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FINAL SOIL SAMPLE COLLECTION SAMPLING AND ANALYSIS PLAN ADDENDUM FOR AREA OF CONCERN 6 (AOC6) PENNIMAN AOC WASTE SLAG MATERIAL SUBAREA
WILLIAMSBURG FISC VA
10/1/2012
CH2M HILL

SAP Worksheet #1—Title Page

Final

Soil Sample Collection Sampling and Analysis Plan Addendum AOC 6 – Penniman AOC, Waste Slag Material Subarea

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

Contract Task Order 0056

October 2012

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL

Virginia Beach, Virginia

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Signature Page

Quality Assurance Approval: *

____
NAVFAC Chemist / Date

Quality Assurance Review:

____
Doug Bitterman
CH2M HILL Activity Quality Manager / Date: 10/31/12

Other Approvals:

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Scott Park
NAVFAC Remedial Project Manager / Date:

____
Sue Haug
USEPA Remedial Project Manager / Date:

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Wade Smith
VDEQ Remedial Project Manager / Date:

*Pre-draft digitally signed by Kenneth Bowers, March 6, 2012.

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Executive Summary

This Sampling and Analysis Plan (SAP) addendum has been prepared to conduct soil sample collection at the Area of Concern (AOC) 6 Waste Slag Material subarea located at Naval Weapons Station Yorktown Cheatham Annex (CAX) in Williamsburg, Virginia. CAX (**Figure 1**) was established in June 1943 as a satellite unit of the Navy Supply Depot to provide bulk storage facilities. Prior to 1943, CAX had been the location of the Penniman Shell Loading Plant (PSLP), a large powder and shell loading facility operated by DuPont during World War I. In 1999, a USEPA-directed site inspection (SI) of the former PSLP was performed to assess the potential contamination sources present at this site and to determine the need for additional investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or other authority and, if appropriate, support site evaluation using the Hazard Ranking System (HRS) for proposal to the National Priorities List (NPL) (Weston, 1999). The SI provided a list of areas recommended for further investigation, and five subareas were chosen to comprise AOC 6, Penniman AOC. The Waste Slag Material subarea is one of these five AOC 6 subareas and consists of an approximate 25 feet long by 10 feet wide pile of metallic slag material that was identified and sampled during the 1999 SI. The following constituents were detected in the waste slag pile sample at concentrations that exceeded the 1999 SI comparison criteria [SI-specific background data and Region 3 Risk-Based Concentrations (RBCs)]: antimony, arsenic, chromium, lead, and manganese.

Investigation of the Waste Slag Material subarea was not included in the current SI for AOC 6 (CH2M HILL, 2012), because the Navy considers the waste slag source to be associated with former railroad activities, and not a CERCLA-regulated release. However, since the Waste Slag Material is included as an AOC 6 subarea in the CAX FFA, the Navy has agreed to regulatory agency requests to address it as part of CAX's Environmental Restoration Program (ERP). Therefore, soil sample collection, as presented in this SAP addendum, will be conducted adjacent to the waste slag pile to determine if contaminants have leached to soil. Based on the sampling results, the Partnering Team will decide the appropriate path forward (e.g., removal, additional sampling, no action, etc.).

This SAP addendum was prepared under the Comprehensive Long-term Environmental Action—Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order 0056, 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 document is an addendum to the Quality Assurance Project Plan (QAPP) that was submitted as Appendix B of the *Work Plan for Site Investigations, Various Areas of Concern,* (CH2M HILL, 2008), which included AOC 6. The purpose of this SAP addendum is to document differences in the data collection and analysis structure between the planned soil sample collection and the original QAPP (**Appendix A**). The original QAPP follows the 37 worksheet format and was developed in general accordance with:

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

Consequently, this addendum follows the same format; however, only those worksheets that contain substantive differences from the original QAPP are included herein. The worksheets in this addendum supersede the corresponding worksheets in the original QAPP.

This SAP addendum will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for the intended uses (i.e., environmental characterization, human health and ecological risk assessments, and path forward). The laboratory information cited in this SAP addendum is provided by Katahdin Analytical Services, Scarborough, Maine, which will provide analytical services for this investigation. Data Validation services will be performed in-house by CH2M HILL, Inc. Data, results, and recommendations will be documented in a technical memorandum.

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SAP Worksheets

Appendices

Figures

Abbreviations and Acronyms

AM	Activity Manager
AOC	Area of Concern
AQM	Activity Quality Manager
bgs	below ground surface
BKG	background
CA	corrective action
CAS	Chemical Abstracts Service
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
CSM	conceptual site model
CV	calibration verification
CVAA	cold vapor atomic absorption spectrometry
CTO	Contract Task Order
DQI	data quality indicator
DL	detection limit
DoD	Department of Defense
DQO	data quality objective
DV	data validator
EDD	Electronic Data Deliverable
EE/CA	Engineering Evaluation/Cost Analysis
ELAP	Environmental Laboratory Accreditation Program
ER	Environmental Restoration
ESV	ecological screening value
FFA	Federal Facilities Agreement
ft^2/day	square feet per day
FTL	Field Team Leader
g	gram
GFAA	graphite furnace atomic absorption
GPL	GPL Laboratories
GPS	global positioning system
HDPE	high density polyethylene
HRS	Hazard Ranking System
HSM	Health and Safety Manager
HSO	Health and Safety Officer
ICAL	initial calibration
ICP-AES	inductively coupled plasma-atomic emission spectrometry
ICP-MS	inductively coupled plasma-mass spectrometry
ICS	interference check solution
ICV	initial calibration verification
IS	Internal Standard

LCL	lower criteria limit
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram
mL	milliliter
MPC	measurement performance criteria
MS/MSD	matrix spike/matrix spike duplicate
MSA	method of standard addition
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
NFA	no further action
NFESC	Naval Facilities Engineering Service Command
NIRIS	Naval Installation Restoration Information Solution
NPL	National Priorities List
NTR	Navy Technical Representative
PAL	project action limit
PC	Project Chemist
PCB	polychlorinated biphenyl
PDM	Project Data Manager
PDS	post-digestion spike
PIL	Project Indicator Level
PM	Project Manager
PQL	project quantitation limit
PSLP	Penniman Shell Loading Plant
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RAA	Remedial Action Alternative
RBC	Risk-Based Concentration
RI	Remedial Investigation
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
RSL	risk screening level
SAP	Sampling and Analysis Plan
SB	subsurface soil
SI	Site Inspection
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
SS	surface soil
SSL	Site Screening Level
STC	Senior Technical Consultant
SVOC	semivolatile organic compound
TAL	target analyte list

TBD	to be determined
TM	Technical Memorandum
UCL	upper criteria limit
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

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SAP Worksheet #2—SAP Identifying Information

Site Name/Number: Area of Concern (AOC) 6 – Penniman AOC, Waste Slag Material Subarea

Operable Unit: Not applicable (N/A)

Contractor Name: CH2M HILL

Contract Number: N62470-08-D-1000 Contract Task Order (CTO) 0056

Contract Title: Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000

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

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

3. This SAP addendum is a project-specific SAP addendum.

4. **List dates of scoping sessions that were held**:

Scoping Session	Date
Partnering Meeting (Site Visit)	1/25/2011
Partnering Meeting (Path forward discussion)	3/9/2011
Partnering Conference Call (Path forward discussion and preliminary scoping session)	10/19/2011
Partnering Meeting (Analytical analyses discussion and agreement)	11/16/2011

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

   Final Work Plan for Site Investigation of Various Areas of Concern, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia (CH2M HILL, 2008)

   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—**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**:

Omitted Worksheet #/Title	Reason for Exclusion
#6/Communication Pathways	The duties from the original Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) to this addendum have not changed, just some of the personnel listed, and this information is included on **Worksheet #5**.
#7/Personnel Responsibilities and Qualifications Table	The duties from the original UFP-QAPP to this addendum have not changed, just some of the personnel listed, and this information is included on **Worksheet #5**.

SAP Worksheet #2—SAP Identifying Information (continued)

Omitted Worksheet #/Title	Reason for Exclusion
#8/Special Personnel Training Requirements Table	The personnel have changed, but there is no change in the training requirements for the FTL and field crew member roles.
#12/Measurement Performance Criteria Table – Field Quality Control Samples	No change since original UFP-QAPP submission.
#13/Secondary Data Criteria and Limitations Table	No change since original UFP-QAPP submission.
#14/Summary of Project Tasks	Only one change is needed to this sentence: "The EDD will be placed in CH2M HILL's Endat system Oracle database and in NIRIS database." Endat no longer exists and the EDD will be loaded directly into NIRIS.
#21/Project Sampling SOP References Table	No change since original UFP-QAPP submission.
#22/Field Equipment Calibration, Maintenance, Testing, and Inspection Table	No change since original UFP-QAPP submission.
#25/Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	No change since original UFP-QAPP submission.
#26/Sampling Handling System	No change since original UFP-QAPP submission.
#27/Sample Custody Requirements Table	No change since original UFP-QAPP submission, except Katahdin is the only laboratory to be used [no GPL Laboratories(GPL)].
#29/Project Documents and Records Table	No change since original UFP-QAPP submission.
#31/Planned Project Assessments Table	No change since original UFP-QAPP submission, except Katahdin is the only laboratory to be used (not GPL), Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) certification is required [not Naval Facilities Engineering Service Command (NFESC)], and the latest audit for Katahdin expires November 04, 2012 (**Appendix C**).
#31-1/Corrective Action Form	No change since original UFP-QAPP submission. (Note: this is Worksheet #31c in the original UFP-QAPP.)
#31-2/Field Performance Audit Checklist	No change since original UFP-QAPP submission. (Note: this is Worksheet #32-1 in the original UFP-QAPP.)
#31-3/Safe Work Observation Form	No change since original UFP-QAPP submission. [Note: this form was included in the original UFP-QAPP as Attachment 6 of Appendix A (Project-Specific Health and Safety Plan).]
#32/Assessment Findings and Corrective Action Responses	No change since original UFP-QAPP submission, except Katahdin is the only laboratory to be used (no GPL).
#33/Quality Assurance Management Reports Table	No change since original UFP-QAPP submission.
#37/Usability Assessment	No change since original UFP-QAPP submission.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	D	F
Scott Park	Remedial Project Manager (RPM) for Cheatham Annex (CAX)	NAVFAC Mid-Atlantic	(757) 341-0481	Scott.park@navy.mil	A	A
John Burchette	RPM (exiting)	USEPA Region 3	(215) 814-3378	Burchette.John@epamail.epa.gov	A	--
Sue Haug	RPM (incoming)	USEPA Region 3	(215) 814-3394	Haug.Susanne@epamail.epa.gov	--	A
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.Smith@deq.virginia.gov	A	A
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785	Bonnie.Capito@navy.mil		A
Marlene Ivester	CAX Activity Manager (AM)	CH2M HILL	(757) 671-6282	Marlene.Ivester@ch2m.com		A
Laura Lampshire	Project Manager (PM)		(301) 570-1042	Laura.Lampshire@ch2m.com	A	A
Toby Stewart	Field Team Leader (FTL)		(757) 671-6270	Toby.Stewart@ch2m.com		A
Doug Bitterman	Senior Technical Consultant (STC)/ Activity Quality Manager (AQM)		(757) 671-6209	doug.bitterman@ch2m.com		A
Greg Lull	Laboratory PM	Katahdin Analytical Services, Inc. (Katahdin)	(207) 874-2400	glull@katahdinlab.com		CD
Herb Kelly	Data Validation PM	CH2M HILL	(352) 384-7100	Hkelly1@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
Doug Bitterman	CH2M HILL/CAX AQM/STC	(757) 671-6209			
Marlene Ivester	CH2M HILL/CAX AM	(757) 671-6282			
Laura Lampshire	CH2M HILL/PM	(301) 570-1042			
Anita Dodson	CH2M HILL/Navy CLEAN Program Chemist	(757) 671-6218			
Clairette Campbell	CH2M HILL/Project Chemist (PC)	(757) 671-6335			
Mark Orman	CH2M HILL/Health and Safety Officer (HSO)	(414) 847-0597			
Toby Stewart	CH2M HILL/FTL	(757) 671-6270			
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			
Greg Lull	Katahdin Analytical Services/Laboratory PM	(207) 874-2400			
Herb Kelly	CH2M HILL/Data Validation PM	(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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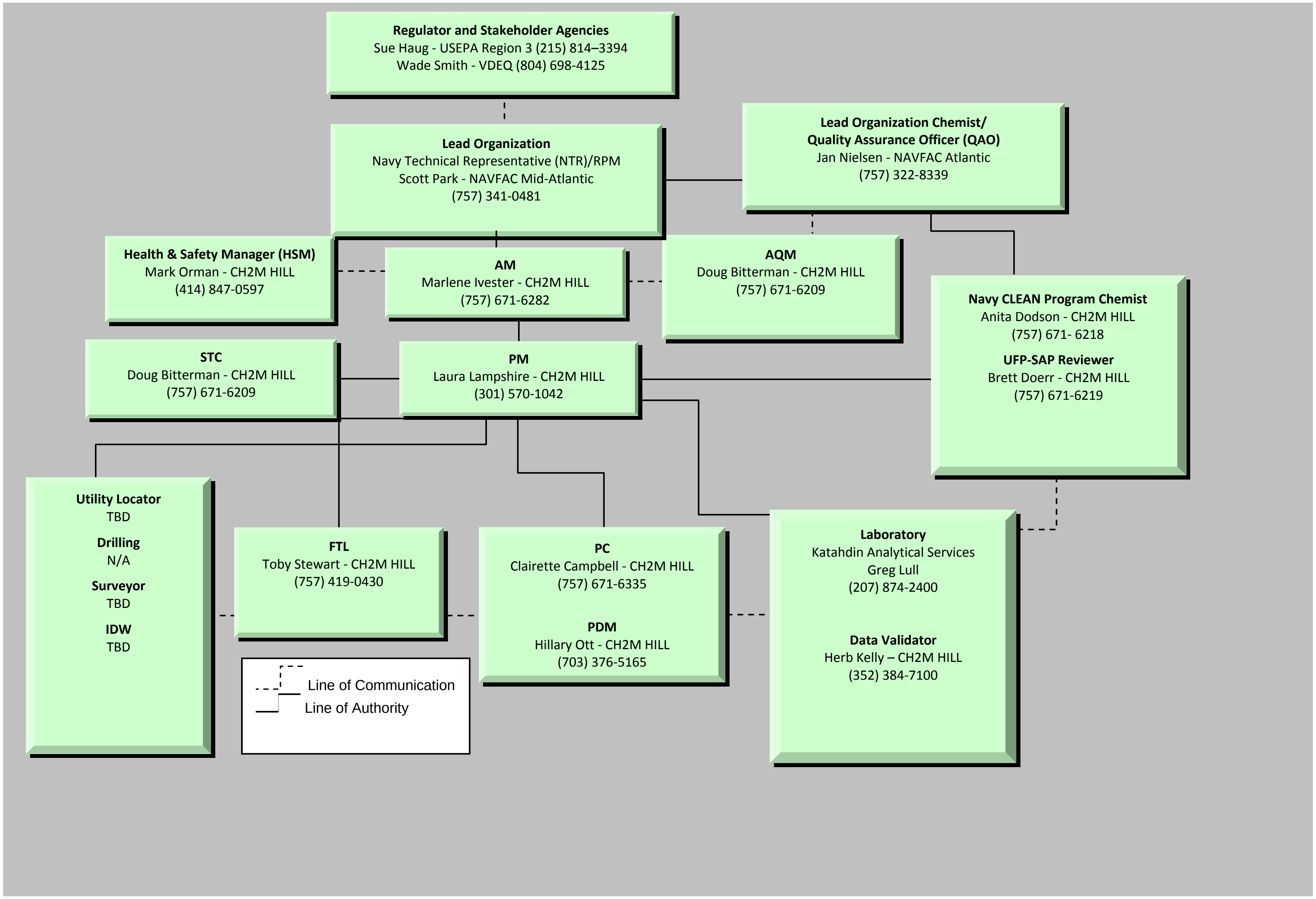
SAP Worksheet #5—Project Organizational Chart



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SAP Worksheet #9-A—Project Scoping Session Participants Sheet

Project Name: AOC 6, Waste Slag Material Subarea Soil Sample Collection **Projected Date(s) of Sampling:** September2012 **PM:** Laura Lampshire		**Site Name:** AOC 6 – Penniman AOC, Waste Slag Material Subarea **Site Location:** CAX, Williamsburg, VA		
Date of Session: January 25, 2011 **Scoping Session Purpose:** The CAX Partnering Team (Team) conducted a site visit to look for the Waste Slag Material identified in the 1999 Site Inspection (SI) Report prepared by Roy F. Weston, Inc. (Weston, 1999).				
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**
Krista Parra	RPM	Navy	(757) 341-0395	krista.parra@navy.mil
Tim Reisch	Environmental Restoration Section Head	Navy	(757) 341-0477	timothy.reisch@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 671-6282	marlene.ivester@ch2m.com
Wade Smith	RPM	VDEQ	(804) 698-4125	wade.smith@deq.virginia.gov
Susanne Haug	RPM	USEPA Region 3	(215) 814-3394	haug.susanne@epamail.epa.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com

Comments/Decisions

The Team conducted a site visit at CAX to search for and locate the Waste Slag Material subarea identified in the 1999 SI Report (Weston, 1999). Since previous attempts by the Navy, CH2M HILL, and Shaw Environmental to locate the Waste Slag Material subarea were unsuccessful, the Team conducted the site visit as part of the January 2011 Partnering Meeting. This site visit also allowed the USEPA and VDEQ RPMs to have another look at the general area where the Waste Slag Material subarea was reported to be. If the Waste Slag Material subarea was not located, the Navy felt no further action (NFA) was appropriate. If the subarea was located, the Team would discuss the path forward to address it.

The Waste Slag Material subarea was found, and the Team agreed to discuss the path forward during the March 2011 Partnering Meeting.

Wrap-Up/Action Item

A path forward discussion for the Waste Slag Material subarea was added to the March 2011 Partnering Meeting agenda.

SAP Worksheet #9-B—Project Scoping Session Participants Sheet

Project Name: AOC 6, Waste Slag Material Subarea Soil Sample Collection **Projected Date(s) of Sampling:** September 2012 **PM:** Laura Lampshire	**Site Name:** AOC 6 – Penniman AOC, Waste Slag Material Subarea **Site Location:** CAX, Williamsburg, VA

Date of Session: March 9, 2011

Scoping Session Purpose: The Team discussed the path forward for addressing the Waste Slag Material.

Name	Title	Affiliation	Phone #	E-mail Address
Krista Parra	RPM	Navy	(757) 341-0395	krista.parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 671-6282	marlene.ivester@ch2m.com
Wade Smith	RPM	VDEQ	(804) 698-4125	wade.smith@deq.virginia.gov
Susanne Haug	RPM	USEPA Region 3	(215) 814-3394	haug.susanne@epamail.epa.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com

Comments/Decisions

The Team reviewed the known history of the Waste Slag Material subarea and discussed the path forward to address it. The Navy proposed to excavate the approximate 25 feet long by 10 feet wide pile of metallic slag material that comprises this subarea, collect floor and wall samples to be analyzed for inorganic constituents, and compare the analytical results to background upper tolerance limits (UTLs) and conservative human health and ecological screening values. If the sample results do not exceed background or screening values, then NFA would be documented in a Technical Memorandum (TM). The Team agreed on this proposed path forward.

Sue informed the Team that she was concerned that a Record of Decision (ROD) for the Waste Slag Material subarea may be necessary since it was part of the CAX Hazard Ranking Score, although it was never determined that a release occurred. The Team agreed that an Engineering Evaluation/Cost Analysis (EE/CA) would be prepared for removal of the waste slag pile. Sue will research how to document closure of the area. Krista mentioned that the Waste Slag Material subarea would be included in the future AOC 6 ROD since it is one of the five AOC 6 subareas. Marlene agreed, as it was likely that a Remedial Investigation (RI) would be completed at three of the five AOC 6 subareas; therefore, a ROD would be completed in the future.

Wrap-Up/Action Item

The waste slag pile removal will be added to a multi-site EE/CA that includes AOC 2 and AOC 7.

SAP Worksheet #9-C—Project Scoping Session Participants Sheet

Project Name: AOC 6, Waste Slag Material Subarea Soil Sample Collection **Projected Date(s) of Sampling:** September 2012 **PM:** Laura Lampshire			**Site Name:** AOC 6 – Penniman AOC, Waste Slag Material Subarea **Site Location:** CAX, Williamsburg, VA	
Date of Session: October 19, 2011 **Scoping Session Purpose:** Team conference call that included a discussion of the path forward for addressing the Waste Slag Material.				
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**
Krista Parra	RPM	Navy	(757) 341-0395	krista.parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 671-6282	marlene.ivester@ch2m.com
Wade Smith	RPM	VDEQ	(804) 698-4125	wade.smith@deq.virginia.gov
John Burchette	RPM	USEPA Region 3	(215) 814-3378	burchette.john@epamail.epa.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com

Comments/Decisions

The Team held a conference call to discuss a few items, including the Waste Slag Material subarea. Krista informed John and Wade that the Navy has further considered the potential to include the Waste Slag Material subarea as part of the upcoming EE/CA. The Navy Technical Reviewer expressed concern with a removal action for the Waste Slag Material subarea without first collecting some soil analytical data to determine if contaminants from the waste slag pile had leached to surrounding soil. If it had, the removal action excavation could become larger than anticipated. Therefore, Krista proposed to not include the AOC 6 Waste Slag Material subarea in the EE/CA and instead collect four surface (0-6 inches) and subsurface (6-24 inches) soil samples from the soil immediately adjacent to the waste slag pile – one from each "side." Wade asked if undisturbed soil samples would be collected. Krista replied yes, and if it is possible, a sample underneath the waste slag pile would occur as well. John asked if there would be a Work Plan to conduct the sampling. Krista replied an addendum to the AOCs 1, 2, 6, 7, and 8 SI Work Plan would be prepared and submitted to the Team for review.

Wrap-Up/Action Item

The Team agreed to:

- Remove the Waste Slag Material subarea from the EE/CA
- Collect four surface (0-6 inches) and subsurface (6-24 inches) soil samples for inorganic constituents analysis only
- Prepare a SAP addendum, which will detail sample quantities, locations, and objectives
- Prepare a TM to present the data and path forward.

In addition, the Team agreed that the results of the inorganic constituent analysis will be screened against the CAX background values (95 percent UTLs), ecological screening values (ESVs), and Residential risk-screening levels (RSLs). Marlene asked if the Team preferred to capture this agreement in meeting minutes or a consensus statement. The Team agreed that meeting minutes were acceptable.

SAP Worksheet #9-D—Project Scoping Session Participants Sheet

Project Name: AOC 6, Waste Slag Material Subarea Soil Sample Collection **Projected Date(s) of Sampling:** September 2012 **PM:** Laura Lampshire			**Site Name:** AOC 6 – Penniman AOC, Waste Slag Material Subarea **Site Location:** CAX, Williamsburg, VA	
Date of Session: November 16, 2011 **Scoping Session Purpose:** The Team discussed the analyte list for the Waste Slag Material soil sample collection.				
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**
Krista Parra	RPM	Navy	(757) 341-0395	krista.parra@navy.mil
Marlene Ivester	AM	CH2M HILL	(757) 671-6282	marlene.ivester@ch2m.com
Wade Smith	RPM	VDEQ	(803) 698-4125	wade.smith@deq.virginia.gov
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Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com

Comments/Decisions

The Team discussed the analyte list for the Waste Slag Material subarea soil sampling during the Roundtable portion of the November 2011 Partnering Meeting. Marlene reminded the Team that the Waste Slag Material subarea would be removed from the EE/CA and soil samples around the waste slag pile will be collected. John had a question about only sampling for inorganic constituents and wondered if any other contaminants were detected in the earlier slag material sample. Marlene presented the analytical tables from the Weston Report (included herein as **Appendix B**) for the Team to review, as full suite (volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], pesticides, polychlorinated biphenyl [PCBs], and inorganic and nitroaromatic [explosive] compounds) analyses were conducted and the results presented in that report. Krista suggested only analyzing for the five inorganic constituents listed in Table 1 of the Weston Report (i.e., antimony, arsenic, chromium, lead, and manganese), because the sample was of the waste slag pile itself, and waste slag is not a typical CERCLA issue.

Wrap-Up/Action Item

After the discussion, the Team agreed the soil samples will be analyzed for the full inorganic constituent list only.

SAP Worksheet #9-E—Project Scoping Session Participants Sheet

Project Name: AOC 6, Waste Slag Material Subarea Soil Sample Collection **Projected Date(s) of Sampling:** September 2012 **PM:** Laura Lampshire	**Site Name:** AOC 6 – Penniman AOC, Waste Slag Material Subarea **Site Location:** CAX, Williamsburg, VA

Date of Session: June 28, 2012

Scoping Session Purpose: The Team discussed EPA BTAG's comment on the draft SAP Addendum, which suggested having six perimeter and three underneath sample locations instead of the four perimeter and one underneath sample locations presented in the draft SAP Addendum.

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Marlene Ivester	AM	CH2M HILL	(757) 671-6282	marlene.ivester@ch2m.com
Wade Smith	RPM	VDEQ	(803) 698-4125	wade.smith@deq.virginia.gov
John Burchette	RPM (exiting)	USEPA Region 3	(215) 814-3378	burchette.john@epamail.epa.gov
Sue Haug	RPM (returning)	USEPA Region 3	(215) 814-3394	haug.susanne@epamail.epa.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	(757) 671-6273	stephanie.sawyer@ch2m.com

Comments/Decisions

CH2M HILL proposed keeping the perimeter sample locations at four (as presented in the SAP) and adding one additional "underneath" sample location, for a total of two underneath locations – one each at opposite ends of the pile. The EPA RPM said, since there will be post removal sampling, he would rather move one of the two underneath sample locations and add it to the locations along the perimeter of the pile. The Team agreed with this proposal to collect soil samples (surface and subsurface) from five evenly distributed locations around the slag pile and from one location underneath the slag pile. The Team also agreed that if it is not possible to collect a soil sample from underneath the slag pile, the underneath location will be added to the number of locations around the perimeter of the slag pile; therefore, surface and subsurface samples will be collected from a total of six locations. The Team agreed this proposal is sufficient to address EPA BTAG Comment #1.

Wrap-Up/Action Item

CH2M HILL will revise the SAP Addendum to add one additional sample location around the perimeter of the Waste Slag pile and to clarify that if collecting soil underneath the pile is not possible, the underneath location will be moved to the perimeter.

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SAP Worksheet #10—Problem Definition

Introduction

This worksheet provides a summary of the site background and key elements of the conceptual site model (CSM) of the AOC 6 Waste Slag Material subarea, followed by a narrative description of the problems to be addressed during the sampling activities.

Site Background

CAX is located in Williamsburg, Virginia, on the York-James Peninsula (**Figure 1**). The peninsula trends northwest-southeast and is roughly bordered to the southwest by the James River, to the northeast by the York River, and to the southeast by the confluence of the James River and the Chesapeake Bay. CAX was established in June 1943 as a satellite unit of the Navy Supply Depot to provide bulk storage facilities. Prior to 1943, CAX had been the location of the PSLP, a large powder and shell loading facility operated by DuPont during World War I. Today the mission of CAX is supplying Atlantic Fleet ships and providing recreational opportunities to military and civilian personnel.

The Waste Slag Material subarea is one of five subareas that comprise AOC 6 (Penniman AOC). It consists of a pile of metallic slag material that was identified and sampled during a 1999 SI of the former PSLP (described in more detail below) (Weston, 1999). The waste slag pile was defined as approximately 25 feet long by 10 feet wide and located in the southern portion of the base (**Figure 2**).

Investigation History

In January 2001, CAX was placed on the National Priorities List (NPL), which required all subsequent activities for Navy Environmental Restoration (ER) sites be conducted under CERCLA procedures. The USEPA included the Waste Slag Material subarea as a source area for the CAX Hazard Ranking System (HRS) scoring, although the Navy considered it to be associated with former railroad activities, and not a CERCLA-regulated release. The Waste Slag Material subarea was one of eight source areas evaluated as part of the CAX HRS, and had no impact on the overall HRS score that placed CAX on the NPL. However, it was included as one of five AOC 6 subareas in the CAX Federal Facilities Agreement (FFA) (USEPA et al., 2005); as a result, the Navy has agreed to address this subarea as part of ER activities.

Previous investigations that helped characterize potential contamination and contaminant sources at the AOC 6 Waste Slag Material subarea are the 1999 PSLP SI (Weston, 1999) and site visits.

1999 Site Inspection, Penniman Shell Loading Plant

The purpose of this USEPA-directed SI was to collect information concerning conditions at the former PSLP sufficient to assess potential contamination sources and to determine the need for additional investigation under CERCLA or other authority, and, if appropriate, support site evaluation using the HRS for proposal to the NPL. The investigation included reviewing background information, sampling waste and environmental media, evaluating and documenting HRS factors, and collecting additional non-sampling information (Weston, 1999).

As part of the SI, one waste source sample was collected from the Waste Slag Material subarea (PEN1-SO-07) and analyzed for VOCs, SVOCs, pesticides, PCBs, inorganics, and nitroaromatic (explosive) compounds. The description of this waste source sample in Table 1 and Attachment 1 of the SI seemed to indicate the slag itself was sampled and analyzed; however, the SI text specified all waste source samples were soil (Weston, 1999). No sample depth information or a description of the exact sample location (e.g., beside the pile, within the pile, under the pile) was provided. The sample results were compared to SI-specific background soil concentrations and USEPA Region 3 RBCs. The Waste Slag Material subarea sample results that exceeded Region 3 RBCs are presented in Table 1 below.

SAP Worksheet #10—Problem Definition (continued)

TABLE 1
1999 SI Waste Slag Material Subarea Sample
Results Exceeding USEPA Region 3 RBCs for Residential Soil

Area	Sample ID	Analytical Results[1]
Waste Slag Material Subarea	PEN1-SO-07	Antimony – 4.6 L mg/kg Arsenic – 33.4 mg/kg Chromium – 32.9 mg/kg Lead – 2,600 mg/kg Manganese – 2,070 J mg/kg

Notes:
[1]Analytical results lists all compounds exceeding the USEPA Region III RBCs for Residential Soil in waste samples
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
J = Analyte present. Reported value may or may not be accurate or precise.
mg/kg = milligrams per kilogram

The SI concluded that the slag material is contaminated with antimony, arsenic, chromium, lead, and manganese, and of these, arsenic and lead were of particular concern. In addition, visual inspection of the slag material indicated that it was an “intact, relatively hard, rock-like material” that had a relatively low potential to migrate as particulates (Weston, 1999). However, further investigation was recommended to determine if contaminants are leaching from the slag material and impacting the site.

The SI presented a list of areas recommended for further investigation, and five of these areas, including the Waste Slag Material, were chosen to comprise AOC 6, Penniman AOC. These five subareas are listed in the CAX FFA.

AOC 6 SI

Although part of AOC 6, Penniman AOC, the Waste Slag Material subarea was not included in the recent SI for AOC 6 (CH2M HILL, 2012) because the Navy’s position has been that the waste slag is associated with former railroad activities (or “rolling stock”) and is therefore not considered a CERCLA-regulated release. However, after several Partnering Team discussions, the Navy has agreed to regulatory agency requests to address this one pile of waste slag as part of CAX’s ER Program since the Waste Slag Material subarea is included as an AOC 6 subarea in the CAX FFA.

Site Visits

The 1999 SI provided a general location of the Waste Slag Material subarea (i.e., a dot on a drawing indicating the location of PEN1-SO-07), but the area was not surveyed and no sample coordinates were provided. The Navy RPM, along with Navy contractor personnel (either from Shaw Environmental or CH2M HILL), conducted three separate site visits (August 2009, December 2009, and February 2010) that attempted, unsuccessfully, to locate the Waste Slag Material subarea. In May 2010, the Navy RPM conducted a fourth site visit with the USEPA and VDEQ RPMs. The Navy RPM showed the USEPA and VDEQ RPMs the general area of where the waste slag was reported to be located and noted that the environment was not stressed, but thriving. The Navy proposed no action for the Waste Slag Material subarea; however, the USEPA requested an additional site visit to look for it again. As part of the January 2011 Partnering Meeting, a site visit was conducted and the Waste Slag Material subarea was found (**Figure 3**); therefore, the Partnering Team subsequently formulated a path forward to address it (refer to SAP Addendum **Worksheets #9-A to #9-E** which summarize the January 2011 site visit and subsequent discussions/decisions).

SAP Worksheet #10—Problem Definition (continued)

Release History

There is no known release of inorganic constituents from the waste slag pile to the surrounding environment. The historical sample collected is believed to have been of the slag itself. The soil samples proposed herein will determine if a release to adjacent soil has occurred.

Conceptual Site Model

A 3-D conceptual site model (CSM) is not warranted at this stage where the focus is to determine if a release from the slag pile to the surrounding soil has occurred. If a release is confirmed and additional sampling is necessary, a CSM that depicts all potential transport and exposure routes will be prepared.

Physical Characteristics

The area surrounding the Waste Slag Material subarea is heavily vegetated and is relatively flat. The waste slag pile itself is within a wooded area near Garrison Road (**Figure 3**). Immediately north and northwest of the waste slag pile is an open area, cleared of large trees and covered with small shrubs, grasses, and greenbriers. Ground elevations at CAX vary from sea level along the eastern boundary, which borders the York River, to a maximum elevation of approximately 50 feet above mean sea level on a few scattered hills in the western portion of the base. At the Waste Slag Material subarea, the topography is relatively flat, with an approximate ground elevation of 30 feet above mean sea level. The Yorktown-Eastover aquifer extends across all of CAX and ranges from 60 to 100 feet thick. Transmissivity of the aquifer ranges from 0.5 to 40 square feet per day (ft^2/day). Groundwater flow is locally controlled by topography with discharge to nearby surface water bodies and a primary flow and discharge direction towards the York River. The depth to groundwater in the Yorktown-Eastover aquifer is likely relatively shallow (i.e., < 30 feet below ground surface [bgs]). At the Waste Slag Material subarea, depth to groundwater should be around 28 feet bgs, based on groundwater collection via temporary wells at nearby AOC 2 and the relatively flat topography between the two AOCs.

Potential Contaminant Sources and Transport Pathways

Inorganic constituents may have leached from the waste slag pile to the adjacent soil. The principal contaminant release and transport mechanisms from the waste slag pile are deterioration of the waste slag itself and leaching from the slag to adjacent soil as a result of rainwater infiltration. Contaminants leached from the slag into soil have the potential to further migrate to the underlying groundwater. Contaminant transport could also occur through surface water runoff carrying contaminated particulate matter; however, the transport of surface soil by surface runoff or wind dispersion is unlikely to be significant because the area is relatively flat and heavily vegetated. No perennial surface water or sediment is present within the site boundary. Surface water may only be present in low lying areas during and immediately following precipitation events.

Receptors

Potential human receptors exposed to waste and soil at the Waste Slag Material subarea are:

- Current site visitors, recreational users, and trespassers (surface soil)
- Future trespassers (surface and subsurface soil)
- Future maintenance workers (surface and subsurface soil)
- Future industrial workers (surface and subsurface soil and groundwater)
- Future residents (surface and subsurface soil and groundwater)
- Future construction workers (surface and subsurface soil and groundwater)

These potential receptors may be exposed to site-related contaminants through:

- Ingestion of, inhalation of particulates from, and dermal contact with soil
- Ingestion of, and dermal contact with groundwater

SAP Worksheet #10—Problem Definition (continued)

Potential ecological receptors exposed to waste and soil at the Waste Slag Material subarea include lower trophic level terrestrial receptors (plants and soil invertebrates). Due to the small size of the waste slag pile, exposures to upper trophic level receptors (i.e., birds and mammals) are not considered significant. The lower trophic level receptors may be exposed to site-related contaminants through root uptake from the soil (plants) and through direct exposure with soil (plants and soil invertebrates).

Problem Statement and Objectives

The problem statement/definition was identified as *"Have inorganic constituents attributable to the waste slag pile leached to soil in exceedance of the human health and ecological screening values."*

The CAX Partnering Team agreed that soil sample collection adjacent to the waste slag pile was necessary to determine if inorganic constituents exist in exceedance of screening values (i.e., a release from the slag pile has occurred). The objectives of the soil sample collection are to:

- Confirm whether a release of inorganic constituents from the waste slag pile to soil has occurred. A release will be assumed to have occurred if any of the constituents have a determined value above the Project Action Limits (PALs) presented in Worksheet 11 (i.e., background 95 percent UTLs and USEPA residential soil RLSs and SSLs and literature-based ecological screening values compiled for use at CAX). The PAL values are listed in Worksheet 15-1.

- Determine if a further investigation, remedial/removal action, or control mechanisms are warranted. If a release has been determined, the TM will recommend further investigation. If it is determined that a release has not occurred, the TM will recommend removal of the waste slag pile and site restoration, followed by no further action.

Environmental Questions answered by the Soil Sample Collection

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

1. Have inorganic constituents attributed to the waste slag pile leached to soil?

Five co-located surface (0–6 inches) and subsurface (6–24 inches) soil samples will be collected around the perimeter of the waste slag pile (**Figure 4**) and analyzed for total inorganic constituents and pH; cyanide analysis will not be conducted as the historic result (0.64 L mg/kg) is well below the proposed screening criteria (**Worksheet #11**). In addition, soil samples (co-located surface and subsurface) will be collected from one location underneath the waste slag pile and analyzed for total inorganic constituents and pH if access allows. If access does not allow sample collection at the underneath sample location, an additional sample location will be added along the perimeter, per Partnering Team discussion and agreement (refer to Worksheet #9-E). Sample locations were selected to provide information about potential leaching of inorganic constituents from the waste slag pile.

2. If inorganic constituents have leached from the waste slag pile to soil, what is the appropriate next step?

This determination will be made based on an evaluation (leaching and human health and ecological risk screenings) of the analytical data in accordance with the decision tree presented in **Figure 5**. Results of the sampling and proposed future activities will be presented in a TM.

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 or removal action is warranted.

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

The Project Action Limits (PALs) will consist of the background 95 percent UTL (CH2M HILL, 2011) and the following human health and ecological screening values for surface and subsurface soil:

- **Human health—**USEPA residential soil RSLs and site screening levels (SSLs)
- **Ecological—**literature-based ecological screening values compiled for use at CAX

The PAL will be the background value where background is higher than the selected screening criteria (**Figure 5**). In some instances the PAL is lower than the laboratory limit of detection (LOD); however, the laboratory limits do not negatively affect data usability, because in all instances the LOD is lower than the max detected background concentration (**Worksheet #15-1**).

Soil pH will be used as a project indicator value. The ecological soil screening value for aluminum (not toxic if soil pH >5.5) and iron (not toxic if soil pH is between 5 and 8) is based on soil pH, not chemical concentration; therefore, pH data are used directly to evaluate these two metals in surface (0-6 inches) and subsurface (6-24 inches) soil.

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)?

- A maximum of six (five “perimeter” and one underneath, if possible) surface soil samples will be collected and shipped to an offsite laboratory (Katahdin Analytical Services) for analysis of inorganic constituents and pH.
- A maximum of six (five “perimeter” and one underneath, if possible) subsurface soil samples will be collected and shipped to an offsite laboratory (Katahdin Analytical Services) for analysis of inorganic constituents and pH.
- Surface soil samples will be collected from a depth interval of 0–6 inches bgs using a stainless steel hand auger.
- Subsurface soil samples will be collected from a depth interval of 6–24 inches bgs using a stainless steel hand auger.

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 whether or not the waste slag pile has leached inorganic constituents to soil and to make a determination of whether further investigation or action is warranted. Sample results will be used to make these determinations. In order to ensure quality analytical data, the laboratory has obtained accreditation from the DoD ELAP for definitive data analytical methods. **Worksheet #31** of the original QAPP contains this information.
- The soil samples will be analyzed for target analyte list (TAL) Metals by SW-846 6010C/6020A (7470A/7471B for mercury) and pH by SW-846 9045D (**Worksheet #15-1**). This sampling is to determine if inorganic

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

constituents have leached to soil from the waste slag pile. These data will be available for use as definitive data.

- The laboratory will follow the Measurement Performance Criteria (MPC) in **Worksheet #12** in the original QAPP for field quality control (QC) samples and **Worksheet #28** in the original QAPP for laboratory QC samples**.** These MPC are consistent with the DoD Quality Systems Manual (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 **Worksheets #34-36**. A data usability study will be conducted by the project team following data validation.

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

- A maximum of six (five "perimeter" and one underneath, if possible) surface soil and six (five "perimeter" and one underneath, if possible) subsurface soil samples will be collected, as outlined in **Worksheet #17**. Proposed sample locations are shown on **Figure 4**.

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

- Proposed sample locations are shown on **Figure 4**. Sample locations will be field-verified, marked with a stake (if possible), and coordinates documented with a global positioning system (GPS) unit. Descriptions of the soil collected will also be recorded in a field log book.
- Samples will be collected during one field mobilization event. This field mobilization is expected to occur in Fall 2012. (**Worksheet #16**).
- 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 Worksheet #21 in the original QAPP.

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

- CH2M HILL field staff will collect the samples according to procedures presented in **Worksheet #21** in the original QAPP.
- Laboratory analysis will be performed by Katahdin Analytical Services, Scarborough, Maine.
- 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 D** 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 a technical memorandum.

List the Project Quality Objectives in the form of if/then qualitative and quantitative statements

The decision framework to determine whether additional sampling is necessary is shown in the decision tree presented in **Figure 5**.

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

Matrix: Surface Soil (SS), Subsurface Soil (SB)

Analytical Group: Metals

Analyte	Chemical Abstracts Service (CAS) Number	Analysis Method	RSLs Residential Soil Adjusted (Oct.2011)[1] (mg/kg)	CAX Background (BKG) SS[1] (mg/kg)	CAX BKG SB[1] (mg/kg)	ESVs[1] (mg/kg)	Risk-based SSLs[1] (mg/kg)	Project Quantitation Limit (PQL) Goal[2] (mg/kg)	Laboratory-Specific (mg/kg)			Laboratory Control Sample (LCS), Matrix Spike(MS), and Matrix Spike Duplicate (MSD) %R Limits[3]		
									Limit of Quantitation (LOQ)	LOD	Detection Limit (DL)	Lower Criteria Limit (LCL)	Upper Criteria Limit (UCL)	%Relative Percent Difference (RPD)
Aluminum	7429-90-5	SW-846 6010C	7700	12200	13000	pH < 5.5	23000	3850	30	10	0.71	80	120	20
Antimony	7440-36-0		3.1	NC	NC	78	0.27	0.135	0.8	0.5	0.07	80	120	20
Arsenic	7440-38-2		0.39	6.36	5.54	18	0.0013	0.00065	0.8	0.5	0.068	80	120	20
Barium	7440-39-3		1500	52.9	84.5	330	120	26.45	0.5	0.3	0.026	80	120	20
Beryllium	7440-41-7		16	0.587	0.52[4]	40	13	0.26	0.5	0.05	0.0068	80	120	20
Cadmium	7440-43-9		7	NC	NC	32	0.52	0.26	1	0.3	0.01	80	120	20
Calcium	7440-70-2		NC	2290	2380	NC	NC	1145	10	8	1.8	80	120	20
Chromium	7440-47-3		0.29	18.2	33.7	64	0.00059	0.000295	1.5	0.4	0.03	80	120	20
Cobalt	7440-48-4		2.3	9.93	5.18	13	0.21	0.105	3	0.4	0.03	80	120	20
Copper	7440-50-8		310	4.25	3.17	70	22	1.585	2.5	1	0.16	80	120	20
Iron	7439-89-6		5500	19900	32000	pH < 5 or > 8	270	135	10	8	1.4	80	120	20
Lead	7439-92-1		400	17.4	8.79	120	NC	4.395	0.5	0.4	0.09	80	120	20
Magnesium	7439-95-4		NC	1070	1120	NC	NC	535	10	8	0.68	80	120	20
Manganese	7439-96-5		180	324	176	220	21	10.5	0.5	0.4	0.16	80	120	20
Mercury	7439-97-6	SW-846 7471A	2.3	0.111	0.14[4]	0.1	0.033	0.0165	0.033	0.01 7	0.0052	80	120	20

SAP Worksheets #15-1—Reference Limits and Evaluation Tables (continued)

Matrix: Surface Soil (SS), Subsurface Soil (SB)

Analytical Group: Metals

Analyte	CAS Number	Analysis Method	RSLs Residential Soil Adjusted (Oct.2011)[1] (mg/kg)	CAX BKG SS[1] (mg/kg)	CAX BKG SB[1] (mg/kg)	ESVs[1] (mg/kg)	Risk-based SSLs[1] (mg/kg)	PQL Goal[2] (mg/kg)	Laboratory-Specific (mg/kg)			LCS, MS, and MSD %R Limits[3]		
									LOQ	LOD	DL	LCL	UCL	%RPD
Nickel	7440-02-0	SW-846 6010C	150	9.52	17.6	38	20	4.76	4	0.4	0.04	80	120	20
Potassium	9/7/7440		NC	708	901	NC	NC	354	100	50	2.9	80	120	20
Selenium	7782-49-2	SW-846 6020A	39	0.51	0.64[4]	0.52	0.4	0.2	0.5	0.3	0.039	80	120	20
Silver	7440-22-4	SW-846 6010C	39	2.1[4]	1.1[4]	560	0.6	0.3	1.5	0.4	0.03	75	120	20
Sodium	7440-23-5		NC	521	811	NC	NC	260.5	100	50	1.5	80	120	20
Thallium	7440-28-0	SW-846 6020A	0.078	NC	NC	1	0.011	0.0055	0.1	0.04	0.0094	80	120	20
Vanadium	7440-62-2	SW-846 6010C	39	27.9	48.3	130	78	13.95	2.5	0.4	0.04	80	120	20
Zinc	7440-66-6		2300	26.5	28	120	290	13.25	2.5	1	0.17	80	120	20

Notes:

[1]Refer to **Worksheets #10 and #11** for a detailed discussion on the development of PALs. Background values will be the PAL where background is higher than a screening value.
[2]Project QL goals are equal to half of the minimum applicable PAL.
[3]Limits are per the DoD QSM version 4.2.
[4]Maximium BKG value, as no 95% UTL established because either not detected or fewer than 5 detections.

NC indicates that there is no criterion for an analyte.

Grey 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 #15-2–Reference Limits and Evaluation Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: Metals

Analyte	CAS Number	Project Indicator Level (PIL) Goal[1]	Laboratory-Specific[2]		
			LOQ	LOD	DL
pH	PH	NA	NA	NA	NA

Notes:

[1]pH will be used as a project indicator value. The ecological soil screening value for aluminum (not toxic if soil pH >5.5) and iron (not toxic if soil pH is between 5 and 8) is based on soil pH, not chemical concentration; therefore, pH data are used directly to evaluate these two metals in surface (0—6 inches) and subsurface (6—24 inches) soil.

[2]Quantitation and detection limits are not applicable to pH analysis.

NA indicates that information is not applicable to this analyte.

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SAP Worksheet #16—Project Schedule/Timeline Table

The anticipated project schedule is presented below.

Activities	Organization	Dates (MM/DD/YY)		Deliverable
		Anticipated Date(s) of Initiation	Anticipated Date of Completion	
Subcontractor/Field Work Preparation	CH2M HILL	8/28/2012	10/15/2012	None
Field Sampling (including fieldwork preparation)	CH2M HILL	10/26/2012*	10/26/2012	None
Laboratory Analysis (7-day turn)	Katahdin Analytical Services	10/29/2012	11/05/2012	Electronic data deliverable (EDD) and data hardcopies
Data Management	CH2M HILL	11/06/2012	11/16/2012	None
Data Validation	CH2M HILL	11/19/2012	11/30/2012	None
Report Generation	CH2M HILL	12/3/2012	2/15/2013	Draft TM Report

*This sampling will occur concurrent with the sampling for the Site 4 RI, the Youth Pond RI, and the Penniman Lake SI Step 2; therefore, the sampling date may be adjusted as needed.

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SAP Worksheet #17—Sampling Design and Rationale

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy
Surface soil	0-6 inches bgs	TAL Metals	SW-846 6010C, 6020A 7470A/7471B (Mercury)	6 samples	• Sample analysis is based on the potential contaminants in the slag pile (i.e., inorganics), based on the results of the sample collected for the 1999 SI; full suite of inorganics is warranted because only one sample was collected in the past and its exact location/content (i.e., slag vs. soil) has some uncertainty. • Sample locations were selected to provide information about potential leaching of inorganic constituents around, and underneath if possible, the waste slag pile. • Soil sample depths were selected based on human health and ecological receptor exposure as well as to help provide an indication of vertical leaching. The top 6 inches of the soil column generally represents the highest exposures for most ecological receptors and for current human receptors. • Five samples will be collected from around the perimeter of the waste slag pile. In addition, a sample will be collected from a location underneath the waste slag pile if access allows. If access does not allow sample collection at the underneath sample location, an additional sample location will be added along the perimeter for a sixth perimeter sample, per Partnering Team agreement (refer to **Worksheet #9-E**).	Surface soil samples will be collected at a depth of 0–6 inches bgs using a stainless steel hand auger. See environmental questions at end of **Worksheet #10** and proposed sample locations on **Figure 4**.
		pH	SW-846 9045D		• The ecological soil screening value for aluminum (not toxic if soil pH >5.5) and iron (not toxic if soil pH is between 5 and 8) is based on soil pH, not chemical concentration; therefore, pH data are used directly to evaluate these two metals in surface soil.	
Subsurface soil	6-24 inches bgs	TAL Metals	SW-846 6010C, 6020A 7470A/7471B (Mercury)	6 samples	• Sample analysis is based on the potential contaminants in the slag pile (i.e., inorganics), based on the results of the sample collected for the 1999 SI; full suite of inorganics is warranted because only one sample was collected in the past and its exact location/content (i.e., slag vs. soil) has some uncertainty. • Sample locations were selected to provide information about potential leaching of inorganic constituents around, and underneath if possible, the waste slag pile. • Soil sample depths were selected based on human health and ecological receptor exposure as well as to help provide an indication of vertical leaching. Potentially significant exposures for most ecological receptors are generally confined to the top 2 feet of the soil column. Also, this depth was selected based on where the highest contamination would be expected to be found in the soil based on past site use, thus the worst case future risks to human receptors can be estimated. • Five samples will be collected from around the perimeter of the waste slag pile. In addition, a sample will be collected from a location underneath the waste slag pile if access allows. If access does not allow sample collection at the underneath sample location, an additional sample location will be added along the perimeter for a sixth perimeter sample, per Partnering Team agreement (refer to **Worksheet #9-E**).	Subsurface soil samples will be collected at a depth of 6–24 inches bgs using a stainless steel hand auger. See environmental questions at end of **Worksheet #10** and proposed sample locations on **Figure 4**.
		pH	SW-846 9045D		• The ecological soil screening value for aluminum (not toxic if soil pH >5.5) and iron (not toxic if soil pH is between 5 and 8) is based on soil pH, not chemical concentration; therefore, pH data are used directly to evaluate these two metals in subsurface soil.	

Notes:

One equipment blank will be collected each day of sampling (per matrix).

One MS/MSD will be collected at a frequency of one per 20 samples per matrix collected.

One field duplicate will be collected at a frequency of one per 10 samples per matrix collected.

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

Sample Location	Sample ID[1]	Matrix	Analytical Group	Number of Samples	Sampling SOP Reference
Surface Soil Samples					
CAA06-SO20	CAA06-SS20-MMYY	Surface Soil	Metals including mercury; pH	6	Refer to **Worksheet #21** in the original QAPP
CAA06-SO21	CAA06-SS21-MMYY				
CAA06-SO22	CAA06-SS22-MMYY				
CAA06-SO23	CAA06-SS23-MMYY				
CAA06-SO24	CAA06-SS24-MMYY				
CAA06-SO25	CAA06-SS25-MMYY[2]				
Surface Soil Quality Assurance (QA)/QC Samples[3,4]					
Field Duplicate	CAA06-SS21P-MMYY		Metals including mercury	1	
Matrix Spike (MS)	CAA06-SS23-MMYY-MS			1	
Matrix Spike Duplicate (MSD)	CAA06-SS23-MMYY-SD			1	
Subsurface Soil Samples					
CAA06-SO20	CAA06-SB20-MMYY	Subsurface Soil	Metals including mercury; pH	6	
CAA06-SO21	CAA06-SB21-MMYY				
CAA06-SO22	CAA06-SB22-MMYY				
CAA06-SO23	CAA06-SB23-MMYY				
CAA06-SO24	CAA06-SB24-MMYY				
CAA06-SO25	CAA06-SB25-MMY Y[2]				
Subsurface Soil QA/QC Samples[3,4]					
Field Duplicate	CAA06-SB21P-MMYY		Metals including mercury	1	
MS	CAA06-SB23-MMYY-MS			1	
MSD	CAA06-SB23-MMYY-SD			1	
Non-matrix QA/QC Samples					
Equipment Blank	CAA06-EB01-MMDDYY	Aqueous Blank	Metals including mercury	Varies[4]	

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 date.

[2]The underneath the waste slag pile location, if access allows. If access does not allow sample collection at the underneath sample location, an additional sample location will be added along the perimeter for a sixth perimeter sample, per Partnering Team agreement (refer to **Worksheet #9-E**).

[3] 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.

[4] Field QC counts may change depending 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)

Equipment Blank - One per type of sampling equipment, per day of sampling

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SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group[1]	Analytical and Preparation Method / SOP Reference[2]	Containers (Number, Size, and Type)	Minimum Sample Amount	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/ Analysis)[3]
Surface Soil, Subsurface Soil	Metals	SW-846 6010C	1 of 8oz glass soil jar with a Teflon-lined lid	2 grams(g)	Cool to 0-6 °C	6 months
		SW-846 6020A		2g		
		SW-846 7471A		0.5g		28 days
	pH	SW-846 9045D		20g		ASAP
Aqueous Blank	Metals	SW-846 6010C	1 of 500mL high density polyethylene (HDPE) bottle	50 milliliters (mL)	HNO_3 to pH < 2, cool to 0-6 °C	6 months
		SW-846 6020A		50mL		
		SW-846 7471A		100mL		28 days

Notes:

1 Refer to **Worksheet #18** for specifics of which samples will be analyzed for which analytical groups.

2 Refer to **Worksheet #23** for a complete reference to relevant analytical SOPs.

3 Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

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SAP Worksheet #20—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[2]	No. of VOC Trip Blanks	Total No. of Samples to Laboratory
Surface Soil	Metals	6[1]	1	1/1	-	1	-	9
	pH	6[1]	-	-	-	-	-	6
Subsurface Soil	Metals	6[1]	1	1/1	-	-	-	8
	pH	6[1]	-	-	-	-	-	6

Notes:

[1]A sample will be collected underneath the waste slag pile if access is possible. If access is not possible, the location will be moved to the perimeter for a sixth perimeter sample, per Partnering Team agreement (refer to **Worksheet #9-E**).

[2]The number of equipment blanks may vary; equipment blanks are collected at a frequency of one per type of sampling equipment, per day of sampling. However, it is anticipated sample collection will take 1 day.

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SAP Worksheet #23—Analytical SOP References Table

Laboratory SOP Number	Title, Revision Date and/or Number	Last Reviewed	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to QSM	Modified for Project Work
CA-101	*Equipment Maintenance, 09/11, Revision 10.*	09/11	N/A	N/A	Various	Katahdin Analytical Services, Inc.	none	no
CA-604	*Acid Digestion of Aqueous Samples By USEPA Method 3010 for ICP Analysis of Total or Dissolved Metals, 04/10, Revision 5.*	05/11	Definitive	SS, SB/ METAL	Block Digester		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.*	09/10	Definitive	SS, SB / METAL	Block Digester		none	no
CA-608	*Trace Metals Analysis By ICP-AES Using USEPA Method 6010, 09/11, Revision 12.*	09/11	Definitive	SS, SB / METAL	Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES)		Post-digestive Spike (PDS) CA refer to **Worksheet #28**	no
CA-611	*Digestion And Analysis Of Solid Samples For Mercury By USEPA Method 7471, 12/10, Revision 8.*	12/10	Definitive	SS, SB / METAL	Mercury Analyzer		none	no
CA-615	*Digestion And Analysis Of Aqueous Samples For Mercury By USEPA Method 7470, 05/11, Revision 6.*	05/11	Definitive	SS, SB / METAL	Mercury Analyzer		none	no
CA-627	*Trace Metals Analysis by ICP-MS using USEPA Method 6020, 04/10, Revision 7.*	in review	Definitive	SS, SB / METAL	Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)		PDS CA	no
CA-709	*pH Concentration Measurements In Soil Matrices – SW 846 Method 9045, 06/10, Revision 8.*	06/10	Screening	SS, SB / WCHEM	pH Meter		none	no
SD-902	*Sample Receipt and Internal Control, 09/10, Revision 9.*	09/10	N/A	All	Not applicable		none	no
SD-903	*Sample Disposal, 05/09, Revision 4.*	10/10	N/A	All	Not applicable		none	no

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SAP Worksheet #24—Analytical Instrument Calibration Table

Due to the substantive update to the DoD QSM in April 2009, information regarding cold vapor atomic absorption spectrometry (CVAA) and ICP-AES and ICP-MS are updated as follows.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Mercury analyzer	Initial calibration (ICAL) - 5 standards and a calibration blank	Instrument receipt, major instrument change, at the start of each day	Correlation coefficient ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst, Supervisor	CA-611, CA-615
	Initial Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	The %R must be within 90-110% of true value for mercury.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.		
	Continuing Calibration Verification (CCV)	At beginning and end of each run sequence and every 10 samples	80-120% of True Value	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.		
	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.		
ICP-AES	Initial calibration (ICAL) - one standard and one calibration blank	At the beginning of each day or if QC is out of criteria.	Per manufacturer's guidelines.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	CA-608
	Initial Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Recovery must be within 90-110 percent of true value for all analytes.	Do not use results for failing elements unless the ICV > 110% and the sample results are non-detect. Investigate and correct the problem.		
	Continuing Calibration Verification (CCV)	At the beginning and end of each run sequence and every 10 samples	Recovery must be within 90-110 percent of the true value for all analytes.	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.		
	Low-level Calibration Check Standard	Daily, after one-point ICAL	Recovery must be within 80-120 percent of the true value for all analytes.	Correct problem, then reanalyze.		
	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.		
ICP-MS	Tune	Daily prior to calibration	Mass calibration within 0.1 amu of true value, Resolution < 0.9 amu at 10% peak height	Perform necessary equipment maintenance	Analyst, Supervisor	CA-627
	Initial calibration	Daily prior to sample analysis.	4 point calibration plus blank – correlation coefficient ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	
	Initial Calibration Verification (ICV)	Before beginning a sample run.	Recovery within + 10 percent of true value.	Do not use results for failing elements, unless ICV >110% and sample result < PQL/reporting limit.	Analyst, Supervisor	
	Calibration Verification (CV)	At the beginning and end of each run sequence and every 10 samples	90-110 percent of True Values	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	
	Low-level Calibration Check Standard	At beginning and end of run	80-120 percent of True Values	Do not use results for failing elements, unless PQL rec.> upper limit and sample result < PQL/reporting limit.	Analyst, Supervisor	

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SAP Worksheet #28-1—Laboratory Quality Control Samples Table

Due to the substantive update to the DoD QSM in April 2009, information regarding the analysis of metals in soils by method SW-846 6010C is updated as follows.

Matrix: Surface Soil, Subsurface Soil

Analytical Group: Metals (except selenium, thallium, and mercury)

Analytical Method/SOP Reference: SW-846 6010C / CA-608

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	Data Quality Indicator (DQI)	MPC
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. If required, 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.
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 #15-1** and **#15-2.** 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	
MS	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific data quality objectives (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	
MSD	One per preparatory batch per matrix.	Same as MS and RPD ≤20% between MS and MSD.	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 PDS addition.		Accuracy	
PDS	When dilution test fails or analyte concentration in all samples < 50X LOD.	Recovery within 75-125%	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 #28-2—Laboratory Quality Control Samples Table

Due to the substantive update to the DoD QSM in April 2009, information regarding the analysis of metals in soils by method SW-846 6020A is updated as follows.

Matrix: Surface Soil, Subsurface Soil

Analytical Group: Metals (Selenium and Thallium)

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	MPC
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. If required, 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 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	
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 #15-1** and **#15-2.** 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	
MS	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	
MSD	One per preparatory batch per matrix.	Same as MS and refer to **Worksheet #15-1** and **#15-2.**	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 PDS addition.		Accuracy	
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 MSA. Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.		Accuracy	
Internal Standards (IS)	Every sample	IS intensity within 70-120% of the intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of ISs.		Accuracy/Bias	

SAP Worksheet #28-3—Laboratory Quality Control Samples Table

Due to the substantive update to the DoD QSM in April 2009, information regarding the analysis of mercury in soils is updated as follows.

Matrix: Surface Soil, Subsurface Soil

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	MPC
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. If required, 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.
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	
Laboratory Control Sample	One per preparatory batch.	Refer to **Worksheet #15-1** and **#15-2**. 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	
MS	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	
MSD	One per preparatory batch per matrix.	Same as MS and %RPD ≤ 20 between MS and MSD.	Same as MS.		Accuracy/Bias, Precision	

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SAP Worksheet #30—Analytical Services Table

A full deliverable, comparable to a USEPA CLP Level IV deliverable, will be reported by Katahdin Analytical Services, Inc. within seven calendar days of sample receipt.

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SAP Worksheet #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.	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 DVation; 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.

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Figures

Legend

Activity Boundaries

City/County Boundaries

N W E S

0 0.6 1.2 Miles

Figure 1
Location of CAX
AOC 6 Waste Slag Material Subarea Soil Sampling SAP Addendum
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

Legend
- Site Location
- CAX Boundary

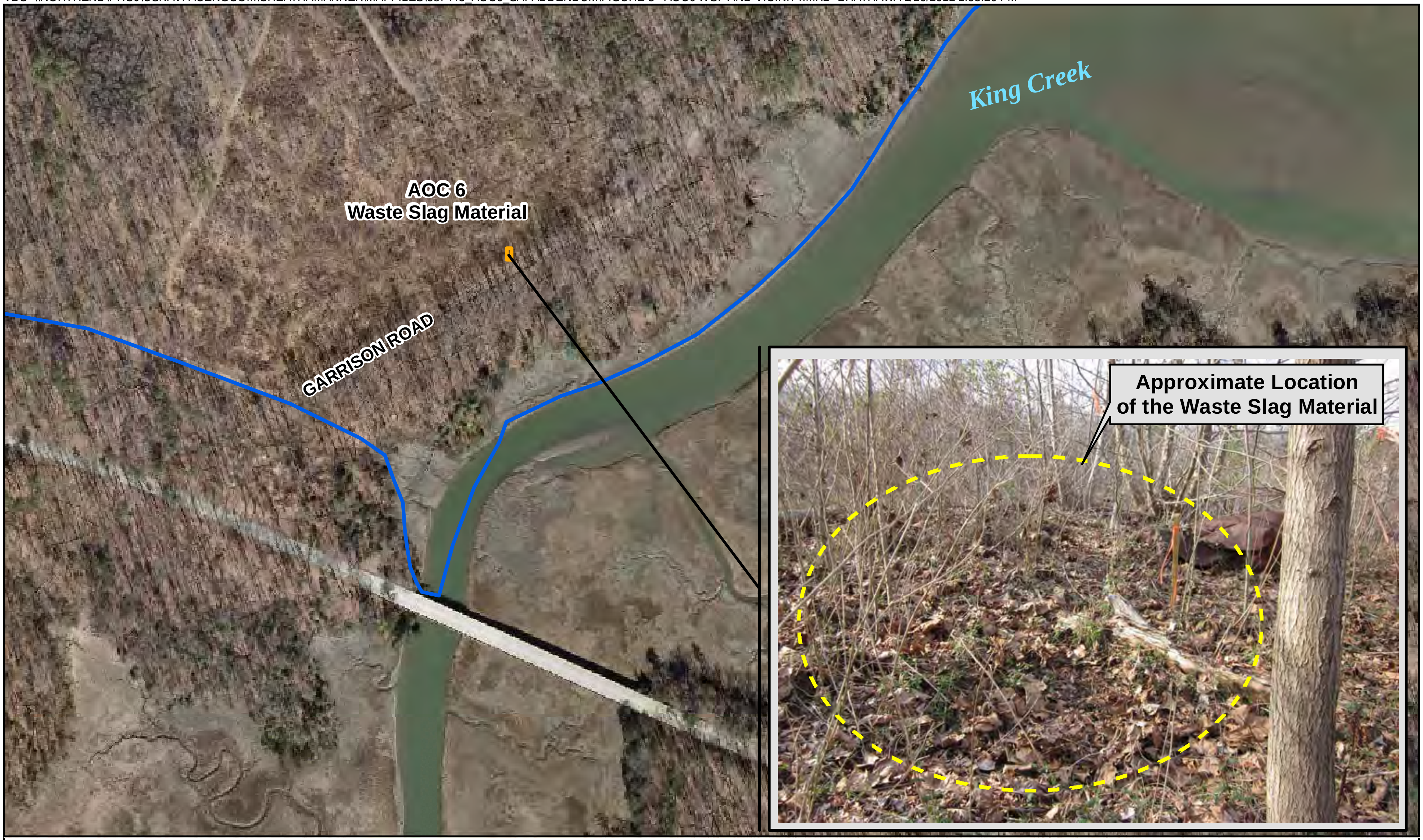
N
W E
S

0 1,000 2,000
Feet

Figure 2
Location of AOC 6 Waste Slag Material Subarea
AOC 6 Waste Slag Material Subarea Soil Sampling SAP Addendum
Cheatham Annex
Williamsburg, Virginia

CH2MHILL.

VBO \\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\387443_AOC6_SAPADDENDUM\FIGURE 3 - AOC6 WSP AND VICINITY.MXD BHATHAWA 1/26/2012 1:33:26 PM



Legend
- Site Location
- CAX Boundary

N
W E
S

0 150 300
Feet

Figure 3
AOC 6 Waste Slag Material Subarea and Vicinity Detail
AOC 6 Waste Slag Material Subarea Soil Sampling SAP Addendum
Cheatham Annex
Williamsburg, Virginia

VBO \\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\387443_AOC6_SAPADDENDUM\FIGURE 4 - PROPOSED SURFACE AND SUBSURFACE SOIL SAMPLES.MXD BHATHAWAY 7/23/2012 1:53:53 PM

Legend

- Proposed co-located surface and subsurface soil sample location
- Proposed co-located surface and subsurface soil sample underneath the waste slag pile (if access allows*)
- Site Location
- CAX Boundary

*If access is not possible, the location will be moved to the perimeter for a sixth perimeter sample, per Partnering Team agreement.

N W E S

0 75 150
Feet

Figure 4
Proposed Surface/Subsurface Soil Sample Locations
AOC 6 Waste Slag Material Subarea Soil Sampling SAP Addendum
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

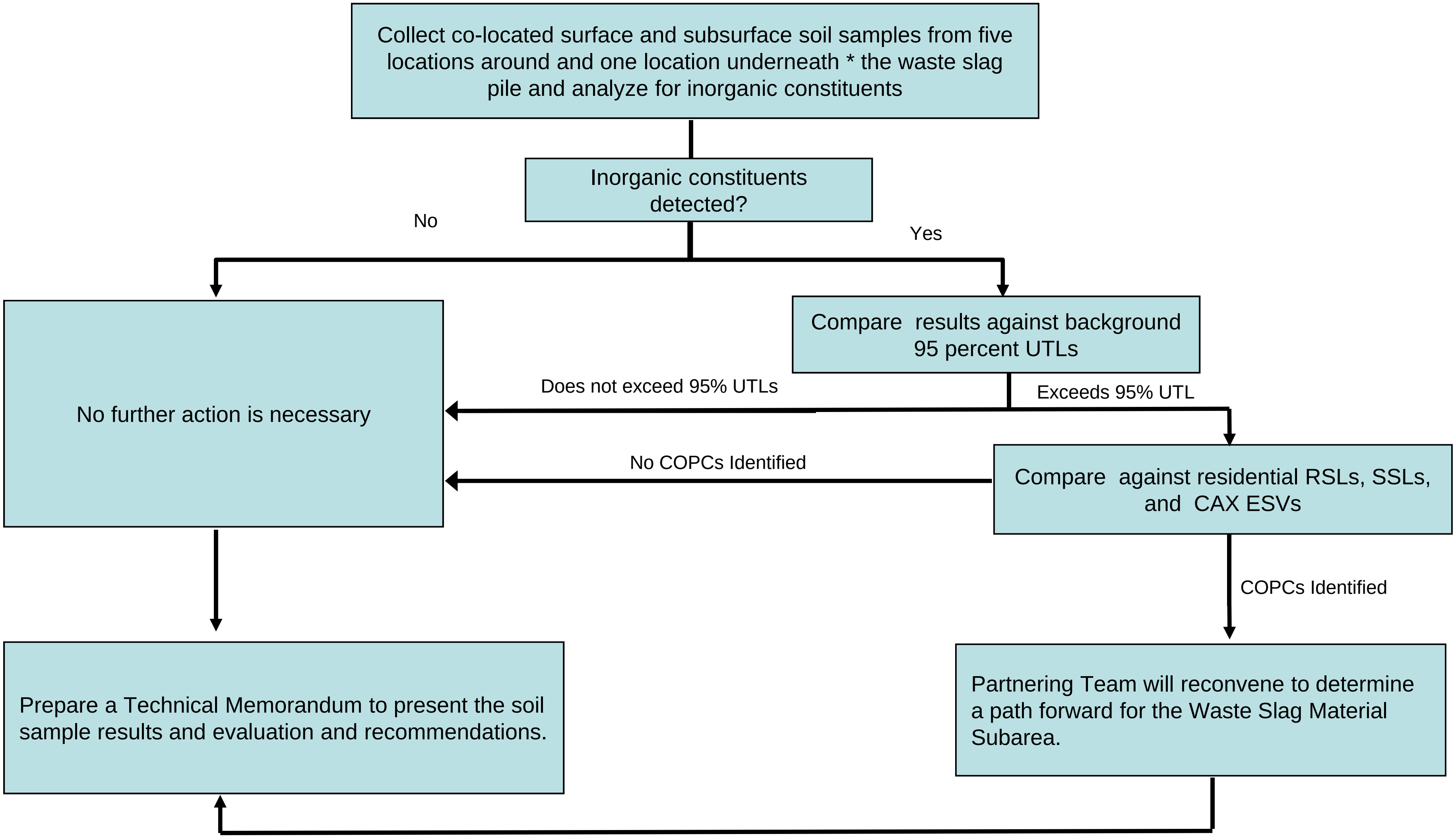


Figure 5
Decision Tree
AOC 6 Waste Slag Material Subarea Soil Sampling SAP Addendum
Cheatham Annex
Williamsburg, Virginia

*If access underneath the waste slag pile is not possible, the location will be moved to the perimeter for a sixth perimeter sample, per Partnering Team agreement.

Appendix A
Original QAPP

Final

Site Inspection Quality Assurance Project Plan for Areas of Concern

Cheatham Annex (CAX)
Williamsburg, Virginia

Contract Task Order 0174

October 2008

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Virginia Beach, Virginia

Contents

Attachment (provided electronically on attached CD-ROM)

A Field SOPs, Analytical Laboratory SOPs, Valid Values

Abbreviations and Acronyms

AOC	Areas of Concern
bgs	below ground surface
BTAG	Biological Technical Assistance Group
CAX	Cheatham Annex
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action, Navy
CLP	Contract Laboratory Program
COC	chain of custody
CTO	Contract Task Order
DoD	Department of Defense
DPT	Direct Push Tool
DQI	data quality indicator
EDS	Environmental Data Services
EIS	Environmental Information Specialist
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FTL	Field Team Leader
GPS	global positioning system
IDW	investigation-derived waste
IR	Installation Restoration
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MPC	Measurement Performance Criteria
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Navy
NIRIS	Navy IR Information Solution
PCB	polychlorinated biphenyl
PQO	project quality objective
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	quality control
QL	quantitation limit
RBC	risk-based concentration

SI	Site Inspection
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TOC	total organic carbon
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
μg/L	micrograms per Liter
U.S.	United States
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

Introduction

This site-specific Quality Assurance Project Plan (QAPP) is being submitted to provide a systematic data collection and analysis structure for the Site Investigation of the Areas of Concern (AOCs) at Cheatham Annex, Williamsburg, Virginia, as a supplement to the *Work Plan for Site Investigation of Various Cheatham Annex Areas of Concern*, CH2M HILL, 2007 (referred to as "Work Plan" in this document). The site investigation will be conducted as a single field mobilization at AOCs 1, 2, 6, 7, and 8. In accordance with the Uniform Federal Policy for QAPPs (UFP-QAPP, March 2005), this QAPP includes 37 worksheets that detail various aspects of the environmental investigation process and serves as guidelines for the field work and data quality. The site-specific laboratory and field standard operating procedures (SOPs) are located in Attachment 1 of this QAPP (on CD).

The United States Navy (Navy), Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic, is conducting the Site Investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA work is being conducted with the United States Environmental Protection Agency (USEPA) Region III as the lead regulatory agency.

This document will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for intended uses. The laboratory information cited in this QAPP is for the analytical laboratories that are currently contracted to provide analytical services for this investigation. Because of the size of scope of this project, the analytical services for this investigation were split between two laboratories. GPL Laboratories will perform explosives, toxicity characteristic leaching procedure (TCLP) and pesticides analysis. Katahdin Analytical Services will provide volatiles, semivolatiles, metals, and wet chemistry analytical services. Additionally, data validation services were also split between two companies. Environmental Data Services (EDS) will validate explosives and pesticide data. DataQual Environmental Services will validate volatiles, semivolatiles, metals, and wet chemistry data.

A summary of the physical characteristics of the CAX AOCS, previous investigations, and more is provided in the Work Plan.

QAPP Worksheet #1—Title and Approval Page
(UFP-QAPP Section 2.1)

Site Name/Project Name: CAX Areas of Concern
Site Location: Cheatham Annex, Williamsburg, Virginia

Document Title: Site Investigation of Cheatham Annex Areas of Concern (AOCs)

Lead Organization: United States Navy

Preparer's Name and Organizational Affiliation: Megan Hilton, CH2M HILL

Preparer's Address, Telephone Number, and E-mail Address: 5700 Cleveland Street, Suite 101, Virginia Beach, VA 23462, (401) 619-2657, megan.hilton@ch2m.com

Preparation Date (Day/Month/Year): October 2008

Investigative Organization's Project Manager/Date:________________________________
Signature
Printed Name/Organization: Laura Lampshire/CH2M HILL

NAVFAC Remedial Project Manager/Date:_______________________________
Signature
Printed Name: Christopher Murray

USEPA Remedial Project Manager/Date:_______________________________
Signature
Printed Name: Susanne Haug

VDEQ Project Manager/Date:_______________________________
Signature
Printed Name: Wade Smith

Document_Control_Numbering_System : ____

QAPP Worksheet #2—QAPP Identifying Information
(UFP-QAPP Section 2.2.4)

Site Name/Project Name: Cheatham Annex AOCs Site Investigation

Title: CAX AOCs UFP-QAPP

Site Location: Cheatham Annex (CAX), Williamsburg, Virginia

Revision Number: 0

Site Number/Code: Various AOCs

Revision Date: September 2007

Operable Unit: Various AOCs

Contractor Name: CH2M HILL

Contractor Number: N62470-02-D-3052

Contract Title: Navy CLEAN III

Work Assignment Number: N62470-02-D-3052 CTO-0174

1. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
2. Identify approval entity: U.S. Navy
3. The QAPP is (select one): ☐Generic ☒Project Specific
4. List dates of scoping sessions that were held: April 25, 2007, November 15, 2007
5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
N/A	

6. List organizational partners (stakeholders) and connection with lead organization:
   U.S. Navy (NAVFAC, Mid-Atlantic), Lead Agency, USEPA Region III, Lead Regulatory Agency, Department of Defense (DoD), Land Owner
7. List data users:
   U.S. Navy (NAVFAC, Mid-Atlantic), Lead Agency, USEPA Region III, Lead Regulatory Agency; Department of Defense (DoD), Land Owner, and their contractors
8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

QAPP Worksheet #2

QAPP Identifying Information (continued)

Identify where each required QAPP element is located in the QAPP (provide section, worksheet, table, or figure number) or other project planning documents (provide complete document title, date, section number, page numbers, and location of the information in the document). Type "NA" for the QAPP elements that are not applicable to the project. Provide an explanation in the QAPP.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	#1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	iii vi
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	#3 #4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	#5 #6 #7 #8

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	#10 #9 #10 Figures 2-1 through 2-12 of SI Work Plan
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	#11 #12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	#13 #13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	#14 #15 #16
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/SOP Requirements Table - Analytical Methods/SOP Requirements Table	#17 #17, Figures 3-1 through 3-6 of SI Work Plan #13, 17, 18 #19

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.3 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.4 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	#20 Attachment 1, #21 #21 #22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Attachment 1, #23 #23 #24 #25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal	Attachment 1, #26, 27 #19 #26 #27

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	#28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	#29 #30 n/a
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	#31 #31 #32 #32
4.2 QA Management Reports	- QA Management Reports Table	#33
4.3 Final Project Report		

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	#34 #35 #36 #37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3—Distribution List

(UFP-QAPP Manual Section 2.3.1)

List those entities to whom copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments will be sent.

☐ Worksheet Not Applicable (State Reason)

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Christopher Murray	Remedial Project Manager	NAVFAC Mid-Atlantic	(757) 444-3811	(757) 444-5822	Christopher.r.murray@navy.mil	Administrative Record number will be assigned upon QAPP approval
Suzanne Haug	Remedial Project Manager	USEPA Region III	(215) 814-3357	(215) 814-3051	Haug.Susanne@epamail.epa.gov	Administrative Record number will be assigned upon QAPP approval
Wade Smith	FUDS Project Manager	VDEQ	(804) 698-4125	(804) 698-4234	Wmsmith@deq.virginia.gov	Administrative Record number will be assigned upon QAPP approval
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785		Bonnie.capito@navy.mil	Administrative Record number will be assigned upon QAPP approval
Laura Lampshire	Project Manager	CH2M HILL	(301) 570-1042		Laura.lampshire@ch2m.com	Administrative Record number will be assigned upon QAPP approval
Cecilia Landin	Deputy Activity Manager	CH2M HILL	(757) 671-6266		Cecilia.Landin@ch2m.com	Administrative Record number will be assigned upon QAPP approval
Marlene Ivester	Activity Manager	CH2M HILL	(757) 873-1442 x34		Marlene.ivester@ch2m.com	Administrative Record number will be assigned upon QAPP approval

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

Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable sections of the QAPP and will perform the tasks as described. Ask each organization to forward signed sheets to the central project file.

☐ Worksheet Not Applicable (State Reason)

Organization: U.S. Navy

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Christopher Murray	Remedial Project Manager	(757) 444-3811		

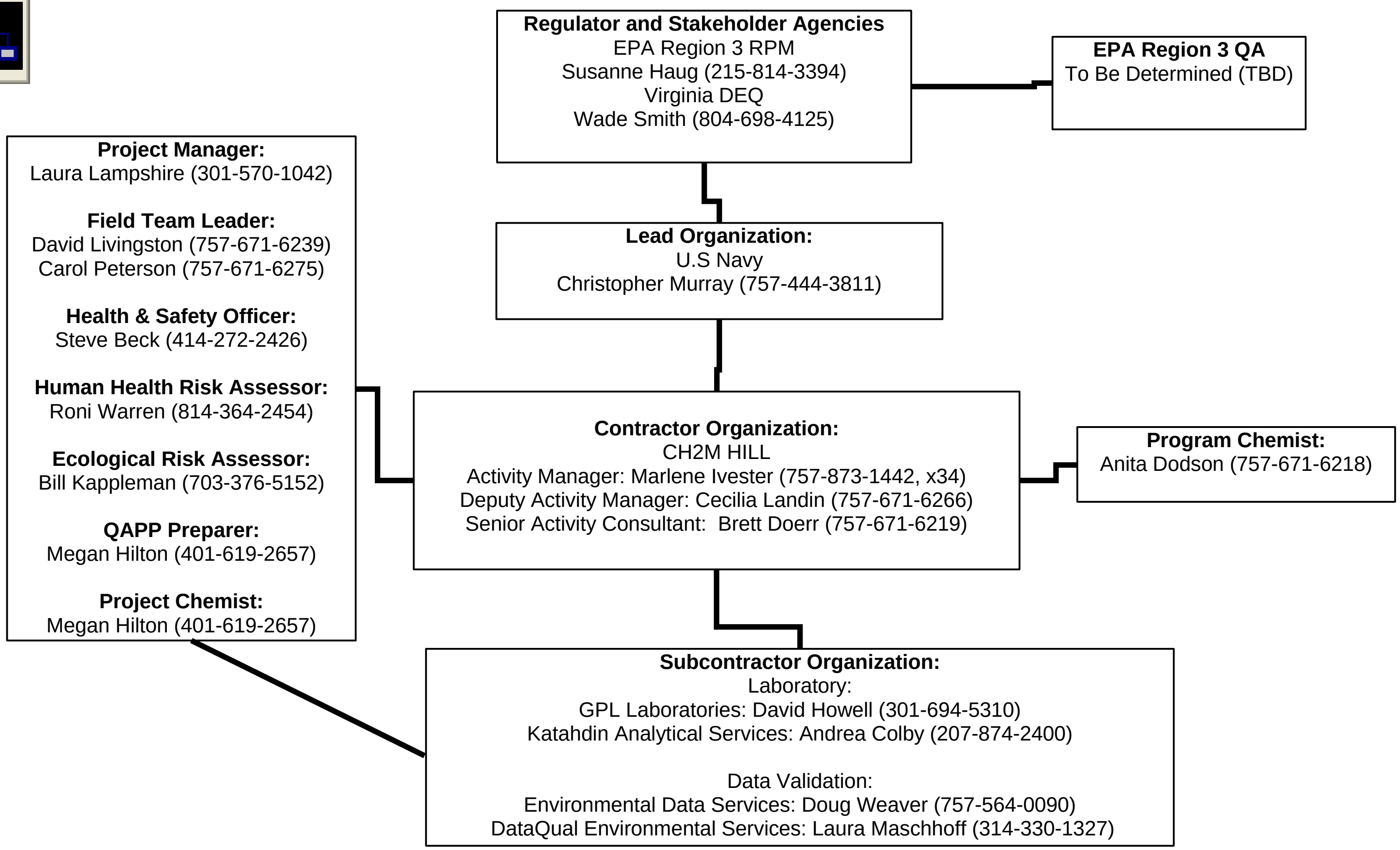
Organization: CH2M HILL

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Marlene Ivester	Activity Manager	(757) 873-1442, x34		
Cecilia Landin	Deputy Activity Manager	(757) 671-6266		
Laura Lampshire	Project Manager	(301) 570-1042		
Anita Dodson	Program Chemist	(757) 671-6218		
Paul Favara	Program Quality Manager	(352) 335-5877, x52396		
Megan Hilton	Project Chemist	(401) 619-2657		
Brett Doerr	Senior Activity Consultant	(757) 671-6219		
Steve Beck	Health and Safety Officer	(414) 272-2426 x277		
Carol Peterson	Field Team Leader (FTL)	(757) 671-6275		
David Livingston	Field Team Leader (FTL)	(757) 671-6239		

QAPP Worksheet #5—Project Organization Chart
(UFP-QAPP Manual Section 2.4.1)

Identify reporting relationships between all organizations involved in the project, including the lead organization and all contractor and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.

☐ Worksheet Not Applicable (State Reason)



QAPP Worksheet #6—Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

Describe the communication pathways and modes of communication that will be used during the project, after the QAPP has been approved. Describe the procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff. Describe the procedure that will be followed when any project activity originally documented in an approved QAPP requires real-time modifications to achieve project goals or a QAPP amendment is required. Describe the procedures for stopping work and identify who is responsible.

☐ Worksheet Not Applicable (State Reason)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Communication with Navy (lead agency)	Navy RPM for WPNSTA Yorktown/CAX	Christopher Murray	(757) 444-3811	Primary point of contact for Navy; can delegate communication to other internal or external points of contact.
Communication with USEPA Region III (lead regulatory agency)	USEPA RPM	Susanne Haug	(215) 814-3394	Primary point of contact for EPA; can delegate communication to other internal or external points of contact.
Communication with VDEQ	FUDS Project Manager	Wade Smith	(804) 698-4125	Primary point of contact for VDEQ; can delegate communication to other internal or external points of contact.
Oversees Project Implementation (Activity level)	CH2M HILL Activity Manager, Cheatham Annex (WPNSTA Yorktown)	Marlene Ivester	(757) 873-1442 x34	Oversees project and will be informed of project status by the project manager, Laura Lampshire
Point of Contact with Navy, EPS and VDEQ	CH2M HILL Project Manager	Laura Lampshire	(301) 570-1042	All information and materials about the project will be forwarded to Christopher Murray (Navy RPM), Susanne Haug (USEPA), and Wade Smith (VDEQ)

QAPP Worksheet #6
Communication Pathways (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Manage all Project Phases	CH2M HILL Project Manager for CTO-0174	Laura Lampshire	(301) 570-1042	Laura Lampshire will be the primary point of contact and responsible for all technical, administrative, and field aspects of the project.
QAPP changes in the field	CH2M HILL Field Team Leader	David Livingston Carol Peterson	(757) 671-6239 (757) 671-6275	Documentation of deviations from the work plan made in the field logbook(s) and the PM will be notified. Deviations made only with approval from the PM.
Daily Field Progress Reports	CH2M HILL Field Team Leader	David Livingston Carol Peterson	(757) 671-6239 (757) 671-6275	Daily field progress reports will be either emailed or faxed to Laura Lampshire
Health and Safety	Site Safety Coordinator	David Livingston Carol Peterson	(757) 671-6239 (757) 671-6275	Responsible for adherence of team members to the site safety requirements described in the HASP.
Reporting Analytical Lab Data Quality Issues	Laboratory QA Officers	Yemane Yohannes/ GPL, Leslie Dimond/ Katahdin	(301) 694-5310/ (207) 874-2400	All QA/QC issues with project field samples will be reported by the subcontracted lab within 2 days, who will relay them to the EIS, Project Chemist, and Contractor Quality Assurance Officer.
Risk Assessment	CH2M HILL Human Health and Ecological Risk Assessors	Roni Warren, Bill Kappleman	814-364-2454, 703-376-5152	Risk Assessors will advise the project so that the data collected will be sufficient for performing a Risk Assessment.

QAPP Worksheet #6
Communication Pathways (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Data tracking from collection through upload to database	Environmental Information Specialist (EIS)	Chelsea Bennet	(757) 671-6208	EIS will track data from sample collection through upload to database, ensuring QAPP requirements are met by laboratory and field staff.
Field and Analytical Corrective Actions	Program Chemist Project Chemist Field Team Leader	Anita Dodson Megan Hilton David Livingston Carol Peterson	(757) 671-6218 (401) 619-2657 (757) 671-6239 (757)671-6275	The need for corrective action for field and analytical issues will be determined by the Field Team Leader, Project Chemist and/or Contractor Quality Assurance Officer. Corrective Action with laboratories will be coordinated by Project Chemist.
Release of Analytical Data	Project Chemist	Megan Hilton	(401) 619-2657	No analytical data can be released until validation is completed and the Project Chemist has approved the release.

QAPP Worksheet #7—Personnel Responsibilities and Qualification Table
(UFP-QAPP Manual Section 2.4.3)

Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. Include data users, decision-makers, project managers, QA officers, project contacts for organizations involved in the project, project health and safety officers, geotechnical engineers and hydrogeologists, field operation personnel, analytical services, and data reviewers. Identify project team members with an asterisk (*). Attach resume to this worksheet or note the location of the resumes.

☐ Worksheet Not Applicable (State Reason)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
Christopher Murray	Remedial Project Manager	NAVFAC Mid-Atlantic	Coordinates all environmental activities at CAX.	B.S. Environmental Science M.S. Environmental Engineering 10 years exp.
Marlene Ivester	Activity Manager	CH2M HILL	Responsible for ERP at CAX	B.A. English B.S. Geology M.S Business Administration 14 years exp.
Cecilia Landin	Deputy Activity Manager	CH2M HILL	Responsible for assisting CAX Activity Manager for ERP at CAX	B.S. Geology 8 years exp.
Laura Lampshire	Project Manager	CH2M HILL	Directs and oversees staff	B.S. Geology and Mathematics M.S. Geophysics 14 years exp.
Brett Doerr	Senior Consultant	CH2M HILL	Provides senior technical oversight	B.S. Chemistry M.S. Environmental Science 16 years exp.
Anita Dodson	Program Chemist	CH2M HILL	Responsible for audits, corrective action, checks of QA performance	B.S. Chemistry 14 years exp.

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
Megan Hilton	Project Chemist	CH2M HILL	Performs oversight of laboratory and data validators, releases analytical data	B.S. Chemistry B.S. Environmental Science 2 years exp.
David Livingston	Field Team Leader	CH2M HILL	Supervises field sampling and coordinates all field activities	B.S. Biology 3 years exp.
Carol Peterson	Field Team Leader	CH2M HILL	Supervises field sampling and coordinates all field activities	B.S. Geology M.S. Geology 4 years exp.
Roni Warren	Human Health Risk Assessor	CH2M HILL	Technical expertise for Human Health Risk Assessment	M.S. Environmental Engineering B.S. Computer Science 17 years exp.
Bill Kappleman	Ecological Risk Assessor	CH2M HILL	Technical expertise for Ecological Risk Assessment	M.S. Wildlife Biology B.S. Wildlife Biology 21 years exp.
Steve Beck	Health and Safety Officer	CH2M HILL	Oversees H&S for field activities	M.S. Occupational Safety and Health 14 years exp.
Andrea Colby	Project Manager	Katahdin Analytical Services	Managing analytical projects from initiation to completion.	B.A. Biology 21 years exp.
Leslie Dimond	QA Officer	Katahdin Analytical Services	Responsible for Corrective Action and oversight of QA	B.A. Chemistry 14 years exp.
David Howell	VP of Sales and Marketing	GPL Laboratories	coordinate, negotiate and manage federal and commercial contracts	B.S. Chemistry, Biology 20 years exp.
Yemane Yohannes	QA Officer	GPL Laboratories	Responsible for Corrective Action and oversight of QA	B.A. Chemistry 22 years exp.
Nancy Weaver	Senior Chemist	Environmental Data Services	Responsible for the analytical data review and validation	B.S. Chemistry 21 years exp.

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
Doug Weaver	Contracts Manager	Environmental Data Services	Responsible for all contractual and administrative issues	B.S. Industrial Engineering 20 years exp.
Laura Maschhoff	President	DataQual Environmental Services	Program Manager/Organic	B.S. Biology 19 years exp.
Jackie Cleveland	Vice-President	DataQual Environmental Services	Program Manager/Inorganic	B.S. Chemistry 20 years exp.
Chelsea Bennet	EIS	CH2M HILL	Manages sample tracking, coordinates with laboratory and data-validator, data management	B.S. Biology 7 years exp.
Resumes of CH2M HILL employees on file with CH2M HILL Human Resources Department.				

QAPP Worksheet #8—Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

Provide the following information for those projects requiring personnel with specialized training. Attach training records and/or certificates to the QAPP or note their location.

☐ Worksheet Not Applicable (State Reason)

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Environmental Field Work at CAX AOCs	HAZWOPER 40 hour training 8 hour refreshers CPR/First Aid SSC-HW training	Various registered organizations	Project-specific	David Livingston (FTL), Carol Peterson (FTL), others TBD	FTL, Field team members, site-safety coordinators, all from CH2M HILL	CH2M HILL Human Resources Dept.

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

Complete this worksheet for each project scoping session held. Identify project team members who are responsible for planning the project.

☐ Worksheet Not Applicable (State Reason)

Project Name: CAX AOCs Site Investigation **Projected Date(s) of Sampling:** December 2007 **Project Manager:** Laura Lampshire	**Site Name:** CAX Areas of Concern **Site Location:** Cheatham Annex, Williamsburg, Virginia

Date of Session: April 25, 2007

Scoping Session Purpose: To summarize site conditions and discuss sampling strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Laura Cook	Deputy Activity Manager, WPNSTA Yorktown	CH2M HILL	757-671-6214	Laura.cook@ch2m.com	Overseeing UFP-QAPP production, project support
Marlene Ivester	Deputy Activity Manager, CAX	CH2M HILL	757-873-1442 x34	Marlene.ivester@ch2m.com	Overseeing UFP-QAPP production, project support
Laura Lampshire	Project Manager	CH2M HILL	301-570-1042	Laura.lampshire@ch2m.com	Work Plan production, project management

Comments/Decisions:

Each AOC was summarized, with review of the site conditions, historical sampling events and reports.

Discussed problems that exist and possible sampling strategies. Reviewed general Work Plan approach and document preparation.

Action Items:

Need to speak to risk assessors and senior consultants concerning number of samples and matrices to collect at each AOC. Need to justify any sampling that will not take place in this round (e.g. AOC 2).

Consensus Decisions:

n/a- mainly an informational session.

QAPP Worksheet #9
Project Scoping Session Participants Sheet (continued)

Project Name: CAX AOCs Site Investigation **Projected Date(s) of Sampling:** July 2008 **Project Manager:** Laura Lampshire	**Site Name:** CAX Areas of Concern **Site Location:** Cheatham Annex, Williamsburg, Virginia

Date of Session: November 15, 2007

Scoping Session Purpose: Review presentation of CAX AOC Draft Work Plan provided at Yorktown Partnering Meeting in Nov. 2007

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Wade Smith	FUDS Project Manager	CH2M HILL	757-671-8311 x 444	wmsmith@deq.virginia.gov	Primary point of contact for VDEQ
Linda Cole	Remedial Project Manager	CH2M HILL	757-873-1442 x34	Linda.cole@navy.mil	Primary point of contact for Navy
Robert Thomson	Remedial Project Manager		215-814-3357	Thomson.bob@epamail.epa.gov	Primary point of contact for EPA
Rebekah Ives	Yorktown Partnering Team Discussion Leader	CH2M HILL	757-671-6235	Rebekah.ives@ch2m.com	Recorder of Yorktown Partnering Meetings
Donna Caldwell	Activity Manager	CH2M HILL	757-873-1442, x28	Donna.caldwell@ch2m.com	Oversees project
Bill Friedmann (via phone)	Deputy Activity Manager	CH2M HILL	757-671-6223	William.friedmann@ch2m.com	Assists in overseeing project
Laura Lampshire (via phone)	Project Manager	CH2M HILL	301-570-1042	Laura.lampshire@ch2m.com	Work Plan production, project management

Comments/Decisions:

Laura Lampshire provided an informal Power Point presentation of the Draft CAX AOC SI Work Plan that is currently being prepared. Purpose of presentation was to provide Yorktown Partnering Team opportunity to review the preliminary Work Plan and provide input regarding the sampling design.

Action Items:

Donna Caldwell will confirm if the Waste Slag Material Area at AOC 6 was listed as a source area on the National Priorities List.

Laura Lampshire will add test pitting at AOC 7 and phthalate analyses at AOC 6.

QAPP Worksheet #9
Project Scoping Session Participants Sheet (continued)

Linda Cole will check to see if photographs (AOC 7) are in the administrative record, if not she will send copies to Rob. The photographs are part of a housekeeping report.

Consensus Decisions:

Robert Thomson (USEPA) requested that SVOC analyses be added to media being sampled at ACO 6 and that test pitting be conducted at AOC 7 to assist in delineation of debris disposal area(s). Partnering Team concurred.

QAPP Worksheet #10—Problem Definition
(UFP-QAPP Manual Section 2.5.2)

Clearly define the problem and the environmental questions that should be answered for the current investigation and develop the project decision "If…, then…" statements in the QAPP, linking data results with possible actions. The prompts below are meant to help the project team define the problem. They are not comprehensive.

☐ Worksheet Not Applicable (State Reason)

The problem to be addressed by the project: The objective of this project is to determine whether a release that has the potential to adversely affect human health or the environment has occurred at any of the CAX AOCs. See Section 1.1 of the SI Work Plan.
The environmental questions being asked: 1. Have there been any releases to the environment? 2. If releases are identified, do they pose a significant threat to public health and the environment, and 3. Are additional actions needed to address these releases?
Observations from any site reconnaissance reports: AOC 1: Contains an extensive amount of debris, as it was a former landfill. See Section 2.2.2 of the SI Work Plan. AOC 6: Ammonia Settling Pits, TNT catch basins, and 1918 Drum storage area has been found. See Section 2.4.2 of the SI Work Plan. AOC 7: 55-gallon drums and cans in several small dumps. See Section 2.5.1 of the SI Work Plan. AOC 8: Small amount of modern-era debris (candy wrappers, Styrofoam) found. See Sections 2.6.1 and 2.6.2 of the SI Work Plan.
A synopsis of secondary data or information from site reports: Reports from past studies (Site Inspection reports, etc.) at AOCs 1, 6, 7, and 8 are found at the web site: http://public.lantops-ir.org/sites/public/yorktown/Site%20Files/AdminRecords.aspx. Historical practices and past studies at these sites suggest the potential exists for soil, groundwater, and possibly sediment and surface water (at AOC 6) contamination.
The possible classes of contaminants and the affected matrices: AOC 1 – soil (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives), groundwater (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives) AOC 6 – soil (Metals, TOC, pH, Explosives, SVOCs), groundwater (Metals, Explosives, SVOCs), sediment (Metals, TOC, pH, grain size, Explosives, SVOCs), surface water (Metals, Explosives, SVOCs) AOC 7 – soil (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives), groundwater (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives) AOC 8 - soil (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives), groundwater (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives)
The rationale for inclusion of chemical and non-chemical analyses: See Section 3.2.2 of the Work Plan
Information concerning various environmental indicators: Discussion and site maps are found in Section 2 (Background) and Section 3 (Field Investigation Work Plan) of the SI Work Plan
Project decision conditions ("If..., then..." statements): See Figure 1-1 of the SI Work Plan

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

(UFP-QAPP Manual Section 2.6.1)

Use this worksheet to develop project quality objectives (PQOs) in terms of type, quantity, and quality of data determined using a systematic planning process. Provide a detailed discussion of PQOs in the QAPP. List PQOs in the form of qualitative and quantitative statements. These statements should answer questions such as those listed below. These questions are examples only, however; they are neither inclusive nor appropriate for all projects.

☐ Worksheet Not Applicable (State Reason)

Who will use the data? The data will be used by the Navy (and its contractors) and the other stakeholder agencies to ensure the sites are adequately assessed and, if necessary, appropriate measures are taken to provide adequate protection of human health and the environment.
What will the data be used for? The data will be used to determine the nature and extent of contamination in environmental media from past Navy operations and the associated potential risks posed by the contamination, if any.
What type of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) The data collected will be representative of historical waste disposal activities at each AOC and will include (refer to Sections 3.2.1 and 3.2.2 of the SI Work Plan for specifics): • Surface soil, subsurface soil, groundwater, surface water, and sediment sample collection • VOC, SVOC, metals, explosives, pest/PCBs, TOC, pH, and grain size analyses • Aqueous Investigation Derived Waste (IDW) sample will be collected for analysis for full suite Toxicity Characteristic Leaching Procedure (TCLP) parameters (VOCs, SVOCs, pesticides, herbicides, and metals), reactivity to cyanide and sulfide, corrosivity as pH, and ignitability. • Adherence to the Standard Operating Procedures for laboratory and sampling techniques referenced in this UFP-QAPP Worksheets 21 and 23.
How “good” do the data need to be in order to support the environmental decision? The quality of the data will depend on their intended use. Project Action Limits (PAL’s) will be requested such that the data will support a Human Health and Ecological Risk Assessment. PAL's are based on the most conservative screening values to ensure that the laboratory's Quantitation Limits (QLs) are low enough to provide results that can be compared to both Human Health or Ecological criteria.For risk assessments and high-level decisions, laboratory methods will meet CERCLA, EPA Region III, and Navy guidance and the data will be validated by a third-party validator using Region III and national functional guidance.
How much data are needed? (number of samples for each analytical group, matrix, and concentration) Figures 3.1 through 3.6 and Sections 3.2.1 through 3.2.2 of the SI Work Plan show/describe proposed sample locations for soil, groundwater, sediment, and surface water. Sample locations were selected consistent with the historical record based on the most likely locations for a release at the sites. The number of samples was selected to provide sufficient coverage to determine the presence of a release. Additional samples may be needed if a release potentially posing risk is identified as described on Figure 1-1. As described in section 3.2.1 of the SI Work Plan, the number of QA/QC samples is detailed in the Master Plans (Baker, 2005a).
Where, when, and how should the data be collected/generated? The data will be collected and generated in accordance with the procedures outlined in the CAX AOC SI WP and the SOPs contained in this QAPP. Fieldwork is tentatively scheduled to begin December 2007. Validated data would be received from a third-party validator approximately six weeks after the lab receives the samples.
Who will collect and generate the data? CH2M HILL field staff will collect the samples. Two analytical laboratories, Katahdin Analytical Services and GPL Laboratories, LLLP, will analyze the samples and generate data.
How will the data be reported? See Section 4.1.4 of the SI Work Plan
How will the data be archived? The data will be archived in accordance with federal law. At the end of the project, archived data will be returned to the Navy.

QAPP Worksheet #12-1—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface
Analytical Group	TCL Volatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/ SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils	EPA CLP OLM04.3/ Katahdin SOP-7, SOP-9, SOP-10	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values> 5X QL: $\pm$ 100%	Field Duplicates	S + A
		Precision-Laboratory	$\pm$ 30% when native conc. $\leq$ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in SOP-9, Section 8.2	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in SOP-9, Section 8.2	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Methylene chloride, Acetone, 2-Butanone).	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP-9, section 7.4.3-7.4.4 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
SOP = Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-2—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil
Analytical Group	TCL Semivolatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils	EPA CLP OLM04.3/ Katahdin SOP-8	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD <100%	Field Duplicates	S + A
		Precision-Laboratory	RPD $\leq$ 50% when native conc. $\leq$ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in SOP 8, Section 8.5	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in SOP 8, Section 8.5	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (bis-(2-ethylhexyl) phthalate)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP-8, Section 7.5.1-7.5.2 for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
EPA = U.S. Environmental Protection Agency
CLP = Contract laboratory program
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-3—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils	EPA CLP OLM04.3/ GPL #Q20	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	Data must meet the relative RT criteria and should meet acceptance criteria and spike recovery criteria in SOP Q20, Attachments 16 and 17.	Matrix spike/Matrix spike duplicate	A
		Accuracy/Bias-Contamination	No target analytes $\geq$ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	all target compound < CRQL; surrogates must be within RT windows; surrogate recoveries must be within 30-150%	Method Blank, Sulfur Blank	A
		Contamination/ Bias	surrogates must be within RT windows; all target compounds < 0.5x CRQL	Instrument Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP Q20, Section 7.2.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
CRQL = Contract Required Quantitation Limit
EPA = U.S. Environmental Protection Agency
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
SOW = Statement of Work
TCL = Target Compound List

QAPP Worksheet #12-4—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	TAL Metals/ Cyanide
Concentration Level	ICP-AES (ILM05.3)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	EPA CLP ILM05.3 / Katahdin SOP-4, SOP-12	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values > 3X QL:RPD < 50%	Field Duplicates	S + A
		Precision-Laboratory	Values > 3X QL: RPD < 20	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 25% when sample concentration ≤ 4X the spike concentration	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 20% of true value	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Na,K, Ca and Mg)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP 4, Table 1 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
EPA = U.S. Environmental Protection Agency
CLP = Contract laboratory program
ICP = Inductively Coupled Plasma- Atomic Emission Spectroscopy
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TAL = Target Analyte List

QAPP Worksheet #12-5—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Explosives (plus PETN and 3,5-Dinitroaniline)
Concentration Level	Medium (SW-846 8330)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	SW-846 8330/ GPL #S1	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits in SOP S1, Section 14.4; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/ Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S1, Section 14.3 for QC limits.	Laboratory Control Samples	A
		Accuracy/Bias - Contamination	No target analytes ≥ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S1, Section 14.1 for QC limits.	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP S1, Sections 8.4-8.5 for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
PETN = Pentaerythritol Tetranitrate
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-6—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	SW-846 8332/ GPL #S7	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits in SOP S7 Section 13.3; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/ Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S7 Section 13.2 for QC limits.	Laboratory Control Samples	A
		Accuracy/ Bias - Contamination	No target analytes $\geq$ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S7 Section 13.1 for QC limits.	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP S7 Section 10.-10.4 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-8—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium (SW-846 8330M)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	SW-846 8330/ GPL #S4	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits in SOP S4, Section 13; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/ Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S4 Section 13 for QC limits.	Laboratory Control Samples	A
		Accuracy/ Bias - Contamination	No target analytes $\geq$ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S4 Section 13 for QC limits.	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP S4, Section 8.3-8.4 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-9—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Wet Chemistry
Concentration Level	Medium (various)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Total Organic Carbon					
Soils, Sediment	Lloyd Kahn / Katahdin SOP-2	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD < 100%	Field Duplicates	S + A
		Precision-Laboratory	RPD ≤ 50% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A
pH					
Soils, Sediment	SW-846 9045C / Katahdin SOP-3	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD < 100%	Field Duplicates	S + A
		Accuracy/Bias	% Recovery 90-110%	Laboratory Control Samples	A
Grain Size					
Soils, Sediment	ASTM D422 / Test America LM-SL-D422	None	None	Replicate	S&A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-10—Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TCL Volatiles				
Concentration Level	Medium (OLM04.3)				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW	EPA CLP OLM04.3/ Katahdin SOP-7, SOP-9	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values> 5X QL: ± 50%	Field Duplicates	S + A
		Precision-Laboratory	± 20% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in Worksheet 28	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in Worksheet 28	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Methylene chloride, Acetone, 2-Butanone).	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
SOP Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-11—Measurement Performance Criteria Table

Matrix	Groundwater
Analytical Group	TCL Semivolatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW	EPA CLP OLM04.3/ Katahdin SOP-8	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD < 70%	Field Duplicates	S + A
		Precision-Laboratory	RPD ≤ 30% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (bis-(2-ethylhexyl) phthalate)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract Laboratory Program
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-12—Measurement Performance Criteria Table

Matrix	Groundwater
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW	EPA CLP OLM04.3/ GPL #Q20	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	Data should meet acceptance criteria and spike recovery criteria specified in the OLM04.3 SOW	Matrix spike/Matrix spike duplicate	A
		Accuracy/Bias-Contamination	No target analytes $\geq$ CRQL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	All target compounds < 0.5x CRQL	Instrument Blank	A
		Contamination/ Bias	All target compounds < CRQL; surrogates must be within RT window	Method Blank	A
		Contamination/ Bias	All target compounds < CRQL; surrogates must be within RT windows; surrogate recoveries must be within 30-150%	Sulfur Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract Laboratory Program
CRQL = Contract Required Quantitation Limit
EPA = U.S. Environmental Protection Agency
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
SOW = Statement of Work
TCL = Target Compound List

QAPP Worksheet #12-13—Measurement Performance Criteria Table

Matrix	Groundwater Surface Water
Analytical Group	TAL Total Metals/ Cyanide TAL Dissolved Metals
Concentration Level	Lowest CRQL from ICP-MS and ICP-AES (ILM05.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	EPA CLP ILM05.3 / Katahdin SOP-4, SOP-11, SOP-17, SOP-19	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values > 3X QL:RPD < 50%	Field Duplicates	S + A
		Precision-Laboratory	Values > 3X QL:	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 25% when sample concentration $\leq$ 4X the spike concentration	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 20% of true value	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes $\geq$ QL; with the exception of common field/laboratory contaminants (Na,K, Ca and Mg)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
CRQL = Contract Required Detection Limit
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TAL = Target Analyte List

QAPP Worksheet #12-14—Measurement Performance Criteria Table

Matrix	Groundwater Surface Water
Analytical Group	Explosives (plus PETN and 3,5-Dinitroaniline)
Concentration Level	Medium (SW-846 8330)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	SW-846 8330/ GPL #S1	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S1	Laboratory Control Samples	A
		Accuracy/Bias-Contamination	No target analytes > QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S1	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
PETN = Pentaerythritol Tetranitrate
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-15—Measurement Performance Criteria Table

Matrix	Groundwater Surface Water
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	SW-846 8332/ GPL #S7	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S7	Laboratory Control Samples	A
		Accuracy/Bias-Contamination	No target analytes > QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S7	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-16—Measurement Performance Criteria Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium (SW-846 8330M)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	SW-846 8330M/ GPL #S4	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S4	Laboratory Control Samples	A
		Accuracy/Bias-Contamination	No target analytes > QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S4	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-17—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-VOCs
Concentration Level	Medium (SW-846 1311/8260B)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 8260B/ H7, M5	Bias/ Contamination	No target analytes > Quantitation Limit Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%	Method Blank	A
		Accuracy/ Bias	Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; Retention times +/- 30 secs of CC	Internal Standards	A
		Accuracy/ Bias/ Precision	Benzene: 80-120% Carbon tetrachloride: 65-140% Chlorobenzene: 80-120% Chloroform: 65-135% 1,2-Dichloroethane: 70-130% 1,1-Dichloroethene: 70-130% 2-Butanone: 30-150% Tetrachloroethene: 45-150% Trichloroethene: 70-125% Vinyl Chloride:50-145%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-18—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-SVOCs
Concentration Level	Medium (SW-846 1311/8270C)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 8270C/ H7, P5	Bias/ Contamination	No target analytes > Quantitation Limit; Surrogates within: 2-Fluorobiphenyl: 46-108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Method Blank	A
		Accuracy/ Bias	Surrogates within: 2-Fluorobiphenyl: 46-108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; Retention times +/- 30 secs of CC	Internal Standards	A
		Accuracy/ Bias/ Precision	2-methylphenol: 17-153% 3&4-methylphenol: 21-143% 1,4-Dichlorobenzene: 24-144% 2,4-Dinitrotoluene: 33-153% Hexachlorobenzene: 24-110% Hexachlorobutadiene 25-137% Hexachloroethane: 23-147% Nitrobenzene: 23-147% Pentachlorophenol: 19-110% Pyridine: 23-121% 2,4,5-Trichlorphenol: 28-144% 2,4,6-Trichlorophenol: 31-147%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-19—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Pesticides
Concentration Level	Medium (SW-846 1311/8081A)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 8081A/ H7, Q6	Bias/ Contamination	No target analytes > Quantitation Limit; surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Method Blank	A
		Accuracy/ Bias	surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	Endrin: 43-134% Heptachlor: 45-128% Heptachlor epoxide: 53-134% Gamma-BHC: 73-125% Methoxychlor: 73-142%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-20—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Herbicides
Concentration Level	Medium (SW-846 1311/8151A)

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 8151A/ H7, Q10	Bias/ Contamination	No target analytes > Quantitation Limit; surrogate values within lab statistical QC limits: DCAA:61-136%	Method Blank	A
		Accuracy/ Bias	surrogates within: DCAA:61-136%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	2,4-D: 61-136% 2,4,5-TP: 61-136%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-21—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Metals
Concentration Level	Medium (SW-846 1311/6010B, 7470A)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 6010B, 7470A/ H7, H10, H12	Bias/ Contamination	No target analytes > ½ Quantitation Limit	Method Blank	A
		Accuracy/ Bias	%Recovery 75-125%	Post-Digestion Spike	A
		Accuracy/ Bias	%Difference 10%	ICP Serial Dilution	A
		Precision	Relative Percent Difference ≤20%	Duplicate	A
		Accuracy/ Bias/ Precision	%Recovery 80% - 120%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias	%Recovery 80% - 120%	Matrix Spike	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-22—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	Reactivity to Cyanide and Sulfide
Concentration Level	Medium

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
HSE-411	SW-846 7.3, 9014, 9034/ J13, J11, J43	Precision	RPD ≤ 15 %	Duplicate	A
		Accuracy/ Bias	Reactive sulfide Recovery 23.7% - 30.3%, Reactive cyanide Recovery 1.7% - 2.9%	Laboratory Control Sample	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-23—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	Corrosivity
Concentration Level	Medium

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
HSE-411	SW-846 7.2.2-1a/ J12	Precision	Relative Percent Difference ≤ 15%	Duplicate	A
		Accuracy/ Bias	± 0.10 pH units	Laboratory Control Sample (pH 7.0 buffer)	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-24—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	Ignitability
Concentration Level	Medium

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
HSE-411	SW-846 1010/ N1	Precision	Relative Percent Difference ≤ 20%	Duplicate	A
		Accuracy/ Bias	% Recovery 80-120%	Laboratory Control Sample	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #13—Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data will be used and the limitations on their use.

☐ Worksheet Not Applicable (State Reason)

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
AOC 1 Historical Data	CH2M HILL and Baker Environmental, Inc., *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site,* May 10, 2001	Baker Environmental, Inc. Surface soil, subsurface soil, surface water, and sediment samples collected November 1999	Data used to determine the proposed sample locations for the SI Work Plan	None known
AOC 2 Historical Data	Baker Environmental, Inc., *Final Field Investigation Report, Site 1 and AOC 2, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site,* September 7, 1999	Baker Environmental, Inc. Surface soil, subsurface soil, and groundwater samples collected October 1998	Data used to justify no further investigation needed at AOC 2 within the SI Work Plan	None known
AOC 2 Historical Data	CH2M HILL and Baker Environmental, Inc., *Final Field Investigation Report, Site 7 and AOC 2, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site,* March 29, 2001	Baker Environmental, Inc. Soil samples collected November 1999	Data used to justify no further investigation needed at AOC 2 within the SI Work Plan	None known
AOC 6 Historical Data	Weston, *Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia,* August 9, 1999	Weston Waste source, surface water, sediment, and background soil samples collected January 1999	Data used to determine the proposed sample locations for the SI Work Plan	Cannot confirm from this report whether data was validated

QAPP Worksheet #14—Summary of Project Tasks
(UFP-QAPP Manual Section 2.8.1)

Provide a brief overview of the listed project activities.

☐ Worksheet Not Applicable (State Reason)

Sampling Tasks: 1. Collect groundwater samples using Direct Push Tool (DPT) at various locations. 2. Monitor groundwater quality parameters for pH, specific conductance, turbidity, dissolved oxygen, temperature, salinity, and oxidation-reduction potential. These parameters must be stabilized before a sample is collected. 3. Practice awareness of munitions and explosives of concern (MEC). 4. Soil sample locations will be marked prior to collection using a hand-held GPS. 5. Surface soil and subsurface soil samples will be collected using a stainless steel trowel or hand auger. 6. A visual description of the soil will be logged. 7. Surface water and sediment samples will be collected beginning downstream and working to upstream locations. 8. Take water quality readings before collecting surface water samples. 9. CH2M HILL will survey to the nearest one meter, soil, groundwater, surface water, and sediment sampling locations using GPS 10. CH2M HILL will decontaminate all field equipment when appropriate, according to the SOPs. 11. All Investigation- Derived Waste (IDW) from decon of sampling equipment generated during sampling will be managed.
Analysis Tasks: • Katahdin will analyze environmental samples for TAL Total Metals/Cyanide, TAL Filtered Metals, TOC, pH, TCL SVOCs, and VOCs. • Test America will be subcontracted by Katahdin to analyze environmental samples for Grain Size. • GPL will analyze environmental samples for Explosives, TCL Pesticides and PCBs, full suite TCLP, reactivity, corrosivity, and ignitability. • Laboratories will process, prepare, and analyze groundwater, surface water, soil, IDW and sediment samples according to Contract Laboratory Program (CLP), SW-846, or other methodologies as applicable. • Laboratories will possess United States Navy (NFESC) approval for analytical methods, if available. • Laboratories will be responsible for any second-tier subcontracted analyses to other labs. This includes turnaround times, deliverables, and data quality. • All analyses and sample custody procedures will be performed in accordance will the laboratories' Standard Operating Procedures, referenced in Worksheet #23 and supplied as an attachment on CD.
Quality Control Tasks: • Implement SOPs for field and analytical laboratory activities being performed (see Worksheets 21 and 23). • Quality Control/ Quality Assurance (QA/QC) samples will be collected in the field and sent to the laboratory to ensure proper field sampling and analytical techniques (see Worksheet 20). • Analytical results will be reviewed by a third party data validator (TBD). • Any deviations from Quality Control tasks will be submitted as an addendum to this QAPP and filed as Corrective Action if necessary.

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

Secondary Data: See Worksheet #13
Data Management Tasks: • Analytical data will be entered into CH2M HILL's Navy CLEAN SNEDD format by the laboratories, using Valid Values lists (supplied as attachment on CD). • Data Validators will receive the EDD and apply data qualifiers as necessary. • The EDD and hardcopy data package will be reviewed by the Project Chemist in order to verify the usability of the data. • The EDD will be placed in CH2M HILL's Endat system Oracle database and in Navy IR Information Solution (NIRIS) database.
Documentation and Records: See Worksheet 29.
Assessment/Audit Tasks: See Worksheets 31 and 32.
Data Review Tasks: Data will be reviewed initially by third party subcontractors, then by CH2M HILL staff. • See Worksheet 35 and 36 for data validation tasks • See Worksheet 37 for data usability assessment tasks.

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

Note for all matrices and parameters: PAL's are based on the most conservative screening values to ensure that the laboratory's QLs are low enough to provide results that can be compared to both Human Health or Ecological criteria.

Matrix: Surface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Dichlorodifluoromethane	75-71-8	16000	Residential RBCs	3200	0.01	0.001
Chloromethane	74-87-3	NC	N/A	0.01	0.01	0.001
Vinyl Chloride	75-01-4	0.09	Residential RBCs	0.045	0.01	0.001
Bromomethane	74-83-9	110	Residential RBCs	22	0.01	0.001
Chloroethane	75-00-3	220	Residential RBCs	44	0.01	0.001
Trichlorofluoromethane	75-69-4	23000	Residential RBCs	4600	0.01	0.001
1,1-Dichloroethene	75-35-4	0.031	CH2M HILL	0.016	0.01	0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2300000	Residential RBCs	460000	0.01	0.001
Acetone	67-64-1	70000	Residential RBCs	14000	0.01	0.001
Carbon Disulfide	75-15-0	0.00085	CH2M HILL	0.00043	0.01	0.001
Methyl Acetate	79-20-9	78000	Residential RBCs	16000	0.01	0.001
Methylene Chloride	75-09-2	0.37	CH2M HILL	0.074	0.01	0.001
trans-1,2-Dichloroethene	156-60-5	0.4	CH2M HILL	0.08	0.01	0.001
Methyl tert-Butyl Ether	1634-04-4	160	Residential RBCs	32	0.01	0.001
1,1-Dichloroethane	75-34-3	0.027	CH2M HILL	0.014	0.01	0.001
cis-1,2-Dichloroethene	156-59-2	0.4	CH2M HILL	0.08	0.01	0.001
2-Butanone	78-93-3	470000	Residential RBCs	94000	0.01	0.001

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

Matrix: Surface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Chloroform	67-66-3	0.022	CH2M HILL	0.011	0.01	0.001
1,1,1-Trichloroethane	71-55-6	0.03	CH2M HILL	0.015	0.01	0.001
Cyclohexane	110-82-7	NC	N/A	0.01	0.01	0.001
Carbon Tetrachloride	56-23-5	0.047	CH2M HILL	0.024	0.01	0.001
Benzene	71-43-2	0.16	CH2M HILL	0.032	0.01	0.001
1,2-Dichloroethane	107-06-2	0.25	CH2M HILL	0.05	0.01	0.001
Trichloroethene	79-01-6	0.22	CH2M HILL	0.044	0.01	0.001
Methylcyclohexane	108-87-2	NC	N/A	0.01	0.01	0.001
1,2-Dichloropropane	78-87-5	9.4	Residential RBCs	1.9	0.01	0.001
Bromodichloromethane	75-27-4	10	Residential RBCs	2.0	0.01	0.001
cis-1,3-Dichloropropene	10061-01-5	0.000051	CH2M HILL	0.000026	0.01	0.001
4-Methyl-2-pentanone	108-10-1	NC	N/A	0.01	0.01	0.001
Toluene	108-88-3	200	CH2M HILL	40	0.01	0.001
trans-1,3-Dichloropropene	10061-02-6	0.000051	CH2M HILL	0.000026	0.01	0.001
1,1,2-Trichloroethane	79-00-5	1.2	CH2M HILL	0.24	0.01	0.001
Tetrachloroethene	127-18-4	0.41	CH2M HILL	0.082	0.01	0.001
2-Hexanone	591-78-6	312	Prov. RfD	62.4	0.01	0.001
Dibromochloromethane	124-48-1	7.6	Residential RBCs	1.5	0.01	0.001
1,2-Dibromoethane	106-93-4	32	Residential RBCs	6.4	0.01	0.001

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

Matrix: Surface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Chlorobenzene	108-90-7	40	CH2M HILL	8.0	0.01	0.001
Ethylbenzene	100-41-4	1.1	CH2M HILL	0.22	0.01	0.001
Xylenes, total	1330-20-7	0.16	CH2M HILL	0.032	0.01	0.001
Styrene	100-42-5	300	CH2M HILL	60	0.01	0.001
Bromoform	75-25-2	0.65	CH2M HILL	0.13	0.01	0.001
Isopropylbenzene	98-82-8	0.086	CH2M HILL	0.017	0.01	0.001
1,1,2,2-Tetrachloroethane	79-34-5	1.4	CH2M HILL	0.28	0.01	0.001
1,3-Dichlorobenzene	541-73-1	1.7	CH2M HILL	0.34	0.01	0.001
1,4-Dichlorobenzene	106-46-7	20	CH2M HILL	4.0	0.01	0.001
1,2-Dichlorobenzene	95-50-1	0.34	CH2M HILL	0.068	0.01	0.001
1,2-Dibromo-3-chloropropane	96-12-8	0.2	Residential RBCs	0.04	0.01	0.001
1,2,4-Trichlorobenzene	120-82-1	20	CH2M HILL	4.0	0.01	0.001

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Prov. RfD is a surrogate value calculated by CH2M HILL human health risk assessors.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Subsurface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Dichlorodifluoromethane	75-71-8	16000	Residential RBCs	3200	0.01	0.001
Chloromethane	74-87-3	NC	N/A	0.01	0.01	0.001
Vinyl Chloride	75-01-4	0.09	Residential RBCs	0.045	0.01	0.001
Bromomethane	74-83-9	110	Residential RBCs	22	0.01	0.001
Chloroethane	75-00-3	220	Residential RBCs	44	0.01	0.001
Trichlorofluoromethane	75-69-4	23000	Residential RBCs	4600	0.01	0.001
1,1-Dichloroethene	75-35-4	3900	Residential RBCs	780	0.01	0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2300000	Residential RBCs	460000	0.01	0.001
Acetone	67-64-1	70000	Residential RBCs	14000	0.01	0.001
Carbon Disulfide	75-15-0	7800	Residential RBCs	1560	0.01	0.001
Methyl Acetate	79-20-9	78000	Residential RBCs	15600	0.01	0.001
Methylene Chloride	75-09-2	85	Residential RBCs	17	0.01	0.001
trans-1,2-Dichloroethene	156-60-5	1600	Residential RBCs	320	0.01	0.001
Methyl tert-Butyl Ether	1634-04-4	160	Residential RBCs	32	0.01	0.001
1,1-Dichloroethane	75-34-3	16000	Residential RBCs	3200	0.01	0.001
cis-1,2-Dichloroethene	156-59-2	780	Residential RBCs	156	0.01	0.001
2-Butanone	78-93-3	470000	Residential RBCs	94000	0.01	0.001
Chloroform	67-66-3	780	Residential RBCs	156	0.01	0.001

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

Matrix: Subsurface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
1,1,1-Trichloroethane	71-55-6	160000	Residential RBCs	32000	0.01	0.001
Cyclohexane	110-82-7	NC	N/A	0.01	0.01	0.001
Carbon Tetrachloride	56-23-5	4.9	Residential RBCs	0.98	0.01	0.001
Benzene	71-43-2	12	Residential RBCs	2.4	0.01	0.001
1,2-Dichloroethane	107-06-2	7	Residential RBCs	1.4	0.01	0.001
Trichloroethene	79-01-6	1.6	Residential RBCs	0.32	0.01	0.001
Methylcyclohexane	108-87-2	NC	N/A	0.01	0.01	0.001
1,2-Dichloropropane	78-87-5	9.4	Residential RBCs	1.9	0.01	0.001
Bromodichloromethane	75-27-4	10	Residential RBCs	2	0.01	0.001
cis-1,3-Dichloropropene	10061-01-5	6.4	Residential RBCs[4]	1.28	0.01	0.001
4-Methyl-2-pentanone	108-10-1	NC	N/A	0.01	0.01	0.001
Toluene	108-88-3	6300	Residential RBCs	1260	0.01	0.001
trans-1,3-Dichloropropene	10061-02-6	6.4	Residential RBCs[4]	1.28	0.01	0.001
1,1,2-Trichloroethane	79-00-5	11	Residential RBCs	2.2	0.01	0.001
Tetrachloroethene	127-18-4	1.2	Residential RBCs	0.24	0.01	0.001
2-Hexanone	591-78-6	313	Prov. RfD	62.6	0.01	0.001
Dibromochloromethane	124-48-1	7.6	Residential RBCs	1.5	0.01	0.001
1,2-Dibromoethane	106-93-4	32	Residential RBCs	6.4	0.01	0.001
Chlorobenzene	108-90-7	1600	Residential RBCs	320	0.01	0.001
Ethylbenzene	100-41-4	7800	Residential RBCs	1560	0.01	0.001
Xylenes, total	1330-20-7	16000	Residential RBCs	3200	0.01	0.001

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

Matrix: Subsurface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Styrene	100-42-5	16000	Residential RBCs	3200	0.01	0.001
Bromoform	75-25-2	81	Residential RBCs	16.2	0.01	0.001
Isopropylbenzene	98-82-8	7800	Residential RBCs	1560	0.01	0.001
1,1,2,2-Tetrachloroethane	79-34-5	3.2	Residential RBCs	0.64	0.01	0.001
1,3-Dichlorobenzene	541-73-1	230	Residential RBCs	46	0.01	0.001
1,4-Dichlorobenzene	106-46-7	27	Residential RBCs	5.4	0.01	0.001
1,2-Dichlorobenzene	95-50-1	7000	Residential RBCs	1400	0.01	0.001
1,2-Dibromo-3-chloropropane	96-12-8	0.2	Residential RBCs	0.10	0.01	0.001
1,2,4-Trichlorobenzene	120-82-1	780	Residential RBCs	160	0.01	0.001

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "1,3-dichloropropene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

Prov. RfD is a surrogate value calculated by CH2M HILL human health risk assessors.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Sediment

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Dichlorodifluoromethane	75-71-8	160000	Residential RBCs	32000	0.01	0.001
Chloromethane	74-87-3	NC	N/A	0.01	0.01	0.001
Vinyl Chloride	75-01-4	0.9	Residential RBCs	0.45	0.01	0.001
Bromomethane	74-83-9	1100	Residential RBCs	220	0.01	0.001
Chloroethane	75-00-3	2200	Residential RBCs	440	0.01	0.001
Trichlorofluoromethane	75-69-4	230000	Residential RBCs	46000	0.01	0.001
1,1-Dichloroethene	75-35-4	0.031	CH2M HILL	0.016	0.01	0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	23000000	Residential RBCs	4600000	0.01	0.001
Acetone	67-64-1	700000	Residential RBCs	140000	0.01	0.001
Carbon Disulfide	75-15-0	0.00085	CH2M HILL	0.00043	0.01	0.001
Methyl Acetate	79-20-9	780000	Residential RBCs	160000	0.01	0.001
Methylene Chloride	75-09-2	0.37	CH2M HILL	0.074	0.01	0.001
trans-1,2-Dichloroethene	156-60-5	0.4	CH2M HILL	0.08	0.01	0.001
Methyl tert-Butyl Ether	1634-04-4	1600	Residential RBCs	320	0.01	0.001
1,1-Dichloroethane	75-34-3	0.027	CH2M HILL	0.014	0.01	0.001
cis-1,2-Dichloroethene	156-59-2	0.4	CH2M HILL	0.08	0.01	0.001
2-Butanone	78-93-3	4700000	Residential RBCs	940000	0.01	0.001
Chloroform	67-66-3	0.022	CH2M HILL	0.011	0.01	0.001

QAPP Worksheet #15-3—Reference Limits and Evaluation Table (continued)

Matrix: Sediment

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
1,1,1-Trichloroethane	71-55-6	0.03	CH2M HILL	0.015	0.01	0.001
Cyclohexane	110-82-7	NC	N/A	0.01	0.01	0.001
Carbon Tetrachloride	56-23-5	0.047	CH2M HILL	0.024	0.01	0.001
Benzene	71-43-2	0.16	CH2M HILL	0.032	0.01	0.001
1,2-Dichloroethane	107-06-2	0.25	CH2M HILL	0.05	0.01	0.001
Trichloroethene	79-01-6	0.22	CH2M HILL	0.044	0.01	0.001
Methylcyclohexane	108-87-2	NC	N/A	0.01	0.01	0.001
1,2-Dichloropropane	78-87-5	94	Residential RBCs	19	0.01	0.001
Bromodichloromethane	75-27-4	100	Residential RBCs	20	0.01	0.001
cis-1,3-Dichloropropene	10061-01-5	0.000051	CH2M HILL	0.000026	0.01	0.001
4-Methyl-2-pentanone	108-10-1	NC	N/A	0.01	0.01	0.001
Toluene	108-88-3	0.05	CH2M HILL	0.025	0.01	0.001
trans-1,3-Dichloropropene	10061-02-6	0.000051	CH2M HILL	0.000026	0.01	0.001
1,1,2-Trichloroethane	79-00-5	1.2	CH2M HILL	0.24	0.01	0.001
Tetrachloroethene	127-18-4	0.41	CH2M HILL	0.21	0.01	0.001
2-Hexanone	591-78-6	3130	Prov. RfD	626	0.01	0.001
Dibromochloromethane	124-48-1	76	Residential RBCs	15	0.01	0.001
1,2-Dibromoethane	106-93-4	320	Residential RBCs	64	0.01	0.001
Chlorobenzene	108-90-7	0.41	CH2M HILL	0.21	0.01	0.001
Ethylbenzene	100-41-4	1.1	CH2M HILL	0.22	0.01	0.001
Xylenes, total	1330-20-7	0.16	CH2M HILL	0.032	0.01	0.001

QAPP Worksheet #15-3—Reference Limits and Evaluation Table (continued)

Matrix: Sediment

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Styrene	100-42-5	0.559	CH2M HILL	0.11	0.01	0.001
Bromoform	75-25-2	0.65	CH2M HILL	0.13	0.01	0.001
Isopropylbenzene	98-82-8	0.086	CH2M HILL	0.043	0.01	0.001
1,1,2,2-Tetrachloroethane	79-34-5	1.4	CH2M HILL	0.28	0.01	0.001
1,3-Dichlorobenzene	541-73-1	1.7	CH2M HILL	0.34	0.01	0.001
1,4-Dichlorobenzene	106-46-7	0.35	CH2M HILL	0.070	0.01	0.001
1,2-Dichlorobenzene	95-50-1	0.34	CH2M HILL	0.068	0.01	0.001
1,2-Dibromo-3-chloropropane	96-12-8	2	Residential RBCs	0.40	0.01	0.001
1,2,4-Trichlorobenzene	120-82-1	9.2	CH2M HILL	1.8	0.01	0.001

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment . These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

"Prov. RfD" is a surrogate value calculated by CH2M HILL human health risk assessors.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzaldehyde	100-52-7	7800	Residential RBCs	1560	0.330	0.165
Phenol	108-95-2	30	CH2M HILL	6.0	0.330	0.165
bis-(2-Chloroethyl) ether	111-44-4	0.58	Residential RBCs	0.29	0.330	0.165
2-Chlorophenol	95-57-8	0.0312	CH2M HILL	0.016	0.330	0.165
2-Methylphenol	95-48-7	3900	Residential RBCs	780	0.330	0.165
2,2'-oxybis(1-Chloropropane)	108-60-1	9.1	Residential RBCs	1.8	0.330	0.165
Acetophenone	98-86-2	7800	Residential RBCs	1600	0.330	0.165
4-Methylphenol	106-44-5	390	Residential RBCs	78	0.330	0.165
N-Nitroso-di-n propylamine	621-64-7	0.091	Residential RBCs	0.046	0.330	0.165
Hexachloroethane	67-72-1	1	CH2M HILL	0.50	0.330	0.165
Nitrobenzene	98-95-3	39	Residential RBCs	7.8	0.330	0.165
Isophorone	78-59-1	670	Residential RBCs	130	0.330	0.165
2-Nitrophenol	88-75-5	NC	N/A	0.330	0.330	0.165
2,4-Dimethylphenol	105-67-9	1600	Residential RBCs	320	0.330	0.165
bis(2-Chloroethoxy) methane	111-91-1	0.58	Residential RBCs[4]	0.29	0.330	0.165
2,4-Dichlorophenol	120-83-2	0.117	CH2M HILL	0.059	0.330	0.165
Naphthalene	91-20-3	0.176	CH2M HILL	0.088	0.330	0.165
4-Chloroaniline	106-47-8	310	Residential RBCs	62	0.330	0.165
Hexachlorobutadiene	87-68-3	8.2	Residential RBCs	1.6	0.330	0.165

QAPP Worksheet #15-4—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Caprolactam	105-60-2	39000	Residential RBCs	7800	0.330	0.165
4-Chloro-3-methylphenol	59-50-7	3900	Residential RBCs[5]	780	0.330	0.165
2-Methylnaphthalene	91-57-6	310	Residential RBCs	62	0.330	0.165
Hexachlorocyclopentadiene	77-47-4	10	CH2M HILL	2.0	0.330	0.165
2,4,6-Trichlorophenol	88-06-2	10	CH2M HILL	2.0	0.330	0.165
2,4,5-Trichlorophenol	95-95-4	4	CH2M HILL	2.0	0.830	0.415
1,1'-Biphenyl	92-52-4	60	CH2M HILL	12.0	0.330	0.165
2-Chloronaphthalene	91-58-7	6300	Residential RBCs	1300	0.330	0.165
2-Nitroaniline	88-74-4	NC	N/A	0.830	0.830	0.415
Dimethylphthalate	131-11-3	200	CH2M HILL	40	0.330	0.165
2,6-Dinitrotoluene	606-20-2	78	Residential RBCs	16	0.330	0.165
Acenaphthylene	208-96-8	2300	Residential RBCs[6]	460	0.330	0.165
3-Nitroaniline	99-09-2	NC	N/A	0.830	0.830	0.415
Acenaphthene	83-32-9	20	CH2M HILL	4.0	0.330	0.165
2,4-Dinitrophenol	51-28-5	20	CH2M HILL	4.0	0.830	0.415
4-Nitrophenol	100-02-7	7	CH2M HILL	4.0	0.830	0.415
Dibenzofuran	132-64-9	0.42	CH2M HILL	0.21	0.330	0.165
2,4-Dinitrotoluene	121-14-2	160	CH2M HILL	32	0.330	0.165
Diethylphthalate	84-66-2	100	CH2M HILL	20	0.330	0.165
Fluorene	86-73-7	30	CH2M HILL	6.0	0.330	0.165

QAPP Worksheet #15-4—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	0.330	0.330	0.165
4-Nitroaniline	100-01-6	NC	N/A	0.830	0.830	0.415
4,6-Dinitro-2-methylphenol	534-52-1	3900	Residential RBCs[7]	780	0.830	0.415
N-Nitroso diphenylamine	86-30-6	20	CH2M HILL	4.0	0.330	0.165
4-Bromophenyl-phenylether	101-55-3	1.3	CH2M HILL	0.65	0.330	0.165
Hexachlorobenzene	118-74-1	0.02	CH2M HILL	0.010	0.330	0.165
Atrazine	1912-24-9	0.00662	CH2M HILL	0.033	0.330	0.165
Pentachlorophenol	87-86-5	5	CH2M HILL	1.0	0.830	0.415
Phenanthrene	85-01-8	0.204	CH2M HILL	0.10	0.330	0.165
Anthracene	120-12-7	0.0572	CH2M HILL	0.029	0.330	0.165
Carbazole	86-74-8	1.8	CH2M HILL	0.90	0.330	0.165
Di-n-butylphthalate	84-74-2	200	CH2M HILL	40	0.330	0.165
Fluoranthene	206-44-0	0.423	CH2M HILL	0.21	0.330	0.165
Pyrene	129-00-0	0.195	CH2M HILL	0.039	0.330	0.165
Butylbenzylphthalate	85-68-7	11	CH2M HILL	2.2	0.330	0.165
3,3'-Dichlorobenzidine	91-94-1	0.127	CH2M HILL	0.063	0.330	0.165
Benzo(a)anthracene	56-55-3	0.108	CH2M HILL	0.054	0.330	0.165
Chrysene	218-01-9	0.166	CH2M HILL	0.083	0.330	0.165
bis(2-Ethylhexyl) phthalate	117-81-7	10	CH2M HILL	2.0	0.330	0.165
Di-n-octylphthalate	117-84-0	NC	N/A	0.330	0.330	0.165

QAPP Worksheet #15-4—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzo(b)fluoranthene	205-99-2	0.22	Residential RBCs	0.11	0.330	0.165
Benzo(k)fluoranthene	207-08-9	0.24	CH2M HILL	0.12	0.330	0.165
Benzo(a)pyrene	50-32-8	0.15	CH2M HILL	0.075	0.330	0.165
Indeno(1,2,3-cd)-pyrene	193-39-5	0.2	CH2M HILL	0.10	0.330	0.165
Dibenzo(a,h)-anthracene	53-70-3	0.022	Residential RBCs	0.011	0.330	0.165
Benzo(g,h,i)perylene	191-24-2	0.17	CH2M HILL	0.085	0.330	0.165

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.
[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
[7] The surrogate analyte "2-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzaldehyde	100-52-7	7800	Residential RBCs	1600	0.330	0.165
Phenol	108-95-2	23000	Residential RBCs	4600	0.330	0.165
bis-(2-Chloroethyl) ether	111-44-4	0.58	Residential RBCs	0.29	0.330	0.165
2-Chlorophenol	95-57-8	390	Residential RBCs	78	0.330	0.165
2-Methylphenol	95-48-7	3900	Residential RBCs	780	0.330	0.165
2,2'-oxybis(1-Chloropropane)	108-60-1	9.1	Residential RBCs	1.8	0.330	0.165
Acetophenone	98-86-2	7800	Residential RBCs	1600	0.330	0.165
4-Methylphenol	106-44-5	390	Residential RBCs	78	0.330	0.165
N-Nitroso-di-n propylamine	621-64-7	130	Residential RBCs	26	0.330	0.165
Hexachloroethane	67-72-1	46	Residential RBCs	9.2	0.330	0.165
Nitrobenzene	98-95-3	39	Residential RBCs	7.8	0.330	0.165
Isophorone	78-59-1	670	Residential RBCs	130	0.330	0.165
2-Nitrophenol	88-75-5	NC	N/A	0.330	0.330	0.165
2,4-Dimethylphenol	105-67-9	1600	Residential RBCs	320	0.330	0.165
bis(2-Chloroethoxy) methane	111-91-1	0.58	Residential RBCs[4]	0.29	0.330	0.165
2,4-Dichlorophenol	120-83-2	230	Residential RBCs	46	0.330	0.165
Naphthalene	91-20-3	1600	Residential RBCs	320	0.330	0.165
4-Chloroaniline	106-47-8	310	Residential RBCs	62	0.330	0.165
Hexachlorobutadiene	87-68-3	8.2	Residential RBCs	1.6	0.330	0.165
Caprolactam	105-60-2	39000	Residential RBCs	7800	0.330	0.165

QAPP Worksheet #15-5—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits CRQLs (mg/kg)	Laboratory-Specific Limits MDLs (mg/kg)
4-Chloro-3-methylphenol	59-50-7	3900	Residential RBCs[5]	780	0.330	0.165
2-Methylnaphthalene	91-57-6	310	Residential RBCs	62	0.330	0.165
Hexachlorocyclopentadiene	77-47-4	470	Residential RBCs	94	0.330	0.165
2,4,6-Trichlorophenol	88-06-2	58	Residential RBCs	12	0.330	0.165
2,4,5-Trichlorophenol	95-95-4	7800	Residential RBCs	1600	0.830	0.415
1,1’-Biphenyl	92-52-4	3900	Residential RBCs	780	0.330	0.165
2-Chloronaphthalene	91-58-7	6300	Residential RBCs	1300	0.330	0.165
2-Nitroaniline	88-74-4	NC	N/A	0.830	0.830	0.415
Dimethylphthalate	131-11-3	NC	N/A	0.330	0.330	0.165
2,6-Dinitrotoluene	606-20-2	78	Residential RBCs	16	0.330	0.165
Acenaphthylene	208-96-8	2300	Residential RBCs[6]	460	0.330	0.165
3-Nitroaniline	99-09-2	NC	N/A	0.830	0.830	0.415
Acenaphthene	83-32-9	4700	Residential RBCs	940	0.330	0.165
2,4-Dinitrophenol	51-28-5	160	Residential RBCs	32	0.830	0.415
4-Nitrophenol	100-02-7	NC	N/A	0.830	0.830	0.415
Dibenzofuran	132-64-9	78	Residential RBCs	16	0.330	0.165
2,4-Dinitrotoluene	121-14-2	160	Residential RBCs	32	0.330	0.165
Diethylphthalate	84-66-2	63000	Residential RBCs	13000	0.330	0.165
Fluorene	86-73-7	3100	Residential RBCs	620	0.330	0.165
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	0.330	0.330	0.165
4-Nitroaniline	100-01-6	NC	N/A	0.830	0.830	0.415

QAPP Worksheet #15-5—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
4,6-Dinitro-2-methylphenol	534-52-1	3900	Residential RBCs[7]	780	0.830	0.415
N-Nitroso diphenylamine	86-30-6	130	Residential RBCs	26	0.330	0.165
4-Bromophenyl-phenylether	101-55-3	NC	N/A	0.330	0.330	0.165
Hexachlorobenzene	118-74-1	0.4	Residential RBCs	0.20	0.330	0.165
Atrazine	1912-24-9	2.9	Residential RBCs	0.58	0.330	0.165
Pentachlorophenol	87-86-5	5.3	Residential RBCs	1.1	0.830	0.415
Phenanthrene	85-01-8	2300	Residential RBCs[6]	460	0.330	0.165
Anthracene	120-12-7	23000	Residential RBCs	4600	0.330	0.165
Carbazole	86-74-8	32	Residential RBCs	6.4	0.330	0.165
Di-n-butylphthalate	84-74-2	7800	Residential RBCs	1560	0.330	0.165
Fluoranthene	206-44-0	3100	Residential RBCs	620	0.330	0.165
Pyrene	129-00-0	2300	Residential RBCs	460	0.330	0.165
Butylbenzylphthalate	85-68-7	16000	Residential RBCs	3200	0.330	0.165
3,3'-Dichlorobenzidine	91-94-1	1.4	Residential RBCs	0.28	0.330	0.165
Benzo(a)anthracene	56-55-3	0.22	Residential RBCs	0.11	0.330	0.165
Chrysene	218-01-9	22	Residential RBCs	4.4	0.330	0.165
bis(2-Ethylhexyl) phthalate	117-81-7	46	Residential RBCs	9.2	0.330	0.165
Di-n-octylphthalate	117-84-0	NC	N/A	0.330	0.330	0.165
Benzo(b)fluoranthene	205-99-2	0.22	Residential RBCs	0.11	0.330	0.165
Benzo(k)fluoranthene	207-08-9	2.2	Residential RBCs	0.44	0.330	0.165
Benzo(a)pyrene	50-32-8	2.2	Residential RBCs	0.44	0.330	0.165

QAPP Worksheet #15-5—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Indeno(1,2,3-cd)-pyrene	193-39-5	0.22	Residential RBCs	0.11	0.330	0.165
Dibenzo(a,h)-anthracene	53-70-3	0.022	Residential RBCs	0.011	0.330	0.165
Benzo(g,h,i)perylene	191-24-2	2300	Residential RBCs[6]	460	0.330	0.165

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte “bis(2-Chloroethyl)ether” was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

[5] The surrogate analyte “3-Methylphenol” was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

[6] The surrogate analyte “Pyrene” was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

[7] The surrogate analyte “2-Methylphenol” was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

“Residential RBCs” are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Sediment

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzaldehyde	100-52-7	78000	Residential RBCs	16000	0.330	0.165
Phenol	108-95-2	0.031	CH2M HILL	0.016	0.330	0.165
bis-(2-Chloroethyl) ether	111-44-4	5.8	Residential RBCs	1.2	0.330	0.165
2-Chlorophenol	95-57-8	0.0312	CH2M HILL	0.016	0.330	0.165
2-Methylphenol	95-48-7	39000	Residential RBCs	7800	0.330	0.165
2,2'-oxybis(1-Chloropropane)	108-60-1	9.1	Residential RBCs	1.8	0.330	0.165
Acetophenone	98-86-2	78000	Residential RBCs	16000	0.330	0.165
4-Methylphenol	106-44-5	390	Residential RBCs	78	0.330	0.165
N-Nitroso-di-n propylamine	621-64-7	1300	Residential RBCs	260	0.330	0.165
Hexachloroethane	67-72-1	1	CH2M HILL	0.5	0.330	0.165
Nitrobenzene	98-95-3	390	Residential RBCs	78	0.330	0.165
Isophorone	78-59-1	6700	Residential RBCs	1300	0.330	0.165
2-Nitrophenol	88-75-5	NC	N/A	0.330	0.330	0.165
2,4-Dimethylphenol	105-67-9	1600	Residential RBCs	320	0.330	0.165
bis(2-Chloroethoxy) methane	111-91-1	5.8	Residential RBCs[4]	1.16	0.330	0.165
2,4-Dichlorophenol	120-83-2	0.117	CH2M HILL	0.059	0.330	0.165
Naphthalene	91-20-3	0.176	CH2M HILL	0.088	0.330	0.165
4-Chloroaniline	106-47-8	3100	Residential RBCs	620	0.330	0.165
Hexachlorobutadiene	87-68-3	82	Residential RBCs	16	0.330	0.165
Caprolactam	105-60-2	390000	Residential RBCs	78000	0.330	0.165
4-Chloro-3-methylphenol	59-50-7	39000	Residential RBCs[5]	7800	0.330	0.165
2-Methylnaphthalene	91-57-6	3100	Residential RBCs	620	0.330	0.165
Hexachlorocyclopentadiene	77-47-4	4700	Residential RBCs	940	0.330	0.165

QAPP Worksheet #15-6—Reference Limits and Evaluation Table (continued)

Matrix: Sediment
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
2,4,6-Trichlorophenol	88-06-2	0.213	CH2M HILL	0.11	0.330	0.165
2,4,5-Trichlorophenol	95-95-4	78000	Residential RBCs	16000	0.830	0.415
1,1'-Biphenyl	92-52-4	1.1	CH2M HILL	0.55	0.330	0.165
2-Chloronaphthalene	91-58-7	63000	Residential RBCs	13000	0.330	0.165
2-Nitroaniline	88-74-4	NC	N/A	0.830	0.830	0.415
Dimethylphthalate	131-11-3	NC	N/A	0.330	0.330	0.165
2,6-Dinitrotoluene	606-20-2	780	Residential RBCs	160	0.330	0.165
Acenaphthylene	208-96-8	23000	Residential RBCs[6]	4600	0.330	0.165
3-Nitroaniline	99-09-2	NC	N/A	0.830	0.830	0.415
Acenaphthene	83-32-9	0.62	CH2M HILL	0.31	0.330	0.165
2,4-Dinitrophenol	51-28-5	1600	Residential RBCs	320	0.830	0.415
4-Nitrophenol	100-02-7	NC	N/A	0.830	0.830	0.415
Dibenzofuran	132-64-9	0.42	CH2M HILL	0.21	0.330	0.165
2,4-Dinitrotoluene	121-14-2	1600	Residential RBCs	320	0.330	0.165
Diethylphthalate	84-66-2	0.6	CH2M HILL	0.30	0.330	0.165
Fluorene	86-73-7	0.0774	CH2M HILL	0.039	0.330	0.165
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	0.330	0.330	0.165
4-Nitroaniline	100-01-6	NC	N/A	0.830	0.830	0.415
4,6-Dinitro-2-methylphenol	534-52-1	39000	Residential RBCs[7]	7800	0.830	0.415
N-Nitroso diphenylamine	86-30-6	2.684	CH2M HILL	0.54	0.330	0.165
4-Bromophenyl-phenylether	101-55-3	1.3	CH2M HILL	0.65	0.330	0.165
Hexachlorobenzene	118-74-1	0.02	CH2M HILL	0.010	0.330	0.165
Atrazine	1912-24-9	0.00662	CH2M HILL	0.0033	0.330	0.165
Pentachlorophenol	87-86-5	0.504	CH2M HILL	0.25	0.830	0.415
Phenanthrene	85-01-8	0.204	CH2M HILL	0.10	0.330	0.165

QAPP Worksheet #15-6—Reference Limits and Evaluation Table (continued)

Matrix: Sediment
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Anthracene	120-12-7	0.0572	CH2M HILL	0.29	0.330	0.165
Carbazole	86-74-8	1.8	CH2M HILL	0.36	0.330	0.165
Di-n-butylphthalate	84-74-2	11	CH2M HILL	2.2	0.330	0.165
Fluoranthene	206-44-0	0.423	CH2M HILL	0.21	0.330	0.165
Pyrene	129-00-0	0.195	CH2M HILL	0.098	0.330	0.165
Butylbenzylphthalate	85-68-7	11	CH2M HILL	2.2	0.330	0.165
3,3'-Dichlorobenzidine	91-94-1	0.127	CH2M HILL	0.064	0.330	0.165
Benzo(a)anthracene	56-55-3	0.108	CH2M HILL	0.054	0.330	0.165
Chrysene	218-01-9	0.166	CH2M HILL	0.083	0.330	0.165
bis(2-Ethylhexyl) phthalate	117-81-7	0.18	CH2M HILL	0.090	0.330	0.165
Di-n-octylphthalate	117-84-0	NC	N/A	0.330	0.330	0.165
Benzo(b)fluoranthene	205-99-2	0.24	CH2M HILL	0.12	0.330	0.165
Benzo(k)fluoranthene	207-08-9	0.24	CH2M HILL	0.12	0.330	0.165
Benzo(a)pyrene	50-32-8	0.22	Residential RBCs	0.11	0.330	0.165
Indeno(1,2,3-cd)-pyrene	193-39-5	0.2	CH2M HILL	0.10	0.330	0.165
Dibenzo(a,h)-anthracene	53-70-3	0.22	Residential RBCs	0.11	0.330	0.165
Benzo(g,h,i)perylene	191-24-2	0.17	CH2M HILL	0.085	0.330	0.165

QAPP Worksheet #15-6
Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[7] The surrogate analyte "2-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment . These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Surface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-BHC	319-84-6	0.006	CH2M HILL	0.003	0.0017	0.00028
beta-BHC	319-85-7	0.005	CH2M HILL	0.001	0.0017	0.00030
delta-BHC	319-86-8	0.12	CH2M HILL	0.024	0.0017	0.00033
gamma-BHC (Lindane)	58-89-9	0.00237	CH2M HILL	0.0012	0.0017	0.00024
Heptachlor	76-44-8	0.068	CH2M HILL	0.014	0.0017	0.00035
Aldrin	309-00-2	0.002	CH2M HILL	0.001	0.0017	0.00032
Heptachlor epoxide	1024-57-3	0.00247	CH2M HILL	0.0012	0.0017	0.00034
Endosulfan I	959-98-8	0.01	CH2M HILL	0.002	0.0017	0.00030
Dieldrin	60-57-1	0.0019	CH2M HILL	0.00095	0.0033	0.00062
4,4'-DDE	72-55-9	0.00316	CH2M HILL	0.0016	0.0033	0.00070
Endrin	72-20-8	0.00222	CH2M HILL	0.0011	0.0033	0.00051
Endosulfan II	33213-65-9	0.01	CH2M HILL	0.0050	0.0033	0.00069
4,4'-DDD	72-54-8	0.00488	CH2M HILL	0.0024	0.0033	0.00064
Endosulfan sulfate	1031-07-8	0.01	CH2M HILL	0.0050	0.0033	0.00065
4,4'-DDT	50-29-3	0.00416	CH2M HILL	0.0021	0.0033	0.00065
Methoxychlor	72-43-5	0.019	CH2M HILL	0.0095	0.017	0.00340
Endrin ketone	53494-70-5	23	Residential RBCs[4]	4.6	0.0033	0.00078
Endrin aldehyde	7421-93-4	23	Residential RBCs[4]	4.6	0.0033	0.00047

QAPP Worksheet #15-7—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-Chlordane	5103-71-9	0.0324	CH2M HILL	0.0065	0.0017	0.00034
gamma-Chlordane	5103-74-2	0.0324	CH2M HILL	0.0065	0.0017	0.00034
Toxaphene	8001-35-2	0.028	CH2M HILL	0.014	0.17	0.036
Aroclor-1016	12674-11-2	5.5	Residential RBCs	1.1	0.033	0.0049
Aroclor-1221	11104-28-2	0.32	Residential RBCs	0.064	0.067	0.0068
Aroclor-1232	11141-16-5	0.32	Residential RBCs	0.064	0.033	0.0032
Aroclor-1242	53469-21-9	0.32	Residential RBCs	0.064	0.033	0.0027
Aroclor-1248	12672-29-6	0.32	Residential RBCs	0.064	0.033	0.0050
Aroclor-1254	11097-69-1	0.32	Residential RBCs	0.064	0.033	0.0069
Aroclor-1260	11096-82-5	0.32	Residential RBCs	0.064	0.033	0.0048

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Subsurface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-BHC	319-84-6	0.1	Residential RBCs	0.020	0.0017	0.00028
beta-BHC	319-85-7	0.35	Residential RBCs	0.070	0.0017	0.00030
delta-BHC	319-86-8	0.35	Residential RBCs[4]	0.07	0.0017	0.00033
gamma-BHC (Lindane)	58-89-9	0.49	Residential RBCs	0.098	0.0017	0.00024
Heptachlor	76-44-8	0.14	Residential RBCs	0.028	0.0017	0.00035
Aldrin	309-00-2	0.038	Residential RBCs	0.0076	0.0017	0.00032
Heptachlor epoxide	1024-57-3	0.07	Residential RBCs	0.014	0.0017	0.00034
Endosulfan I	959-98-8	47	Residential RBCs	9.4	0.0017	0.00030
Dieldrin	60-57-1	0.04	Residential RBCs	0.0080	0.0033	0.00062
4,4'-DDE	72-55-9	1.9	Residential RBCs	0.38	0.0033	0.00070
Endrin	72-20-8	2.3	Residential RBCs	0.46	0.0033	0.00051
Endosulfan II	33213-65-9	470	Residential RBCs[5]	94	0.0033	0.00069
4,4'-DDD	72-54-8	2.7	Residential RBCs	0.54	0.0033	0.00064
Endosulfan sulfate	1031-07-8	47	Residential RBCs	9.4	0.0033	0.00065
4,4'-DDT	50-29-3	1.9	Residential RBCs	0.38	0.0033	0.00065
Methoxychlor	72-43-5	39	Residential RBCs	7.8	0.017	0.00340
Endrin ketone	53494-70-5	23	Residential RBCs[6]	4.6	0.0033	0.00078
Endrin aldehyde	7421-93-4	23	Residential RBCs[6]	4.6	0.0033	0.00047

QAPP Worksheet #15-8—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-Chlordane	5103-71-9	1.8	Residential RBCs[7]	0.36	0.0017	0.00034
gamma-Chlordane	5103-74-2	1.8	Residential RBCs[7]	0.36	0.0017	0.00034
Toxaphene	8001-35-2	0.58	Residential RBCs	0.29	0.17	0.036
Aroclor-1016	12674-11-2	5.5	Residential RBCs	1.1	0.033	0.0049
Aroclor-1221	11104-28-2	0.32	Residential RBCs	0.16	0.067	0.0068
Aroclor-1232	11141-16-5	0.32	Residential RBCs	0.064	0.033	0.0032
Aroclor-1242	53469-21-9	0.32	Residential RBCs	0.064	0.033	0.0027
Aroclor-1248	12672-29-6	0.32	Residential RBCs	0.064	0.033	0.0050
Aroclor-1254	11097-69-1	0.32	Residential RBCs	0.064	0.033	0.0069
Aroclor-1260	11096-82-5	0.32	Residential RBCs	0.064	0.033	0.0048

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Technical HCH" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "Endsulfan" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Chlordane" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[7] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Sediment

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-BHC	319-84-6	0.006	CH2M HILL	0.0030	0.0017	0.00028
beta-BHC	319-85-7	0.005	CH2M HILL	0.0025	0.0017	0.00030
delta-BHC	319-86-8	0.12	CH2M HILL	0.024	0.0017	0.00033
gamma-BHC (Lindane)	58-89-9	0.00237	CH2M HILL	0.0012	0.0017	0.00024
Heptachlor	76-44-8	0.068	CH2M HILL	0.014	0.0017	0.00035
Aldrin	309-00-2	0.002	CH2M HILL	0.0010	0.0017	0.00032
Heptachlor epoxide	1024-57-3	0.00247	CH2M HILL	0.0012	0.0017	0.00034
Endosulfan I	959-98-8	0.01	CH2M HILL	0.0020	0.0017	0.00030
Dieldrin	60-57-1	0.0019	CH2M HILL	0.00095	0.0033	0.00062
4,4'-DDE	72-55-9	0.00316	CH2M HILL	0.0016	0.0033	0.00070
Endrin	72-20-8	0.00222	CH2M HILL	0.0011	0.0033	0.00051
Endosulfan II	33213-65-9	0.01	CH2M HILL	0.0050	0.0033	0.00069
4,4'-DDD	72-54-8	0.00488	CH2M HILL	0.0024	0.0033	0.00064
Endosulfan sulfate	1031-07-8	0.01	CH2M HILL	0.0050	0.0033	0.00065
4,4'-DDT	50-29-3	0.00416	CH2M HILL	0.0021	0.0033	0.00065
Methoxychlor	72-43-5	0.019	CH2M HILL	0.0095	0.017	0.00340
Endrin ketone	53494-70-5	230	Residential RBCs[4]	46	0.0033	0.00078
Endrin aldehyde	7421-93-4	230	Residential RBCs[4]	46	0.0033	0.00047
alpha-Chlordane	5103-71-9	0.0324	CH2M HILL	0.0065	0.0017	.00034

QAPP Worksheet #15-9—Reference Limits and Evaluation Table (continued)

Matrix: Sediment

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
gamma-Chlordane	5103-74-2	0.0324	CH2M HILL	0.0065	0.0017	0.00034
Toxaphene	8001-35-2	0.028	CH2M HILL	0.014	0.17	0.036
Aroclor-1016	12674-11-2	55	Residential RBCs	11	0.033	0.0049
Aroclor-1221	11104-28-2	3.2	Residential RBCs	0.64	0.067	0.0068
Aroclor-1232	11141-16-5	3.2	Residential RBCs	0.64	0.033	0.0032
Aroclor-1242	53469-21-9	3.2	Residential RBCs	0.64	0.033	0.0027
Aroclor-1248	12672-29-6	3.2	Residential RBCs	0.64	0.033	0.0050
Aroclor-1254	11097-69-1	3.2	Residential RBCs	0.64	0.033	0.0069
Aroclor-1260	11096-82-5	3.2	Residential RBCs	0.64	0.033	0.0048

NC: No Criteria; These constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment. These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Surface Soil

Analytical Group: TAL Metals/ Cyanide

Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	IDLs (mg/kg)
Aluminum	7429-90-5	78000	Residential RBCs	16000	20	2.21
Antimony	7440-36-0	5	CH2M HILL	2.5	6	0.0562
Arsenic	7440-38-2	0.43	Residential RBCs	0.22	1	0.265
Barium	7440-39-3	330	CH2M HILL	66	20	0.0312
Beryllium	7440-41-7	10	CH2M HILL	2	0.5	0.0124
Cadmium	7440-43-9	32	CH2M HILL	6.4	0.5	0.00775
Calcium	7440-70-2	NC	N/A	500	500	2.96
Chromium	7440-47-3	0.4	CH2M HILL	0.2	1	0.0461
Cobalt	7440-48-4	13	CH2M HILL	2.6	5	0.0273
Copper	7440-50-8	70	CH2M HILL	14	2.5	0.133
Iron	7439-89-6	55000	Residential RBCs	11000	10	0.611
Lead	7439-92-1	120	CH2M HILL	24	1	0.122
Magnesium	7439-95-4	NC	N/A	500	500	1.08
Manganese	7439-96-5	220	CH2M HILL	44	1.5	0.196
Mercury	7439-97-6	0.1	CH2M HILL	0.020	0.1	0.00242
Nickel	7440-02-0	38	CH2M HILL	7.6	4	0.0131
Potassium	7440-09-7	NC	N/A	500	500	3.71
Selenium	7782-49-2	1	CH2M HILL	0.5	3.5	0.377

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

Matrix: Surface Soil

Analytical Group: TAL Metals/ Cyanide

Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	IDLs (mg/kg)
Silver	7440-22-4	390	Residential RBCs	78	1	0.0624
Sodium	7440-23-5	NC	N/A	500	500	2.21
Thallium	7440-28-0	1	CH2M HILL	0.5	2.5	0.0638
Vanadium	7440-62-2	2	CH2M HILL	1	5	0.0316
Zinc	7440-66-6	50	CH2M HILL	10	6	0.171
Cyanide	57-12-5	1600	Residential RBCs	320	2.5	0.22

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Subsurface Soil
Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Aluminum	7429-90-5	78000	Residential RBCs	16000	20	2.21
Antimony	7440-36-0	31	Residential RBCs	6.2	6	0.0562
Arsenic	7440-38-2	0.43	Residential RBCs	0.22	1	0.265
Barium	7440-39-3	16000	Residential RBCs	3200	20	0.0312
Beryllium	7440-41-7	160	Residential RBCs	32	0.5	0.0124
Cadmium	7440-43-9	39	Residential RBCs	7.8	0.5	0.00775
Calcium	7440-70-2	NC	N/A	500	500	2.96
Chromium	7440-47-3	120000	Residential RBCs	24000	1	0.0461
Cobalt	7440-48-4	NC	N/A	5.0	5	0.0273
Copper	7440-50-8	3100	Residential RBCs	620	2.5	0.133
Iron	7439-89-6	55000	Residential RBCs	11000	10	0.611
Lead	7439-92-1	400	Human Health	80	1	0.122
Magnesium	7439-95-4	NC	N/A	500	500	1.08
Manganese	7439-96-5	1600	Residential RBCs	320	1.5	0.196
Mercury	7439-97-6	78	Residential RBCs[4]	15.6	0.1	0.00242
Nickel	7440-02-0	1600	Residential RBCs	320	4	0.0131
Potassium	7440-09-7	NC	N/A	500	500	3.71
Selenium	7782-49-2	390	Residential RBCs	78	3.5	0.377

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

Matrix: Subsurface Soil

Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES
(ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Silver	7440-22-4	390	Residential RBCs	78	1	0.0624
Sodium	7440-23-5	NC	N/A	500	500	2.21
Thallium	7440-28-0	5.5	Residential RBCs	2.8	2.5	0.0638
Vanadium	7440-62-2	78	Residential RBCs	16	5	0.0316
Zinc	7440-66-6	23000	Residential RBCs	4600	6	0.171
Cyanide	57-12-5	1600	Residential RBCs	320	2.5	0.22

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Methylmercury" was used for this analyte and multiplied by a factor of 10. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Sediment
Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Aluminum	7429-90-5	25500	CH2M HILL	5100	20	2.21
Antimony	7440-36-0	64	CH2M HILL	12.8	6	0.0562
Arsenic	7440-38-2	4.3	Residential RBCs	2.15	1	0.265
Barium	7440-39-3	500	CH2M HILL	100	20	0.0312
Beryllium	7440-41-7	1600	Residential RBCs	320	0.5	0.0124
Cadmium	7440-43-9	0.99	CH2M HILL	0.495	0.5	0.00775
Calcium	7440-70-2	NC	N/A	500	500	2.96
Chromium	7440-47-3	43.4	CH2M HILL	8.68	1	0.0461
Cobalt	7440-48-4	50	CH2M HILL	10	5	0.0273
Copper	7440-50-8	31.6	CH2M HILL	6.32	2.5	0.133
Iron	7439-89-6	20000	CH2M HILL	4000	10	0.611
Lead	7439-92-1	35.8	CH2M HILL	7.16	1	0.122
Magnesium	7439-95-4	NC	N/A	500	500	1.08
Manganese	7439-96-5	460	CH2M HILL	92	1.5	0.196
Mercury	7439-97-6	0.18	CH2M HILL	0.09	0.1	0.00242
Nickel	7440-02-0	22.7	CH2M HILL	4.54	4	0.0131
Potassium	7440-09-7	NC	N/A	500	500	3.71
Selenium	7782-49-2	2	CH2M HILL	1	3.5	0.377
Silver	7440-22-4	4.5	CH2M HILL	2.25	1	0.0624

QAPP Worksheet #15-12—Reference Limits and Evaluation Table (continued)

Matrix: Sediment
Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Sodium	7440-23-5	NC	N/A	500	500	2.21
Thallium	7440-28-0	55	Residential RBCs	11	2.5	0.0638
Vanadium	7440-62-2	780	Residential RBCs	156	5	0.0316
Zinc	7440-66-6	121	CH2M HILL	24.2	6	0.171
Cyanide	57-12-5	16000	Residential RBCs	3200	2.5	0.22

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable
[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.
[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment . These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Surface Soil

Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)

Concentration Level: Medium

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	10	CH2M HILL	2	0.08	0.014
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	5.8	Residential RBCs	1.16	0.08	0.012
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	230	Residential RBCs	46	0.04	0.0050
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.78	Residential RBCs	0.16	0.04	0.0052
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	10	CH2M HILL	2	0.08	0.022
Nitrobenzene (NB)	98-95-3	3.9	Residential RBCs	0.78	0.04	0.0048
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	3.9	Residential RBCs	0.78	0.04	0.0058
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	160	Residential RBCs[4]	32	0.04	0.0079
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	80	CH2M HILL	16	0.04	0.0051
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	16	Residential RBCs	3.2	0.04	0.0073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	7.8	Residential RBCs	1.6	0.04	0.0025
2-Nitrotoluene (2-NT)	88-72-2	78	Residential RBCs	16	0.08	0.014
3-Nitrotoluene (3-NT)	99-08-1	160	Residential RBCs	32	0.08	0.025
4-Nitrotoluene (4-NT)	99-99-0	31	Residential RBCs	6.2	0.10	0.034
PETN	78-11-5	NC	N/A	0.2	0.20	0.029
3,5-Dinitroaniline	618-87-1	NC	N/A	80	80	0.0095
Nitroglycerine	55-63-0	0.78	Residential RBCs	0.39	5	1
Nitroguanidine	556-88-7	782	Human Health	156	0.12	0.011

QAPP Worksheet #15-13—Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Aminoinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Subsurface Soil
Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)
Concentration Level: Medium

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	390	Residential RBCs	78	0.08	0.014
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	5.8	Residential RBCs	1.2	0.08	0.012
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	230	Residential RBCs	46	0.04	0.0050
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.78	Residential RBCs	0.16	0.04	0.0052
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	31	Residential RBCs	6.2	0.08	0.022
Nitrobenzene (NB)	98-95-3	3.9	Residential RBCs	0.78	0.04	0.0048
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	3.9	Residential RBCs	0.78	0.04	0.0058
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	160	Residential RBCs[4]	32	0.04	0.0079
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	160	Residential RBCs[4]	32	0.04	0.0051
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	16	Residential RBCs	3.2	0.04	0.0073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	7.8	Residential RBCs	1.6	0.04	0.0025
2-Nitrotoluene (2-NT)	88-72-2	78	Residential RBCs	16	0.08	0.014
3-Nitrotoluene (3-NT)	99-08-1	160	Residential RBCs	32	0.08	0.025
4-Nitrotoluene (4-NT)	99-99-0	31	Residential RBCs	6.2	0.10	0.034
PETN	78-11-5	NC	N/A	0.20	0.20	0.029
3,5-Dinitroaniline	618-87-1	NC	N/A	80	80	0.0095
Nitroglycerine	55-63-0	0.78	Residential RBCs	0.39	5	1
Nitroguanidine	556-88-7	782	Human Health	156	0.12	0.011

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Aminoinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Sediment

Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)

Concentration Level: Medium

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	10	CH2M HILL	2.0	0.08	0.014
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	10	CH2M HILL	2.0	0.08	0.012
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	2300	Residential RBCs	460	0.04	0.0050
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	7.8	Residential RBCs	1.6	0.04	0.0052
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	10	CH2M HILL	2	0.08	0.022
Nitrobenzene (NB)	98-95-3	39	Residential RBCs	7.8	0.04	0.0048
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	10	CH2M HILL	2	0.04	0.0058
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	1600	Residential RBCs[4]	320	0.04	0.0079
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	1600	Residential RBCs[4]	320	0.04	0.0051
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	160	Residential RBCs	32	0.04	0.0073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	78	Residential RBCs	16	0.04	0.0025
2-Nitrotoluene (2-NT)	88-72-2	780	Residential RBCs	160	0.08	0.014
3-Nitrotoluene (3-NT)	99-08-1	1600	Residential RBCs	320	0.08	0.025
4-Nitrotoluene (4-NT)	99-99-0	310	Residential RBCs	62	0.10	0.034
PETN	78-11-5	NC	N/A	0.20	0.20	0.029
3,5-Dinitroaniline	618-87-1	NC	N/A	80	80	0.0095
Nitroglycerine	55-63-0	7.8	Residential RBCs	3.9	5	1
Nitroguanidine	556-88-7	7820	Human Health	1560	0.12	0.011

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

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Aminoinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment. These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

	Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Surface and Subsurface Soil

Analytical Group: Wet Chemistry

Concentration Level: Medium (various)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits QLs (mg/kg)	Laboratory-Specific Limits MDLs (mg/kg)
Total organic carbon (TOC)	TOC[4]	NC	N/A	400	400	45.5
pH	PH[4]	NC	N/A	N/A	N/A	N/A

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria. Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] Contractor-specific CAS number

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Sediment

Analytical Group: Wet Chemistry

Concentration Level: Medium (various)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Total organic carbon (TOC)	TOC[4]	NC	N/A	400	400	45.5
Grain Size	GRAIN SIZE[4]	NC	N/A	N/A	N/A	N/A
pH	PH[4]	NC	N/A	N/A	N/A	N/A

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] Contractor-specific CAS number

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Groundwater

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Dichlorodifluoromethane	75-71-8	350	Tap Water RBCs	70	10	1.0
Chloromethane	74-87-3	190	Tap Water RBCs	38	10	1.0
Vinyl Chloride	75-01-4	0.015	Tap Water RBCs	0.0075	10	1.0
Bromomethane	74-83-9	8.5	Tap Water RBCs	1.7	10	1.0
Chloroethane	75-00-3	3.6	Tap Water RBCs	0.72	10	1.0
Trichlorofluoromethane	75-69-4	1300	Tap Water RBCs	260	10	1.0
1,1-Dichloroethene	75-35-4	7	MCLs	1.4	10	1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	59000	Tap Water RBCs	12000	10	1.0
Acetone	67-64-1	5500	Tap Water RBCs	1100	10	1.0
Carbon Disulfide	75-15-0	1000	Tap Water RBCs	200	10	1.0
Methyl Acetate	79-20-9	6100	Tap Water RBCs	1200	10	1.0
Methylene Chloride	75-09-2	4.1	Tap Water RBCs	2.05	10	1.0
trans-1,2-Dichloroethene	156-60-5	100	MCLs	20	10	1.0
Methyl tert-Butyl Ether	1634-04-4	2.6	Tap Water RBCs	0.52	10	1.0
1,1-Dichloroethane	75-34-3	900	Tap Water RBCs	180	10	1.0
cis-1,2-Dichloroethene	156-59-2	61	Tap Water RBCs	12	10	1.0
2-Butanone	78-93-3	7000	Tap Water RBCs	1400	10	1.0
Chloroform	67-66-3	0.15	Tap Water RBCs	0.075	10	1.0
1,1,1-Trichloroethane	71-55-6	200	MCLs	40	10	1.0

QAPP Worksheet #15-18—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Cyclohexane	110-82-7	12000	Tap Water RBCs	2400	10	1.0
Carbon Tetrachloride	56-23-5	0.16	Tap Water RBCs	0.08	10	1.0
Benzene	71-43-2	0.34	Tap Water RBCs	0.17	10	1.0
1,2-Dichloroethane	107-06-2	0.12	Tap Water RBCs	0.06	10	1.0
Trichloroethene	79-01-6	0.026	Tap Water RBCs	0.013	10	1.0
Methylcyclohexane	108-87-2	6300	Tap Water RBCs	1300	10	1.0
1,2-Dichloropropane	78-87-5	0.26	Tap Water RBCs	0.13	10	1.0
Bromodichloromethane	75-27-4	0.17	Tap Water RBCs	0.085	10	1.0
cis-1,3-Dichloropropene	10061-01-5	0.44	Tap Water RBCs[4]	0.22	10	1.0
4-Methyl-2-pentanone	108-10-1	6300	Tap Water RBCs	1300	10	1.0
Toluene	108-88-3	1000	MCLs	200	10	1.0
trans-1,3-Dichloropropene	10061-02-6	0.44	Tap Water RBCs[4]	0.22	10	1.0
1,1,2-Trichloroethane	79-00-5	0.19	Tap Water RBCs	0.095	10	1.0
Tetrachloroethene	127-18-4	0.1	Tap Water RBCs	0.05	10	1.0
2-Hexanone	591-78-6	1.04	Human Health	0.52	10	1.0
Dibromochloromethane	124-48-1	0.13	Tap Water RBCs	0.065	10	1.0
1,2-Dibromoethane	106-93-4	0.0053	Tap Water RBCs	0.0027	10	1.0
Chlorobenzene	108-90-7	90	Tap Water RBCs	18	10	1.0
Ethylbenzene	100-41-4	700	MCLs	140	10	1.0

QAPP Worksheet #15-18—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Xylenes, total	1330-20-7	210	Tap Water RBCs	42	10	1.0
Styrene	100-42-5	100	MCLs	20	10	1.0
Bromoform	75-25-2	8.5	Tap Water RBCs	1.7	10	1.0
Isopropylbenzene	98-82-8	660	Tap Water RBCs	130	10	1.0
1,1,2,2-Tetrachloroethane	79-34-5	0.053	Tap Water RBCs	0.027	10	1.0
1,3-Dichlorobenzene	541-73-1	18	Tap Water RBCs	3.6	10	1.0
1,4-Dichlorobenzene	106-46-7	0.28	Tap Water RBCs	0.14	10	1.0
1,2-Dichlorobenzene	95-50-1	270	Tap Water RBCs	54	10	1.0
1,2-Dibromo-3-chloropropane	96-12-8	0.0002	Tap Water RBCs, MCLs	0.00010	10	1.0
1,2,4-Trichlorobenzene	120-82-1	61	Tap Water RBCs	12.2	10	1.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "1,3-Dichloropropene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

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

Matrix: Surface Water

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Dichlorodifluoromethane	75-71-8	3500	Tap Water RBCs	700	10	1.0
Chloromethane	74-87-3	1900	Tap Water RBCs	380	10	1.0
Vinyl Chloride	75-01-4	0.15	Tap Water RBCs	0.075	10	1.0
Bromomethane	74-83-9	85	Tap Water RBCs	17	10	1.0
Chloroethane	75-00-3	36	Tap Water RBCs	7.2	10	1.0
Trichlorofluoromethane	75-69-4	13000	Tap Water RBCs	2600	10	1.0
1,1-Dichloroethene	75-35-4	25	CH2M HILL	5.0	10	1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	590000	Tap Water RBCs	120000	10	1.0
Acetone	67-64-1	1500	CH2M HILL	300	10	1.0
Carbon Disulfide	75-15-0	0.92	CH2M HILL	0.46	10	1.0
Methyl Acetate	79-20-9	61000	Tap Water RBCs	12000	10	1.0
Methylene Chloride	75-09-2	41	Tap Water RBCs	8.2	10	1.0
trans-1,2-Dichloroethene	156-60-5	590	CH2M HILL	120	10	1.0
Methyl tert-Butyl Ether	1634-04-4	26	Tap Water RBCs	5.2	10	1.0
1,1-Dichloroethane	75-34-3	47	CH2M HILL	9.4	10	1.0
cis-1,2-Dichloroethene	156-59-2	590	CH2M HILL	120	10	1.0
2-Butanone	78-93-3	14000	CH2M HILL	2800	10	1.0
Chloroform	67-66-3	1.5	Tap Water RBCs	0.75	10	1.0
1,1,1-Trichloroethane	71-55-6	11	CH2M HILL	2.2	10	1.0

QAPP Worksheet #15-19—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Cyclohexane	110-82-7	120000	Tap Water RBCs	24000	10	1.0
Carbon Tetrachloride	56-23-5	1.6	Tap Water RBCs	0.80	10	1.0
Benzene	71-43-2	3.4	Tap Water RBCs	0.68	10	1.0
1,2-Dichloroethane	107-06-2	1.2	Tap Water RBCs	0.60	10	1.0
Trichloroethene	79-01-6	0.26	Tap Water RBCs	0.13	10	1.0
Methylcyclohexane	108-87-2	63000	Tap Water RBCs	13000	10	1.0
1,2-Dichloropropane	78-87-5	2.6	Tap Water RBCs	0.52	10	1.0
Bromodichloromethane	75-27-4	1.7	Tap Water RBCs	0.85	10	1.0
cis-1,3-Dichloropropene	10061-01-5	24.4	CH2M HILL	4.9	10	1.0
4-Methyl-2-pentanone	108-10-1	170	CH2M HILL	34	10	1.0
Toluene	108-88-3	9.8	CH2M HILL	2.0	10	1.0
trans-1,3-Dichloropropene	10061-02-6	24.4	CH2M HILL	4.9	10	1.0
1,1,2-Trichloroethane	79-00-5	1.9	Tap Water RBCs	0.95	10	1.0
Tetrachloroethene	127-18-4	1	Tap Water RBCs	0.20	10	1.0
2-Hexanone	591-78-6	99	CH2M HILL	20	10	1.0
Dibromochloromethane	124-48-1	1.3	Tap Water RBCs	0.65	10	1.0
1,2-Dibromoethane	106-93-4	0.053	Tap Water RBCs	0.027	10	1.0
Chlorobenzene	108-90-7	64	CH2M HILL	13	10	1.0
Ethylbenzene	100-41-4	90	CH2M HILL	18	10	1.0

QAPP Worksheet #15-19—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Xylenes, total	1330-20-7	13	CH2M HILL	2.6	10	1.0
Styrene	100-42-5	72	CH2M HILL	14	10	1.0
Bromoform	75-25-2	85	Tap Water RBCs	17	10	1.0
Isopropylbenzene	98-82-8	2.6	CH2M HILL	0.52	10	1.0
1,1,2,2-Tetrachloroethane	79-34-5	0.53	Tap Water RBCs	0.27	10	1.0
1,3-Dichlorobenzene	541-73-1	71	CH2M HILL	14	10	1.0
1,4-Dichlorobenzene	106-46-7	2.8	Tap Water RBCs	0.56	10	1.0
1,2-Dichlorobenzene	95-50-1	14	CH2M HILL	2.8	10	1.0
1,2-Dibromo-3-chloropropane	96-12-8	0.002	Tap Water RBCs	0.0010	10	1.0
1,2,4-Trichlorobenzene	120-82-1	110	CH2M HILL	22	10	1.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-20—Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Benzaldehyde	100-52-7	3700	Tap Water RBCs	740	10	5
Phenol	108-95-2	11000	Tap Water RBCs	2200	10	5
bis-(2-Chloroethyl) ether	111-44-4	0.0096	Tap Water RBCs	0.0048	10	5
2-Chlorophenol	95-57-8	30	Tap Water RBCs	6.0	10	5
2-Methylphenol	95-48-7	1800	Tap Water RBCs	360	10	5
2,2'-oxybis(1-Chloropropane)	108-60-1	0.26	Tap Water RBCs	0.13	10	5
Acetophenone	98-86-2	610	Tap Water RBCs	120	10	5
4-Methylphenol	106-44-5	180	Tap Water RBCs	36	10	5
N-Nitroso-di-n propylamine	621-64-7	0.0096	Tap Water RBCs	0.0048	10	5
Hexachloroethane	67-72-1	4.8	Tap Water RBCs	2.4	10	5
Nitrobenzene	98-95-3	3.5	Tap Water RBCs	1.8	10	5
Isophorone	78-59-1	70	Tap Water RBCs	14	10	5
2-Nitrophenol	88-75-5	NC	N/A	10.0	10	5
2,4-Dimethylphenol	105-67-9	730	Tap Water RBCs	150	10	5
bis(2-Chloroethoxy) methane	111-91-1	0.0096	Tap Water RBCs[4]	0.0048	10	5
2,4-Dichlorophenol	120-83-2	110	Tap Water RBCs	22	10	5
Naphthalene	91-20-3	6.5	Tap Water RBCs	3.2	10	5
4-Chloroaniline	106-47-8	150	Tap Water RBCs	30	10	5
Hexachlorobutadiene	87-68-3	0.086	Tap Water RBCs	0.043	10	5
Caprolactam	105-60-2	18000	Tap Water RBCs	3600	10	5

QAPP Worksheet #15-20—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
4-Chloro-3-methylphenol	59-50-7	1800	Tap Water RBCs[5]	360	10	5
2-Methylnaphthalene	91-57-6	24	Tap Water RBCs	12	10	5
Hexachlorocyclopentadiene	77-47-4	50	MCLs	10	10	5
2,4,6-Trichlorophenol	88-06-2	6.1	Tap Water RBCs	3.0	10	5
2,4,5-Trichlorophenol	95-95-4	3700	Tap Water RBCs	740	25	12.5
1,1'-Biphenyl	92-52-4	300	Tap Water RBCs	60	10	5
2-Chloronaphthalene	91-58-7	490	Tap Water RBCs	98	10	5
2-Nitroaniline	88-74-4	NC	N/A	25.0	25	12.5
Dimethylphthalate	131-11-3	NC	N/A	10.0	10	5
2,6-Dinitrotoluene	606-20-2	37	Tap Water RBCs	7.4	10	5
Acenaphthylene	208-96-8	180	Tap Water RBCs[6]	36	10	5
3-Nitroaniline	99-09-2	NC	N/A	25	25	12.5
Acenaphthene	83-32-9	370	Tap Water RBCs	74	10	5
2,4-Dinitrophenol	51-28-5	73	Tap Water RBCs	37	25	12.5
4-Nitrophenol	100-02-7	NC	N/A	25	25	12.5
Dibenzofuran	132-64-9	37	Tap Water RBCs	7.4	10	5
2,4-Dinitrotoluene	121-14-2	73	Tap Water RBCs	15	10	5
Diethylphthalate	84-66-2	29000	Tap Water RBCs	5800	10	5
Fluorene	86-73-7	240	Tap Water RBCs	48	10	5
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	10.0	10	5

QAPP Worksheet #15-20—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
4-Nitroaniline	100-01-6	NC	N/A	25	25	12.5
4,6-Dinitro-2-methylphenol	534-52-1	73	Tap Water RBCs	37	25	12.5
N-Nitroso diphenylamine	86-30-6	14	Tap Water RBCs	7.0	10	5
4-Bromophenyl-phenylether	101-55-3	NC	N/A	10.0	10	5
Hexachlorobenzene	118-74-1	0.042	Tap Water RBCs	0.021	10	5
Atrazine	1912-24-9	0.3	Tap Water RBCs	0.15	10	5
Pentachlorophenol	87-86-5	1	MCLs	0.50	25	12.5
Phenanthrene	85-01-8	180	Tap Water RBCs[6]	36	10	5
Anthracene	120-12-7	1800	Tap Water RBCs	360	10	5
Carbazole	86-74-8	3.3	Tap Water RBCs	1.7	10	5
Di-n-butylphthalate	84-74-2	3700	Tap Water RBCs	740	10	5
Fluoranthene	206-44-0	1500	Tap Water RBCs	300	10	5
Pyrene	129-00-0	180	Tap Water RBCs	36	10	5
Butylbenzylphthalate	85-68-7	7300	Tap Water RBCs	1500	10	5
3,3'-Dichlorobenzidine	91-94-1	0.15	Tap Water RBCs	0.075	10	5
Benzo(a)anthracene	56-55-3	0.03	Tap Water RBCs	0.015	10	5
Chrysene	218-01-9	30	Tap Water RBCs	6.0	10	5
bis(2-Ethylhexyl) phthalate	117-81-7	4.8	Tap Water RBCs	5.0	10	5
Di-n-octylphthalate	117-84-0	NC	N/A	10.0	10	5
Benzo(b)fluoranthene	205-99-2	0.03	Tap Water RBCs	0.015	10	5
Benzo(k)fluoranthene	207-08-9	0.3	Tap Water RBCs	0.15	10	5

QAPP Worksheet #15-20—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Benzo(a)pyrene	50-32-8	0.003	Tap Water RBCs	0.0015	10	5
Indeno(1,2,3-cd)-pyrene	193-39-5	0.03	Tap Water RBCs	0.015	10	5
Dibenzo(a,h)-anthracene	53-70-3	0.003	Tap Water RBCs	0.0015	10	5
Benzo(g,h,i)perylene	191-24-2	180	Tap Water RBCs[4]	36	10	5

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.
"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-21—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Benzaldehyde	100-52-7	37000	Tap Water RBCs	7400	10	5.00
Phenol	108-95-2	110	CH2M HILL	22	10	5.00
bis-(2-Chloroethyl) ether	111-44-4	0.096	Tap Water RBCs	0.048	10	5.00
2-Chlorophenol	95-57-8	24	CH2M HILL	12	10	5.00
2-Methylphenol	95-48-7	13	CH2M HILL	6.5	10	5.00
2,2'-oxybis(1-Chloropropane)	108-60-1	2.6	Tap Water RBCs	1.3	10	5.00
Acetophenone	98-86-2	6100	Tap Water RBCs	1200	10	5.00
4-Methylphenol	106-44-5	543	CH2M HILL	109	10	5.00
N-Nitroso-di-n propylamine	621-64-7	0.096	Tap Water RBCs	0.048	10	5.00
Hexachloroethane	67-72-1	12	CH2M HILL	6.0	10	5.00
Nitrobenzene	98-95-3	35	Tap Water RBCs	7.0	10	5.00
Isophorone	78-59-1	700	Tap Water RBCs	140	10	5.00
2-Nitrophenol	88-75-5	1920	CH2M HILL	380	10	5.00
2,4-Dimethylphenol	105-67-9	21.2	CH2M HILL	11	10	5.00
bis(2-Chloroethoxy) methane	111-91-1	0.096	Tap Water RBCs[4]	0.048	10	5.00
2,4-Dichlorophenol	120-83-2	11	CH2M HILL	5.5	10	5.00
Naphthalene	91-20-3	12	CH2M HILL	6.0	10	5.00
4-Chloroaniline	106-47-8	232	CH2M HILL	46	10	5.00
Hexachlorobutadiene	87-68-3	1.3	CH2M HILL	0.65	10	5.00
Caprolactam	105-60-2	180000	Tap Water RBCs	36000	10	5.00
4-Chloro-3-methylphenol	59-50-7	0.3	CH2M HILL	0.15	10	5.00
2-Methylnaphthalene	91-57-6	4.7	CH2M HILL	2.3	10	5.00
Hexachlorocyclopentadiene	77-47-4	0.07	CH2M HILL	0.035	10	5.00
2,4,6-Trichlorophenol	88-06-2	4.9	CH2M HILL	2.5	10	5.00
2,4,5-Trichlorophenol	95-95-4	63	CH2M HILL	32	25	12.50
1,1'-Biphenyl	92-52-4	14	CH2M HILL	7.0	10	5.00
2-Chloronaphthalene	91-58-7	4900	Tap Water RBCs	980	10	5.00

QAPP Worksheet #15-21—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
2-Nitroaniline	88-74-4	NC	N/A	25.0	25	12.50
Dimethylphthalate	131-11-3	330	CH2M HILL	66	10	5.00
2,6-Dinitrotoluene	606-20-2	370	Tap Water RBCs	74	10	5.00
Acenaphthylene	208-96-8	23000	Tap Water RBCs[5]	4600	10	5.00
3-Nitroaniline	99-09-2	NC	N/A	25	25	12.50
Acenaphthene	83-32-9	23	CH2M HILL	12	10	5.00
2,4-Dinitrophenol	51-28-5	6.2	CH2M HILL	3.1	25	12.50
4-Nitrophenol	100-02-7	300	CH2M HILL	60	25	12.50
Dibenzofuran	132-64-9	3.7	CH2M HILL	1.9	10	5.00
2,4-Dinitrotoluene	121-14-2	730	Tap Water RBCs	150	10	5.00
Diethylphthalate	84-66-2	210	CH2M HILL	42	10	5.00
Fluorene	86-73-7	3.9	CH2M HILL	2.0	10	5.00
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	10.0	10	5.00
4-Nitroaniline	100-01-6	NC	N/A	25	25	12.50
4,6-Dinitro-2-methylphenol	534-52-1	2.3	CH2M HILL	1.2	25	12.50
N-Nitroso diphenylamine	86-30-6	140	Tap Water RBCs	28	10	5.00
4-Bromophenyl-phenylether	101-55-3	1.5	CH2M HILL	0.75	10	5.00
Hexachlorobenzene	118-74-1	0.42	Tap Water RBCs	0.21	10	5.00
Atrazine	1912-24-9	1.8	CH2M HILL	0.90	10	5.00
Pentachlorophenol	87-86-5	15	CH2M HILL	7.5	25	12.50
Phenanthrene	85-01-8	6.3	CH2M HILL	3.2	10	5.00
Anthracene	120-12-7	0.73	CH2M HILL	0.37	10	5.00
Carbazole	86-74-8	33	Tap Water RBCs	6.6	10	5.00
Di-n-butylphthalate	84-74-2	35	CH2M HILL	7.0	10	5.00
Fluoranthene	206-44-0	8.1	CH2M HILL	4.1	10	5.00
Pyrene	129-00-0	0.025	CH2M HILL	0.013	10	5.00
Butylbenzylphthalate	85-68-7	19	CH2M HILL	9.5	10	5.00

QAPP Worksheet #15-21—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits CRQLs (µg/L)	Laboratory-Specific Limits MDLs (µg/L)
3,3'-Dichlorobenzidine	91-94-1	1.5	Tap Water RBCs	0.75	10	5.00
Benzo(a)anthracene	56-55-3	0.027	CH2M HILL	0.014	10	5.00
Chrysene	218-01-9	30	Tap Water RBCs	6.0	10	5.00
bis(2-Ethylhexyl) phthalate	117-81-7	16	CH2M HILL	8.0	10	5.00
Di-n-octylphthalate	117-84-0	22	CH2M HILL	11	10	5.00
Benzo(b)fluoranthene	205-99-2	0.3	Tap Water RBCs	0.15	10	5.00
Benzo(k)fluoranthene	207-08-9	3	Tap Water RBCs	1.5	10	5.00
Benzo(a)pyrene	50-32-8	0.014	CH2M HILL	0.0070	10	5.00
Indeno(1,2,3-cd)-pyrene	193-39-5	0.3	Tap Water RBCs	0.15	10	5.00
Dibenzo(a,h)-anthracene	53-70-3	0.03	Tap Water RBCs	0.015	10	5.00
Benzo(g,h,i)perylene	191-24-2	23000	Tap Water RBCs[4]	4600	10	5.00

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-22—Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: TCL Pesticides/ Aroclors
Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
alpha-BHC	319-84-6	0.011	Tap Water RBCs	0.0055	0.05	0.0042
beta-BHC	319-85-7	0.037	Tap Water RBCs	0.019	0.05	0.0039
delta-BHC	319-86-8	0.037	Tap Water RBCs[4]	0.019	0.05	0.0040
gamma-BHC (Lindane)	58-89-9	0.052	Tap Water RBCs	0.010	0.05	0.0049
Heptachlor	76-44-8	0.015	Tap Water RBCs	0.0075	0.05	0.0043
Aldrin	309-00-2	0.0039	Tap Water RBCs	0.0020	0.05	0.0037
Heptachlor epoxide	1024-57-3	0.0074	Tap Water RBCs	0.0037	0.05	0.0038
Endosulfan I	959-98-8	220	Tap Water RBCs	44	0.05	0.0043
Dieldrin	60-57-1	0.0042	Tap Water RBCs	0.0021	0.1	0.0082
4,4'-DDE	72-55-9	0.2	Tap Water RBCs	0.04	0.1	0.0079
Endrin	72-20-8	2	MCLs	0.40	0.1	0.0092
Endosulfan II	33213-65-9	220	Tap Water RBCs	44	0.1	0.0075
4,4'-DDD	72-54-8	0.28	Tap Water RBCs	0.056	0.1	0.0098
Endosulfan sulfate	1031-07-8	220	Tap Water RBCs[5]	44	0.1	0.0074
4,4'-DDT	50-29-3	0.2	Tap Water RBCs	0.040	0.1	0.0056
Methoxychlor	72-43-5	40	MCLs	8.0	0.5	0.032
Endrin ketone	53494-70-5	11	Tap Water RBCs[6]	2.2	0.1	0.0056
Endrin aldehyde	7421-93-4	11	Tap Water RBCs[6]	2.2	0.1	0.012
alpha-Chlordane	5103-71-9	0.19	Tap Water RBCs[7]	0.038	0.05	0.0039

QAPP Worksheet #15-22—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater
Analytical Group: TCL Pesticides/ Aroclors
Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
gamma-Chlordane	5103-74-2	0.19	Tap Water RBCs[7]	0.038	0.05	0.0035
Toxaphene	8001-35-2	0.061	Tap Water RBCs	0.031	5	0.65
Aroclor-1016	12674-11-2	0.5	MCLs	0.25	1	0.084
Aroclor-1221	11104-28-2	0.033	Tap Water RBCs	0.017	2	0.10
Aroclor-1232	11141-16-5	0.033	Tap Water RBCs	0.017	1	0.14
Aroclor-1242	53469-21-9	0.033	Tap Water RBCs	0.017	1	0.14
Aroclor-1248	12672-29-6	0.033	Tap Water RBCs	0.017	1	0.16
Aroclor-1254	11097-69-1	0.033	Tap Water RBCs	0.017	1	0.13
Aroclor-1260	11096-82-5	0.033	Tap Water RBCs	0.017	1	0.088

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Technical HCH" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "Endosulfan" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[7] The surrogate analyte "Chlordane" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.
"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-23—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
alpha-BHC	319-84-6	0.11	Tap Water RBCs	0.022	0.05	0.0042
beta-BHC	319-85-7	0.37	Tap Water RBCs	0.074	0.05	0.0039
delta-BHC	319-86-8	2.2	CH2M HILL	0.44	0.05	0.0040
gamma-BHC (Lindane)	58-89-9	0.08	CH2M HILL	0.016	0.05	0.0049
Heptachlor	76-44-8	0.0069	CH2M HILL	0.0035	0.05	0.0043
Aldrin	309-00-2	0.039	Tap Water RBCs	0.020	0.05	0.0037
Heptachlor epoxide	1024-57-3	0.0069	CH2M HILL	0.0035	0.05	0.0038
Endosulfan I	959-98-8	0.056	CH2M HILL	0.011	0.05	0.0043
Dieldrin	60-57-1	0.042	Tap Water RBCs	0.021	0.1	0.0082
4,4'-DDE	72-55-9	10.5	CH2M HILL	2.1	0.1	0.0079
Endrin	72-20-8	0.036	CH2M HILL	0.018	0.1	0.0092
Endosulfan II	33213-65-9	0.056	CH2M HILL	0.028	0.1	0.0075
4,4'-DDD	72-54-8	0.011	CH2M HILL	0.0055	0.1	0.0098
Endosulfan sulfate	1031-07-8	0.056	CH2M HILL	0.028	0.1	0.0074
4,4'-DDT	50-29-3	0.013	CH2M HILL	0.0065	0.1	0.0056
Methoxychlor	72-43-5	0.03	CH2M HILL	0.015	0.5	0.032
Endrin ketone	53494-70-5	0.036	CH2M HILL	0.018	0.1	0.0056
Endrin aldehyde	7421-93-4	0.036	CH2M HILL	0.018	0.1	0.012
alpha-Chlordane	5103-71-9	0.17	CH2M HILL	0.034	0.05	0.0039

QAPP Worksheet #15-23—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
gamma-Chlordane	5103-74-2	0.17	CH2M HILL	0.034	0.05	0.0035
Toxaphene	8001-35-2	0.011	CH2M HILL	0.0055	5	0.65
Aroclor-1016	12674-11-2	0.28	CH2M HILL	0.14	1	0.084
Aroclor-1221	11104-28-2	0.28	CH2M HILL	0.14	2	0.10
Aroclor-1232	11141-16-5	0.33	Tap Water RBCs	0.17	1	0.14
Aroclor-1242	53469-21-9	0.053	CH2M HILL	0.027	1	0.14
Aroclor-1248	12672-29-6	0.081	CH2M HILL	0.041	1	0.16
Aroclor-1254	11097-69-1	0.033	CH2M HILL	0.017	1	0.13
Aroclor-1260	11096-82-5	0.33	Tap Water RBCs	0.017	1	0.088

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-24—Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Aluminum	7429-90-5	37000	Tap Water RBCs	7400	200	2.21
Antimony	7440-36-0	6	MCLs	3	60.0	0.0562
Arsenic	7440-38-2	0.045	Tap Water RBCs	0.0225	10.0	0.265
Barium	7440-39-3	2000	MCLs	400	200.0	0.0312
Beryllium	7440-41-7	4	MCLs	2	5.0	0.0124
Cadmium	7440-43-9	5	MCLs	1	5.0	0.00775
Calcium	7440-70-2	NC	N/A	5000	5000	2.96
Chromium	7440-47-3	100	MCLs	20	10	0.0461
Cobalt	7440-48-4	150	Tap Water RBCs[4]	50	50	0.0273
Copper	7440-50-8	1300	MCLs	260	25	0.133
Iron	7439-89-6	26000	Tap Water RBCs	5200	100	0.611
Lead	7439-92-1	15	MCLs	3	10.0	0.122
Magnesium	7439-95-4	NC	N/A	5000	5000	1.08
Manganese	7439-96-5	730	Tap Water RBCs	146	15.0	0.196
Mercury	7439-97-6	2	MCLs	0.4	0.20	0.0309
Nickel	7440-02-0	730	Tap Water RBCs	146	40	0.0131
Potassium	7440-09-7	NC	N/A	5000	5000	3.71
Selenium	7782-49-2	50	MCLs	10	35	0.377
Silver	7440-22-4	180	Tap Water RBCs	36	10	0.624

QAPP Worksheet #15-24—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Sodium	7440-23-5	NC	N/A	5000	5000	2.21
Thallium	7440-28-0	2	MCLs	1	25	0.0638
Vanadium	7440-62-2	37	Tap Water RBCs	7.4	50	0.0316
Zinc	7440-66-6	11000	Tap Water RBCs	2200	60	0.171
Cyanide	57-12-5	200	MCLs	40	10	4.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable
[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.
[2] Groundwater results will be compared to Tap Water RBCs and MCLs.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.
[3] This value was taken from a previous publication of the Tap Water RBCs, from April 2005. This action was recommended by a CH2M HILL human health risk assessor.
"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.
"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.
Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-25—Reference Limits and Evaluation Table

Matrix: Surface Water
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Aluminum	7429-90-5	87	CH2M HILL	44	200	2.21
Antimony	7440-36-0	30	CH2M HILL	6.0	60.0	0.0562
Arsenic	7440-38-2	0.45	Tap Water RBCs	0.23	10.0	0.265
Barium	7440-39-3	4	CH2M HILL	2.0	200.0	0.0312
Beryllium	7440-41-7	0.66	CH2M HILL	0.33	5.0	0.0124
Cadmium	7440-43-9	0.27	CH2M HILL	0.14	5.0	0.00775
Calcium	7440-70-2	NC	N/A	5000	5000	2.96
Chromium	7440-47-3	11.4	CH2M HILL	2.3	10	0.0461
Cobalt	7440-48-4	23	CH2M HILL	4.6	50	0.0273
Copper	7440-50-8	9.33	CH2M HILL	4.7	25	0.133
Iron	7439-89-6	1000	CH2M HILL	200	100	0.611
Lead	7439-92-1	3.18	CH2M HILL	1.6	10.0	0.122
Magnesium	7439-95-4	NC	N/A	5000	5000	1.08
Manganese	7439-96-5	120	CH2M HILL	24	15.0	0.196
Mercury	7439-97-6	0.91	CH2M HILL	0.46	0.20	0.0309
Nickel	7440-02-0	52.2	CH2M HILL	10	40	0.0131
Potassium	7440-09-7	NC	N/A	5000	5000	3.71
Selenium	7782-49-2	5	CH2M HILL	2.5	35	0.377
Silver	7440-22-4	0.36	CH2M HILL	0.18	10	0.624

QAPP Worksheet #15-25—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Sodium	7440-23-5	NC	N/A	5000	5000	2.21
Thallium	7440-28-0	12	CH2M HILL	2.4	25	0.0638
Vanadium	7440-62-2	20	CH2M HILL	4.0	50	0.0316
Zinc	7440-66-6	120	CH2M HILL	24	60	0.171
Cyanide	57-12-5	5.2	CH2M HILL	2.6	10	4.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-26—Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)

Concentration Level: Medium

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					QLs (µg/L)	MDLs (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	1800	Tap Water RBCs	360	0.40	0.13
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	0.61	Tap Water RBCs	0.31	0.40	0.068
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	1100	Tap Water RBCs	220	0.20	0.035
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	3.7	Tap Water RBCs	1.9	0.20	0.022
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	150	Tap Water RBCs	30	0.55	0.180
Nitrobenzene (NB)	98-95-3	3.5	Tap Water RBCs	0.7	0.20	0.038
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	2.2	Tap Water RBCs	0.44	0.20	0.024
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	73	Tap Water RBCs[4]	14.6	0.20	0.028
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	73	Tap Water RBCs[4]	14.6	0.20	0.023
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	73	Tap Water RBCs	15	0.22	0.073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	37	Tap Water RBCs	7.4	0.40	0.028
2-Nitrotoluene (2-NT)	88-72-2	61	Tap Water RBCs	12	0.40	0.075
3-Nitrotoluene (3-NT)	99-08-1	120	Tap Water RBCs	24	0.40	0.088
4-Nitrotoluene (4-NT)	99-99-0	4.2	Tap Water RBCs	0.84	0.40	0.12
PETN	78-11-5	NC	N/A	1.0	1.0	0.35
3,5-Dinitroaniline	618-87-1	NC	N/A	0.40	0.40	0.095
Nitroglycerine	55-63-0	3.7	Tap Water RBCs	1.85	1000	200
Nitroguanidine	556-88-7	365	Human Health	73	10	2.70

QAPP Worksheet #15-26—Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable
[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.
[2] Groundwater results will be compared to Tap Water RBCs and MCLs.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.
[4] The surrogate analyte "Aminodinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.
"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.
"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-27—Reference Limits and Evaluation Table

Matrix: Surface Water
Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)
Concentration Level: Medium

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					QLs (µg/L)	MDLs (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	330	CH2M HILL	66	0.40	0.13
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.1	Tap Water RBCs	0.31	0.40	0.068
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	11	CH2M HILL	2.2	0.20	0.035
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	17	CH2M HILL	3.4	0.20	0.022
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	1500	Tap Water RBCs	30	0.55	0.180
Nitrobenzene (NB)	98-95-3	35	Tap Water RBCs	0.7	0.20	0.038
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	55	Tap Water RBCs	0.44	0.20	0.024
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	730	Tap Water RBCs[4]	146	0.20	0.028
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	1480	CH2M HILL	300	0.20	0.023
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	37	CH2M HILL	7.4	0.22	0.073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	81	CH2M HILL	16	0.40	0.028
2-Nitrotoluene (2-NT)	88-72-2	610	Tap Water RBCs	12	0.40	0.075
3-Nitrotoluene (3-NT)	99-08-1	120	Tap Water RBCs	24	0.40	0.088
4-Nitrotoluene (4-NT)	99-99-0	42	Tap Water RBCs	0.84	0.40	0.12
PETN	78-11-5	85000	CH2M HILL	17000.0	1.0	0.35
3,5-Dinitroaniline	618-87-1	59	CH2M HILL	12.00	0.40	0.095
Nitroglycerine	55-63-0	37	Tap Water RBCs	7.4	1000	200
Nitroguanidine	556-88-7	3650	Human Health	730	10	2.70

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-28—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: TCLP-VOCs (Volatile results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
1,1-Dichloroethene	75-35-4	700	40 CFR 261.4	140	100	4.2
1,2-Dichloroethane	107-06-2	500	40 CFR 261.4	100	100	7.1
2-Butanone	78-93-3	200000	40 CFR 261.4	40000	100	24
Benzene	71-43-2	500	40 CFR 261.4	100	100	3.2
Carbon tetrachloride	56-23-5	500	40 CFR 261.4	100	100	7.4
Chlorobenzene	108-90-7	100000	40 CFR 261.4	20000	100	4.9
Chloroform	67-66-3	6000	40 CFR 261.4	1200	100	5.2
Tetrachloroethene	127-18-4	700	40 CFR 261.4	140	100	3.8
Trichloroethene	79-01-6	500	40 CFR 261.4	100	100	4.4
Vinyl chloride	75-01-4	200	40 CFR 261.4	40	100	9.5

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-29—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-SVOCs (Semivolatile results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
2-Methylphenol	95-48-7	200000	40 CFR 261.4	40000	150	48
4-Methylphenol	106-44-5	200000	40 CFR 261.4	40000	150	44
1,4-Dichlorobenzene	106-46-7	7500	40 CFR 261.4	1500	50	6.5
2,4-Dinitrotoluene	121-14-2	130	40 CFR 261.4	65	50	12
Hexachlorobenzene	118-74-1	130	40 CFR 261.4	65	50	9
Hexachlorobutadiene	87-68-3	500	40 CFR 261.4	100	50	9.5
Hexachloroethane	67-72-1	3000	40 CFR 261.4	600	50	9.5
Nitrobenzene	98-95-3	2000	40 CFR 261.4	400	50	6.5
Pentachlorophenol	87-86-5	100000	40 CFR 261.4	20000	100	22
Pyridine	110-86-1	5000	40 CFR 261.4	1000	50	8.5
2,4,5-Trichlorophenol	95-95-4	400000	40 CFR 261.4	80000	52	17
2,4,6-Trichlorophenol	88-06-2	2000	40 CFR 261.4	400	50	15

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-30—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-Pesticides (Pesticide results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
gamma-BHC (Lindane)	58-89-9	400	40 CFR 261.4	80	0.25	0.010
Heptachlor	76-44-8	8	40 CFR 261.4	1.6	0.25	0.010
Heptachlor epoxide	1024-57-3	8	40 CFR 261.4	0.17	0.25	0.015
Endrin	72-20-8	20	40 CFR 261.4	4	0.25	0.012
Methoxychlor	72-43-5	10000	40 CFR 261.4	2000	0.25	0.016
Toxaphene	8001-35-2	500	40 CFR 261.4	100	5.0	0.28
Chlordane (technical)	12789-03-6	30	40 CFR 261.4	6	5.0	0.26

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-31—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-Herbicides (Herbicide results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
2,4,5-TP (Silvex)	93-72-1	1000	40 CFR 261.4	200	5.0	0.32
2,4-D	94-75-7	10000	40 CFR 261.4	2000	5.0	0.55

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-32—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-Metals (Metal results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
Arsenic	7440-38-2	5000	40 CFR 261.4	1000	200	42
Barium	7440-39-3	100000	40 CFR 261.4	20000	1000	32
Cadmium	7440-43-9	1000	40 CFR 261.4	200	60	2.1
Chromium	7440-47-3	5000	40 CFR 261.4	1000	50	6.3
Lead	7439-92-1	5000	40 CFR 261.4	1000	100	12
Selenium	7782-49-2	1000	40 CFR 261.4	200	200	1.7
Silver	7440-22-4	5000	40 CFR 261.4	1000	50	4.7
Mercury	7439-97-6	200	40 CFR 261.4	40	2.0	0.19

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-34—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: Corrosivity

Analyte	CAS Number	Project Action Limit[1] (s.u.)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (s.u.)	Laboratory-specific	
					QLs (s.u.)	MDLs (s.u.)
pH	PH	2<pH<12.5	40 CFR 261.4	0<pH<14	0<pH<14	N/A

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-35—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: Ignitability

Analyte	CAS Number	Project Action Limit[1] (degrees F)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (degrees F)	Laboratory-specific	
					QLs (F)[2]	MDLs (F)
Ignitablitity	FLASHPOINT	140	40 CFR 261.4	140	70 - 140 - 200	N/A

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Project Action Limit.

QAPP Worksheet #15-36—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: Reactivity

Analyte	CAS Number	Project Action Limit[1] (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal[2] (mg/L)	Laboratory-specific	
					QLs	MDLs
Reactivity to Sulfide	REACT-S	NC	N/A	10	10	N/A
Reactivity to Cyanide	REACT-CN	NC	N/A	0.025	0.025	N/A

NC = No Criteria; N/A = Not Applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #16—Project Schedule/Timeline Table

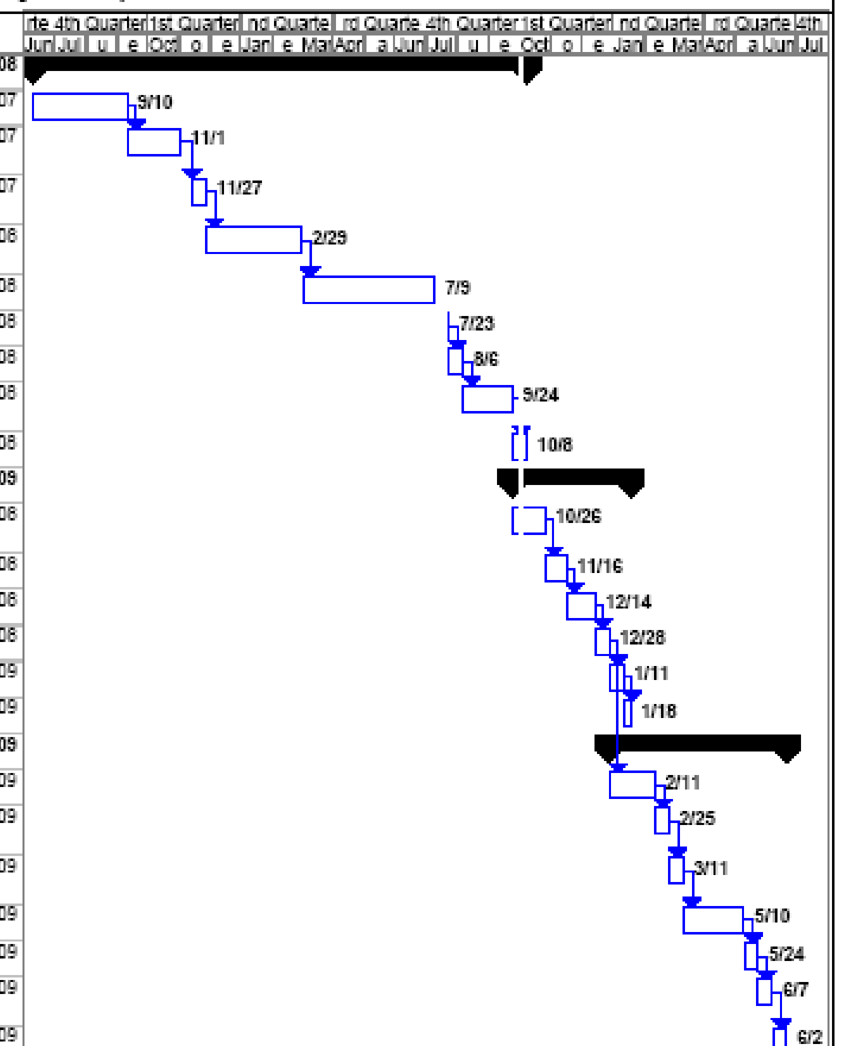
(UFP-QAPP Manual Section 2.8.2)

List all project activities as well as the QA assessments that will beperformed during the course of the project. Include the anticipated start and completion dates.

☐ Worksheet Not Applicable (State Reason)

Table 4-1
CAX AOCs 1, 6, 7, and 8 Site Investigations - Project Schedule

ID	CAX AOCs Site Investigation - CTO-174	Duration	Start	Finish
1	**Work Plan**	**486 days**	**Mon 6/11/07**	**Wed 10/8/08**
2	Preparation of Preliminary Work Plan	92 days	Mon 6/11/07	Mon 9/10/07
3	Preliminary Work Plan review by NAVFAC	52 days	Tue 9/11/07	Thu 11/1/07
4	Respond to NAVFAC Comments and Produce Draft Work Plan	14 days	Wed 11/14/07	Tue 11/27/07
5	Comment Resolution and QAPP revisons	94 days	Wed 11/28/07	Fri 2/29/08
6	Regulatory Review of Draft Work Plan	129 days	Mon 3/3/08	Wed 7/9/08
7	Comment Resolution	1 day	Wed 7/23/08	Wed 7/23/08
8	RTCs on Draft Work Plan	14 days	Thu 7/24/08	Wed 8/6/08
9	Regulatory Review of Draft Final Work Plan, QAPP and RTCs	49 days	Thu 8/7/08	Wed 9/24/08
10	Final Work Plan Production	14 days	Thu 9/25/08	Wed 10/8/08
11	**Field Investigation**	**117 days**	**Wed 9/24/08**	**Sun 1/18/09**
12	Field Work - Subcontractor procurement and field preparation	33 days	Wed 9/24/08	Sun 10/26/08
13	Field Work - test pits, media sampling	21 days	Mon 10/27/08	Sun 11/16/08
14	Laboratory Analyses	28 days	Mon 11/17/08	Sun 12/14/08
15	Analytical Data QC	14 days	Mon 12/15/08	Sun 12/28/08
16	Analytical Data Validation	14 days	Mon 12/29/08	Sun 1/11/09
17	Loading of Analytical Data into Endat	7 days	Mon 1/12/09	Sun 1/18/09
18	**SI Report**	**175 days**	**Mon 12/29/08**	**Sun 6/21/09**
19	Preparation of Preliminary SI Report	45 days	Mon 12/29/08	Wed 2/11/09
20	Preliminary SI Report review by NAVFAC	14 days	Thu 2/12/09	Wed 2/25/09
21	Respond to NAVFAC Comments and Product Draft SI Report	14 days	Thu 2/26/09	Wed 3/11/09
22	Regulatory Review of Draft SI Report	60 days	Thu 3/12/09	Sun 5/10/09
23	RTCs on Draft SI Report	14 days	Mon 5/11/09	Sun 5/24/09
24	Regulatory Review of Draft Final SI Report and RTCs	14 days	Mon 5/25/09	Sun 6/7/09
25	Final SI Report Production	14 days	Mon 6/8/09	Sun 6/21/09



CTO 174 Page 1

QAPP Worksheet #17—Sampling Design and Rationale
(UFP-QAPP Section 3.1.1)

Describe the project sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

☐ Worksheet Not Applicable (State Reason)

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach): The proposed sampling locations were chosen consistent with historical records in order to bias the sampling to areas where releases most likely occurred.
Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]: The number of samples to be taken was based on prior history of the AOCs, site topography, and known transport routes and were agreed to by the project team. For the sampling design and rationale, See Section 3.2.2 of the SI Work Plan. For details of the QA/QC sampling, see Section 3.2.1 of the SI Work Plan. The sampling design and rationale was developed using the *Guidance for Performing Site Inspections Under CERCLA* (Interim Final, U.S. Environmental Protection Agency, EPA/540-R-92-021, PB92-963375, September 1992) as a reference.

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

List all site locations that will be sampled and include sample/ID number, if available. (Provide a range of sampling locations or ID numbers if a site has a large number.) Specify matrix and, if applicable, depth at which samples will be taken. Only a short reference for the sampling location rationale is necessary for the table. The text of the QAPP should clearly identify the detailed rationale associated with each reference. Complete all required information, using additional worksheets if necessary.

☐ Worksheet Not Applicable (State Reason)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
N/A	Aqueous IDW	N/A	TCLP VOCs	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP SVOCs	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP Pesticides	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP Herbicides	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP Metals	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	Reactivity to Cyanide and Sulfide	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	Corrosivity	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	Ignitability	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TCL Volatiles	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TAL Metals/ Cyanide	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TAL Dissolved Metal	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TCL Pesticides/ Aroclors	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 1	Groundwater	Dependent on potential concentration*	Explosives	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TCL Volatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TAL Metals/ Cyanide	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TCL Pesticides/ Aroclors	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Explosives	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Nitroglycerin	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Nitroguanadine	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Total Organic Carbon, pH	Medium	19/ 19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	TAL Metals/ Cyanide	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	TCL Pesticides/ Aroclors	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Explosives	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 1	Subsurface Soil	6-24” bgs	TCL Volatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Total Organic Carbon, pH	Medium	19/ 19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	TAL Metals/Cyanide	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	TAL Dissolved Metals	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	Explosives	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	TAL Metals/Cyanide	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	TAL Dissolved Metals	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	TCL Semivolatiles	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Explosives	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Nitroglycerin	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Nitroguanadine	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Hardness	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	TAL Metals/Cyanide	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Total Organic Carbon	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 6	Surface Soil	0-6” bgs	pH	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Explosives	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Nitroglycerin	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Nitroguanadine	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	TAL Metals/Cyanide	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Total Organic Carbon	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	pH	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Explosives	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	TAL Metals/ Cyanide	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	TCL Semivolatiles	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Total Organic Carbon	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	pH	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Grain Size	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Explosives	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Nitroglycerin	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 6	Sediment	Top 4”	Nitroguanadine	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Acid Volatile Sulfate/Simultaneously Extracted Metals (AVS/SEM)	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TCL Volatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TAL Metals/ Cyanide	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TAL Dissolved Metal	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TCL Pesticides/Aroclors	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	Explosives	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TCL Volatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TAL Metals/ Cyanide	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TCL Pesticides/ Aroclors	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	Explosives	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	Nitroglycerin	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	Nitroguanadine	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 7	Surface Soil	0-6" bgs	Total Organic Carbon	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6" bgs	pH	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	TCL Volatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	TAL Metals/ Cyanide	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	TCL Semivolatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	TCL Pesticides/ Aroclors	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	Explosives	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	Nitroglycerin	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	Nitroguanadine	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	Total Organic Carbon	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24" bgs	pH	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TCL Volatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TAL Metals/ Cyanide	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TAL Dissolved Metals	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TCL Pesticides/ Aroclors	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	Explosives	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 8	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TCL Volatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TAL Metals/ Cyanide	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TCL Pesticides/ Aroclors	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Explosives	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Nitroglycerin	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Nitroguanadine	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Total Organic Carbon	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	pH	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TCL Volatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TAL Metals/ Cyanide	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TCL Pesticides/ Aroclors	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Explosives	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Total Organic Carbon	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 8	Subsurface Soil	6-24" bgs	pH	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet_#21).

* In the source areas, the sample collection depth will be determined based on the depth of the observed potential contamination. In upgradient and downgradient areas, the sample depth interval will be approximately 0 to 2 ft below the water table.

QAPP Worksheet #19—Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

For each matrix, analytical group, and concentration level, list the analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding time.

☐ Worksheet Not Applicable (State Reason)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference1	Sample Volume	Containers (Number, Size, and Type)	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)
Aqueous IDW	TCLP Volatiles	Medium	SW-846 1311, 8260B	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to analyze
Aqueous IDW	TCLP Semivolatiles	Medium	SW-846 1311, 8270C	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to extract/40 days analysis
Aqueous IDW	Corrosivity	Medium	SW-846 7.2.2-1a	100ml	125ml HDPE	cool to 4±2 degrees C	24 hours to analyze
Aqueous IDW	Ignitability	Medium	SW-846 1010	100ml	125ml HDPE	cool to 4±2 degrees C	28 days to analyze
Aqueous IDW	TCLP Herbicides	Medium	SW-846 1311, 8151A	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to extract/40 days analysis
Aqueous IDW	TCLP Metals	Medium	SW-846 1311, 6010B, 7470A	1L	1 L HDPE	cool to 4±2 degrees C	6 months
Aqueous IDW	TCLP Pesticides	Medium	SW-846 1311, 8081A	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to extract/40 days analysis
Aqueous IDW	Reactivity to cyanide	Medium	SW-846 7.3, 9014	100 mL	250 mL plastic	cool to 4±2 degrees C, NaOH to pH > 12	14 days
Aqueous IDW	Reactivity to sulfide	Medium	SW-846 7.3, 9034	100 mL	250 mL plastic	cool to 4±2 degrees C, NaOH to pH >2, ZnAce	7 days
GW	TCL VOCs	Medium	CLP OLM04.3	(3) 40 mL	(3) 40 mL VOA Vial	cool to 4±2 degrees C, 1:1 HCL, pH <2	10 Days VTSR

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

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference1	Sample Volume	Containers (Number, Size, and Type)	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)
GW	TAL Metals, TAL Diss. Metals	Medium	CLP ILM05.3	500 mL	Plastic	cool to 4±2 degrees C HNO3, pH <2	6 Months/28 Days (Hg)
GW	Cyanide	Medium	CLP ILM05.3	250 mL	Plastic	cool to 4±2 degrees C, NaOH	14 Days
GW	TCL SVOCs	Medium	CLP OLM04.3	(2)1000 mL	Glass	cool to 4±2 degrees C	5 Days VSTR/40 Days
GW	TCL Pesticides/ PCBs	Medium	CLP OLM04.3	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	5-days of VTSR / 40 -days analysis
GW	Explosives	Medium	SW846 8330	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
GW	Nitroglycerin	Medium	SW846 8332	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
GW	Nitroguanadine	Medium	SW846 8330M	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	TAL Metals, TAL Diss. Metals	Medium	CLP ILM05.3	500 mL	Plastic	cool to 4±2 degrees C HNO3, pH <2	6 Months/28 Days (Hg)
SW	Cyanide	Medium	CLP ILM05.3	250 mL	Plastic	cool to 4±2 degrees C, NaOH	14 Days
SW	Explosives	Medium	SW846 8330	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	Nitroglycerin	Medium	SW846 8332	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	Nitroguanadine	Medium	SW846 8330M	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	Hardness	Medium	SM 2340B	500 mL	Plastic	HNO3, pH <2, cool to 4±2 degrees C, dark	6 months/ 28 days
SS/SB	TCL VOCs	Medium	CLP OLM04.3	2 oz.	Soil jar with Teflon-lined cap	cool to 4±2 degrees C	10 VSTR Days
SS/SB	TAL Metals	Medium	CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	6 Months/28 Days (Hg)
SS/SB	Cyanide		CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SS/SB	Total Organic Carbon	Medium	Lloyd Kahn	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SS/SB	pH	Medium	SW846 9045C	2 oz.	Soil jar	cool to 4±2 degrees C	7 Days
SS/SB	TCL SVOCs	Medium	CLP OLM04.3	4 oz.	Soil jar	cool to 4±2 degrees C	10 Days VSTR/40 Days

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

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference1	Sample Volume	Containers (Number, Size, and Type)	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)
SS/SB	TCL Pesticides/ PCBs	Medium	CLP OLM04.3	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	10-days of VTSR / 40 -days analysis
SS/SB	Explosives	Medium	SW846 8330	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SS/SB	Nitroglycerin	Medium	SW846 8332	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SS/SB	Nitroguanadine	Medium	SW846 8330M	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SD	TAL Metals	Medium	CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	6 Months
SD	Cyanide	Medium	CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SD	AVS/SEM	Medium	EPA 821-R-91-100	2 oz.	Soil jar	cool to 4±2 degrees C, dark	14 Days
SD	Total Organic Carbon	Medium	Lloyd Kahn	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SD	pH	Medium	SW846 9045C	2 oz.	Soil jar	cool to 4±2 degrees C	7 Days
SD	Grain Size	Medium	ASTM D422	500 g	1 16oz jar or zip-lock bag	None	None
SD	Explosives	Medium	SW846 8330	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SD	Nitroglycerin	Medium	SW846 8332	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SD	Nitroguanadine	Medium	SW846 8330M	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis

[1] See Analytical SOP References table (Worksheet #23).

QAPP Worksheet #20— Field Quality Control Sample Summary Table
(UFP-QAPP Manual Section 3.1.1)

Summarize by matrix, analytical group, and concentration level the number of field QC samples that will be collected and sent to the laboratory.

☐ Worksheet Not Applicable (State Reason)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSDs (total)	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	Total No. of Samples to Lab
Aqueous IDW	TCLP-VOCs	Medium	H7, M5	1	0	0	0	0	0	1
Aqueous IDW	TCLP-SVOCs	Medium	H7, P5	1	0	0	0	0	0	1
Aqueous IDW	TCLP-Pesticides	Medium	H7, Q6	1	0	0	0	0	0	1
Aqueous IDW	TCLP-Herbicides	Medium	H7, Q10	1	0	0	0	0	0	1
Aqueous IDW	TCLP-Metals	Medium	H7, H10, H12	1	0	0	0	0	0	1
Aqueous IDW	Reactivity to Cyanide	Medium	J13, J43	1	0	0	0	0	0	1
Aqueous IDW	Reactivity to Sulfide	Medium	J13, J11	1	0	0	0	0	0	1
Aqueous IDW	Corrosivity	Medium	J12	1	0	0	0	0	0	1
Aqueous IDW	Ignitability	Medium	N1	1	0	0	0	0	0	1
Groundwater	VOA	Medium	SOP-7, SOP-9	12	2	2	1	3	3	23
Groundwater	TAL Metals/Cyanide	Medium	SOP-4, SOP-11, SOP-17, SOP-19	22	3	4	1	4	0	33
Groundwater	TAL Dissolved Metals	Medium	SOP-4, SOP-11, SOP-17, SOP-19	22	3	4	1	4	0	33
Groundwater	TCL Semivolatiles	Medium	SOP-6, SOP-8	12	2	2	1	3	0	20

QAPP Worksheet #20—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSDs (total)	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	Total No. of Samples to Lab
Groundwater	TCL Pesticides/ Aroclor	Medium	Q20	12	2	2	1	3	0	20
Groundwater	Explosives	Medium	S1	22	3	4	1	4	0	33
Groundwater	Nitroglycerin	Medium	S7	22	3	4	1	4	0	33
Groundwater	Nitroguanadine	Medium	S4	22	3	4	1	4	0	33
Surface Water	TAL Metals/Cyanide	Medium	SOP-4, SOP-11, SOP-17, SOP-19	2	1	2	1	1	0	7
Surface Water	TAL Dissolved Metals	Medium	SOP-4, SOP-11, SOP-17, SOP-19	2	1	2	1	1	0	7
Surface Water	Explosives	Medium	S1	2	1	2	1	1	0	7
Surface Water	Nitroglycerin	Medium	S7	2	1	2	1	1	0	7
Surface Water	Nitroguanadine	Medium	S4	2	1	2	1	1	0	7
Surface Water	Hardness	Medium	SOP-8	2	1	2	0	0	0	5
Soil	TCL Volatiles	Medium	SOP-7, SOP-10	62	7	10	1	4	4	88
Soil	TAL Metals/Cyanide	Medium	SOP-4, SOP-12, SOP-18, SOP-19	88	9	12	1	5	0	115
Soil	Total Organic Carbon	Medium	SOP-2	88	9	10	0	0	0	107
Soil	pH	Medium	SOP-3	88	9	0	0	0	0	107
Soil	TCL Semivolatiles	Medium	SOP-5, SOP-8	62	7	8	1	4	0	82
Soil	TCL Pesticides/ Aroclor	Medium	Q20	52	6	8	1	4	0	71
Soil	Explosives	Medium	S1	88	9	12	1	5	0	115
Soil	Nitroglycerin	Medium	S7	88	9	12	1	5	0	115

QAPP Worksheet #20—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSDs (total)	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	Total No. of Samples to Lab
Soil	Nitroguanadine	Medium	S4	88	9	12	1	5	0	115
Sediment	TAL Metals/Cyanide	Medium	SOP-4, SOP-12, SOP-18, SOP-19	4	1	2	1	1	0	9
Sediment	Total Organic Carbon	Medium	SOP-2	4	1	2	0	0	0	7
Sediment	pH	Medium	SOP-3	4	1	0	0	0	0	5
Sediment	Grain Size	Medium	SOP-16	4	0	0	0	0	0	4
Sediment	AVS/SEM	Medium	SOP-20	4	1	2	1	1	0	9
Sediment	Explosives	Medium	S1	4	1	2	1	1	0	9
Sediment	Nitroglycerin	Medium	S7	4	1	2	1	1	0	9
Sediment	Nitroguanadine	Medium	S4	4	1	2	1	1	0	9

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

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

List all SOPs associated with project sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody. Include copies of the SOPs as attachments or reference all in the QAPP. Sequentially number sampling SOP references in the Reference Number column. The reference number can be used throughout the QAPP to refer to a specific SOP.

☐ Worksheet Not Applicable (State Reason)

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
BlankPrep	Equipment Blank and Field Blank Preparation, reviewed 1/08	CH2M HILL	Sample bottles, gloves, blank liquid, preservatives	☐	
COC	Chain-of-Custody, reviewed and updated 1/08	CH2M HILL	Chain-of-Custody	☐	
Decon	Decontamination of Personnel and Equipment, QCd and revised 1/08	CH2M HILL	DI water, distilled water, potable water, Liquinox, plastic pails or tubs, 55 gallon drum, gloves, decon pad	☐	
DeconRig	Decontamination of Drilling Rigs and Equipment, QCed and revised 1/08	CH2M HILL	Portable steam cleaner, potable water, Liquinox, buckets, brushes, distilled water, methanol, ASTM Type-II water, aluminum foil	☐	
DPGW	Direct Push Groundwater Sample Collection, reviewed 1/08	CH2M HILL	Hydraulic percussion hammer, direct push sampling rods, polyethylene tubing	☐	
DPSoil	Direct-Push Soil Sample Collection, reviewed and revised 1/08	CH2M HILL	Truck-mounted hydraulic percussion hammer, sampling rods, sampling tubes and acetate liners, pre-cleaned sample containers and stainless-steel sampling implements	☐	
Homog	Homogenization of Soil and Sediment Samples, reviewed 1/08	CH2M HILL	Sample containers, stainless steel spoons or spatulas, stainless steel pans	☐	
HoribaU22	Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature using the Horiba® U-22 with Flow-through Cell, QC review 1/08	CH2M HILL	Horiba® U-22 Water Quality Checker with flow-through cells, distilled water in squirt bottle, Horiba® U-22 Auto-Calibration Standard Solution.	☐	
HSE-408	Waste Management: Analysis and Characterization	CH2M HILL	N/A	N	Contains drum labeling information

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

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
HSE-411	Waste Management: Non-Hazardous Waste	CH2M HILL	N/A	N	
HSE-413	Waste Management Planning	CH2M HILL	N/A	N	
HSE-414	Waste Management: Subcontractor Qualifications	CH2M HILL	N/A	N	
Log Books	Preparing Field Log Books, reviewed and revised 1/08	CH2M HILL	Log book, indelible pen	☐	
LowFlow	Low-Flow Groundwater Sampling from Monitoring Wells, reviewed 1/08	CH2M HILL	Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe, Horiba® U-22 Water Quality Checker with flow-through cells, water-level indicator, in-line disposable 0.45 µm filters, adjustable-rate positive displacement pump, submersible pump, or peristaltic pump, generator, disposable polyethylene tubing, plastic sheeting, calibrated bucket or other container and watch with second indicator to determine flow rate	☐	
Sediment	Sediment Sampling, QCed and revised 5/20/03	CH2M HILL	Sample collection device (hand corer, scoop, dredge, grab sampler, etc), stainless steel spoon or spatula, measuring tape, log book, personal protection equipment, materials for classifying soils, sample jars	☐	
Soils	Soil Sampling, reviewed and revised 1/08	CH2M HILL	Stainless steel trowel, shovel, scoopula, coring device, hand auger, etc; stainless steel split-spoon samplers, thin-walled sampling tubes, drilling rig or soil-coring rig, stainless steel pan or bowl, sample bottles	☐	
Surface Water	Surface Water Sampling, QCed and revised 5/20/03	CH2M HILL	Open tube sampler, dip sampler, weighted bottle sampler, hand pump, Kemmerer or Van Dorn sampler, depth-integrating sampler, sample containers, meters for specific conductance, temperature, pH, and dissolved oxygen.	☐	
Trench	Trenching for Landfill Delineation, reviewed and revised 1/08	CH2M HILL	Backhoe, shovels, barricades, plastic sheeting, decon pad	Yes	Procedures are correct, but will not take place at a technical “landfill”
Utility Location_General	Locating and Clearing Underground Utilities, revised 1/15/08	CH2M HILL	Magnetic Field Methods, Optical Methods, Ground Penetrating Radar, Electromagnetic Induction	☐	
WaterLevels	Water-Level Measurements, reviewed 1/08	CH2M HILL	Electronic water-level meter with 100 foot tape, interface probe	☐	
VOCAq	VOC Sampling- Water, reviewed and revised 1/08	CH2M HILL	Sample vials, gloves, pH meter, HCl	☐	

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

Identify all field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection and provide the SOP reference number for each type of equipment. In addition, document the frequency of activity, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Horiba U-22 pH probe	Calibrate using Auto-Calibration Standard Solution				Calibrate daily, before use	pH reads 4.0 +/- 3%	Clean probe with Deionized water and calibrate again. Do not use instrument if not able to calibrate properly	Field Team Lead	HoribaU22
Horiba U-22 Specific conductance probe	Calibrate using Auto-Calibration Standard Solution				Calibrate daily, before use	Conductivity reads 4.49 +/- 3%	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22
Horiba U-22 Turbidity probe	Calibrate using Auto-Calibration Standard Solution				Calibrate daily, before use	Turbidity reads 0 +/- 3%	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table (continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Horiba U-22 Dissolved oxygen and Temperature Probes			During calibration of other probes, check these readings against the day's atmospheric pressure and ambient temperature		Test daily, before use	Consistent with the current atmospheric pressure and ambient temperature	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22
Horiba U-22		Check mechanical and electronic parts, verify system continuity, check battery, and clean probes. Calibration check.	Visual inspection		Perform Maintenance daily before use, at the end of the day, and when unstable readings occur.	Stable readings after 3 minutes. pH reads 4.0 +/- 3% conductivity reads 4.49 +/- 3% turbidity reads 0 +/- 3%	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

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

List all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP reference in the Reference Number column. Include copies of the SOPs as attachments or reference in the QAPP. The reference number can be used throughout the QAPP to refer to a specific SOP.

☐ Worksheet Not Applicable (State Reason)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
SOP-1 (CA-751)	Preparation and Analysis Of Samples For Cyanide Using Midi-Distillation Followed By Flow Injection Analysis	05/06	4	Definitive	Wet Chemistry	Konelab	Katahdin Analytical Services	N
SOP-2 (CA-741)	Determination of Total Organic Carbon in Solids Using the EPA Region II Lloyd Kahn Method	01/07	1	Definitive	Wet Chemistry	TOC Analyzer	Katahdin Analytical Services	N
SOP-3 (CA-709)	pH Concentration Measurements In Soil Matrices - SW 846 Method 9045	03/07	6	Definitive	Wet Chemistry	pH Meter	Katahdin Analytical Services	N
SOP-4 (CA-630)	Analysis of Aqueous and Solid Samples by ICP in Accordance With USEPA CLP Statement Of Work, Document Number ILM05.3	07/25/06	0	Definitive	Metals	ICP/ICPMS	Katahdin Analytical Services	N
SOP-5 (CA-533)	Preparation of Sediment/Soil Samples For CLP Extractable Semivolatile Analysis: USEPA Contract Laboratory Program, Document Numbers OLM03.1 & OLM04.2	04/06	3	Definitive	Extractions	TEKMAR ARCON ENCON	Katahdin Analytical Services	N
SOP-6 (CA-509)	Preparation of Aqueous Samples For CLP Extractable Semivolatile Analysis: USEPA Contract Laboratory Program, Document Numbers OLM03.1 & OLM04.2	04/06	1	Definitive	Extractions	TEKMAR ARCON ENCON	Katahdin Analytical Services	N
SOP-7 (CA-320)	Purge and Trap Extraction of Volatiles for GC Analysis - Method 5030	06/18/04	3	Definitive	VOA	GC/MS	Katahdin Analytical Services	N
SOP-8 (CA-219)	Analysis of Semivolatile Organic Compounds By Capillary Column GC/MS: USEPA Contract Laboratory Program, Document Number OLM04.2	04/06	1	Definitive	SVOA	GC/MS	Katahdin Analytical Services	N
SOP-9 (CA-218)	Analysis of VOA's By Purge and Trap GC/MS: USEPA Contract Laboratory Program, Document Number OLM04.2 and OLM04.3	06/07	4	Definitive	VOA	GC/MS	Katahdin Analytical Services	N

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
SOP-10 (CA-214)	Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil And Waste Samples Using Sw846 Method 5035	04/06	4	Definitive	VOA	GC/MS	Katahdin Analytical Services	N
SOP-11 (CA-622)	Acid Digestion of Aqueous Samples For ICP Metals Analysis In Accordance With USEPA CLP Statement of Work, Document Number ILM04.0	03/07	2	Definitive	Metals	ICP/ICPMS	Katahdin Analytical Services	N
SOP-12 (CA-623)	Acid Digestion of Soil/Sediment Samples For ICP and GFAA Metals Analysis In Accordance With USEPA CLP Statement of Work, Document Number ILM04.0	08/29/02	7	Definitive	Metals	ICP/ICPMS	Katahdin Analytical Services	N
SOP-13 (SD-902)	Sample Receipt and Internal Control	02/07	7	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
SOP-14 (SD-903)	Sample Disposal	02/05	2	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
SOP-15 (SD-900)	Subcontracting Analyses	04/06	3	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
LM-SL-D4 22	Particle Size Analysis of Soils D422-63	07/29/05	5	Definitive	Geotechnical	None	STL	N
Q20	CLP OLM04.3	06/07	2	Definitive	TCL Pesticides/ PCBs	GC-ECD	GPL Laboratories, LLLP	N
S1	SW846 8330	05/07	24	Definitive	Explosives	HPLC	GPL Laboratories, LLLP	N
S7	SW846 8332	10/06	7	Definitive	Nitroglycerin	HPLC	GPL Laboratories, LLLP	N
S4	SW846 8330M	06/07	1	Definitive	Nitroguanadine	HPLC	GPL Laboratories, LLLP	N
F.1	Sample Chain-of-Custody Procedures	11/00	9				GPL Laboratories, LLLP	
F.2	Sample Receipt, Inspection, Preservation, and Storage Condition Requirements	09/06	18				GPL Laboratories, LLLP	
F.3	Sample Logging and Record Keeping	02/03	6				GPL Laboratories, LLLP	

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
F2	Sample Receipt, Inspection, Preservation, and Storage Condition Requirements, September 07, Rev. 18	09/07	18	Definitive	Sample Management	N/a	GPL Laboratories, LLLP	N
H7	Toxicity Characterization Leaching Procedure (TCLP) , October 06, Rev. 9	10/06	9	Definitive	TCPL Organics/Inorganics	N/A	GPL Laboratories, LLLP	N
M5	SW-846 8260B	08/07	18	Definitive	TCLP Volatiles	GC/MS	GPL Laboratories, LLLP	N
P5	SW-846 8270C	08/07	15	Definitive	TCLP Semivolatiles	GC/MS	GPL Laboratories, LLLP	N
Q6	SW-846 8081A	08/07	12	Definitive	TCLP Pesticides	GC/ECD	GPL Laboratories, LLLP	N
Q10	SW-846 8151A	12/05	7	Definitive	TCLP Herbicides	GC/ECD	GPL Laboratories, LLLP	N
H10	SW-846 6010B	11/07	18	Definitive	TCLP Metals	ICP	GPL Laboratories, LLLP	N
H12	SW-846 7470A	09/07	22	Definitive	TCLP Metals	Mercury Analyzer	GPL Laboratories, LLLP	N
N1	SW-846 1010	02/07	8	Definitive	Ignitability	Flashpoint Analyzer	GPL Laboratories, LLLP	N
J12	SW-846 7.2.2-1a	08/04	5	Definitive	Corrosivity (pH)	pH meter	GPL Laboratories, LLLP	N
J13	SW-846 7.3	10/06	5	Definitive	Reactivity	N/A	GPL Laboratories, LLLP	N

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
J11	SW-846 9034	02/07	7	Definitive	Sulfide	N/A	GPL Laboratories, LLLP	N
J43	SW-846 9014	10/06	5	Definitive	Cyanide	UV/Vis	GPL Laboratories, LLLP	N

QAPP Worksheet #24—Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Identify all analytical instrumentation that requires calibration and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS - VOA	Initial Calibration	IC – instrument receipt, instrument change (new trap, column, etc.), when CCC does not meet criteria or when manual tune performed.	IC – RSD for each CCC < 30%, minimum mean RF for each SPCC as noted in 7.3.5.4 of method 8260B. If RSD for an analyte is > 15% apply linear (r2 > 0.99) or quadratic method for quantitation	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-7, SOP-9, SOP-10
GC/MS - VOA	Calibration Check	CV – at beginning of each 12 hour shift immediately after BFB tune.	CV - %D for each CCC < 20%, minimum RF for each SPCC as noted in 7.3.5.4 of method 8260B.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-7, SOP-9, SOP-10
GC/MS - VOA	BFB Tune	Every 12 hours	Criteria listed in section 7.3 current rev. of SOP CA-202	Retune and/or clean source	Analyst, Supervisor	SOP-7, SOP-9, SOP-10
GC/MS - SVOA	Initial Calibration	IC – Instrument receipt, instrument change (new column, source cleaning, etc.), when CCC is out of criteria or when manual tune performed	IC – minimum RF of ≥ 0.050 for each SPCC, % RSD of ≤ 30% for each CCC. If RSD for an analyte is > 15% apply linear or quadratic method for quantitation	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-8
GC/MS - SVOA	Calibration Check	CV – at the beginning of each 12 hour shift immediately after DFTPP tune.	CV – minimum RF of each SPCC ≥ 0.050, % RSD ≤ 20% for each CCC.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-8
GC/MS - SVOA	DFTPP Tune	Every 12 hours	Criteria listed in section 7.4 current rev. of SOP CA-204	Retune and/or clean source	Analyst, Supervisor	SOP-8
Mercury analyzer	Initial calibration	IC-instrument receipt, major instrument change, at the start of each day	Correlation coefficient ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
Mercury analyzer	continuing calibration	CCV-at beginning and end of each run sequence and every 10 samples	80-120% of True Value	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	SOP-4, SOP-11, SOP-12

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Konelab	Initial calibration	Initial Calibration- prior to sample analysis.	Correlation coefficient ≥ 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-1
Konelab	continuing calibration	CCV (undistilled)-at beginning and end of each run sequence and every 10 samples	± 15% of True Value	If the CCV fails high, report samples that are <PQL. Recalibrate and/or reanalyze samples back to last acceptable CCV recovery.	Analyst, Supervisor	SOP-1
TOC analyzer	Initial calibration	Initial Calibration- initially, when the daily CCV does not pass, but, no longer than every 3 months.	Correlation coefficient ≥ 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-2
TOC analyzer	continuing calibration	CCV-every 10 samples and at the end of the run	80-120% of true value for 415.1 75-125% of true value for Lloyd Kahn	If the CCV fails high, report samples that are <PQL. Recalibrate and/or reanalyze samples back to last acceptable CCV recovery.	Analyst, Supervisor	SOP-2
ICP	Initial calibration	At the beginning of each day or if QC is out of criteria.	One point calibration per manufacturer's guidelines; analytes run at their calibration levels must fall within 95-105% of True Values	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
ICP	continuing calibration	At the beginning and end of each run sequence and every 10 samples	90-110% of True Values	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
ICP/MS	Initial Calibration	Daily prior to sample analysis.	0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
ICP/MS	Continuing Calibration Verification CCV)	At beginning of run, after every 10 samples, and at end of run.	Recovery within ± 10% of true value.	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
pH Meter	Initial Calibration	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	Analyst, Supervisor	SOP-3
GC-ECD	Calibration procedure according to the method	Initial calibration prior to sample analysis	acceptance criteria from the method	correct problem and rerun	Rekha Patel	Q20

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HPLC	Minimum 5 point initial calibration	Initial calibration prior to sample analysis	RSD for each analyte ≤ 20%	correct problem and rerun	Samy Shawky	S1
HPLC	Minimum 5 point initial calibration	Initial calibration prior to sample analysis	RSD for analyte ≤ 20%	correct problem and rerun	Samy Shawky	S4
HPLC	Minimum 5 point initial calibration	Initial calibration prior to sample analysis	RSD for analyte ≤ 20%	correct problem and rerun	Samy Shawky	S4
GCMS Semivolatiles	Minimum five point calibration for all analytes	Daily, Prior to sample analysis or instrument change, when instrument does not meet method criteria	30% RSD for CCC's and Min RF for SPCCs, 15% for Avg RF, 0.995 corr for linear, 0.99 corr for Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Hall Moore	P5
GCMS Volatiles	Minimum five point calibration for all analytes	Daily, Prior to sample analysis or instrument change, when instrument does not meet method criteria	30% RSD for CCC's and Min RF for SPCCs, 15% for Avg RF, 0.995 corr for linear, 0.99 corr for Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Nathan Krueger	M5
GC-ECD Pesticides	5 point calibration plus ICV	CCV every 10 samples	%RSD <20% for initial curve, %difference from ICAL <15% for CCV	correct problem and rerun	Rekha Patel	Q6
GC-ECD Herbicides	5 point calibration plus ICV	CCV every 10 samples	%RSD <20% for initial curve, %difference from ICAL <15% for CCV	correct problem and rerun	Rekha Patel	Q10

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
pH Meter	Calibrate meter at pH 10 and 4, check 7 4 and 10 alternately as appropriate to pH of samples	Before analysis and check every 3 hrs or 10 samples	±0.10 pH units for every check	Recalibrate as necessary	James Anderson	J.12
ICP	One point calibration per manufacturers guidelines	At the beginning of each day or if QC is outside criteria	90-110% of true value	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Rita Amin	H.10
UV/Vis Spectrophoto-meter	Minimum five point calibration	At the beginning of each day or if QC is outside criteria	Correlation coefficient >0.995 ICV/CCV 85-115% recovery	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	James Anderson	J.43
Titration	ICV/ CCV	CCV every 10 samples	ICV/CCV 70-130% recovery	Check calibration standards, Reanalyze affected samples	James Anderson	J.11
Hg Analyzer/FIMS	Minimum five point calibration	At the beginning of each day or if QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Rita Amin	H.12

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Flashpoint Tester	Flashpoint of p-xylene	At the beginning and end of each set of 20 samples or less	Flash at 27 degrees C, $\pm$ 2.2 degrees C	Check standard	Namory Keita	N.1

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

(UFP-QAPP Manual Section 3.2.3)

Identify all analytical instruments that require maintenance, testing, or inspection and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS (VOA)	Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	Prior to initial calibration and/or as necessary.	Refer to SOP 9, Section 7.5	Refer to SOP 9, Section 7.5	Analyst, Department Manager	SOP-9
GC/MS (SVOA)	Check pressure and gas supply daily. Manual tune if DFTPP not in criteria, change septa as needed, change liner as needed, cut column as needed. Other maintenance specified in lab Equipment Maintenance SOP	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	Prior to initial calibration and/or as necessary	Refer to SOP-8, Section 8.0	Refer to SOP-8, Section 8.0	Analyst, Department Manager	SOP-8
ICP	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 chamber, pump, pump tubing	Prior to initial calibration and as necessary	Refer to SOP-4, Section 8.0	Refer to SOP-4, Section 8.0	Analyst, Department Manager	SOP-4
CVAA	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	Refer to SOP-4, Section 8.0	Refer to SOP-4, Section 8.0	Analyst, Department Manager	SOP-4
ICP/MS	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	Refer to SOP-4, Section 8.0	Refer to SOP-4, Section 8.0	Analyst, Department Manager	SOP-4
Konelab Autoanalyzer	Check and clean segments weekly, clean reagent tubes monthly. Change lamp, change diluent and wash tubes, change mixing paddles and syringes, change dispensing needle, all as needed	QC standards	Segments, reagent tubes, diluent reservoir, dispersing needle, cuvette waste container	Prior to initial calibration and as necessary	Refer to SOP-1, Section 8.0	Refer to SOP-1, Section 8.0	Analyst, Department Manager	SOP-1

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
TOC Combustion Analyzer	Check level of dilution water, drain vessel water, humidifier water, autosampler rinse water and phosphoric acid vessel and fill as needed. Replace oxygen cylinder.	QC standards	Tubing, sample boat, syringe, humidifier, rinse reservoir, phosphoric acid vessel, oxygen pressure	Prior to initial calibration and as necessary	Refer to SOP-2, Section 8.0	Refer to SOP-2, Section 8.0	Analyst, Department Manager	SOP-2
pH meter	Clean probe	QC standards	probe	As necessary	Refer to SOP-3, Section 8.0	Refer to SOP-3, Section 8.0	Analyst, Department Manager	SOP-3
Sieves	Cleaning	None	Visual	Per Sample	Visual	Re-clean	Analyst	LM-SL-D422
GC-ECD	change septum and liner, trim abnalytical column	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Rekha Patel	Q20
Spectrophotometric	Clear cuvettes and lense as necessary. Outside calibration annually.	QC Standards	Cuvettes, cuvette holder, lenses	As necessary	Refer to SOP-20, Section 8.0	Refer to SOP-20, Section 8.0	Analyst, Department Manager	SOP-20
HPLC	change pre-column filter, wash system with MeOH, replace pump seals	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Samy Shawky	S1
HPLC	change pre-column filter, wash system with MeOH, replace pump seals	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Samy Shawky	S4
HPLC	change pre-column filter, wash system with MeOH, replace pump seals	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Samy Shawky	S7
GCMS	Check gas supply daily, Bake or change trap as necessary, Manual tune if BFB/DFTPP not within criteria, Cut column, change septum as needed	VOA/ SVOA Analysis	Ion source, seal septum, liner	Prior to sample analysis or, when instrument does not meet method criteria	30% RSD CCCs, min RF SPCCs, 15% Avg RSD, 0.995 linear, 0.99 corr. Quadratic init cal; 20% diff CCV for CCCs, min RF SPCCs	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Nathan Krueger/Hall Moore	M5, P5
GC/ECD	change septum and liner, trim analytical column	Calibration	CCV analysis	Daily	Acceptable chromatography and %Difference	repeat	Rekha Patel	Q6, Q10

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
pH meter	Change buffer solutions or pH probe	Calibration	Calibration Check	Before analysis begins, check every 3 hrs	pH within +/- 0.10 of buffer value	Recalibrate as necessary	James Anderson	J.12
UV/Vis Spectrophotometer	check wavelength, prepare fresh coloring reagents	Calibration	Calibration Check	At the beginning of each day or when QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or Check calibration standards, prepare fresh color reagents	James Anderson	J.43
Hg Analyzer	Change tubing, change filter, clean windows, check gas flow, Check reagents and standards	Hg Analysis	Change tubing, change filter, clean windows, check gas flow, Check reagents and standards	At the beginning of each day or when QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Rita Amin	H.12
Flashpoint Tester	Change propane tank, calibrate thermometer	Flashpoint	Tank, thermometer	Before use	Flash at 27 degrees C, + 2.2 degrees C	Check standard	Namory Keita	N.1

QAPP Worksheet #26—Sample Handling System
(UFP-QAPP Manual Appendix A)

Use this worksheet to identify components of the project-specific sample handling system. Record personnel, and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal. Indicate the number of days field samples and their extracts/digestates will be archived prior to disposal.

☐ Worksheet Not Applicable (State Reason)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Project Field Team, FTL/CH2M HILL. Field SOPs are in Attachment 1 of this QAPP.
Sample Packaging (Personnel/Organization): Project Field Team, FTL/CH2M HILL. Field SOPs are in Attachment 1 of this QAPP.
Coordination of Shipment (Personnel/Organization): FTL David Livingston/CH2M HILL.
Type of Shipment/Carrier: Overnight/Fed Ex
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
Sample Custody and Storage (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
Sample Preparation (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
Sample Determinative Analysis (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): See Worksheet 19.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): See Worksheet 19.
Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Personnel/Organization: Lab SOPs in Attachment 1 of this QAPP.
Number of Days from Analysis: After submission, the laboratory will keep samples 90 days and the sample extracts for a minimum of 60 days.

QAPP Worksheet #27—Sample Custody Requirements
(UFP-QAPP Manual Section 3.3.3)

Describe the procedures that will be used to maintain sample custody and integrity. Include examples of chain-of-custody forms, traffic reports, sample identification, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms. Attach or reference applicable SOPs.

☐ Worksheet Not Applicable (State Reason)

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 field team leader. As samples are collected, they will be places into containers and labeled, as outlined below. Labels will be taped to the jar to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4 degrees Celsius until they are received by the laboratory. The chain of custody will be placed into the cooler as well. Coolers will be 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.
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Laboratory custody procedures can be found in the following SOPs, which are referenced in Worksheet 23 and can be found in Attachment 1 of this QAPP: **GPL:** GPL SOP #F.1/#F.2/#F.3 **Katahdin:** SD-900, SD-902, SD-903
Sample Identification Procedures: Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, 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 chain of custody. The laboratory will send sample log-in forms to the EIS to check that sample IDs and parameters are correct.
Chain-of-custody Procedures: Chain of custodies 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 LIMS database for each sample.

QAPP Worksheet #27a—Example Sample Labels

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	____ GRAB ____ COMPOSITE

ANALYSIS REQUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

SAMPLE ID SAMPLE DATE
SAMPLED BY SAMPLE TIME
PRESERVATIVE ____ GRAB ____ COMPOSITE

ANALYSIS REQUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

SAMPLE ID SAMPLE DATE
SAMPLED BY SAMPLE TIME
PRESERVATIVE ____ GRAB ____ COMPOSITE

ANALYSIS REQUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

SAMPLE ID SAMPLE DATE
SAMPLED BY SAMPLE TIME
PRESERVATIVE ____ GRAB ____ COMPOSITE

ANALYSIS REQUESTED

QAPP Worksheet #27b—Example Custody Seals

QAPP Worksheet #27c—GPL Chain-of-Custody

GPL LABORATORIES
7210A Corporate Ct.
Frederick, MD 21703
301-694-5310

CHAIN OF CUSTODY

PAGE: 1 OF 1

GPL Project Manager:	Client Name:	Phone:	
Project Name:	Address:	Cell:	
Purchase Order:	City, State	Zip Code	

Comments: H=Hold Analysis Request X=Analyze

Preservatives and Containers

Sample Information — Methods for Analysis — RUSH

No.	Client Name, address and phone #	Date Sampled	Time Sampled	Matrix	Sampler's Initials																	QC (MS/MSD)	TOTAL BOTTLES
1							X	X	X	X	X	X	X	X	X	X	X	X					4
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Sample Matrix: WG= Groundwater; SO= Soil; WS= Surface Water; AA= Ambient Air; WQ= Water Quality

Total number of samples 4

			For Lab Use	COOLER RECEIPT CONDITION
Relinquished By:	Date:	Time:	GPL WORK ORDER #:________	
Received By:	Date:	Time:		
Relinquished By:	Date:	Time:		
Received By:	Date:	Time:		
Relinquished By:	Date:	Time:		

QAPP Worksheet #27d—Katahdin Chain-of-Custody

Katahdin ANALYTICAL SERVICES

600 Technology Way
P.O. Box 540
Scarborough, ME 04070
Tel: (207) 874-2400
Fax: (207) 775-4029

Chain of Custody

Client:	Contract:	Phone #: ( )	Fax #: ( )
Address:	City:	State:	Zip Code:
Purchase Order #:	Proj. Name/No.:		Katahdin Quote #:
Bill (if different than above):		Address:	
Sampler (Print/Sign):			Copies To:

LAB USE ONLY	Work Order #: Katahdin Project Number:			Analysis and Container Type Preservatives									
Remarks:				Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N
Shipping Info: Airbill No:	FEDEX	UPS	CLIENT										
Temp C:	Temp Blank	Intact	Not Intact										

*	Sample Description	Date/Time Collected	Matrix	No. of Containers										

COMMENTS:

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

QAPP Worksheet #27e—Example Form I Result Pages

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: ____________ Contract: ____________

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: ______

Matrix: (soil/water) ______ Lab Sample ID: ______

Sample wt/vol: ______ (g/mL) ______ Lab File ID: ______

Level: (low/med) ______ Date Received: ______

% Moisture: not dec. ______ Date Analyzed: ______

GC Column: ______ ID: ______ (mm) Dilution Factor: ______

Soil Extract Volume: ______ (µL) Soil Aliquot Volume: ______ (µL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (µg/L or µg/Kg) ______	Q
75-71-8	Dichlorodifluoromethane		
74-87-3	Chloromethane		
75-01-4	Vinyl Chloride		
74-83-9	Bromomethane		
75-00-3	Chloroethane		
75-69-4	Trichlorofluoromethane		
75-35-4	1,1-Dichloroethene		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane		
67-64-1	Acetone		
75-15-0	Carbon Disulfide		
79-20-9	Methyl Acetate		
75-09-2	Methylene Chloride		
156-60-5	trans-1,2-Dichloroethene		
1634-04-4	Methyl tert-Butyl Ether		
75-34-3	1,1-Dichloroethane		
156-59-2	cis-1,2-Dichloroethene		
78-93-3	2-Butanone		
67-66-3	Chloroform		
71-55-6	1,1,1-Trichloroethane		
110-82-7	Cyclohexane		
56-23-5	Carbon Tetrachloride		
71-43-2	Benzene		
107-06-2	1,2-Dichloroethane		

1B
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: ____________ Contract: ____________

Lab Code: ______ Case No.: ____ SAS No.: ________ SDG No.: ______

Matrix: (soil/water) ______ Lab Sample ID: ________

Sample wt/vol: ______ (g/mL) ______ Lab File ID: ________

Level: (low/med) ______ Date Received: ________

% Moisture: not dec. ______ Date Analyzed: ________

GC Column: ________ ID: ______ (mm) Dilution Factor: ________

Soil Extract Volume: ______ (µL) Soil Aliquot Volume: ______ (µL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (µg/L or µg/Kg) ______	Q
79-01-6	Trichloroethene		
108-87-2	Methylcyclohexane		
78-87-5	1,2-Dichloropropane		
75-27-4	Bromodichloromethane		
10061-01-5	cis-1,3-Dichloropropene		
108-10-1	4-Methyl-2-pentanone		
108-88-3	Toluene		
10061-02-6	trans-1,3-Dichloropropene		
79-00-5	1,1,2-Trichloroethane		
127-18-4	Tetrachloroethene		
591-78-6	2-Hexanone		
124-48-1	Dibromochloromethane		
106-93-4	1,2-Dibromoethane		
108-90-7	Chlorobenzene		
100-41-4	Ethylbenzene		
1330-20-7	Xylene (total)		
100-42-5	Styrene		
75-25-2	Bromoform		
98-82-8	Isopropylbenzene		
79-34-5	1,1,2,2-Tetrachloroethane		
541-73-1	1,3-Dichlorobenzene		
106-46-7	1,4-Dichlorobenzene		
95-50-1	1,2-Dichlorobenzene		
96-12-8	1,2-Dibromo-3-chloropropane		
120-82-1	1,2,4-Trichlorobenzene		

QAPP Worksheet #28-1—QC Samples Table

(UFP-QAPP Manual Section 3.4)

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

☐ Worksheet Not Applicable (State Reason)

Matrix	Soil
Analytical Group	TCL Volatiles
Concentration Level	Medium Soil (OLM04.3)
Sampling SOP[1]	Soils
Analytical Method/SOP Reference	EPA CLP OLM04.3/ SOP-7, SOP-9, SOP-10
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	80

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per prep batch	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.
MS	One MS per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
MSD	One MSD per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
LCS	One LCS per every 20 samples.	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
SMC spike	Every sample, control, standard, and method blank	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
SMC = System Monitoring Compounds
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-2—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	TCL Semivolatiles
Concentration Level	Medium Soil (OLM04.3)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/ SOP Reference	EPA CLP OLM04.3/ SOP-8
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	120

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per 20 samples or whenever samples are extracted by the same procedure.	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters.	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters.
MS	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
MSD	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
LCS	Every 20 samples of a similar matrix or concentration or every batch of samples extracted.	QC acceptance criteria, section 8.3 of KAS SOP CA-219.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.3 of KAS SOP CA-219.
Surrogate spike	Every sample, control, standard, and method blank	QC acceptance criteria, section 8.2 of KAS SOP CA-219.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-219.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-3—QC Samples Table

Matrix	Soil
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Soil (OLM04.3)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	EPA CLP OLM04.3/ #Q20
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	80

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every extraction batch	must meet acceptance criteria for surrogates; all target analytes<CRQL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes<CRQL
Instrument Blank	every 12 hours	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL	reanalysis	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL
Field duplicate	one per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet spike recovery and RPD criteria in OLM04.3	document matrix interference	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision/accuracy	must meet spike recovery and RPD criteria in OLM04.3

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
CRQL= Contract Required Quantitation Limit
RPD= Relative Percent Difference

QAPP Worksheet #28-4—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	TAL Total Metals
Concentration Level	Soil (ILM05.3)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-12, SOP-18, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katadin Analytical Services
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Blank (ICB)	Immediately after the ICV	≤ CRQL	Correct problem, recalibrate and reanalyze ICV and ICB	Analyst/Supervisor, QA Manager	Accuracy/bias, Contamination	≤ CRQL
CRQL Standard for ICP (CRI)	At the beginning of a sample run, after every 20 samples and at the end of the run	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.	1. Reanalyze immediately for failing elements only. 2. Terminate analysis, correct problem, recalibrate and reanalyze all analytical samples analyzed since last good CRI.	Analyst/Supervisor, QA Manager	Sensitivity	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.
Preparation Blank (PBS)	One per digestion batch	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.	1. If blank value > CRQL report sample results if < CRQL or > 10 x the blank value; otherwise redigest. 2. If blank value is less than negative CRQL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.	Analyst/Supervisor, QA Manager	Accuracy/bias-	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.
Serial Dilution (DL)	Once per matrix type or SDG, whichever is more frequent	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with "E".	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.
Laboratory Control Sample (CSS)	One per digestion batch.	Recovery within reference limits supplied by SRM vendor.	Redigest and reanalyze all associated samples for affected analyte (except Ag and Sb)	Analyst/Supervisor, QA Manager	Accuracy/Bias	Recovery within reference limits supplied by SRM vendor.
Sample Duplicate (D)	Once per matrix type or SDG, whichever is more frequent	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.	Flag results for affected analytes for all associated samples with "*".	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.
Spike Sample (S)	Once per matrix type or SDG, whichever is more frequent	Recovery ± 25 % of true value if sample < 4x spike value	Flag results for affected analytes for all associated samples with "N", Perform post-digestion spike for all failing elements, except Ag, at 2x the indigenous level or 2x the CRQL, whichever is greater.	Analyst/Supervisor, QA Manager	Accuracy/bias	Recovery ± 25 % of true value if sample < 4x spike value

CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-4—QC Samples Table (continued)

Matrix	Soil/Sediment
Analytical Group	Cyanide
Concentration Level	Soil (ILM05.3)
Sampling SOP[1]	Soils/ Sediment
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-12, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch	No analyte > CRQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with “B”. Reprep and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Instrument Blank	After each ICV and CCV,	No analyte > CRQL	Investigate source of contamination. Report sample results < CRQL	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Laboratory Duplicate	One per twenty samples.	RPD < 20 % for samples greater than 5x the CRQL.	Investigate problem and reanalyze sample in duplicate	Analyst, Supervisor, QA Manager	Precision	If RPD is still > 20, report original result.
Matrix Spike (MS)	One per distillation batch.	Recovery ± 25 % if sample < 4x spike concentration.	Flag results for affected samples	Analyst, Supervisor, QA Manager	Accuracy/Bias	Recovery ± 25 % if sample < 4x spike concentration.
Laboratory Control Sample(LCS)	One per prep batch	85-115 %	If the LCS fails high, report samples that are < CRQL. Reprep and reanalyze all other samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	85-115 %
Low-level Calibration Sample	With each initial calibration	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.	Reanalyze sample	Analyst, Supervisor, QA Manager	Accuracy/Bias	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.

CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-5—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Explosives
Concentration Level	Medium (SW-846 8330)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	SW-846 8330/#S1
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	must meet acceptance criteria for surrogate; the target analytes<1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	must meet acceptance criteria for surrogate; the target analytes<1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-6—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	SW-846 8332/#S7
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	must meet acceptance criteria for surrogates ; all target analytes<1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	must meet acceptance criteria for surrogates ; all target analytes<1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD - Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-7—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	SW-846 8330M/#S4
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	target analyte <1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	target analyte <1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD - Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-9—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Wet Chemistry (TOC, pH, Grain Size)
Concentration Level	Medium (various)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	Lloyd Kahn/ SOP-2; SW-846 9045C/ SOP-3; ASTM D422/ SOP-16
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	55/ 55/ 3

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Total Organic Carbon (Lloyd Kahn method)						
Method Blank	One per 20 samples	No analyte > PQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with "B". Reprep and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > PQL
Instrument Blank	After each ICV and CCV,	No analyte >PQL	Samples analyzed before or after an unacceptable blank will be reanalyzed.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > PQL
Laboratory Quadruplicate	One sample quadruplicate per 20 samples.	RSD < 30%	If lab QC in criteria and matrix interference suspected, flag data. Else, reanalyze.	Analyst, Supervisor, QA Manager	Precision	RSD < 30%
Matrix Spike (MS)	One per 10 samples	75-125 % recovery	If LCS in criteria and matrix interference suspected, flag data. Else, reanalyze.	Analyst, Supervisor, QA Manager	Accuracy/Bias	75-125 % recovery
Laboratory Control Sample(LCS)	One per 20 samples	80-120%	Investigate source of problem. f the LCS fails high, report samples that are < PQL. Reprep a blank the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	80-120%
Low-level Calibration Sample	With each initial calibration	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.	Reanalyze sample	Analyst, Supervisor, QA Manager	Accuracy/Bias	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.
pH (SW-846 9045C)						
Laboratory Control Sample(LCS)	One per 20 samples	90-110% recovery	Correct problem, recalibrate	Analyst, Supervisor, QA Manager	Accuracy/Bias	90-110% recovery
Sample duplicate	One sample duplicate per every 10 field samples.	RPD < 20	1) Investigate problem and reanalyze sample in duplicate (2) If RPD is still unacceptable, report original result with notation or narration.	Analyst, Supervisor, QA Manager	Precision	RPD < 20
Grain Size (ASTM D422)						
As requested	None	None	Not Applicable	None	None	None

ICV= Initial Calibration Verification
CCV= Continuing Calibration Verification
PQL = Project Quantitation Limit
RPD = Relative Percent Difference

QAPP Worksheet #28-10—QC Samples Table

Matrix	Groundwater
Analytical Group	TCL Volatiles
Concentration Level	Water (OLM04.3)
Sampling SOP[1]	DPGW
Analytical Method/SOP Reference	EPA CLP OLM04.3/ SOP-7, SOP-9
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	11

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per prep batch	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.
MS	One MS per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
MSD	One MSD per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
LCS	One LCS per every 20 samples.	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.3 of this SOP.
SMC spike	Every sample, control, standard, and method blank	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
SMC = System Monitoring Compounds
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-11—QC Samples Table

Matrix	Groundwater , Surface Water
Analytical Group	TCL Semivolatiles
Concentration Level	Water (OLM04.3)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	EPA CLP OLM04.3/ SOP-8
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	23

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per 20 samples or whenever samples are extracted by the same procedure.	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters..	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters..
MS	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
MSD	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
LCS	Every 20 samples of a similar matrix or concentration or every batch of samples extracted.	QC acceptance criteria, section 8.3 of KAS SOP CA-219.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.3 of KAS SOP CA-219.
Surrogate spike	Every sample, control, standard, and method blank	QC acceptance criteria, section 8.2 of KAS SOP CA-219.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-219.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-12—QC Samples Table

Matrix	Groundwater
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Water (OLM04.3)
Sampling SOP[1]	DPGW
Analytical Method/SOP Reference	EPA CLP OLM04.3/#Q20
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	11

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every extraction batch	must meet acceptance criteria for surrogates; all target analytes<CRQL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes<CRQL
Instrument Blank	every 12 hours	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL	reanalysis	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet spike recovery and RPD criteria in OLM04.3	document matrix interference	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision/accuracy	must meet spike recovery and RPD criteria in OLM04.3

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
CRQL= Contract Required Quantitation Limit
RPD= Relative Percent Difference

QAPP Worksheet #28-13—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	TAL Metals TAL Filtered Metals
Concentration Level	Water (ILM05.3)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-11, SOP-17, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	21/ 21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Blank (ICB)	Immediately after the ICV	≤ CRQL	Correct problem, recalibrate and reanalyze ICV and ICB	Analyst/Supervisor, QA Manager	Accuracy/bias, Contamination	≤ CRQL
CRQL Standard for ICP (CRI)	At the beginning of a sample run, after every 20 samples and at the end of the run	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.	1. Reanalyze immediately for failing elements only. 2. Terminate analysis, correct problem, recalibrate and reanalyze all analytical samples analyzed since last good CRI.	Analyst/Supervisor, QA Manager	Sensitivity	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.
Preparation Blank (PBW)	One per digestion batch	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.	1. If blank value > CRQL report sample results if < CRQL or > 10 x the blank value; otherwise redigest. 2. If blank value is less than negative CRQL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.	Analyst/Supervisor, QA Manager	Accuracy/bias-	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.
Serial Dilution (DL)	Once per matrix type or SDG, whichever is more frequent	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.
Laboratory Control Sample (LCSW)	One per digestion batch.	Recovery within ± 20% of true value.	Redigest and reanalyze all associated samples for affected analyte (except Ag and Sb)	Analyst/Supervisor, QA Manager	Accuracy/Bias	Recovery within reference limits supplied by SRM vendor.
Sample Duplicate (D)	Once per matrix type or SDG, whichever is more frequent	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.	Flag results for affected analytes for all associated samples with “*”.	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.
Spike Sample (S)	Once per matrix type or SDG, whichever is more frequent	Recovery ± 25 % of true value if sample < 4x spike value	Flag results for affected analytes for all associated samples with ”N”, Perform post-digestion spike for all failing elements, except Ag, at 2x the indigenous level or 2x the CRQL, whichever is greater.	Analyst/Supervisor, QA Manager	Accuracy/bias	Recovery ± 25 % of true value if sample < 4x spike value

ICV = Initial Calibration Verification
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-13—QC Samples Table (continued)

Matrix	Groundwater / Surface Water
Analytical Group	Cyanide
Concentration Level	Water (ILM05.3)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-11, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	21/ 21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch	No analyte > CRQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with “B”. Reprep and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Instrument Blank	After each ICV and CCV,	No analyte > CRQL	Investigate source of contamination. Report sample results < CRQL	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Laboratory Duplicate	One per twenty samples.	RPD < 20 % for samples greater than 5x the CRQL.	Investigate problem and reanalyze sample in duplicate	Analyst, Supervisor, QA Manager	Precision	If RPD is still > 20, report original result.
Matrix Spike (MS)	One per distillation batch.	Recovery ± 25 % if sample < 4x spike concentration.	Flag results for affected samples	Analyst, Supervisor, QA Manager	Accuracy/Bias	Recovery ± 25 % if sample < 4x spike concentration.
Laboratory Control Sample(LCS)	One per prep batch	85-115%	If the LCS fails high, report samples that are < CRQL. Reprep and reanalyze all other samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	85-115%
Low-level Calibration Sample	With each initial calibration	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.	Reanalyze sample	Analyst, Supervisor, QA Manager	Accuracy/Bias	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.

ICV = Initial Calibration Verification
CRQL = Contract Required Quantitation Limit
CCV= Continuing Calibration Verification

QAPP Worksheet #28-14—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives
Concentration Level	Medium (SW-846 8330)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	SW-846 8330/#S1
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	must meet acceptance criteria for surrogate; the target analytes<1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	must meet acceptance criteria for surrogate; the target analytes<1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-15—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	SW-846 8332/#S7
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	21

QC Sample:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action[2]**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	one every batch of 20 samples or less	target analyte <1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	target analyte <1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-16—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	SW-846 8330M/#S4
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	target analyte <1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	target analyte <1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-17—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-VOCs
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8260B/ H7, M5
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%	Re-clean and re-analyze	Nathan Kreuger	Bias/ Contamination	No target analytes > Quantitation Limit Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%
Surrogates	Each sample	Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%	Check instrument performance, re-analyze and qualify data	Nathan Kreuger	Accuracy/ Bias	Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%
LCS	1 per batch or 1 per 20 samples	Benzene: 80-120% Carbon tetrachloride: 65-140% Chlorobenzene: 80-120% Chloroform: 65-135% 1,2-Dichloroethane: 70-130% 1,1-Dichloroethene: 70-130% 2-Butanone: 30-150% Tetrachloroethene: 45-150% Trichloroethene: 70-125% Vinyl Chloride:50-145%	Check instrument performance, re-analyze	Nathan Kreuger	Accuracy/ Bias	Benzene: 80-120% Carbon tetrachloride: 65-140% Chlorobenzene: 80-120% Chloroform: 65-135% 1,2-Dichloroethane: 70-130% 1,1-Dichloroethene: 70-130% 2-Butanone: 30-150% Tetrachloroethene: 45-150% Trichloroethene: 70-125% Vinyl Chloride:50-145%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Nathan Kreuger	Accuracy/ Bias	Same acceptance criteria as LCS
Internal Standards	Each sample	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration	Check instrument performance, re-analyze and qualify data	Nathan Kreuger	Precision/ Accuracy/ Bias	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Nathan Kreuger	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-18—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-SVOCs
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8270C/ H7, P5
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Re-clean and re-analyze	Hall Moore	Bias/ Contamination	No target analytes > Quantitation Limit Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%
Surrogates	Each sample	Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Check instrument performance, re-analyze and qualify data	Hall Moore	Accuracy/ Bias	Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%
LCS	1 per batch or 1 per 20 samples	2-methylphenol: 17-153% 3&4-methylphenol: 21-143% 1,4-Dichlorobenzene: 24-144% 2,4-Dinitrotoluene: 33-153% Hexachlorobenzene: 24-110% Hexachlorobutadiene: 25-137% Hexachloroethane: 23-147% Nitrobenzene: 23-147% Pentachlorophenol: 19-110% Pyridine: 23-121% 2,4,5-Trichlorphenol: 28-144% 2,4,6-Trichlorophenol: 31-147%	Check instrument performance, re-analyze	Hall Moore	Accuracy/ Bias	2-methylphenol: 17-153% 3&4-methylphenol: 21-143% 1,4-Dichlorobenzene: 24-144% 2,4-Dinitrotoluene: 33-153% Hexachlorobenzene: 24-110% Hexachlorobutadiene: 25-137% Hexachloroethane: 23-147% Nitrobenzene: 23-147% Pentachlorophenol: 19-110% Pyridine: 23-121% 2,4,5-Trichlorphenol: 28-144% 2,4,6-Trichlorophenol: 31-147%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Hall Moore	Accuracy/ Bias	Same acceptance criteria as LCS
Internal Standards	Each sample	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration	Check instrument performance, re-analyze and qualify data	Hall Moore	Precision/ Accuracy/ Bias	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Hall Moore	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-19—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Pesticides
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8081A/ H7, Q6
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Re-clean and re-analyze	Rekha Patel	Bias/ Contamination	No target analytes > Quantitation Limit surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%
Surrogates	Each sample	surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Check instrument performance, re-analyze and qualify data	Rekha Patel	Accuracy/ Bias	surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%
LCS	1 per batch or 1 per 20 samples	Endrin: 43-134% Heptachlor: 45-128% Heptachlor epoxide: 53-134% Gamma-BHC: 73-125% Methoxychlor: 73-142%	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	Endrin: 43-134% Heptachlor: 45-128% Heptachlor epoxide: 53-134% Gamma-BHC: 73-125% Methoxychlor: 73-142%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	Same acceptance criteria as LCS
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Rekha Patel	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-20—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Herbicides
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8151A/ H7, Q10
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit surrogate values within lab statistical QC limits: DCAA: 61-136%	Re-clean and re-analyze	Rekha Patel	Bias/ Contamination	No target analytes > Quantitation Limit surrogate values within lab statistical QC limits: DCAA: 61-136%
Surrogates	Each sample	surrogate values within lab statistical QC limits: DCAA: 61-136%	Check instrument performance, re-analyze and qualify data	Rekha Patel	Accuracy/ Bias	surrogate values within lab statistical QC limits: DCAA: 61-136%
LCS	1 per batch or 1 per 20 samples	2,4-D: 61-136% 2,4,5-TP: 61-136%	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	2,4-D: 61-136% 2,4,5-TP: 61-136%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	Same acceptance criteria as LCS
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Rekha Patel	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-21—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Metals
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 6010B, 7470A/ H7, H10, H12
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch or 1 per 20 samples	No target analytes > ½ Quantitation Limit	Re-digest and re-analyze	Rita Amin	Bias/ Contamination	No target analytes > ½ Quantitation Limit
LCS	1 per batch or 1 per 20 samples	%Recovery 80% - 120%	Re-digest and re-analyze	Rita Amin	Accuracy/ Bias/ Contamination	%Recovery 80% - 120%
Duplicate Sample	1 per 20 samples	RPD ≤20%	Qualify data	Rita Amin	Precision	RPD ≤20%
Matrix Spike	1 per 20 samples	%Recovery 80% - 120%	Perform post-digestion spike analysis, qualify data	Rita Amin	Accuracy/ Bias	%Recovery 80% - 120%
Post-digestion Spike	For compounds outside of QC limits in Matrix Spike	%Recovery 75% - 125%	Qualify data	Rita Amin	Accuracy/ Bias	%Recovery 75% - 125%
ICP Serial Dilution	per analytical run	% Difference < 10%	Qualify data	Rita Amin	Accuracy/ Bias	% Difference < 10%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-22—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	Reactivity to Cyanide and Sulfide
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 7.3, 9014, 9034/ J11, J13, J43
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	1 per batch or 1 per 20 samples	CN %Recovery 1.7% - 2.9% S %Recovery 23.7% - 30.3%	Recalibrate/ reanalyze	James Anderson	Accuracy/ Bias	CN %Recovery 1.7% - 2.9% S %Recovery 23.7% - 30.3%
Duplicate Sample	1 per 20 samples	RPD ≤15%	Qualify data	James Anderson	Precision	RPD ≤15%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-23—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	Reactivity to Cyanide and Sulfide
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 7.2.2-1a/ J12
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS (pH 7.0 buffer)	Every 10 samples	± 0.10 pH units	Recalibrate/ reanalyze	James Anderson	Accuracy/ Precision	± 0.10 pH units
Duplicate Sample	1 per 20 samples	RPD ≤20%	Qualify data	James Anderson	Precision	RPD ≤20%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-24—QC Samples Table

Matrix	Aqueous IDW					
Analytical Group	Ignitability					
Concentration Level	Medium					
Sampling SOP[1]	HSE-411					
Analytical Method/SOP Reference	SW-846 1010/ N1					
Field Team Leader	Carol Peterson/ David Livingston					
Field Sampling Organization	CH2M HILL					
Analytical Organization	GPL Laboratories, LLLP					
No. of Sample Locations	1					
QC Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
LCS	One per batch of 20 or fewer samples	%Recovery 80% - 120%	Reanalyze	Namory Keita	Accuracy	%Recovery 80% - 120%
Duplicate Sample	One set per 20 field samples, for every sample that flashes, or extinguishes flame <140 degrees	RPD ≤20%	Repeat, qualify data	Namory Keita	Precision	RPD ≤20%

[1]Reference number from QAPP Worksheet #21.

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

Identify the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment.

☐ Worksheet Not Applicable (State Reason)

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Field Notebooks • Chain-of-Custody Records • Air Bills • Custody Seals • Corrective Action Forms • Electronic Data Deliverables • Identification of QC Samples • Meteorological Data from Field • Sampling instrument calibration logs • Sampling locations and sampling plan • Sampling notes and drilling logs	• No onsite analysis will take place other than collecting water quality parameters. These readings will be recorded in field logbooks as they are collected	• Sample Receipt, Chain-of-Custody, and Tracking Records • Standard Traceability Logs • Equipment Calibration Logs • Sample Prep Logs • Run Logs • Equipment Maintenance, Testing, and Inspection Logs • Corrective Action Forms • 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 • If manual integration was performed, will include chromatagrams before and after each manual integration and reasons for the integration. • Data Package Completeness Checklists • Sample disposal records • Extraction/Clean-up Records • Raw Data (stored on disk)	• Fixed Laboratory Audit Checklists • Data Validation Reports • Corrective Action Forms • Laboratory QA Plan • MDL Study Information	

QAPP Worksheet #30—Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

Complete this worksheet for each matrix, analytical group, and concentration level. Identify all laboratories or organizations that will provide analytical services for the project, including on-site screening, on-site definitive, and off-site laboratory analytical work. If applicable, identify the subcontractor laboratories and backup laboratory or organization that will be used if the primary laboratory or organizations cannot be used.

☐ Worksheet Not Applicable (State Reason)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
GW	TCL VOCs	Medium	TBD	SOP-2, SOP-7	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	TBD
GW	TAL Total Metals/Cyanide, TAL Dissolved Metals	Medium	TBD	SOP-4, SOP-1, SOP-11, SOP-17, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
GW	TCL SVOCs	Medium	TBD	SOP-8, SOP-6	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SW	TAL Total Metals/Cyanide, TAL Dissolved Metals	Medium	TBD	SOP-4, SOP-1, SOP-11, SOP-17, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SW	Hardness	Medium	TBD	SOP-8	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
SS/SB	TCL VOCs	Medium	TBD	SOP-9, SOP-10	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	TBD
SS/SB	TAL Total Metals/Cyanide	Medium	TBD	SOP-4, SOP-1, SOP-12, SOP-18, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SS/SB	Total Organic Carbon	Medium	TBD	SOP-2	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SS/SB	pH	Medium	TBD	SOP-3	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SS/SB	TCL SVOCs	Medium	TBD	SOP-8, SOP-5	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SD	AVS/SEM	Medium	TBD	SOP-20	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SD	TAL Total Metals/Cyanide	Medium	TBD	SOP-4, SOP-1, SOP-12, SOP-18, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SD	Total Organic Carbon	Medium	TBD	SOP-2	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
						(207)874-2400	
SD	pH	Medium	TBD	SOP-3	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	TBD
SD	Grain Size	Medium	TBD	SOP-16	28 calendar days	Ron Pentkowski Test America Labs Burlington, Vermont 30 Community Drive, Suite 11 South Burlington, VT 05403 (802) 923-1027	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
Aqueous IDW	TCLP-VOCs	Medium	TBD	H7, M5	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	TBD
Aqueous IDW	TCLP-SVOCs	Medium	TBD	H7, P5	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	TCLP-Pesticides	Medium	TBD	H7, Q6	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	TCLP-Herbicides	Medium	TBD	H7, Q10	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	TCLP-Metals	Medium	TBD	H7, H10, H12	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	Reactivity- Sulfide	Medium	TBD	J13, J11	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	Reactivity- Cyanide	Medium	TBD	J13, J43	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	Corrosivity	Medium	TBD	J12	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
Aqueous IDW	Ignitability	Medium	TBD	N1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	TBD
GW	TCL Pesticides/PCBs	Medium	TBD	#Q20	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
GW	Explosives	Medium	TBD	#S1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
GW	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
GW	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SW	Explosives	Medium	TBD	#S1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SW	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SW	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
SO	TCL Pesticides/PCBs	Medium	TBD	#Q20	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	TBD
SO	Explosives	Medium	TBD	#S1	28 calendar days (48 hours for Form I's from AOC 6, full package within 28 calendar days)	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SO	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SO	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SD	Explosives	Medium	TBD	#S1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SD	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SD	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	

[1] A backup laboratory has not been identified for this project. If a situation arises where the primary laboratories cannot perform the work, a backup will be identified at that time.

QAPP Worksheet #31—Planned Project Assessments Table
(UFP-QAPP Manual Section 4.1.1)

Identify the type, frequency, and responsible parties of planned assessment activities that will be preformed for the project.

☐ Worksheet Not Applicable (State Reason)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Offsite Laboratory Technical Systems Audit	Yearly, expires August 16, 2009	External	U.S. Navy	Project QA Officer- Pati Moreno/ NFESC, Port Hueneme, CA	Yemane Yohannes, GPL QA Officer	Yemane Yohannes, GPL QA Officer	Program Chemist- Anita Dodson- CH2M HILL
Offsite Laboratory Technical Systems Audit	Yearly, expires September 30, 2008	External	U.S. Navy	Project QA Officer- Pati Moreno/ NFESC, Port Hueneme, CA	Leslie Dimond, Katahdin QA Officer	Leslie Dimond, Katahdin QA Officer	Program Chemist- Anita Dodson- CH2M HILL

QAPP Worksheet #31a—GPL Laboratories NFESC Letter

Elsa Tai

From: Moreno, Pati (NFESC) [pati.moreno@navy.mil]
Sent: Friday, October 05, 2007 1:24 PM
To: tai@gplab.com
Cc: Neil, Kenda L. (NFESC)
Subject: Navy Assessment - GPL Laboratories

Ms. Tai,

This email addresses the status of GPL Laboratories, LLLP of Frederick Maryland in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

NAVSEA 04XQ conducted a laboratory assessment of GPL Laboratories, LLLP of Frederick Maryland as a support service to the Naval Facilities Engineering Service Center (NFESC). The general conclusion of the assessment is that the laboratory has successfully completed the evaluation for the parameters summarized in NAVSEA 04XQ letter Ser 04XQ (LABS)/274 dated October 5, 2007; these results are applicable to the Navy ER QA Program administered by NFESC. Based on the outcome of the assessment, a re-evaluation of your laboratory under the Navy ER QA Program will be due not later than August 16, 2009.

The outcome of this assessment does not guarantee the delivery of any analytical samples, and is facility specific (i.e. is not applicable to an affiliated or subcontract laboratory). The Navy reserves the right to conduct additional laboratory assessments. The outcome of the assessment may result in the addition or removal of parameters listed in the original scope of review, or reclassification from successful to unsuccessful.

Contact Ms. Kenda Neil (kenda.neil@navy.mil / 805 982-6060) if there are parameters not presented on the table in the aforementioned NAVSEA letter that the laboratory expects to run on a routine basis in support of Navy environmental restoration projects. In these circumstances the laboratory's capability to run the tests will be assessed and the table will be modified accordingly. Any other questions concerning the information provided should be directed to me.

Sincerely,
Pati Moreno
NFESC ER QA Program Coordinator
PH: (805) 982-1659 Fax: (805) 982-4304
Email: pati.moreno@navy.mil

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
1333 ISAAC HULL AVE SE
WASHINGTON NAVY YARD DC 20376-0001

IN REPLY TO

5090
Ser 04XQ (LABS)/274
October 5, 2007

Ms. Elsa Tai
GPL Laboratories
7210A Corporate Court
Frederick, Maryland 21703-8386

Subj: COMPLETION LETTER REPORT, GPL LABORATORIES – FREDERICK, MARYLAND

NAVSEA Laboratory Quality and Accreditation Office (LQAO) has concluded the assessment of GPL Laboratories, located in Frederick, Maryland.

The assessment was intended as a general review of analytical capability to support remediation projects and the laboratory's ability to meet quality assurance requirements presented in the DoD Quality Systems Manual for Environmental Laboratories (Version 3, dated Jan 2006). The specific methods reviewed under the assessment are summarized in the attached table. This letter presents the outcome of our assessment documented in the following reports:

LQAO ltr 5090 Ser 04XQ(LABS)/ 214 of 16 Aug 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 235 of 5 Sep 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 260 of 27 Sep 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 273 of 4 Oct 07

- **Desk Assessment:** A review of laboratory supplied documentation was conducted. Documentation included the laboratory's quality assurance (QA) manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, and historical PT information. The documentation was reflective of a laboratory that was in a position to meet Navy requirements; however findings that required resolution were identified.

- **Proficiency Testing (PT) Samples:** GPL Laboratories participates in a number of external certification and PT programs, and provided results for the past two years. Recurring failures were not identified in any specific analyte group, and the laboratory appears to be processing PT samples regularly (i.e. two times a year for each method/matrix).

5090
Ser 04XQ (LABS)/274
October 5, 2007

- **On-site Assessment:** Existing on-site assessment documentation is available and was applied to this assessment. The State of Florida Environmental Laboratory Accreditation Program (FL ELAP) conducted an on-site assessment of the laboratory on June 19 - 21, 2007. FL ELAP is a National Environmental Laboratory Accreditation Conference (NELAC) recognized accreditation body. The State of Florida accepted the corrective actions and accredited the laboratory effective July 1, 2007, expiring June 30, 2008. The Florida assessment report and the laboratory Corrective Action Report (CAR) were reviewed. The nature of the findings did not raise a level of concern that would require a Navy follow-up on-site assessment.

- **Corrective Actions:** The laboratory successfully remedied all of the Navy findings associated with the desk assessment.

The laboratory has provided documentation that demonstrates their capability to support environmental restoration projects (for the tests reviewed under this assessment, and summarized in the following table), and conformance the DoD Quality Systems Manual. However, due to the number of repeat finding from the Navy's 2005 desk assessment, an on-site assessment will be conducted in order to evaluate the laboratory's implementation the DoD QSM. If you have questions concerning your standing in the Navy ER QA Program, please contact Pati Moreno at (805) 982-1659.

Sincerely,

by direct.

E. B. HARTZOG, JR.
Director, Laboratory Quality
and Accreditation Office

Copy To: NFESC (P. Moreno, Code 413)

GPL Laboratories - Methods Reviewed
(including parameters and matrices)

METHOD	PARAMETER	MATRIX
8260B/8021	Volatile Organics	Water/ Solids
6010B/7000A/6020	TAL Metals: Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/ Solids
8270D	Semivolatile Organics	Water/ Solids
8081A	Organochlorine Pesticides	Water/ Solids
8082	Polychlorinated Biphenyls	Water/ Solids/Oil
8015B	Diesel Range Organics	Water/ Solids
7196A	Hexavalent Chromium	Water/ Solids
9056	Anions: Chloride, Fluoride, Sulfate, Nitrate, and Nitrite	Water/Solids
9012/9014	Cyanide	Water/ Solids
9066	Total Phenolics	Water/ Solids
9020	Total Organic Halides	Water/ Solids
8330	Explosives by HPLC	Water/ Solids
9071	Oil and Grease	Water/ Solids
8310	Polyaromatics Hydrocarbons (PAHs)	Water/ Solids
8151A	Chlorinated Herbicides	Water/ Solids
RSK-175	Methane, Ethane, and Ethene	Water/ Solids
8011	1,2-Dibromoehtane, 1,2-Dibromo-3-chloropropane, and 1,2,3-Trichloropropane by GC	Water/ Solids
8315A	Carbonyl Compounds by HPLC	Water/ Solids

QAPP Worksheet #31b—Katahdin Analytical Services NFESC Letter

08/23/07 THU 15:41 FAX 002

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
August 23, 2007

Ms. Leslie Dimond
Quality Assurance Officer
Katahdin Analytical Services
340 Country Road No. 5
Westbrook, ME 04098

Dear Ms. Dimond,

This correspondence addresses the status of Katahdin Analytical Services of Westbrook, Maine in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires September 30, 2008. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's assessment included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and onsite assessment documentation[1].

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
300 Series/9056	Anions: Bromide, Chloride, Fluoride, Nitrate, Nitrite, Orthophosphate, Phosphorus, Sulfate, Sulfide, Sulfite	Water/Solid
8260B	Volatile Organic Compounds	Water/Solid
8270C	Semivolatile Organic Compounds	Water/Solid
8081A	Organochlorine Pesticides	Water/Solid
8330	Explosives	Water/Solid
8082	Polychlorinated Biphenyls (PCBs)	Water/Solid

[1] The State of Florida conducted the onsite on August 28-30, 2006 to assess laboratory conformance with National Environmental Laboratory Accreditation Conference (NELAC) requirements. A supplementary Navy onsite was conducted May 8, 2007.

NFESC 413
August 23, 2007

6010B/7000A	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
6020	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
7196	Chromium VI	Water/Solid
1664	Total Petroleum Hydrocarbons (TPH)	Water/Solid
8011	1,2 Dibromoehtane and 1,2 Dibromo-3-Chloropropane by Microestraction and Gas Chromatograph	Water/Solid
8015M	Total Petroleum Hydrocarbons – Gasoline Range Organics (GRO) Diesel Range Organics (DRO)	Water/Solid
9012	Cyanide	Water/Solid

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at pati.moreno@navy.mil.

Sincerely,

Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

QAPP Worksheet #31c—Corrective Action Form

(UFP-QAPP Manual Section 4.1.1)

Person initiating corrective action ______________________________ Date ____

Description of problem and when identified: ____

____

Cause of problem, if known or suspected: ____

____

____

Sequence of Corrective Action (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:

____

____

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

For each type of assessment describe procedures for handling QAPP and project deviations encountered during the planned project assessments.

☐ Worksheet Not Applicable (State Reason)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Performance Audit Checklist[1]	Written Audit Report	Project Manager, CH2M HILL	Within one week of audit	Memorandum	FTL, CH2M HILL	Within one week of receipt of Corrective Action Form
Laboratory Performance and Systems Audits	Written Audit Report	Laboratory QA Manager: GPL- Yemane Yohannes Katahdin- Leslie Dimond	Within 2 months of audit	Memorandum	NFESC Auditor, TBD	Within two months of receipt of initial notification.

Notes:

[1]CH2M HILL has an internal performance audit that is performed on a project-by-project basis. If an audit is selected to be performed by the Project Manager, the Field Performance Audit Checklist will be utilized. Additional checks include review of the field notebook and chain-of-custody forms concurrent with the field investigation, during the SI report development, and through a post-field investigation meeting.

QAPP Worksheet #32-1—Field Performance Audit Checklist

Project Responsibilities

Project No.: ____________________________ Date: __________________________________

Project Location: ________________________ Signature: ______________________________

Team Members:

Yes __ No __ 1) Is the approved CAX AOCs SI 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 SOPs?
Comments ____

____

Yes __ No __ 3) Are samples collected in the type of containers specified in the CAX AOCs SI work plan?
Comments ____

____

Yes __ No __ 4) Are samples preserved as specified in the CAX AOCs SI work plan?
Comments ____

____

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

____

QAPP Worksheet #32-1—Field Performance Audit Checklist (continued)

Yes __ No __ 6) Are quality assurance checks performed as specified in the CAX AOCs SI work plan?
Comments ____

____

Yes __ No __ 7) Are photographs taken and documented?
Comments ____

____

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 ____

QAPP Worksheet #33—QA Management Reports Table
(UFP-QAPP Manual Section 4.2)

Identify the frequency and type of planned QA Management Reports, the projected delivery date, the personnel responsible for report preparation, and the report recipients.

☐ Worksheet Not Applicable (State Reason)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Site Investigation Report	Post- Field Event	TBD	Laura Lampshire, Project Manager, CH2M HILL	Stakeholders, see Worksheet 4

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

(UFP-QAPP Manual Section 5.2.1)

Describe the processes that will be followed to verify project data. Verification inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be verified, when the activity will occur, and what documentation is necessary, and identify the persons responsible. *Internal or external* is in relation to the data generator.

☐ Worksheet Not Applicable (State Reason)

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of Custody and shipping forms	CoC 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 CoC will be initialed by the reviewer, a copy of the CoC retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See CoC SOP (on CD) for further details.	Internal	Carol Peterson, David Livingston, Chelsea Bennet CH2M HILL
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, sample collection times, etc. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and Master Plans (Baker, 2005d).	Internal	Laura Lampshire CH2M HILL
Laboratory Data	Upon their arrival at the laboratory, the samples will be cross-referenced against the COC records. All sample labels will be checked against the COC, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.	External	GPL and Katahdin employees
Field Investigation Interpretive Data	Immediately following receipt of the analytical data from the laboratory and prior to submittal to the data validator, a population to population comparison will be conducted comparing site results and the results from the background sample set. The background population to population comparison for will be used to determine the likelihood of a release relative to background. The data will also be compared to unadjusted residential risk-based concentration (RBC) and Biological Technical Assistance Group (BTAG) flora and fauna screening values.	Internal	Laura Lampshire, Roni Warren, Bill Kappleman CH2M HILL

QAPP Worksheet #35—Validation (Steps IIa and IIb) Process Table
(UFP-QAPP Manual Section 5.2.2)

Describe the processes that will be followed to validate project data. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be validated, when the activity will occur, and what documentation is necessary and identify the person responsible. Differentiate between steps IIa and IIb of validation.

☐ Worksheet Not Applicable (State Reason)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Review field logbooks, laboratory case narratives, data deliverables for compliance to methods.	**David Livingston, Megan Hilton** *CH2M HILL* **Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*
IIa	QC Results	Establish that all QC samples were run and compliant with method-required limits.	**Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*
IIa/ IIb	Field QC Samples	Field QC provides information on the precision of the field sample collection and laboratory procedures. The field QC will also provide useful information on matrix interferences and biases, which can be used to determine the levels of uncertainty during a risk assessment.	**Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services* **Bill Kappleman, Roni Warren** *CH2M HILL*
IIb	QC Results	Verify that QC samples were run and compliant with limits established in the UFP-QAPP.	**Anita Dodson** *CH2M HILL* **Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*
IIb	Project Quantification Limits	Ensure all sample results met the project quantification and action limits specified in the QAPP.	**Laura Lampshire, Megan Hilton** *CH2M HILL*
IIb	Raw data	10% review of raw data to confirm laboratory calculations.	**Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*

QAPP Worksheet #36—Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2)

Identify the matrices, analytical groups, and concentration levels that each entity performing validation will be responsible for, as well as criteria that will be used to validate those data.

☐ Worksheet Not Applicable (State Reason)

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	GW	TCL Volatiles, TCL Semivolatiles,	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Laura Maschhoff DataQual Environmental Services
IIa	GW	TCL Pesticides and PCBs	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Nancy Weaver Environmental Data Services
IIa	GW, SW	Total Metals, Dissolved Metals	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Inorganic Data Review (April 1993)	Jackie Cleveland DataQual Environmental Services
IIa	SW, Soil, Sediment	TOC, pH, hardness, AVS/SEM	Medium	Region III Modifications to the National Functional Guidelines as appropriate, SOPs, Methodology	Jackie Cleveland DataQual Environmental Services
IIa	GW, SW	Explosives, Nitroglycerin, Nitroguanadine,	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Inorganic Data Review (April 1993)	Nancy Weaver Environmental Data Services
IIa	Soil, Sediment	TCL Volatiles, TCL Semivolatiles, Wet Chemistry	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Laura Maschhoff DataQual Environmental Services
IIa	Soil, Sediment	TCL Pesticides and PCBs	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Nancy Weaver Environmental Data Services
IIa	Soil, Sediment	Total Metals	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Inorganic Data Review (April 1993)	Jackie Cleveland DataQual Environmental Services

QAPP Worksheet #36—Validation (Steps IIa and IIb) Summary Table (continued)

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Soil, Sediment	Explosives, Nitroglycerin, Nitroguanadine	Medium	Region III Modifications to the National Functional Guidelines as appropriate, SOPs, Methodology	Nancy Weaver Environmental Data Services
IIa	Aqueous IDW	TCLP-VOCs, SVOCs, Pesticides, Herbicides, Metals, Reactivity, Corrosivity, Ignitability	Medium	Data will be reviewed against the analytical methods for outstanding QA/QC issues and anomalies by the laboratory. Issues will be summarized in the case narrative. CH2M HILL chemist and PM will review the analytical results and case narrative before the data is loaded to ensure no major problems exist.	Laboratory QA Officers Megan Hilton Laura Lampshire CH2M HILL
IIb	GW	TCL Volatiles, TCL Semivolatiles,	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	GW	TCL Pesticides and PCBs	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	GW, SW	Total Metals, Dissolved Metals	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	GW, SW	Explosives, Nitroglycerin, Nitroguanadine	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	SW, Soil, Sediment	TOC, pH, hardness, AVS/SEM	Medium	Region III Modifications to the National Functional Guidelines as appropriate, SOPs, Methodology	Anita Dodson Laura Lampshire CH2M HILL
IIb	Soil, Sediment	TCL Volatiles, TCL Semivolatiles, Wet Chemistry	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	Soil, Sediment	TCL Pesticides and PCBs	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL

QAPP Worksheet #36—Validation (Steps IIa and IIb) Summary Table (continued)

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIb	Soil, Sediment	Total Metals	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	Soil, Sediment	Explosives, Nitroglycerin, Nitroguanadine	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	Aqueous IDW	TCLP-VOCs, SVOCs, Pesticides, Herbicides, Metals, Reactivity, Corrosivity, Ignitability	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL

QAPP Worksheet #37—Usability Assessment
(UFP-QAPP Manual Section 5.2.3)

Describe the procedures/methods/activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Describe how data quality issues will be addressed and how limitations of the use of the data will be handled.

☐ Worksheet Not Applicable (State Reason)

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
It is the joint responsibility of the contractor project chemist and the data validation subcontractor to ensure that the data meet the method detection limits, reporting limits, and laboratory QC limits listed in this Work Plan and the laboratory Scope of Work. In this approach, the entire analytical process is reconstructed and recalculated from the raw data, non-conformances are documented, and the data are qualified for use in decision making.
Describe the evaluative procedures used to assess overall measurement error associated with the project:
In-depth assessment occurs during the data validation process. The third-party validation contractor will follow the national EPA and Region III data validation guidance for the EPA CLP to assess conformance with the quality control limits. The findings of the data validation reports and the qualifiers applied to the data will be considered in context with field logs and corrective action reports to assess overall usability.
Identify the personnel responsible for performing the usability assessment:
The PM, Project Chemist, 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.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:
The data validation reports will identify precision and accuracy outliers with respect to the laboratory performance of each batch of samples, as well as comparability of field and lab duplicates. All the results will be assembled and statistically reported for an overall quality assessment provided in the final project event report. Discussion will cover completeness and representativeness. Attachments supporting this report will include data validation narratives, corrective action forms, and field audit reports.

Appendix B
Waste Slag Sample Organic Analytical Results from the 1999 Weston SI Report

Site Soil Sample Summaries - U.S. EPA CLP
Volatile Organic Analysis Data Sheet

Site Name: Penniman Shell Loading Plant   All units in ug/kg

	Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
CAS#	Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
74873	Chloromethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
74839	Bromomethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75014	Vinyl chloride	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75003	Chloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75092	Methylene chloride	9	B	14	B	11	B	8	B	3	B	15	B	14	U
67641	Acetone	62.14	J	27	B	20	UJ	12	U	11	UJ	13	UJ	14	U
75150	Carbon disulfide	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75354	1,1-Dichloroethene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75343	1,1-Dichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
540590	1,2-Dichloroethene (total)	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
67663	Chloroform	4	B	3	B	10	J	12	U	11	U	5	B	14	U
107062	1,2-Dichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
78933	2-Butanone (MEK)	12	UJ	20	U	20	UJ	12	U	11	UJ	13	UJ	14	U
71556	1,1,1-Trichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
56235	Carbon tetrachloride	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75274	Bromodichloromethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
78875	1,2-Dichloropropane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
542756	1,3-Dichloropropene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
79016	Trichloroethene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
124481	Dibromochloromethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
79005	1,1,2-Trichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
71432	Benzene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75252	Bromoform	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
108101	4-Methyl-2-pentanone	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
591786	2-Hexanone	12	U	20	U	20	UJ	12	U	11	UJ	13	UJ	14	U
127184	Tetrachloroethene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
79345	1,1,2,2-Tetrachloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
108883	Toluene	3	B	20	U	20	UJ	12	U	11	U	3	B	14	U
108907	Chlorobenzene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
100414	Ethylbenzene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
100425	Styrene	12	U	2.666666667	J	20	UJ	12	U	11	U	13	UJ	14	U
1330207	Xylene (total)	2	J	20	U	20	UJ	12	U	11	U	13	UJ	14	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Soil Sample Summaries- U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet

Site Name: Penniman Shell Loading Plant   All units in ug/kg

	Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
CAS#	Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
108952	Phenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
111444	bis(2-Chloroethyl) ether	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95578	2-Chlorophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
541731	1,3-Dichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
106467	1,4-Dichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95501	1,2-Dichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95487	2-Methylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
108601	2,2'-oxybis(1-Chloropropane)	410	U	660	U	670	U	400	U	380	U	430	U	480	U
106445	4-Methylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
621647	N-Nitroso-di-n-propylamine	410	U	660	U	670	U	400	U	380	U	430	U	480	U
67721	Hexachloroethane	410	U	660	U	670	U	400	U	380	U	430	U	480	U
98953	Nitrobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
78591	Isophorone	410	U	660	U	670	U	400	U	380	U	430	U	480	U
88755	2-Nitrophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
105679	2,4-Dimethylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
111911	bis(2-Chloroethoxy) methane	410	U	660	U	670	U	400	U	380	U	430	U	480	U
120832	2,4-Dichlorophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
120821	1,2,4-Trichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
91203	Naphthalene	410	U	660	U	670	U	400	U	380	U	430	U	21.5	J
106478	4-Chloroaniline	410	U	660	U	670	U	400	U	380	U	430	U	480	U
87683	Hexachlorobutadiene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
59507	4-Chloro-3-methylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
91576	2-Methylnaphthalene	410	U	660	U	670	U	400	U	380	U	430	U	45	J
77474	Hexachlorocyclopentadiene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
88062	2,4,6-Trichlorophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95954	2,4,5-Trichlorophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
91587	2-Chloronapthalene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
88744	2-Nitroaniline	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
131113	Dimethylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
208968	Acenaphthylene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
606202	2,6-Dinitrotoluene	410	U	660	U	670	U	14.61	J	910	U	1000	U	480	U
99092	3-Nitroaniline	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
83329	Acenaphthene	410	U	660	U	670	U	400	U	380	U	430	U	480	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Soil Sample Summaries- U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet (continued)

Site Name: Penniman Shell Loading Plant All units in ug/kg

CAS#	Compound	PEN1-SO-01 Results	Q	PEN1-SO-03 Results	Q	PEN1-SO-03A Results	Q	PEN1-SO-04 Results	Q	PEN1-SO-05 Results	Q	PEN1-SO-06 Results	Q	PEN1-SO-07 Results	Q
51285	2,4-Dinitrophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
100027	4-Nitrophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
132649	Dibenzofuran	410	U	660	U	670	U	400	U	380	U	430	U	9.10	J
121142	2,4-Dinitrotoluene	410	U	660	U	670	U	111.76	J	380	U	430	U	480	U
84662	Diethylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
7005723	4-Chlorophenyl-phenylether	410	U	660	U	670	U	400	U	380	U	430	U	480	U
86737	Fluorene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
100016	4-Nitroaniline	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
534521	4,6-Dinitro-2-methylphenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
86306	N-Nitrosodiphenylamine	410	U	660	U	670	U	400	U	380	U	430	U	480	U
101553	4-Bromophenyl-phenylether	410	U	660	U	670	U	400	U	380	U	430	U	480	U
118741	Hexachlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
87865	Pentachlorophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
85018	Phenanthrene	410	U	42	J	34	J	2.8	J	380	U	3.5	J	24	J
120127	Anthracene	410	U	660	U	670	U	3.6	J	380	U	430	U	480	U
86748	Carbazole	410	U	660	U	670	U	400	U	380	U	430	U	480	U
84742	Di-n-butylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
206440	Fluoranthene	410	U	42	J	48	J	25	J	380	U	430	U	3	J
129000	Pyrene	410	U	**1300**	-	**1500**	-	**510**	-	380	U	3.49	J	5.18	J
85687	Butylbenzylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
91941	3,3'-Dichlorobenzidine	410	U	660	U	670	U	400	U	380	U	430	U	480	U
56553	Benzo(a)anthracene	410	U	97.67	J	125.58	J	21.86	J	380	U	6.51	J	7.21	J
218019	Chrysene	410	U	**740**	-	840	-	30.23	J	380	U	13.26	J	15.81	J
117817	bis(2-Ethylhexyl)phthalate	140	B	200	B	140	B	190	B	140	B	430	U	130	B
117840	Di-n-octylphthalate	130	B	150	B	57	B	200	B	140	B	170	B	110	B
205992	Benzo(b)fluoranthene	410	U	33	J	38	J	3.6	J	380	U	12	J	6.1	J
207089	Benzo(k)fluoranthene	410	U	31	J	37	J	4.5	J	380	U	8.2	J	5.7	J
50328	Benzo(a)pyrene	410	U	47	J	55	J	400	U	380	U	6.4	J	480	U
193395	Indeno(1,2,3-cd)pyrene	410	U	22.47	J	22.47	J	400	U	380	U	26.97	J	7.64	J
53703	Dibenz(a,h)anthracene	410	U	15.73	J	19.10	J	400	U	380	U	7.87	J	480	U
191242	Benzo(g,h,i)perylene	410	U	26	J	35	J	400	U	380	U	28	J	9.6	J

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Soil Sample Summaries - U.S. EPA CLP
Pesticide/Polychlorinated Biphenyl Analysis Data Sheet

Site Name: Penniman Shell Loading Plant All units in ug/kg

CAS#	Compound	PEN1-SO-01 Results	Q	PEN1-SO-03 Results	Q	PEN1-SO-03A Results	Q	PEN1-SO-04 Results	Q	PEN1-SO-05 Results	Q	PEN1-SO-06 Results	Q	PEN1-SO-07 Results	Q
319846	alpha-HCH	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
319857	beta-HCH	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
319868	delta-HCH	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
58899	gamma-HCH (Lindane)	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
76448	Heptachlor	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
309002	Aldrin	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
1024573	Heptachlor epoxide	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
959988	Endosulfan I	2.1	U	16	J	14	J	11	J	1.9	U	2.2	U	2.5	U
60571	Dieldrin	4.1	U	66	U	1.35	J	80	U	3.8	U	4.3	U	4.8	U
72559	4,4'-DDE	0.066	J	0.9	J	1.2	J	0.48	J	3.8	U	0.16	J	0.12	J
72208	Endrin	4.1	U	4	J	67	U	80	U	3.8	U	4.3	U	0.15	J
33213659	Endosulfan II	4.1	U	0.43	J	67	U	80	U	3.8	U	4.3	U	4.8	U
72548	4,4'-DDD	4.1	U	0.72	J	67	U	80	U	3.8	U	0.46	J	0.45	J
1031078	Endosulfan sulfate	4.1	U	66	U	67	U	80	U	3.8	U	4.3	U	4.8	U
50293	4,4'-DDT	4.1	U	66	U	67	U	80	U	3.8	U	4.3	U	4.8	U
72435	Methoxychlor	21	U	340	U	350	U	410	U	19	U	22	U	25	U
53494705	Endrin ketone	4.1	U	1.2	J	1.8	J	80	U	3.8	U	0.35	J	0.16	J
7421363	Endrin aldehyde	4.1	U	66	U	67	U	80	U	3.8	U	0.3	J	0.3	J
5103719	alpha-Chlordane	0.18	J	34	U	35	U	41	U	1.9	U	0.14	J	2.5	U
5103742	gamma-Chlordane	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
8001352	Toxaphene	210	U	3400	U	3500	U	4100	U	190	U	220	U	250	U
12674112	Aroclor-1016	210	U	660	U	670	U	800	U	38	U	43	U	48	U
11104282	Aroclor-1221	41	U	1300	U	1400	U	1600	U	76	U	88	U	97	U
11141165	Aroclor-1232	83	U	660	U	670	U	800	U	38	U	43	U	48	U
53469219	Aroclor-1242	41	U	660	U	670	U	800	U	38	U	43	U	48	U
12672296	Aroclor-1248	41	U	660	U	670	U	800	U	38	U	43	U	48	U
11097691	Aroclor-1254	41	U	660	U	670	U	800	U	38	U	43	U	48	U
11096825	Aroclor-1260	41	U	660	U	670	U	800	U	38	U	43	U	48	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Soil Sample Summaries - U.S. EPA CLP
Nitroaromatics and Mustard Decomp. Analyses Data Sheet

Site Name: Penniman Shell Loading Plant

All units in mg/kg

Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
HMX	2.2	U	22	U	22	U	220	U	2.2	U	2.2	U	2.2	U
1,3,5-Trinitrobenzene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
RDX	1.0	U	10	U	10	U	100	U	1.0	U	1.0	U	1.0	U
1,3-Dinitrobenzene	0.25	U	2.5	U	2.5	U	25.00	U	0.25	U	0.25	U	0.25	U
Nitrobenzene	0.26	U	2.6	U	2.6	U	26	U	0.26	U	0.26	U	0.26	U
2,4,6-Trinitrotoluene	0.25	U	**26**		**28**		**620**		0.25	U	0.25	U	0.25	U
Tetryl	0.65	U	6.5	U	6.5	U	65	U	0.65	U	0.65	U	0.65	U
2,4-Dinitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
2,6-Dinitrotoluene	0.26	U	2.6	U	2.6	U	26	U	0.26	U	0.26	U	0.26	U
2-Amino-4,6-dinitrotoluene	0.25	U	1.8	J	1.8	U	18	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	0.25	U	1.4	B	1.1	B	11	B	0.25	U	0.25	U	0.25	U
2-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
4-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
Bis(2-chloroethyl) sulfide (HD)	NA		NA		NA		NA		NA		NA		NA	
1,4-Dithiane	NA		NA		NA		NA		NA		NA		NA	
1,4-Oxathiane	NA		NA		NA		NA		NA		NA		NA	

Note1: NA in results column indicates that this compound was not analyzed for in the sample.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Appendix C
Laboratory DoD ELAP Certification

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 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 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
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)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 608 / 8081B	Heptachlor
GC/ECD	EPA 608 / 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 608 / 8081B	Toxaphene (Chlorinated camphene)
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)
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 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)

Non-Potable Water

Technology	Method	Analyte
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
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 8015B/C MOD	Diesel range organics (DRO)
GC/FID	EPA 8015B/C MOD	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable 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

Non-Potable Water

Technology	Method	Analyte
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 / 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)
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 / 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 / 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

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C / 524.2	Allyl chloride
GC/MS	EPA 624 / 8260B,C / 524.2	Benzene
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
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	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 / 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

Non-Potable Water

Technology	Method	Analyte
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
GC/MS	EPA 8260B,C / 524.2	n-Propylbenzene
GC/MS	EPA 8260B,C / 524.2	o-Xylene
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

Non-Potable Water		
Technology	**Method**	**Analyte**
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-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 625 / 8270C,D	3, 3’-Dichlorobenzidine
GC/MS	EPA 8270C,D	3, 3’-Dimethylbenzidine
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

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Certificate # L2223

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270C,D	4-Methylphenol
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 625 / 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	5-Nitro-o-toluidine
GC/MS	EPA 8270C,D	7,12-Dimethylphenethylamine
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	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	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) phthalate (DEHP)
GC/MS	EPA 625 / 8270C,D	Butyl benzyl phthalate
GC/MS	EPA 8270C,D	Caprolactam
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chlorobenzilate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625 / 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Diallate
GC/MS	EPA 625 / 8270C,D	Dibenz(a h)anthracene
GC/MS	EPA 8270C,D	Dibenzofuran
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	Ethyl methanesulfonate
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	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
GC/MS	EPA 8270C,D	Isosafrole
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

Non-Potable Water		
Technology	**Method**	**Analyte**
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-Triethyl phosphorothioate
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
GC/MS	EPA 8270C,D	Thionazin
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-2,3-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

Non-Potable Water		
Technology	**Method**	**Analyte**
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
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

LABORATORY ACCREDITATION BUREAU

Certificate # L2223

Non-Potable Water		
Technology	**Method**	**Analyte**
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
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

Non-Potable Water

Technology	Method	Analyte
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 310.2 / SM 2320B	Alkalinity
Caculation	SM 2340C	Hardness
Gravimetric	EPA 1664A	Oil and Grease
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 2340B	Hardness
Titration	SM 4500SO_3 B	Sulfite
Titration	EPA 9034 / SM 4500S^{2-} E	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 365.1 / SM 4500P E	Orthophosphate as P
UV/VIS	EPA 365.4	Phosphorus total

Non-Potable Water		
Technology	**Method**	**Analyte**
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
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	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
GC/ECD	EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 608 / 8081B	Chlordane (tech.)
GC/ECD	EPA 8081B	delta-BHC
GC/ECD	EPA 8081B	Dieldrin

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
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	EPA 8081B	Methoxychlor
GC/ECD	EPA 8081B	Toxaphene (Chlorinated camphene)
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)
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)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
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 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
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	Diesel range organics (DRO)

Certificate # L2223

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/FID	EPA 8015C	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable 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
GC/MS	EPA 8260B,C	1, 2, 3-Trichloropropane
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-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-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

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
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	Bromobenzene
GC/MS	EPA 8260B,C	Bromochloromethane
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	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

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	Isopropyl benzene
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)
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	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-Methylnaphthalene
GC/MS	EPA 8270C,D	1-Naphthylamine

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
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-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
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-Methylphenol
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	5-Nitro-o-toluidine
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	Benzaldehyde
GC/MS	EPA 8270C,D	Benzidine
GC/MS	EPA 8270C,D	Benzo(a)anthracene
GC/MS	EPA 8270C,D	Benzo(a)pyrene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 8270C,D	Benzo(g h i)perylene
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	Biphenyl
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-Ethylhexyl) phthalate (DEHP)
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	Dibenzofuran
GC/MS	EPA 8270C,D	Diethyl phthalate
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	Ethyl methanesulfonate
GC/MS	EPA 8270C,D	Famfur
GC/MS	EPA 8270C,D	Fluoranthene
GC/MS	EPA 8270C,D	Fluorene
GC/MS	EPA 8270C,D	Hexachlorobenzene
GC/MS	EPA 8270C,D	Hexachlorobutadiene
GC/MS	EPA 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C,D	Hexachloroethane
GC/MS	EPA 8270C,D	Hexachloropropene
GC/MS	EPA 8270C,D	Isodrin
GC/MS	EPA 8270C,D	Isophorone

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Isosafrole
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	Nitroquinoline-1-oxide
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-Triethyl phosphorothioate
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
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	Thionazin
GC/MS	EPA 8270C,D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C,D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8270C,D	1, 3, 5-Trinitrobenzene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 8270C,D	2, 4, 5-Trochlorophenol
GC/MS	EPA 8270C,D	2, 4, 6-Trichlorophenol
GC/MS	EPA 8270C,D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C,D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 2-Diphenylhydrazine
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	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane))
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	3, 3`-Dichlorobenzidine
GC/MS	EPA 8270C,D	3, 3’-Dimethylbenzidine
GC/MS	EPA 8270C,D	2-Methyl-4, 6-dinitrophenol
GC/MS	EPA 8270C,D	7,12-Dimethylphenethylamine
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

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A	4-Amino-2,3-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
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

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/AES	EPA 6010B,C	Beryllium
ICP/AES	EPA 6010B,C	Boron
ICP/AES	EPA 6010B,C	Cadmium
ICP/AES	EPA 6010B,C	Calcium
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

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/MS	EPA 6020A	Cobalt
ICP/MS	EPA 6020A	Copper
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	Sulfate
Gravimetric	EPA 9070A / 9071B	Oil and Grease
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
UV/VIS	Chap. 7.3.4	Reactive Cyanide

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Solid and Chemical Waste		
Technology	**Method**	**Analyte**
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

Notes:

1) This laboratory offers commercial testing service.

Approved By: ______________________ Date: May 26, 2011

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

Appendix D
Navy CLEAN Data Management Plan

Version 3

Navy CLEAN
Data Management Plan

Prepared for

Navy CLEAN & Joint Venture Programs

July 2011

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. 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
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 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 Navy CHIMPTool will be used to transfer the data into the Navy CLEAN data warehouse. At the data evaluation stage, the Navy 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

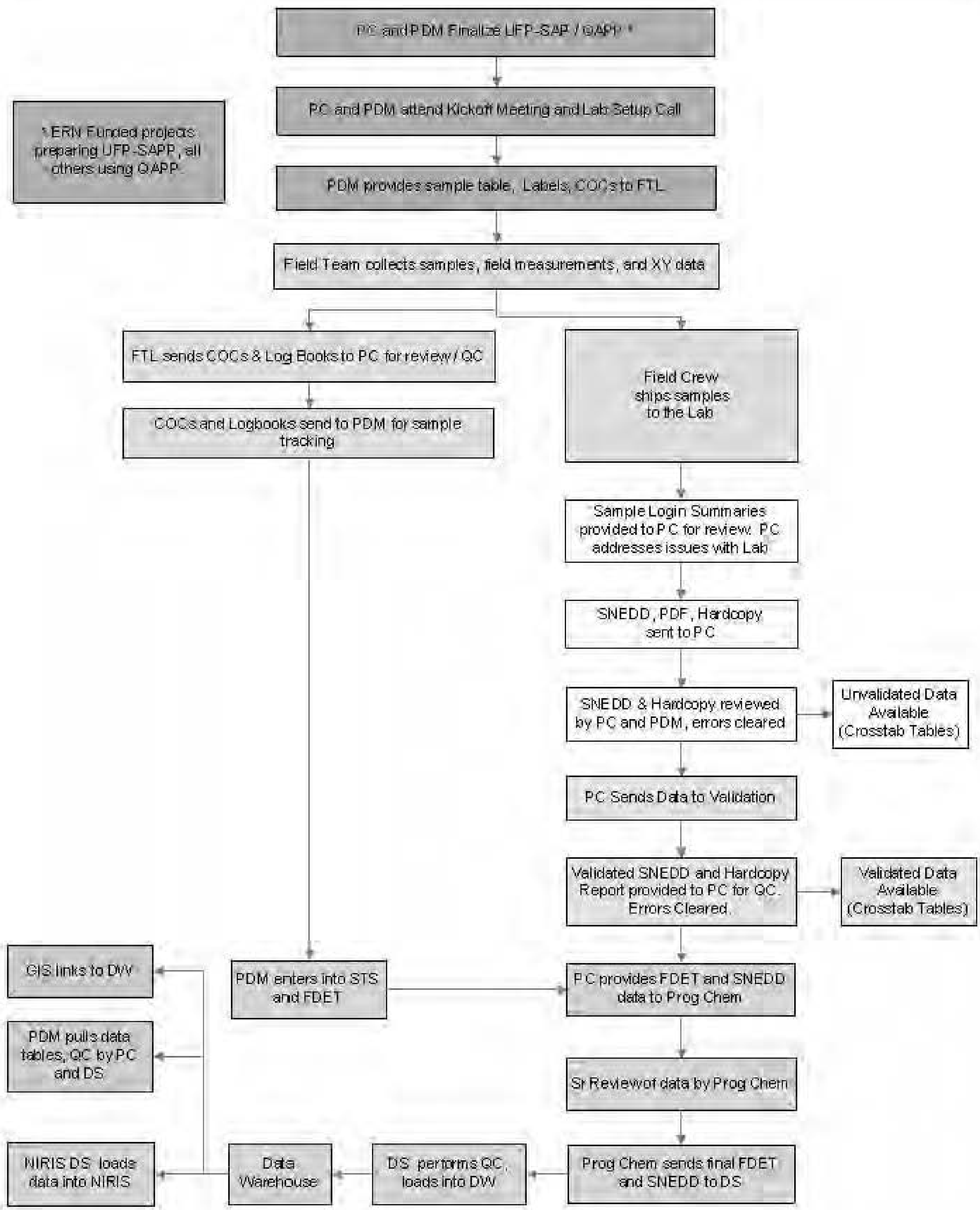

FIGURE P-1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

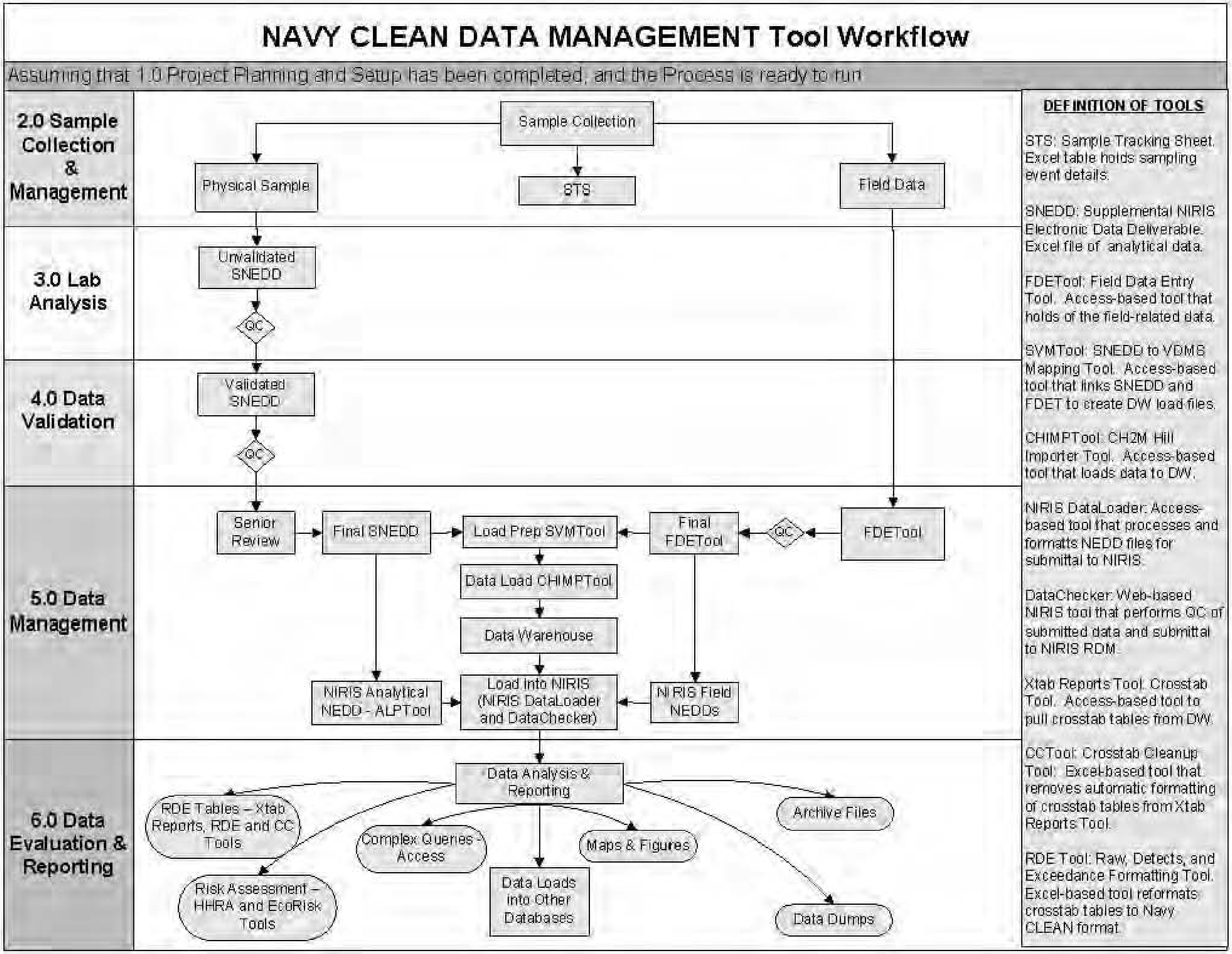

FIGURE P-2
TOOL WORKFLOW PROCESS

Contents

Appendices

Tables

Figures

Acronyms and Abbreviations

ALPTool	Archive Load and Prep Tool
AM	Activity Manager
CAD	Computer-Aided Design
COC	Chain-of-Custody
CH-IMPTool	CH2M Hill Importer Tool
DBMS	Database Management System
DS	Database 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
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

NIRIS DS	Naval Installation Restoration Information Solution Database Specialist
ODBC	Open Database Connectivity
PC	Project Chemist
PDM	Project Data Manager
PGL	Program GIS Lead
PM	Project Manager
Prog Chem	Program Chemist
QA	Quality Assurance
QC	Quality Control
RDM	Regional Database Manager
RPM	Regional Project 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
XTab	Crosstab

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, 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
Field Team Leader (FTL)	Various	Various	Various	Various
Program Critigen Team Lead	Mike Dierstein 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierste@critigen.com
Database Specialist (DS)	Chelsea Barnes 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6208	757-497-6885	cleigh@critigen.com
NIRIS Database Specialist (NIRIS DS)	Bhavana Reddy 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703- 462-3784	703- 376-5010	breddy@critigen.com
Program Chemist	Anita Dodson 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6218	757-497-6885	adodson@ch2m.com
Project Chemist (PC)	Mike Zamboni 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5111	703-376-5801	mzamboni@ch2m.com
Project Chemist (PC)	Megan Morrison 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5053	703-376-5801	megan.morrison@ch2m.com

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
Project Chemist (PC)	Bianca Kleist 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6281	757-497-6885	bkleist@ch2m.com
Project Chemist (PC)	Juan Acaron 3011 S.W. Williston Road. Gainesville, FL 32608	352-384-7002-		juan.acaron@ch2m.com
Project Chemist (PC)	Clairette Campbell 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6335	757-497-6885	clairette.campbell@ch2m.com
Project Data Manager (PDM)	Gwendolyn Buckley 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-8311	757-497-6885	Gbuckle1@ch2m.com
Project Data Manager (PDM)	Victoria Brynildsen 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6252	757-497-6885	vbrynildsen@ch2m.com
Project Data Manager (PDM)	Troy Horn 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-8311	757-497-6885	troy.horn@ch2m.com
Project Data Manager (PDM)	Hillary Ott 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5165	703-376-5801	hillary.ott@ch2m.com

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
Program GIS Lead (PGL)	Mike Dierstein 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierstein@critigen.com
GIS Analyst (GA)	Blake Hathaway 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6230	757-497-6885	bhathawa@critigen.com
GIS Analyst (GA)	Mary Beth Artese 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6228	757-497-6885	martese@critigen.com
GIS Analyst (GA)	Mark Unwin 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6261	757-497-6885	munwin@critigen.com
GIS Analyst (GA)	Chris Bowman 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6276	757-497-6885	cbowman@critigen.com
GIS Analyst (GA)	Matt Rissing 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6243	757-497-6885	mrissing@critigen.com
GIS Analyst (GA)	Forrest Cain 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6271	757-497-6885	fcain@critigen.com
GIS Analyst (GA)	Jeremy Quan 9191 South Jamaica St Englewood, CO 80112	720-286-0738	720-286-9168	jquan@critigen.com

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 presentsthe tools used in each step of the process.

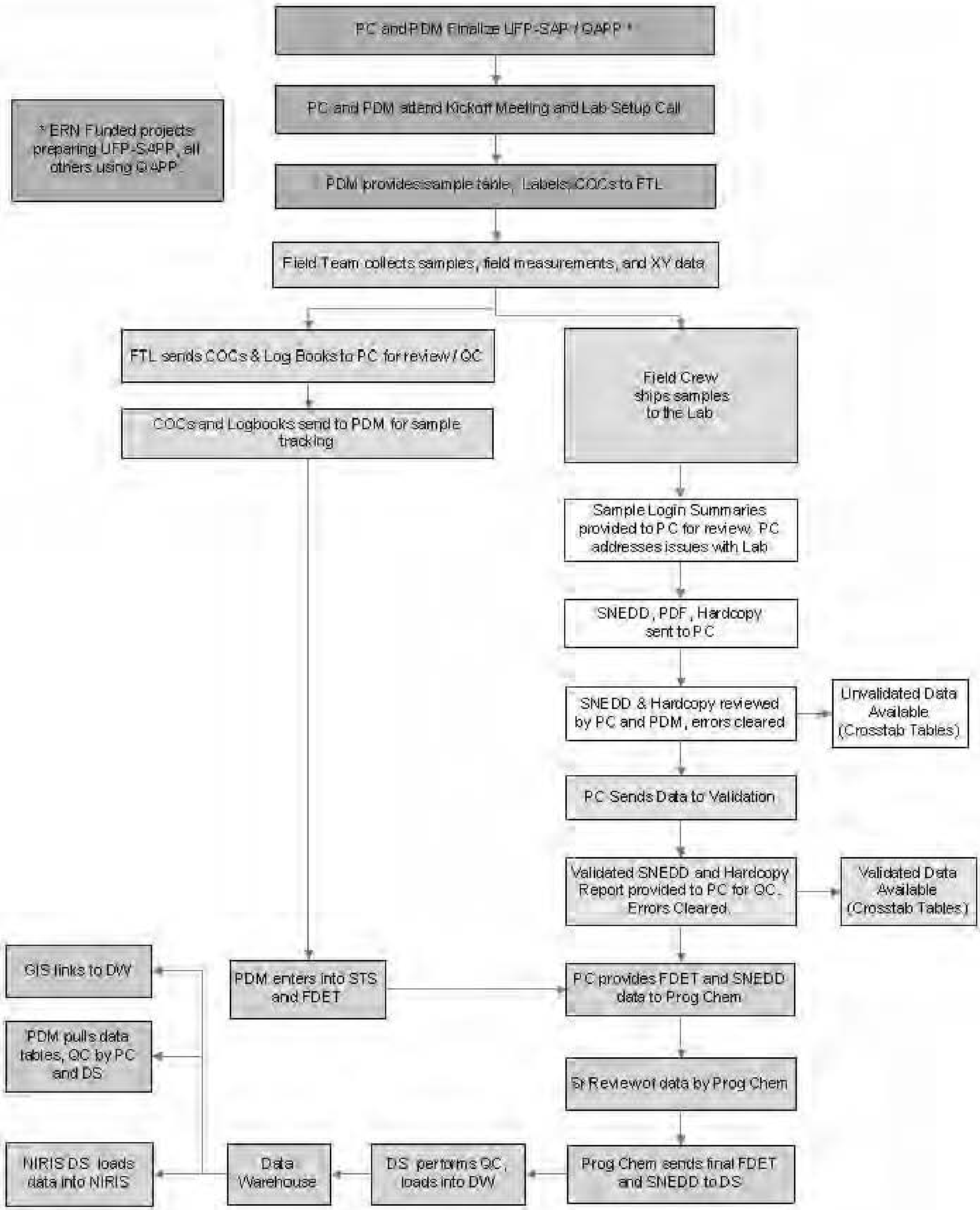

FIGURE 1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

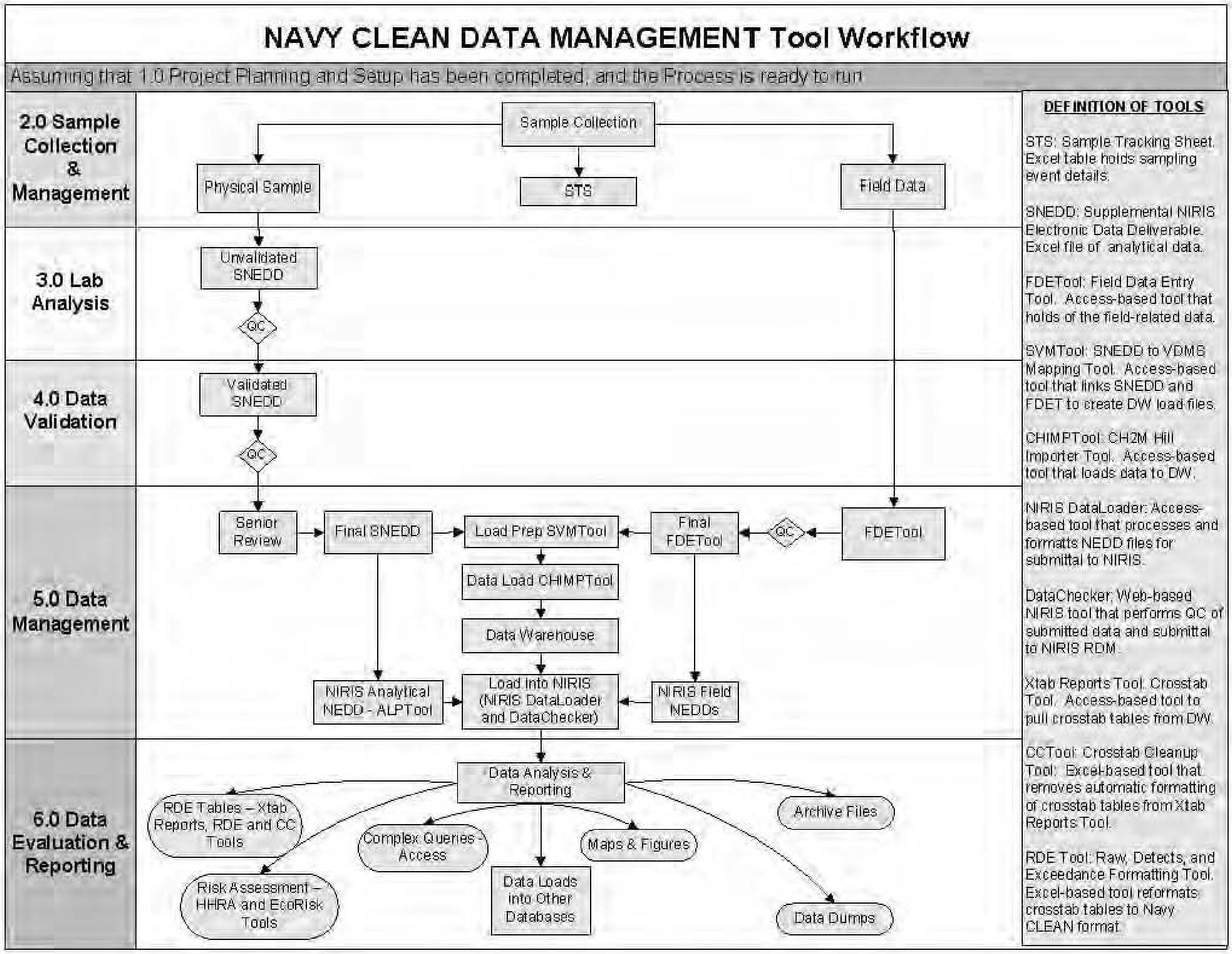

FIGURE 2
DBMS PROCESS

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 Database Specialist (DS) and the Project Manager (PM) and/or Activity Manager (AM) 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 DS ***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), DS, Program GIS Lead (PGL) and Program Chemist (Prog Chem). The team can then proceed upon client authorization of the overall project budget. Figure 3 shows the process for project planning.

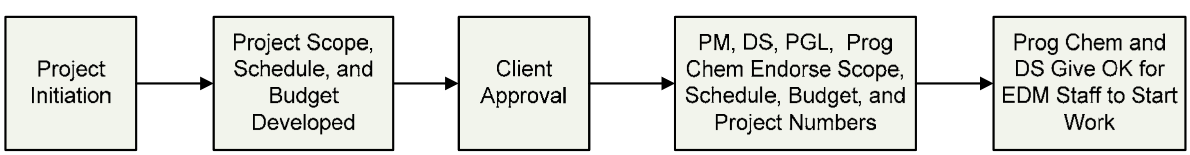

FIGURE 3
PROJECT PLANNING

4.1.1 Database Setup and Administration

CH2M HILL Database

The DS 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 DS 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 PDM will maintain the table content and the DS will manage it. All SNEDD-Approach tools will adhere to version control procedures to ensure that the most current versions and look-up tables are used at all times.

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 applications and data are stored in a secure location with login and password protection. Authorized users will have logins and passwords in advance. The DS 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 DS.

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.

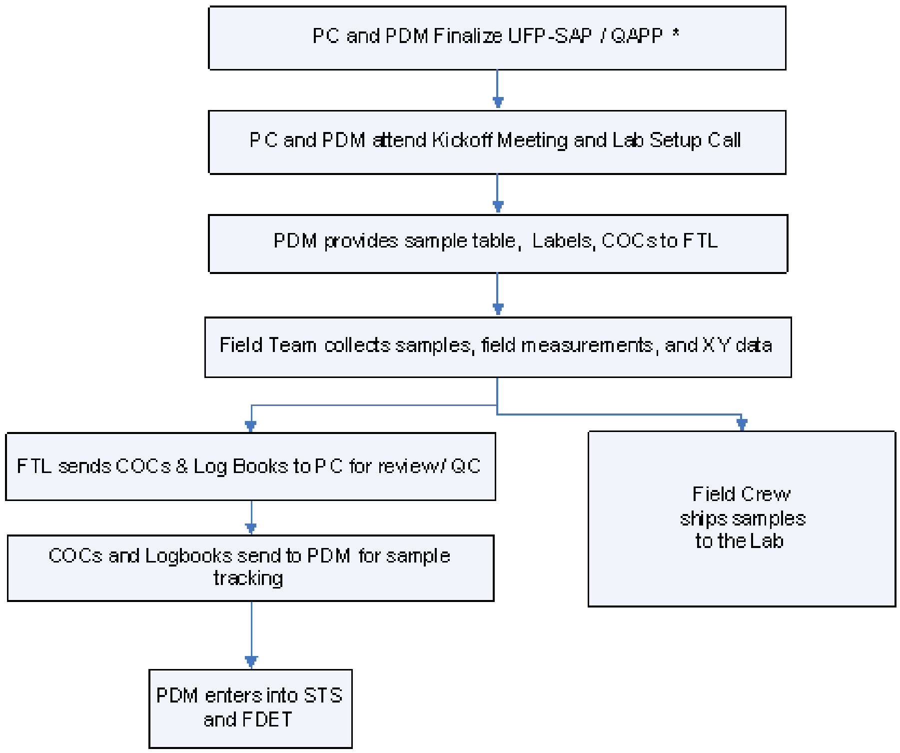

FIGURE 4
FIELD SAMPLING

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 Sample Tracking Sheet (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 DS or PDM. 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 DS or PDM 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 DS or PDM. 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 DS or PDM 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		

<u>Facility:</u>

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

<u>Site/AOC/SWMU Number – Sequential Number:</u>

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)

<u>QC and IDW Stations</u>
Site ID (First Segment) followed by –QC or -IDW

<u>Station Type:</u>

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

<u>Station Number:</u>
Sequential Station Number (i.e., 01, 02, 03…)

<u>Modifier (used selectively):</u>
D = Deep monitoring well
S = Shallow monitoring well

<u>Example Station IDs</u>:

<u>YS01-DP02</u> = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1
<u>CHR05-MW02S</u> = Shallow monitoring well location 2, at the Cheatham Annex facility, Range 5.
<u>NMBKL-SD02</u> = Background sediment location #2 located outside of NNMC
<u>CHBS03-SO05</u> = Soil location #5, located in reference area outside of Site 3 in Cherry Point
<u>VEW04-QC</u> = QC Station at East Vieques SWMU-4
<u>CAA08-IDW</u> = 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

<u>Site/AOC/SWMU – Sequential Number:</u>

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)

<u>Sample Type:</u>
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

<u>Station Number:</u>
Sequential Number (e.g., 001, 002, 003)

<u>Modifier (used selectively):</u>
D = Deep monitoring well
S = Shallow monitoring well
P = Duplicate

<u>Depth</u>:

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…

<u>Sample Number:</u>

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

<u>Qualifier Codes</u>:
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…

<u>Example Sample IDs:</u>

<u>WNA01-MW102S-0105A</u> = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at the Washington Navy Yard facility.
<u>PIW01-SW023P-0306</u> = Pineros Island duplicate surface water sample collected at location 23, at SMWU-1 in March 2006.
<u>SSW06-FB01-061106</u> = 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 PC at predefined intervals during sampling events. This information will serve as notification to the PC 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 PC 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 by the PC 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) and provided to the PC. 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 PDM will update the STS with sample collection and tracking information, and ensure that it is 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 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.

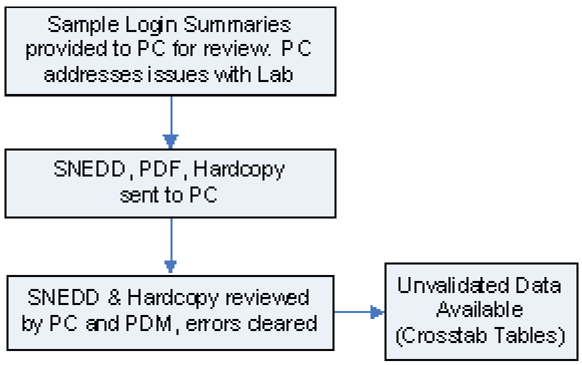

FIGURE 5
LABORATORY ANALYSIS

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 PC. Login summaries detailing all samples and analyses received by the lab should be provided daily to the PC for review. All discrepancies should be corrected to ensure that all samples are analyzed as per project instructions.

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.

The Laboratory will provide hard copy data, a PDF of the report, and SNEDDs to the PC. The PC and PDM will concurrently review the data 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.

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.

Upon SNEDD receipt at CH2M Hill, the PDM 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.

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 with the SNEDD Crosstab Tool. 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 will prepare the data 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 PDM will provide the unvalidated data tables and a QC Association Table to the PC.

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.

Data Validators will provide the following materials to the PC within the required turn around time:

- Hardcopy Data Validation Report
- PDF Copy of the Data Validation Report
- Validated Version of the SNEDD

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 with the SNEDD Crosstab Tool. A separate table must be created for each matrix. Unvalidated tables must be reviewed by the PC prior to distribution to the PM.

4.4.2 Internal Data Validation

For internal data validation, a copy of the SNEDD, hard copy data, unvalidated data tables 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 with the SNEDD Crosstab Tool. A separate table must be created for each matrix. Unvalidated tables must be reviewed by the PC prior to distribution to the PM.

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 Prog Chem will provide input and oversight to ensure that data flags are applied correctly by the PC.

4.4.4 Senior Review

The Prog Chem 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, PDM, laboratory, or validator as needed.

4.5 Data Preparation and Loading

Once the data are considered final and approved by the Prog Chem, they are provided to the DS for loading 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. The DS will load data into the warehouse using the following three programs: SNEDD-QC-Tool, SVMTool and Navy 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 Prog Chem, PC, or PDM 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 and 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 Navy 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, with the approval of the installations Regional Project Manager (RPM). Following the successful loading of data into the data warehouse, the NIRIS DS 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 Archive Load Prep Tool (ALPTool) to generate the analytical NEDD. The NIRIS DS will then use the NIRIS DataLoader Tool to ensure that all NEDDs files are complete and formatted correctly.

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 NIRIS DS 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 SNEDD-Approach tools used, has a data structure designed to achieve compliance with NIRIS and Navy data reporting standards specified for Navy CLEAN and the Joint Venture Program.

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 PDM and DS 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 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 PDM assigned as the POC for that particular Navy installation. The PDM 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 data deliverables generated by the PDM will be reviewed by the PC and DS to ensure accuracy and that request requirements were met. 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 PDM, and updated as necessary by the DS.

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 PDM 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 Prog Chem and DS 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 DS will work with the PDM to determine the appropriate intermediary files and tools used to collect the data. The PDM is responsible for assembling the field and laboratory data in formats that facilitate data review. The Prog chem will oversee the data review and flagging process and approve the data for upload into the Data Warehouse. The data will be loaded into the Data Warehouse after approval by the DS and Prog Chem.

The GA, DS, Prog Chem, and PM have the primary responsibility for reviewing the data in their area of expertise and providing the Prog Chem and/or PDM 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 PDM 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 archived on CH2M HILL's corporate local area network servers by the DS.

Any modifications made to the SNEDD-Approach tools, criteria data sets, lookup tables, etc will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users, and old versions will be archived on Gaia. After revision, it is the user's responsibility to conform to revised portions of the DMP.

5.2 Invoice Review and Approval

The PDM 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, PDMs 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
Standard Operating Procedures

The following SOPs can be located on the Ariadne server at the following link:
\\ariadne\Proj\CLEANII\DataMgmt\EIS\Reference Manual\2010

Checklist – Archive and NIRIS Load Prep

Checklist – Data QC

Checklist - PDM Project Start-up Questions

Checklist - Generating RDE Tables

Checklist - Historic Data Cleanup

Checklist - SNEDD DM Process

Roles – Data Management Coordinator

Roles – PDM

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 C
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, Annual Quarter, etc (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 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.
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

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
			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. Required for QSM Version 3.X
Detection_Limit	N18,7	RA	Reported Detection Limit. Required for QSM Version 3.X
QSM_Version	N18,7*	RA	QSM Version of data reported
DL	N18,7	RA	QSM4.1 defined Detection Limit. Required if QSM Version is 4.1 or greater.
LOD	N18,7	RA	QSM4.1 defined Limit of Detection. Required if QSM Version is 4.1 or greater. Non-Detects shall be reported to this value.
LOQ	N18,7	RA	QSM4.1 defined Limit of Quantitation. Required if QSM Version is 4.1 or greater.
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Lab 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.

Response to Comments

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

April 30, 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: Comments on the AOC 6 – Penniman AOC, Waste Slag Material Subarea

Mr. Park:

Thank you for the opportunity to review the subject document. EPA would like to provide the following comments at this time.

EPA ESC General Comment: The document is inconsistent with the naming conventions used in 40CFR . A sampling and analysis plan (SAP) is defined as being both a quality assurance project plan (QAPP) and a field sampling plan (FSP) combined. A QAPP can reference other documents. A FSP must be stand alone - as it could well be the only document with the sampling team in the field. This document references the original QAPP repeatedly, as in SAP Worksheet #11 (Original QAPP **-Worksheet #12, Worksheet #28, Worksheet #36, Worksheet #37…and others)** while technically an acceptable practice; as a practical matter it makes this document impossible to review. For future iterations of this document, please include all the named worksheets as an appendix, or include the original QAPP.

Major Concerns:

EPA ESC Comment 1: [**General**] a) The document refers to "TAL" to describe what inorganic analytes the project is concerned with. It is assumed by the reviewer that TAL is from the Superfund contract abbreviation for Target Analyte List. This particular plan seems to also have its own subset of SW-846 metals: so the TAL abbreviation is not sufficient to define the analytes needed for this sampling event. If you wish to use the Superfund Contract Laboratory Program (CLP) protocols, please refer to the specific contract which has the parameters needed for this event. For example, CLP contract SOW 5.4 specifies the analyte suite and other method parameters needed. Alternatively, the text can identify SAP Worksheet #15-1 as identifying the TAL list for this project.

b) The data validation protocol is referenced to a second document. The validation should address 100% of data generated and be consistent with those specified in the documents "Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis," April 1993. Validation should be performed by an independent third party, and the third party validators should be named prior to sampling. All data packet and electronic tapes should be accessible to the EPA upon request. Please state the validation level, personnel, their affiliations, and Data Validation guidance documents to be used in validation.

EPA ESC Comment 2: [**SAP Worksheet #11, page 30]** The use of four data quality levels as referenced has been superseded. Currently there are two levels:

i) definitive data, and
ii) screening data

The requirement should state that all definitive data submitted to EPA Region 3, must have a full "CLP like" deliverable package.

EPA ESC Comment 3: [**SAP Worksheet #1, page 29**] This section states that having an accredited laboratory ensures the quality of the analytical results. Accreditation does not establish anything about the quality of the current analysis being performed. The quality of the analysis is demonstrated by the individual sample delivery group's (SDG) adherence to the QC protocols; and the documentation for that SDG which supports the Precision, Accuracy, Representativeness, Completeness parameters, performance on evaluation samples, and audits. As this project references SW-846, the quality of the data necessary for this site's environmental decision will be determined by the quality control parameters used in the analysis. As "Test Methods for Evaluating Solid Waste," SW-846 is a guidance document; all analytical parameters have to be specified when using this document; which is what establishes the quality of the analytical results. Parameters which need to be specified include; the specific analytes, (including their CAS numbers,) their required detection limits, the calibration precision requirements, the percentage deviation and the matrix spike matrix spike duplicate, the extraction or workup method...the entire analytical suite needs to be defined when utilizing most methods in SW-846.

EPA ESC Comment 4: [**SAP Worksheet #10 page 28**] More detail is needed in this section. Particular emphasis needs to be placed on the decision threshold. The sampling event has delineated its objectives as:

i. “Confirm whether a release of inorganic constituents from the waste slag pile has occurred.”
ii. “Determine if further investigation, remedial/removal action, or control mechanism are warranted.”

There needs to be a numerical threshold concentration set for every analyte in this study as it pertains to the above objectives. The statement needs to be framed like: “A release will be assumed to be present if any of the constituents have a determined value above the Region 3 RSLs” or “…above background as established by the USGS”, or “...above the values in Table X as established by our toxicologist.” The second question also needs threshold values established with a numerically grounded format. These thresholds can then be used to determine the applicability of the proposed analytical methods and the ability to achieve the necessary sensitivity for this sampling event. These thresholds need to be established before sampling begins.

EPA ESC Comment 5: **[SAP Worksheet #9, page 24]** There is a lengthy discussion of previous organic testing performed at the waste slag pile, but the results of those tests are not presented or documented in any way. If the results are known, state them, and show how they support the decision to drop the organics from the analytical suite for this sampling event.

Comments:

[**SAP Worksheet #10, page 29**] There is a duplicate bulleted paragraph “A maximum…”

EPA Tox Comment 1: I recommend performing chromium speciation on the five soil samples collected around and beneath the slag pile. Determining whether chromium is present in the toxic hexavalent form or the more benign trivalent form could make a difference when determining the extent of excavation.

EPA RPM Comment 1: Can we add in a sentence which states what exceeded the comparison to the approved background dataset as well.

EPA RPM Comment 2: What if we find levels significantly exceeding the RSL in the 6-24in samples. Will we be sampling deeper or will this be addressed via confirmation samples following the removal action?

If you have any questions, please contact me at 215-814-3378.

Sincerely,

John Burchette
Remedial Project Manager

cc: Wade Smith, VDEQ

From: John Burchette [Burchette.John@epamail.epa.gov]
Sent: Thursday, May 10, 2012 4:19 PM
To: Sawyer, Stephanie/VBO; Ivester, Marlene/VBO; Wade.Smith@deq.virginia.gov; scott.park@navy.mil
Subject: Additional Comment on AOC 6

Guys,
I'm really sorry about this, but EPA BTAG has 1 additional comment

1. Worksheet #10 on page 28 states that soil samples (co-located surface and subsurface) will be collected from one location underneath the waste slag pile and analyzed for total inorganic constituents and pH. The collection of one sample within the pile is insufficient since the distribution of contaminants is unknown, and if concentrations are heterogeneous, there is a high potential for a false negative (low metal concentrations detected even though concentrations are high within the pile). A minimum of three soil samples should be collected underneath the pile. In addition, two samples should be collected along the two long sides of the pile, and one sample should be collected along the short side of the pile. The preferential surface water migration pathways off site also need to be identified and sampled.

Contact me with any questions.
Thanks,
John Burchette(3HS11)
Remedial Project Manager
NPL/BRAC/Federal Facilities Branch
U.S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103-2029
Phone: 215.814.3378
Fax: 215.814.5518
Burchette.john@epa.gov

Ivester, Marlene/VBO

From: Smith, Wade (DEQ) [Wade.Smith@deq.virginia.gov]
Sent: Thursday, July 05, 2012 9:34 AM
To: scott.park@navy.mil
Cc: Ivester, Marlene/VBO; Sawyer, Stephanie/VBO; Burchette.John@epamail.epa.gov
Subject: CAX: AOC 6 SAP - DEQ Comments

Thank you for giving the DEQ the opportunity to comment on the March 2012 Draft SAP for AOC 6 at CAX.

The Draft SAP was received by the DEQ on March 13, 2012.

Based on our discussion of this SAP during the June 28, 2012 CAX Partnering Meeting, the DEQ has no additional comments.

Upon your submittal of the Draft Final SAP and/or RTCs, the DEQ will issue an official letter for your files.

Please let me know if you have any questions.

Sincerely,

Wade M. Smith
Remediation Project Manager
Virginia Department of Environmental Quality
Office of Remediation Programs
Phone: (804) 698-4125
wade.smith@deq.virginia.gov

Response to Comments

Soil Sample Collection
Sampling and Analysis Plan Addendum
AOC 6 – Penniman AOC, Waste Slag Material Subarea

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, VA
June 26, 2012
Revised 7/20/12 (based on June 28, 2012 Partnering Team discussion of EPA RPM Comment 1 and EPA BTAG Comment 1)

*EPA ESC General Comment: The document is inconsistent with the naming conventions used in 40CFR. A sampling and analysis plan (SAP) is defined as being both a quality assurance project plan (QAPP) and a field sampling plan (FSP) combined. A QAPP can reference other documents. A FSP must be stand alone - as it could well be the only document with the sampling team in the field. This document references the original QAPP repeatedly, as in SAP Worksheet #11 (Original QAPP -**Worksheet #12, Worksheet #28, Worksheet #36, Worksheet #37…and others)** while technically an acceptable practice; as a practical matter it makes this document impossible to review. For future iterations of this document, please include all the named worksheets as an appendix, or include the original QAPP.*

<u>Response</u>: For ease of review, the original UFP-QAPP has been included as Appendix A (and the existing appendices re-lettered accordingly).

*EPA ESC Comment 1: [**General**] a) The document refers to "TAL" to describe what inorganic analytes the project is concerned with. It is assumed by the reviewer that TAL is from the Superfund contract abbreviation for Target Analyte List. This particular plan seems to also have its own subset of SW-846 metals: so the TAL abbreviation is not sufficient to define the analytes needed for this sampling event. If you wish to use the Superfund Contract Laboratory Program (CLP) protocols, please refer to the specific contract which has the parameters needed for this event. For example, CLP contract SOW 5.4 specifies the analyte suite and other method parameters needed. Alternatively, the text can identify SAP Worksheet #15-1 as identifying the TAL list for this project.*

<u>Response</u>: For this project, the SW-846 methods, not CLP, will be used, as indicated by the last bullet on page 29 of 58 (Worksheet 11). Reference to Worksheet #15-1 was added to this bullet.

b) The data validation protocol is referenced to a second document. The validation should address 100% of data generated and be consistent with those specified in the documents ARegion III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis,@ April 1993. Validation should be performed by an independent third party, and the third party validators should be named prior to sampling. All data packet and electronic tapes should be accessible to the EPA upon request. Please state the validation level, personnel, their affiliations, and Data Validation guidance documents to be used in validation.

<u>Response</u>: The validation will address 100% of the data generated and will be consistent with those specified in the documents referenced above. The SAP Worksheets 34-36 have been revised to provide this detail, rather than just reference the original QAPP (copy of revised worksheet is provided). The validator, CH2M HILL, has been named prior to sampling. According to the DoD Quality Systems Manual

(QSM) Version 4.2 (dated 10/25/2010), third-party is defined as "from outside the laboratory" or data generator. Additionally, Part 2B of the UFP-QAPP Compendium (March 2005) gives the following guidance on validation, which is similar to the DoD QSM in regards to validation of the analytical data:

> **Step II (validation):** Step IIa (Compliance with Methods, Procedures, and Contracts). Validation associated with Step IIa should be conducted by an entity *at least one step removed from the entity that generated the data* (field or analytical). In general, this will mean that validation Step IIa of analytical data will be conducted outside the laboratory, while the validation of the field sampling activities will be conducted by entities working for the prime contractor who are not responsible for the field sampling activities.

While CH2M HILL will collect the samples, they are not the entity that generates the data, that entity is the laboratory specified in the SAP. CH2M HILL has a team of chemists that completes the data validation and is not associated with the project in any other fashion, is 100% completely removed from the sample collection and data generation, and is located in CH's Gainesville, FL office. The group consists of chemists with decades of laboratory and data validation experience. CH2M HILL has performed data validation for projects on several Region 3 Navy bases for a few years now and with no issues. All data packet and electronic files are accessible to EPA upon request. The use of CH2M HILL to perform data validation is a Partnering Team decision. No changes were made to the SAP.

*EPA ESC Comment 2: [**SAP Worksheet #11, page 30]** The use of four data quality levels as referenced has been superseded. Currently there are two levels:*

> *i) definitive data, and*
> *ii) screening data*

The requirement should state that all definitive data submitted to EPA Region 3, must have a full CLP like deliverable package.

Response: On SAP Worksheet #11 (page 30 of 58), it does state "The data report will include a Contract Laboratory Program (CLP) Level IV-equivalent package" (refer to the second bullet from the bottom of the page). No changes were made to the SAP.

*EPA ESC Comment 3: [**SAP Worksheet #1, page 29**] This section states that having an accredited laboratory ensures the quality of the analytical results. Accreditation does not establish anything about the quality of the current analysis being performed. The quality of the analysis is demonstrated by the individual sample delivery group's (SDG) adherence to the QC protocols; and the documentation for that SDG which supports the Precision, Accuracy, Representativeness, Completeness parameters, performance on evaluation samples, and audits. As this project references SW-846, the quality of the data necessary for this site's environmental decision will be determined by the quality control parameters used in the analysis. As ATest Methods for Evaluating Solid Waste,@ SW-846 is a guidance document; all analytical parameters have to be specified when using this document; which is what establishes the quality of the analytical results. Parameters which need to be specified include; the specific analytes, (including their CAS numbers,) their required detection limits, the calibration precision requirements, the percentage deviation and the matrix spike matrix spike duplicate, the extraction or workup method...the entire analytical suite needs to be defined when utilizing most methods in SW-846.*

Response: The parameters cited are already specified within the SAP Addendum on the following worksheets:

Worksheets 15-1 and 15-2 (for pH) - *the specific analytes, (including their CAS numbers,)* and *their required detection limits*

Worksheet 24 - *the calibration precision requirements*

Worksheets 28-1 and 28-2 - *the percentage deviation and the matrix spike matrix spike duplicate and the extraction or workup method*

In addition, the original UFP-QAPP is now included as Appendix A.

*EPA ESC Comment 4: [**SAP Worksheet #10 page 28**] More detail is needed in this section. Particular emphasis needs to be placed on the decision threshold. The sampling event has delineated its objectives as:*

i. "Confirm whether a release of inorganic constituents from the waste slag pile has occurred."

ii. "Determine if further investigation, remedial/removal action, or control mechanism are warranted."

There needs to be a numerical threshold concentration set for every analyte in this study as it pertains to the above objectives. The statement needs to be framed like: "A release will be assumed to be present if any of the constituents have a determined value above the Region 3 RSLs" or "…above background as established by the USGS", or "...above the values in Table X as established by our toxicologist." The second question also needs threshold values established with a numerically grounded format. These thresholds can then be used to determine the applicability of the proposed analytical methods and the ability to achieve the necessary sensitivity for this sampling event. These thresholds need to be established before sampling begins.

Response: This information is provided in Figure 5, the Decision Tree. Also, the referenced bullets have been revised as follows:

The objectives of the soil sampling are to:

- Confirm whether a release of inorganic constituents from the waste slag pile has occurred. A release will be assumed to be present if any of the constituents have a determined value above the Project Action Limits (PALs) presented in Worksheet 11 (i.e., background 95 percent UTLs and USEPA residential soil RLSs and SSLs and literature-based ecological screening values compiled for use at CAX). The PAL values are listed in Worksheet 15-1.

- Determine if further investigation, remedial/removal action, or control mechanism are warranted. If a release has been determined, the TM will recommend further investigation. If a release has not been determined, the TM will recommend removal of the waste slag pile and site restoration, followed by no further action.

*EPA ESC Comment 5: **[SAP Worksheet #9, page 24]** There is a lengthy discussion of previous organic testing performed at the waste slag pile, but the results of those tests are not presented or documented in any way. If the results are known, state them, and show how they support the decision to drop the organics from the analytical suite for this sampling event.*

Response: The referenced organic results have been added to the SAP as Appendix B (and the existing appendices re-lettered accordingly).

*[**SAP Worksheet #10, page 29**] There is a duplicate bulleted paragraph "A maximum…"*

Response: The referenced bullets are similar, but not duplicates. The first bullet refers to *surface* soil samples, while the second bullet refers to *subsurface* soil samples. No changes were made to the SAP.

EPA Tox Comment 1: I recommend performing chromium speciation on the five soil samples collected around and beneath the slag pile. Determining whether chromium is present in the toxic hexavalent form or the more benign trivalent form could make a difference when determining the extent of excavation.

Response: The objective of the sampling presented in this SAP is to determine if there has been a release from the waste slag pile. If a release is determined, then further investigation will be recommended, which may include chromium speciation, if chromium is identified as a COPC. The Partnering Team will discuss and decide the path forward for the site during the technical memorandum review stage of the project.

EPA RPM Comment 1: Can we add in a sentence which states what exceeded the comparison to the approved background dataset as well.

Response: Since this comment did not specify a particular section of the SAP, CH2M HILL asked the EPA RPM at the June 2012 Partnering Meeting to clarify the statement. The EPA RPM reviewed his notes and said his comment was in regards to the Executive Summary where a summary of the 1999 SI data was presented (paragraph one, last sentence). He was unsure what background criteria was exceeded. CH2M HILL informed him that the 1999 SI data was compared to site-specific background data collected as part of the SI, as referenced in the sentence. However, the newly collected data will be compared to the PALs outlined in the SAP Addendum, which includes the approved 95% UTLs. This being the case, the EPA RPM said, per this discussion, the comment has been satisfied and that no changes to the Executive Summary (or SAP) were needed to address the comment.

EPA RPM Comment 2: What if we find levels significantly exceeding the RSL in the 6-24in samples. Will we be sampling deeper or will this be addressed via confirmation samples following the removal action?

Response: The results of the sampling presented in the SAP will be presented in a technical memorandum, including recommendations for the next steps for the site. If the data indicate further investigation is warranted, that recommendation will be made. The Team will decide if any additional samples will be collected prior to or following the removal action. No changes were made to the SAP.

EPA BTAG Comment 1: Worksheet #10 on page 28 states that soil samples (co-located surface and subsurface) will be collected from one location underneath the waste slag pile and analyzed for total inorganic constituents and pH. The collection of one sample within the pile is insufficient since the distribution of contaminants is unknown, and if concentrations are heterogeneous, there is a high potential for a false negative (low metal concentrations detected even though concentrations are high within the pile). A minimum of three soil samples should be collected underneath the pile. In addition, two samples should be collected along the two long sides of the pile, and one sample should be collected along the short side of the pile. The preferential surface water migration pathways off site also need to be identified and sampled.

Response: The CAX Partnering Team discussed this comment at the June 2012 Partnering Meeting. CH2M HILL proposed keeping the perimeter sample locations at four (as presented in the SAP) and adding one additional "underneath" sample location, for a total of two underneath locations – one each at opposite ends of the pile. The EPA RPM said, since there will be post removal sampling, he would rather move one of the two underneath sample locations and add it to the locations along the perimeter of the pile. The Team agreed with this proposal to collect soil samples (surface and subsurface) from five evenly distributed locations around the slag pile and from one location underneath the slag pile. The Team also agreed that if it is not possible to collect a soil sample from underneath the slag pile, the underneath location would be added to the number of locations around the perimeter of the slag pile; therefore, surface and subsurface samples will be collected from a total of six locations. The Team agreed this proposal is sufficient to address this comment. A summary of this discussion was added to the SAP as Worksheet # 9-E.

Regarding migration pathways off-site, the objective of the sampling presented in this SAP is to determine if there has been a release from the waste slag pile. If a release is determined, then further investigation will be recommended and migration pathways identified and sampled, as applicable. The Partnering Team will discuss and decide the path forward for the site during the technical memorandum review stage of the project.

Regulatory Acceptance

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

August 9, 2012

Mr. Scott Park
NAVFAC MIDLANT, Building N-26
Hampton Roads Restoration Product Line, Code OPHREV4
9742 Maryland Avenue
Norfolk, VA 23511-3095

RE: Final Red-Line Sampling and Analysis Plan Addendum
AOC 6 – Penniman AOC, Waste Slag Material Subarea
Naval Weapons Station Yorktown
Cheatham Annex
Williamsburg, Virginia

Dear Mr. Park:

The Virginia Department of Environmental Quality (DEQ) has received the *Final Red-Line Sampling and Analysis Plan Addendum* (SAP Addendum) for AOC 6 – Penniman AOC, Waste Slag Material Subarea at Naval Weapons Station Yorktown, Cheatham Annex (CAX), Williamsburg, Virginia. The August 2012 SAP Addendum, prepared by CH2M HILL, was received by the DEQ (electronically) on July 23, 2012.

Thank you for providing the DEQ's Office of Remediation Programs the opportunity to review the above-referenced SAP Addendum. Subsequent to DEQ's internal review and per CAX Partnering Team discussion, this office concurs with the proposed text revisions and recommends submittal of the *Final Sampling and Analysis Plan Addendum*.

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

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

August 9, 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 Sampling and Analysis Plan Addendum, AOC 6 – Penniman AOC, Waste Slag Material Subarea, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, VA

Mr. Park:

Thank you for your responses to our comments regarding the subject document. Responses are acceptable as long as the following are revised:

Response to EPA ESC Comment 4, second bullet: Change "If a release has not been determined" to "If it is determined that a release has not occurred".

Response to EPA BTAG Comment 1: This response is acceptable as long as the pile is removed and confirmation samples beneath the pile are collected. Also, the Navy should verify that the selected sample locations around the pile perimeter include the preferential surface runoff pathway.

Please contact me at 215-814-3394 if you have any questions.

Sincerely,

Susanne Haug

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

cc: Wade Smith, VDEQ

Response to Acceptance Letter Comments

Soil Sample Collection
Sampling and Analysis Plan Addendum
AOC 6 – Penniman AOC, Waste Slag Material Subarea

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, VA

From EPA Acceptance Letter dated 8/9/12:

Thank you for your responses to our comments regarding the subject document. Responses are acceptable as long as the following are revised:

Response to EPA ESC Comment 4, second bullet: Change "If a release has not been determined" to "If it is determined that a release has not occurred".

Navy Response: The text in the SAP Addendum (Worksheet #10, second bullet from top of page) has been changed from "If a release has not been determined" to "If it is determined that a release has not occurred . . ."

Response to EPA BTAG Comment 1: This response is acceptable as long as the pile is removed and confirmation samples beneath the pile are collected. Also, the Navy should verify that the selected sample locations around the pile perimeter include the preferential surface runoff pathway.

Navy Response: Yes, the pile will be removed (per January 2011 Team agreement) and post removal samples will be collected (the location and analytic parameters will be determined during the development of the removal action EE/CA). Yes, we'll verify that the selected sample locations around the pile perimeter include the preferential surface runoff pathway. No changes to the SAP Addendum are necessary.