also warrant sampling as part of this larger and more recent sampling effort due simply to their location within the pond and would also, incidentally, allow for a comparison of current with historical concentrations. Given the small Youth Pond sample size in the Pond Study (n = 2) and the difficulty in sampling the exact same location, the comparison will be qualitative in nature and will be included in the discussion of nature and extent. The earlier Pond Study data will not be used in the risk assessments.

EPA Comment 8: Worksheet #10 on page 40 states that following a biological survey, three fish tissue samples, of the most appropriate species for human exposures, will be collected. The human health fish tissue samples will be filleted and analyzed for contaminants. The offal of these fish should also be analyzed so that a whole body concentration of large fish can be estimated and risk to birds (e.g., bald eagle [Haliaeetus leucocephalus] and osprey [Pandion haliaetus]) that eat larger fish can be evaluated.

Response: The main purpose of the Phase 1 biological survey and fish tissue sampling is to characterize the fishery that is present within the pond and to obtain an initial estimate of chemical concentrations within key components of this fishery that may be utilized by key human and ecological receptors. Larger bird species such as the bald eagle and osprey are less likely to regularly use smaller ponds such as Youth Pond relative to larger water bodies such as Penniman Lake, Cheatham Pond, and the York River. Thus, while the Navy does not object to the approach proposed in the comment in principle, the collection of these samples is of lesser importance for a Phase 1 study at Youth Pond given the lower exposure potential of these potential receptors. The limited resources available in Phase 1 are better spent characterizing other receptors, such as the addition of three frog tissue samples to the Phase 1 sampling (please see the response to EPA Comment 5). In addition, during the February 1, 2012 Team and technical support conference call, John McCloskey said the larger fish fillet data (that will be collected for human health) would work to look at risk to eagles, ospreys, etc., species that eat larger fish, but do not consume them whole. Therefore, offal analyses is not needed. However, if the data suggest a second phase of tissue sampling is needed, the team will discuss the need to conduct offal analyses.

EPA Comment 9: Worksheet #10 on page 40 states that following a biological survey, three composite fish tissue samples will be collected for evaluation of ecological risk. Depending on the number of fish species found in the pond, their size range, and life history, it is not clear that three fish tissue samples will be adequate to assess risk to the fish and upper trophic levels in Youth Pond. Justification for this low sample size should be provided.

Response: Please see the responses to EPA Comments 5 and 8. Three additional tissue samples (frogs) were added to the Phase 1 sampling to support the ecological evaluation.

EPA Comment 10: Worksheet #11 on page 43 states that contaminant concentrations in surface soil, sediment, subsurface sediment, and surface water will be compared to literature based ecological screening values. These literature based ecological screening values need to be identified along with their sources and provided to BTAG for review. Obviously Region 3 BTAG screening values need to be used when available, as should the EPA Eco-SSLs. The guidance on screening values on EPA Region 3's website should be followed.

Response: The numerical literature-based screening values are listed in Worksheet #15 which is also referenced on Worksheet #11 (page 43). The source of each of these values has been included as an appendix to the SAP.

EPA Comment 11: Worksheet #11 on page 43 states that fish PALs will also consider literature based tissue effect levels. These literature based tissue effect levels need to be identified along with their sources and provided to BTAG for review.

Response: The numerical values are listed in Worksheet #15, which is also referenced on Worksheet #11 (page 43). The source of these values (other than the values derived from back-calculating using the food web models from the Site 4 SI) are

Jarvinen and Ankley (1999; *linkage of effects to tissue residues: development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals)* and the Army Corp of Engineers *Residue-Effects Database*. These references have been added the Project Action Limits section of Worksheet #11.

EPA Comment 12: Worksheet #11 on page 43 states that site concentrations for fish tissue will also be compared with concentrations from reference areas (to be collected separately as part of the Site 4 RI). Specific information should be provided on the reference tissue samples including the quantity and locations of reference samples and how they will be used. This information is needed to ensure that these reference tissue samples are applicable to the site.

Response: For planning purposes, the addition of three filet fish tissue, three whole body fish tissue, and three frog tissue samples from the reference pond was added to the SAP. However, the specific number and type of reference tissue samples that will be collected and used for the Youth Pond evaluation will depend upon the results of the biological survey since reference tissue samples will be collected to as closely as possible match the type of tissue samples that will be collected in Youth Pond (e.g., type of organism, species, etc.).

Cheatham Pond is the preferred choice for the reference area since it is more likely to provide areas with similar habitats for all of the site evaluations (Site 4, Youth Pond, and Penniman Lake). The results of the 2000 Pond Study indicate that very few organic constituents were detected in Cheatham Pond sediments (eight samples); a comparison of detected organic constituent concentrations with ecological sediment screening values indicate that none of the existing screening values were exceeded (see attached table). While several detected metals (e.g., arsenic, barium, and iron) exceeded ecological sediment screening values in one or more samples, the relatively small range in the detected concentrations do not suggest that they are the result of a release. It is the Navy's position that the Pond Study sediment data do not preclude the use of Cheatham Pond as a potential reference area, particularly since the Pond Study sampling was biased toward portions of the pond nearest known source areas (sites); there are large, un-sampled areas within the pond that are not near any known Navy source areas.

EPA Comment 13: Worksheet #11 on page 46 states that fish tissue will be analyzed for metals and PCBs only. It is unclear why analysis is being limited at this point in the investigation with such limited historical sampling. Any other bioaccumulative chemicals detected in sediment must also be analyzed in fish tissue to assess the potential for ecological risk.

Response: These constituent groups were the risk drivers from the Site 4 SI for aquatic habitats. Since Site 4 is the most likely source area to Youth Pond, these were the most logical groups to include in the Phase 1 sampling for Youth Pond. If any other bioaccumulative chemicals are detected in sediment, they will be evaluated through food web modeling. This comment was discussed during the August 21, 2012 Partnering Team and technical support conference call, and the Team agreed this approach was acceptable.

EPA Comment 14: Worksheet #11 on page 47 states that if organic constituent concentrations are below method detection limits, it will be assumed that soil and sediment from the sampled locations are not a source of contamination to Youth Pond. The Navy needs to discuss the result if the method detection limits are greater than the screening criteria.

Response: Should this occur, it will be discussed in the uncertainty section of the risk assessments.

EPA Comment 15: Worksheet #11 on page 49 provides the process for evaluating risk to ecological receptors. Because of their limited mobility, maximum contaminant concentrations need to be used to assess risk to plants and invertebrates.

Response: Maximum concentrations will be included as one of the exposure point concentrations used to characterize the range of potential ecological risks at the site. The Ecological Risk Decision Logic section of Worksheet #11 was revised to include this information.

EPA Comment 16: Worksheet #14 on page 60 states that a reconnaissance-level biological survey of fish will be conducted in Youth Pond to determine the presence and type of aquatic community that exists within this water body. The results of this survey will be used to characterize the ecological receptors that are present and to guide the collection of fish tissue samples. Specific information on how the results of the aquatic biological survey will be used to determine which fish species will be collected for tissue analysis should be provided. The presence and relative abundance of frogs should also be noted. As stated previously, if they are present in sufficient numbers to constitute an important food source for birds and mammals, frogs should also be collected for tissue analysis.

Response: The decision to sample frog tissue, which will be made in the field, will be based on the professional judgment of the senior aquatic field biologist conducting the sampling, in consultation with the risk assessors and Partnering Team, and

will be based upon such factors as relative abundance, size range available, and trophic level. Frog tissue samples have been added to the SAP for possible collection (please see the response to EPA Comment 5).

EPA Comment 17: Worksheet #14 on page 61 states that whole-body fish tissue samples of an appropriate size range for piscivorous wildlife (4 to 12 cm based upon the size range of possible receptors such as great blue heron, belted kingfisher, and mink) will be collected from Youth Pond. Larger and older fish will generally have higher concentrations of contaminants. Fish species from all age/size classes need to be included in tissue sampling to ensure ecological exposure is fully characterized.

Response: Please see the response to EPA Comment 8.

EPA Comment 18: Worksheet #14 on page 61 discusses the decontamination procedure for equipment. The specific procedure is in Appendix A. For equipment where sampling for metal analysis will be performed, the procedure should include a step to rinse equipment with a nitric acid solution to prevent cross contamination of samples.

Response: The EPA's concern regarding cross-contamination among samples is noted. There are some circumstances in which a nitric acid rinse would be of greater importance, such as analysis for trace metals or mercury speciation; however, those circumstances don't apply to the work being proposed in these SAPs. The proposed work includes the standard metals analysis, not trace metals analysis or any type of mercury speciation. Most cross-contamination would typically come from poor scrubbing procedures during decontamination, not a lack of nitric acid rinsing. Equipment blanks will be collected each day which would identify any possible cross-contamination from poor or inadequate decontamination procedures. In addition, when possible, disposable equipment will be used and sample collection will proceed from areas of suspected lowest concentrations to areas of suspected highest concentrations. This comment was discussed during the August 21, 2012 Partnering Team and technical support conference call, and all participating parties agreed the nitric rinse was not necessary for this investigation.

EPA Comment 19: Worksheet #17 on page 91 states that surface water samples will be collected just below the water surface. Depending on the depth of the pond, it is unlikely that this single sample will be sufficient. Provide support for selecting this sampling depth.

Response: The proposed sampling methodology for these samples followed the same procedures used for the Site 4 SI sampling. However, for the Youth Pond investigation, if the water depth exceeds 4 feet at a sampling location, the sample will be collected at mid-depth in the water column. Worksheet #11, Worksheet #14, and Worksheet #17 were revised to include this information.

EPA Comment 20: Figure 4 shows the proposed and previous sampling locations at Youth Pond. Sample locations SD08 and SD09 are shown as proposed sediment locations (orange circles). However, results for these locations are shown, which seems to indicate that they were previous sample locations and should be shown as red circles. The figure also shows that SD-14 would be collected in the storm water line between the pond and the river. The document should clarify if this is an open ditch or closed pipe, and if an outfall pipe extends all the way to the river. It also appears that SD-13 is not in the water and is on the land between the pond and river. These issues should be clarified.

Response: During the June 2012 Partnering Meeting, the CAX Partnering Team identified and discussed the SD08 and SD09 symbol errors listed above. As a result, Figure 4 was revised and resubmitted to the team on July 2, 2012 with a request that the revised figure be used to replace the one included in the draft SAP. The revised figure is also attached here. Regarding the SD14 sediment location, the text in Worksheet #10 (Conceptual Site Model; Physical Characteristics) was revised to clarify that the culvert is an underground pipe that leads to a depositional area just short of the York River shoreline. While SD13 appears to be located on land between the pond and the river, it only appears this way because of the nature of the aerial photograph used. The actual perimeter of the pond is indicated by the blue boundary, labeled Youth Pond Study Area; therefore, SD13 is located in the water and not on open land between the pond and river.

Table 1
Exceedances - Cheatham Pond Surface Sediment - Pond Study
Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia

Station ID	**Sediment ESV**	Cheatham Pond-SD02		Cheatham Pond-SD03	Cheatham Pond-SD04	Cheatham Pond-SD05	Cheatham Pond-SD06	Cheatham Pond-SD07	Cheatham Pond-SD18	Cheatham Pond-SD19
Sample ID		CP-00-POND-SD02-0300	CP-00-POND-SD02D-0300	CP-00-POND-SD03-0300	CP-00-POND-SD04-0300	CP-00-POND-SD05-0300	CP-00-POND-SD06-0300	CP-00-POND-SD07-0300	CP-00-POND-SD18-0300	CP-00-POND-SD19-0300
Sample Date		03/30/00	03/30/00	03/30/00	03/30/00	03/31/00	03/31/00	03/31/00	03/30/00	03/30/00
Volatile Organic Compounds (UG/KG)										
Acetone	NSV	210 B	110 U	310 B	180 B	65 U	**780**	**1,500**	320 B	540 B
Toluene	4,194	110 U	110 U	85 U	**11 J**	65 U	79 U	**32 J**	82 U	60 U
Semivolatile Organic Compounds (UG/KG)										
bis(2-Ethylhexyl)phthalate	750	220 B	3,600 U	**260 J**	2,600 U	120 B	2,600 U	180 B	2,700 U	2,000 U
Diethylphthalate	630	3,600 U	3,600 U	2,900 U	**370 J**	2,100 U	2,600 U	2,900 U	2,700 U	2,000 U
Nitrobenzene	11,137	3,600 U	3,600 U	2,900 U	2,600 U	2,100 U	2,600 U	**69 J**	2,700 U	2,000 U
Pesticide/Polychlorinated Biphenyls (UG/KG)										
No Detections	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides (UG/KG)										
Diquat	NSV	NA	NA	NA	NA	NA	NA	NA	**110,000**	**48,000**
Explosives (UG/KG)										
4-Amino-2,6-dinitrotoluene	145	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ	250 UJ	**96 J**	250 UJ
Inorganics (MG/KG)										
Aluminum	25,500	**8,710**	**9,400**	**10,100**	**12,400**	**10,900**	**12,200**	**7,990**	**10,300**	**4,880**
Arsenic	9.79	**63.6**	**65.3**	**75.2**	**58.5**	**50.3**	**45.4**	**51.1**	**61.6**	**36.5**
Barium	20	**59**	**56.9**	**69.9**	**61.8**	**67.8**	**66**	**57.6**	**56.7**	**46.2**
Beryllium	NSV	**1.2**	1.15 U	**0.53**	0.851 U	**0.4**	**0.54**	**0.29**	**1.2**	**1.1**
Calcium	--	**177,000**	**172,000**	**65,700**	**79,600**	**180,000**	**66,700**	**150,000**	**128,000**	**189,000**
Chromium	43.4	**22.9**	**31.3**	**25.7**	**38**	**21.2**	**26.5**	**17.2**	**29.1**	**9**
Cobalt	50	**8**	**12.7**	**4.5**	**9.4**	**2.7**	**3.8**	**3.4**	**6.3**	**5.4**
Copper	31.6	**19.5**	**19.1**	**15.6**	**20.2**	**11.6**	**13.3**	**12.5**	**20.8**	**10**
Iron	20,000	**24,100**	**23,800**	**35,800**	**32,800**	**20,300**	**28,600**	**16,300**	**22,600**	**11,000**
Lead	35.8	**27**	**27.4**	**31.3**	**29.6**	**23.6**	**29.1**	**26.2**	**29.2**	**13.8**
Magnesium	--	**1,660**	**1,780**	**2,300**	**2,650**	**2,340**	**1,950**	**1,730**	**2,110**	**1,450**
Manganese	460	**221**	**222**	**300**	**292**	**186**	**179**	**129**	**244**	**141**
Mercury	0.18	**0.15**	**0.13**	**0.18**	**0.18**	**0.12**	**0.17**	**0.13**	**0.24**	**0.08**
Nickel	22.7	22.2 U	24.4 U	**13.2**	18.1 U	**9.5**	**10.3**	**7.1**	16.3 U	11.7 U
Potassium	--	**1,600**	**2,090**	**2,080**	**2,440**	**1,510**	**1,870**	**1,490**	**1,670**	**1,020**
Sodium	--	**308**	**329**	**343**	**349**	**344**	**344**	**341**	**519**	**212**
Thallium	NSV	5.90 U	6.72 U	5.61 U	**6.5**	4.02 U	4.95 U	5.34 U	4.51 U	3.23 U
Vanadium	57	**27**	**33**	**36.9**	**41.1**	**30.9**	**39.1**	**28.2**	**35.2**	**17.5**
Zinc	121	**76.9**	**79.2**	**77.1**	**91.1**	**51.4**	**58.3**	**45.6**	**61.1**	**30.4**
Other Parameters (various units)										
pH (PH)	--	**7.6**	**7.7**	**8**	**7.8**	**7.7**	**7.9**	**7.3**	**7.7**	**7.8**
Total organic carbon (TOC) (MG/KG)	--	**43,200**	**60,800**	**108,000**	**29,500**	**46,700**	**78,300**	**12,700**	**96,500**	**68,500**

Notes:

Grey highlighting indicates value greater than screening value

Yellow highlighting indicates value equal to screening value

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

BJ

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

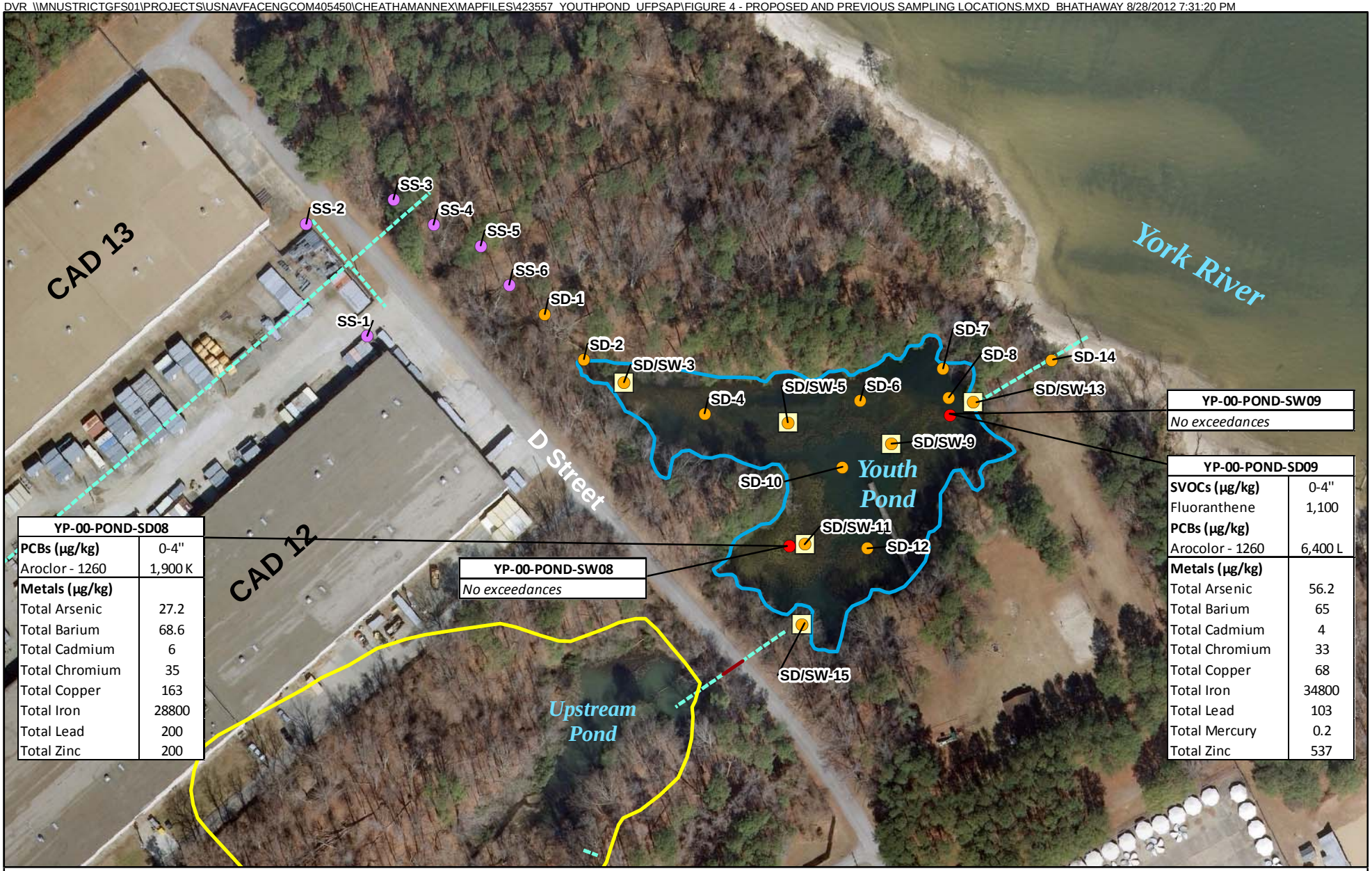
UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHEATHAMANNEX\MAPFILES\423557_YOUTHPOND_UFPSAP\FIGURE 4 - PROPOSED AND PREVIOUS SAMPLING LOCATIONS.MXD BHATHAWAY 8/28/2012 7:31:20 PM



YP-00-POND-SD08	
PCBs (µg/kg)	0-4"
Aroclor - 1260	1,900 K
Metals (µg/kg)	
Total Arsenic	27.2
Total Barium	68.6
Total Cadmium	6
Total Chromium	35
Total Copper	163
Total Iron	28800
Total Lead	200
Total Zinc	200

YP-00-POND-SW08
No exceedances

YP-00-POND-SW09
No exceedances

YP-00-POND-SD09	
SVOCs (µg/kg)	0-4"
Fluoranthene	1,100
PCBs (µg/kg)	
Arocolor - 1260	6,400 L
Metals (µg/kg)	
Total Arsenic	56.2
Total Barium	65
Total Cadmium	4
Total Chromium	33
Total Copper	68
Total Iron	34800
Total Lead	103
Total Mercury	0.2
Total Zinc	537

Legend

- Proposed Sediment Sample Location
- Proposed Sediment/Surface Water Sample Location
- Proposed Surface Soil Sample Location
- Previous Sample Locations
- Culvert
- Storm Water Line
- Site 4 Boundary
- Youth Pond Study Area Boundary

N W E S

0 75 150 Feet

Figure 4
Proposed and Previous Sampling Locations
Youth Pond UFP-SAP
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

Regulatory Acceptance

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

September 28, 2012

Mr. Scott Park
NAVFAC MIDLANT, Building N-26, Room 3208
Attention: Code OPHE3, Mr. Scott Park
9742 Maryland Avenue
Norfolk, VA 23511-3095

Subject: Draft Remedial Investigation Sampling and Analysis Plan, Youth Pond, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, VA, June 2012

Mr. Park:

Thank you for your responses to our comments regarding the subject document. Based on the written responses and subsequent meeting discussions the report is acceptable. Please forward a final copy for our records.

Please contact me at 215-814-3394 if you have any questions.

Sincerely,

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

cc: Wade Smith, VDEQ

COMMONWEALTH of VIRGINIA

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September 19, 2012

Mr. Scott Park
NAVFAC MIDLANT, Building N-26
Hampton Roads Restoration Product Line, Code OPHREV4
9742 Maryland Avenue
Norfolk, VA 23511-3095

Remedial Investigation Sampling and Analysis Plan Response to Comments
Youth Pond
Naval Weapons Station Yorktown
Cheatham Annex
Williamsburg, Virginia

Dear Mr. Park:

The Virginia Department of Environmental Quality (DEQ) has received the *Remedial Investigation Sampling and Analysis Plan Response to Comments* (SAP RTCs) for the Youth Pond site at Naval Weapons Station Yorktown, Cheatham Annex (CAX), Williamsburg, Virginia. The SAP RTCs, prepared by CH2M HILL, was received by the DEQ (electronically) on September 10, 2012.

Thank you for providing the DEQ's Office of Remediation Programs the opportunity to review the above-referenced SAP RTCs. Subsequent to DEQ's internal review and discussion of the SAP RTCs during the CAX Partnering Meeting on September 13, 2012, this office concurs with the proposed text revisions and recommends submittal of the *Final Remedial Investigation Sampling and Analysis Plan.*

Please contact me at (804) 698-4125 or wade.smith@deq.virginia.gov with any additional questions.

Sincerely,

Wade M. Smith
Remediation Project Manager
Office of Remediation Programs

cc: Susanne Haug, EPA