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FINAL SAMPLING AND ANALYSIS PLAN FOR EXPANDED SITE INSPECTION, FIELD
SAMPLING, AND QUALITY ASSURANCE PLAN FORMER SKEET TRAP RANGE 1 MCAS
CHERRY POINT NC
12/6/2011
CH2M HILL

SAP Worksheet #1—Title and Approval Page

Final

**Sampling and Analysis Plan
(Field Sampling Plan and
Quality Assurance Project Plan)
Former Skeet and Trap Range #1
Expanded Site Inspection**

98

**Marine Corps Air Station Cherry Point
Cherry Point, North Carolina**

Contract Task Order 0026

December 6, 2011

Prepared for

**Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic Division**

Under the

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

Prepared by:



CH2MHILL

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Approval Signatures

The following person(s) hereby state that they have reviewed this document and approved this document.

Review Signatures:

Doug Bitterman/ CH2M HILL MCAS Cherry Point AQM/ Date

Other Approval Signatures:

Jason Williams/ NAVFAC Remedial Project Manager/ Date

Gena Townsend/ USEPA Project Manager/ Date

George Lane/ NCDENR Project Manager/ Date

Mike Skeeane/ CH2M HILL Project Manager/ Date

Document Control Numbering System: Document control is addressed in the header information in the upper-right or upper-left corner of each page. Later versions will have the version number and date on revised pages, and copies of all revised pages will be provided to the distribution list in **Worksheet #3**.

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Executive Summary

This site-specific Sampling and Analysis Plan (SAP) is being submitted to provide a systematic data collection and analysis structure for the Expanded Site Inspection (SI) being conducted at the Former Skeet and Trap Range #1 associated with Marine Corps Air Station (MCAS) Cherry Point in Havelock, North Carolina. In accordance with the Guidance for Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP, March 2005), this United States Navy (Navy) specific SAP 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 field standard operating procedures (SOPs) are located in **Appendix A**.

The Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic, is conducting this Expanded SI following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. CERCLA work is being conducted with the North Carolina Department of Environment and Natural Resources (NCDENR) as the lead regulatory agency. The United States Environmental Protection Agency (USEPA) Region 4 is the supporting federal regulatory agency. Together, these three agencies form the stakeholder agencies for this project.

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 SAP is for the analytical laboratories that are currently contracted to provide analytical services for this investigation. The analytical services for this investigation will be provided by Empirical Laboratories, LLC. The Environmental Laboratory Accreditation Program (ELAP) documentation for Empirical Laboratories, LLC, is presented in **Appendix B**. Additionally, data validation services will be provided by CH2M HILL.

The former Skeet and Trap Range #1 (Skeet Range) is located along the Neuse River adjacent to the MCAS Cherry Point golf course. The shooting station was located in an area that is currently a forested riparian buffer zone between the golf course greenway and the Neuse River. The shooting station was oriented to the north with the shotfall zone located almost entirely in the Neuse River. The former Skeet Range appears on maps from 1949 through 1955 and is no longer used for the firing of live ammunition (USACE, 2001).

The purpose of this Expanded SI is to gather additional sediment data to further evaluate the presence of polynuclear aromatic hydrocarbon (PAH) constituents identified during the May 2009 Site Inspection. The following is a summary of how the data collected will be evaluated:

- Data collected upstream and downstream of the samples from the May 2009 Site Inspection will be evaluated for evidence of any potential upstream contaminant sources and to assess the downstream dispersal of PAH constituents.
- Data will be compared to human health and ecological risk-based screening levels but will not be used to quantitatively calculate or estimate risks to human health or the environment. A full Screening Level Ecological Risk Assessment (SLERA) and Human Health Risk Assessment (HHRA) will not be conducted.

- Sediment samples will be analyzed for total organic carbon (TOC) and grain size analysis to evaluate transport characteristics of the PAHs.

Data, results, and recommendations regarding the path forward for the Former Skeet and Trap Range #1 will be documented in the Expanded SI Report.

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- A Field Standard Operating Procedures
- B Laboratory DoD ELAP Letters
- C Navy CLEAN Data Management Plan

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- 1 Site Location Map
- 2 Conceptual Site Model
- 3 Expanded SI Sediment Sampling Locations

Abbreviations and Acronyms

AM	Activity Manager
AQM	Activity Quality Manager
ASTM	American Society for Standards and Materials
bgs	below ground surface
CA	corrective action
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action – Navy
COC	chain of custody
COPC	contaminants of potential concern
CSM	conceptual site model
CTO	Contract Task Order
DDT	dichlorodiphenyltrichloroethane
DFTPP	decafluoro-triphenyl-phosphine
DL	detection limit
DoD	Department of Defense
DQI	data quality indicator
DRMO	Defense Reutilization and Marketing Office
DV	data validation
EIS	Environmental Information Specialist
ELAP	Environmental Laboratory Accreditation Program
ERP	Environmental Restoration Program
FID	flame ionization potential
FRC	Fleet Readiness Center
FTL	Field Team Leader
gal	gallon
GCMS	gas chromatography/mass spectroscopy
GPS	global positioning system
H&S	health and safety
HHRA	human health risk assessment
HHRS	human health risk screening
HS&E	health, safety, and environment
HSO	Health and Safety Officer
HSP	Health and Safety Plan
ICAL	initial calibration
ICV	initial calibration verification

IDW	investigation-derived waste
IRP	Installation Restoration Program
IS	internal standard
LCL	lower control limit
LCS	laboratory control sample
LIMS	Laboratory Information Management Systems
LOD	limit of detection
LOQ	limit of quantitation
µg/L	micrograms per liter
MCAS	Marine Corps Air Station
MDL	method detection limit
mg/kg	milligrams per kilogram
MPC	measurement performance criteria
MS/MSD	matrix spike/matrix spike duplicate
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
Navy	United States Navy
NCDENR	North Carolina Department of Environment and Natural Resources
ND	non detect
NIRIS	Naval Installation Restoration Information Solution
PAH	polynuclear aromatic hydrocarbon
PAL	project action limit
PC	Project Chemist
PFD	personal flotation device
PID	photo ionization detector
PM	Project Manager
POC	point of contact
PPE	personal protective equipment
PQL	practical quantitation limit
PQO	Project Quality Objective
PT	proficiency testing
QA	quality assurance
QAMS	Quality Assurance Management Staff
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RPD	relative percent difference
RPM	Remedial Project Manager
RSD	relative standard deviation
RSL	risk-based screening level

SAP	Sampling and Analysis Plan
SD	sediment
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SOP	standard operating procedure
STC	senior technical consultant
SVOC	semi-volatile organic compound
TBD	to be determined
TM	Task Manager
TOC	total organic carbon
UCL	upper control limit
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WCSD	Watershed Contaminated Source Document

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SAP Worksheet #2—SAP Identifying Information

([UFP-QAPP Manual Section 2.2.4](#))

Site Name/Number: Former Skeet and Trap Range #1
Operable Unit: Not applicable (N/A)
Contractor Name: CH2M HILL
Contract Number: N62470-08-D-1000
Contract Title: Comprehensive Long-term Environmental Action—Navy (CLEAN)
1000
Work Assignment Number: N62470-08-D-1000, Contract Task Order (CTO)-0026

1. This Sampling and Analysis (SAP) was prepared in accordance with the requirements of:

- *Navy Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP) Template* (Navy, 2008)
- *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA, 2006)
- *Uniform Federal Policy for Quality Assurance Project Plans* (USEPA, 2005)
- *Guidance for Quality Assurance Project Plans, USEPA QA/G-5, QAMS* (USEPA, 2002)

2. Regulatory program:

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This SAP is project-specific.

4. Scoping Sessions:

Scoping Session	Date
Partnering Team Meeting	March 16, 2011

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

- *Final Site Inspection Work Plan for Former Skeet and Trap Range #1, Marine Corps Station Cherry Point, Havelock, North Carolina*, November 2008 (CH2M HILL, 2008).

SAP Worksheet #2—SAP Identifying Information (continued)

Copies of these listed reports may be obtained through the Naval Facilities Engineering Command (NAVFAC) website: <https://portal.navfac.navy.mil>

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

- **North Carolina Department of Environment and Natural Resources (NCDENR):**
State regulatory oversight (lead regulatory agency)
- **United States Environmental Protection Agency (USEPA) Region 4:** Federal regulatory oversight
- **Marine Corps Air Station (MCAS) Cherry Point**

5. Lead organization:

- United States Navy (NAVFAC, Mid-Atlantic)

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

- All SAP elements required for this project are described herein. Therefore, the crosswalk table is not necessary for this project.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	Document Control Number
Jason Williams	Remedial Project Manager (RPM)	NAVFAC Mid-Atlantic	(757) 322-4088	jason.e.williams2@navy.mil	An Administrative Record number will be assigned when the final document is being prepared.
John Myers	Project Manager (PM)	MCAS Cherry Point	(252) 466-4903	john.s.myers@usmc.mil	
Gena Townsend	PM	USEPA Region 4	(404) 562-8538	townsend.gena@epa.gov	
George Lane	PM	NCDENR	(919) 707-8338	george.lane@ncdenr.gov	
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785	bonnie.capito@navy.mil	
Doug Bitterman	Contractor Activity Quality Manager (AQM)	CH2M HILL	(757) 671-8311 x46209	doug.bitterman@ch2m.com	
Bill Hannah	Contractor Activity Manager (AM)	CH2M HILL	(757) 671-6277	bill.hannah@ch2m.com	
Mike Skeeane	Contractor PM	CH2M HILL	(704) 543-3285	mike.skeeane@ch2m.com	
Ward Dickens	Data Validation (DV)	CH2M HILL	(352) 384-7049	ward.dickens@ch2m.com	
Sonya Gordon	Empirical Laboratories PM	Empirical	(615) 345-1115	sgordon@empirlabs.com	

SAP Worksheet #3—Distribution List (continued)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	Document Control Number
The following people may receive copies of the SAP, subsequent SAP revisions, addenda, and amendments provided by people/organizations listed above.					
Roni Warren	Contractor Navy CLEAN Human Health Risk Assessor	CH2M HILL	(814) 364-2454	roni.warren@ch2m.com	
Dan Lavoie	Contractor Navy CLEAN Ecological Risk Assessor	CH2M HILL	(202) 290-1455	daniel.lavoie@ch2m.com	
Juan Acaron	Contractor Project Chemist (PC)	CH2M HILL	(352) 384-7002	juan.acaron@ch2m.com	
Victoria Brynildsen	Contractor Environmental Information Specialist (EIS)	CH2M HILL	(757) 671-6252	victoria.brynildsen@ch2m.com	
Renee Clore	Task Manager (TM)	CH2M HILL	(312) 873-9758	renee.clore@ch2m.com	
To Be Determined (TBD)	Field Team Leader (FTL)	CH2M HILL	TBD	TBD	
TBD	Contractor Field Team Members	CH2M HILL	TBD	TBD	

SAP Worksheet #4—Project Personnel Sign-Off Sheet

The responsibility of implementing the SAP will vary upon the role of the people and their organization. It is anticipated that the lead PM from each organization will be responsible for the overall SAP implementation. However, technical support staff, support contractors, and additional stakeholders may have input to the SAP and are also listed as potential signers, if applicable. The table is broken into two areas; those that will be responsible for the complete SAP implementation and the supporting staff, contractors or stakeholders who may sign the SAP. Personnel will indicate which sections of the SAP they reviewed.

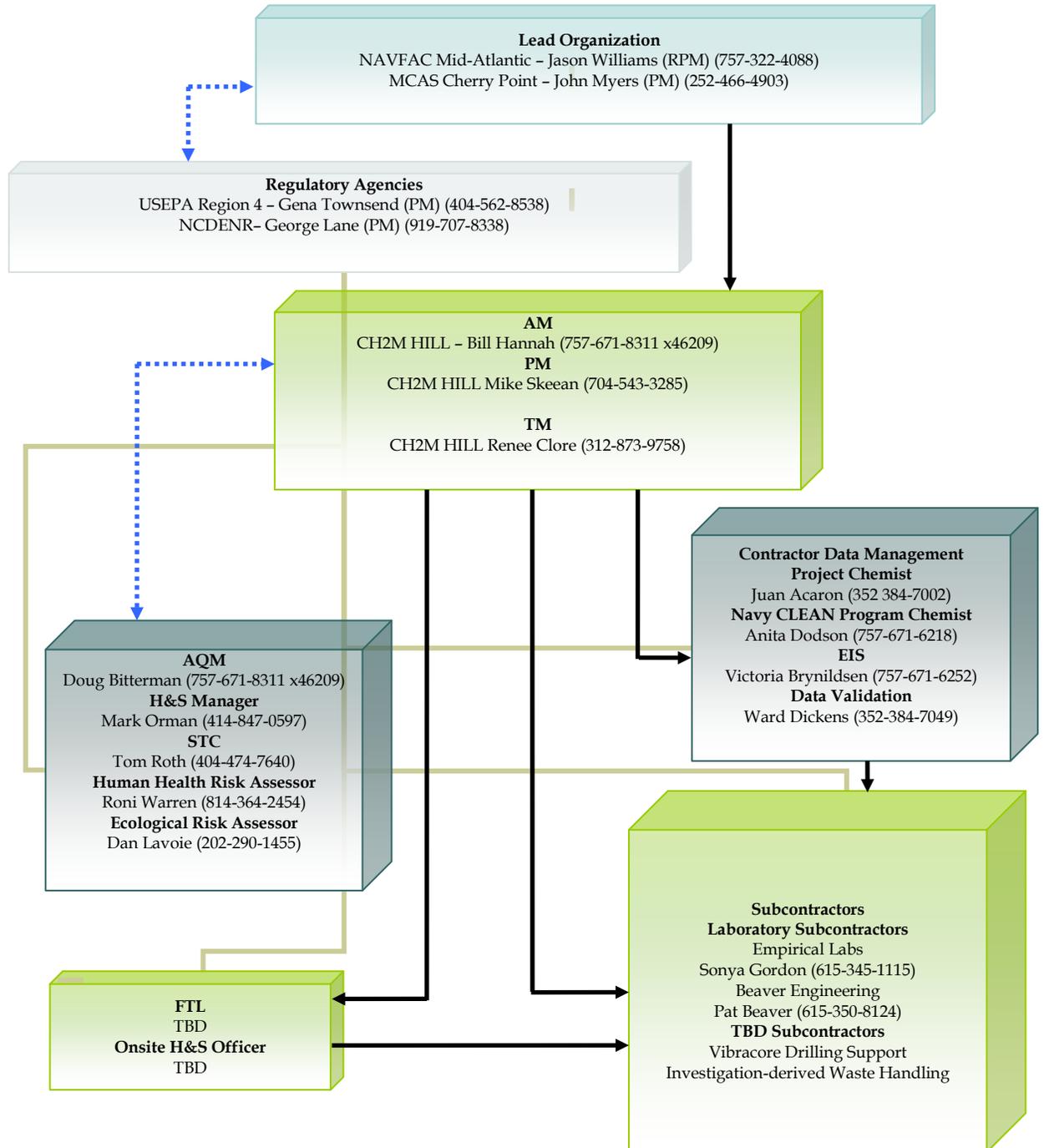
Due to the difficulties involved with obtaining signatures from all project personnel listed in **Worksheet #4**, concurrence with the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) will be obtained from the listed project personnel by email, as indicated in Column 4 "Signature/email receipt". Documentation of this concurrence will be maintained within the project file by CH2M HILL.

SAP Worksheet #4—Project Personnel Sign-Off Sheet (continued)

Name	Organization/Title/Role	Telephone Number	Signature/email receipt	SAP Section Reviewed	Date SAP Read
The following is a list of people who are responsible for ensuring overall implementation of the SAP.					
Jason Williams	NAVFAC Mid-Atlantic RPM	(757) 322-4088			
John Myers	MCAS Cherry Point PM	(252) 466-4903			
Gena Townsend	USEPA PM	(404) 562-8538			
George Lane	NCDENR PM	(919) 707-8338			
Doug Bitterman	CH2M HILL AQM	(757) 671-8311 x46209			
Mike Skeean	CH2M HILL PM	(704) 543-3285			
Anita Dodson	CH2M HILL Navy CLEAN Program Chemist	(757) 671-6218			
Bill Hannah	CH2M HILL AM	(757) 671-6277			
The following is a list of people who may provide input and therefore review portions or all of the SAP.					
Tom Roth	CH2M HILL Senior Technical Consultant (STC)	(404) 474-7640			
Bonnie Capito	NAVFAC Atlantic Librarian	(757) 322-4785			
Juan Acaron	CH2M HILL PC	(352) 384-7002			
Roni Warren	CH2M HILL Human Health Risk Assessor	(814) 364-2454			
Dan Lavoie	CH2M HILL Ecological Risk Assessor	(202) 290-1455			
Victoria Brynildsen	CH2M HILL EIS	(757) 671-6252			
Renee Clore	CH2M HILL TM	(312) 873-9758			
TBD	CH2M HILL FTL	TBD			
TBD	CH2M HILL Field Team Members	TBD			
Ward Dickens	CH2M HILL DV	(352) 384-7049			
Sonya Gordon	Empirical PM	(615) 345-1115			
Marcia McGinnity	Empirical Quality Assurance Officer (QAO)	(615) 345-1115			
Pat Beaver	Beaver Engineering PM	(615) 350-8124			

SAP Worksheet #5—Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)



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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Point of Contact (POC) with USEPA Region 4 and NCDENR PMs and the Navy chemist	RPM, NAVFAC Mid-Atlantic	Jason Williams	(757) 322-4088	All materials and information pertaining to the project will be forwarded to the USEPA and NCDENR as necessary. The RPM will also communicate with the Navy chemist regarding data usability and laboratory corrective actions as necessary.
POC for MCAS Cherry Point activity coordination	PM, MCAS Cherry Point	John Myers	(252) 466-4903	All project coordination with MCAS Cherry Point personnel will be communicated as necessary.
Oversight on all projects at MCAS Cherry Point; AM	CH2M HILL AM	Bill Hannah	(757) 671-6277	Issues are to be reported to the RPM immediately and followed up in writing within 2 business days.
Implement SAP and manage all phases of this project	CH2M HILL PM	Mike Skeeane	(704) 543-3285	Communicate directly (verbal and/or in writing) with the AM, NAVFAC and MCAS Cherry Point as necessary.
Oversee implementation of project technical aspects	CH2M HILL STC	Tom Roth	(404) 474-7640	Communicate directly with the AM and PM as necessary.
SAP changes in the field	CH2M HILL FTL	TBD	TBD	Communicate directly (verbal and/or in writing) with CH2M HILL AM or PM with daily meetings. Documentation of deviations from the UFP-SAP made in field logbooks; deviations made only with approval of PM, who will communicate with the AM, Navy and regulators. The FTL will ensure SAP requirements are met by field staff.
Data tracking from collection through upload to database	EIS	Victoria Brynildsen	(757) 671-6252	The EIS tracks the data and informs the PM and PC of potential problems or issues as necessary. The PM and AM are informed within 24 hours to pass on communications to Navy and regulators as appropriate.
Reporting Analytical Lab Data Quality Issues	Laboratory PM Laboratory QAO Laboratory PM	Sonya Gordon/ Empirical Marcia McGinnity/ Empirical Pat Beaver/Beaver Engineering	(615) 345-1115 (615) 350-8124	All quality assurance (QA)/quality control (QC) issues with project field samples will be reported by the subcontracted lab, who will relay them to the EIS, PC, and Contractor QAO within 2 days of discovery. If significant issues are identified that impact the usability of the data, the project chemist will inform the RPM within two days of discovery. The RPM will subsequently notify the Navy Chemist for evaluation to determine what corrective actions should be taken.
Reporting Data Validation Issues	CH2M HILL DV	Ward Dickens	(352) 384-7049	All completeness and data issues will be addressed with the laboratory. The DV PM should copy the CH2M HILL EIS on all communications to the lab as necessary. The validated data package will be due within 14 calendar days of data receipt.
Field and Analytical Corrective Actions (CAs)	CH2M HILL Program Chemist PC FTL	Anita Dodson Juan Acaron TBD	(757) 671-6218 (352) 384-7002 TBD	The need for CA for field and analytical issues will be determined by the FTL, PC, senior support staff, and/or Contractor QAO as necessary. The Sr. support will ensure Quality Assurance Project Plan (QAPP) requirements are met by field staff. The project chemist will ensure QAPP requirements are met by the laboratory. The FTL will notify the PM of any needed field CAs. The PM will have 24 hours to respond to the request for field CA. CA with laboratories will be coordinated by PC.

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SAP Worksheet #7—Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Jason Williams	RPM	NAVFAC Mid-Atlantic	Coordinates NAVFAC environmental activities for MCAS Cherry Point.
John Myers	PM	MCAS Cherry Point	Coordinates environmental activities on MCAS Cherry Point
Gena Townsend	PM	USEPA Region 4	Manages all aspects of project to confirm Federal regulations and requirements are met.
George Lane	PM	NCDENR	Manages all aspects of project to confirm State regulations and requirements are met.
Bonnie Capito	NAVFAC Librarian	NAVFAC Mid-Atlantic	Responsible for document tracking and filing.
Doug Bitterman	AQM	CH2M HILL	Provides program level review of the UFP-SAP
Bill Hannah	AM	CH2M HILL	Responsible for support to Navy to implement CERCLA Environmental Restoration Program (ERP) at MCAS Cherry Point and provides program level review of the UFP-SAP
Mike Skeean	PM	CH2M HILL	Day-to-day project management to implement SAP. Directs and oversees staff; health, safety, and environment (HS&E). Contractor POC for decision-making. Conducts data usability assessment.
Tom Roth	STC	CH2M HILL	Provides senior technical oversight.
Dan Lavoie	Senior Ecological Risk Assessor	CH2M HILL	Responsible for Ecological Risk Screening
Roni Warren	Human Health Risk Assessor	CH2M HILL	Responsible for Human Health Risk Screening
Anita Dodson	Navy CLEAN Program Chemist	CH2M HILL	Provides program level review of the UFP-SAP
Juan Acaron	PC	CH2M HILL	Performs oversight of laboratory and data validators, and evaluates usability of data
TBD	FTL	CH2M HILL	Supervises field sampling and coordinates all field activities
Mark Orman	Health and Safety Officer (HSO)	CH2M HILL	Oversees health and safety (H&S) for CLEAN Program
Sonya Gordon	PM	Empirical	Provide analytical services for Empirical
Pat Beaver	PM	Beaver Engineering Inc	Provide analytical services for Beaver Engineering
Ward Dickens	DV	CH2M HILL	Responsible for the analytical data review and validation
Victoria Brynildsen	EIS	CH2M HILL	Manages sample tracking, coordinates with laboratory and data-validator, data management

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SAP Worksheet #8—Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
None						

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SAP Worksheet #9a—Project Scoping Session Participants Sheet

Project Name: Expanded Site Investigation (SI) at Former Skeet and Trap Range #1 Projected Date(s) of Sampling: August 2011 (tentative) PM: Mike Skeean		Site Name: Former Skeet and Trap Range #1 Site Location: MCAS Cherry Point, Havelock, NC		
Date of Session: March 16, 2011 Scoping Session Purpose: Partnering Team Meeting				
Name	Title/Project Role	Affiliation	Phone #	E-mail Address
Doug Bitterman	Contractor AQM	CH2M HILL	757-671-6209	doug.bitterman@ch2m.com
Erica DeLattre	PM	Rhea	724-443-4111	erica@rhea.us
Bill Hannah	Contractor AM	CH2M HILL	757-671-6277	bill.hannah@ch2m.com
George Lane	PM	NCDENR	919-707-8338	george.lane@ncdenr.gov
Will Potter	Installation Restoration Program (IRP) PM	MCAS Cherry Point	252-466-5376	william.r.potter@usmc.mil
Gena Townsend	PM	USEPA	404-562-8538	townsend.gena@epa.gov
Jason Williams	RPM	NAVFAC	757-322-4088	jason.e.williams2@navy.mil
Erin Twamley	Project Staff/Meeting Recorder	CH2M HILL	919-760-1763	erin.twamley@ch2m.com
Jeff Christopher	PM	MCAS Cherry Point	252-466-4421	jeffrey.christopher@usmc.mil
John Myers	PM	MCAS Cherry Point	252-466-4903	john.s.myers@usmc.mil

Comments/Decisions:

The team reviewed the historical range activities at this site and discussed the results of the May 2009 SI. The initial SI identified polynuclear aromatic hydrocarbon (PAH) concentrations exceeding human health screening criteria in site sediments. In order to further define the source of PAHs in site sediments, an Expanded SI will be conducted. Expanded SI sampling will include analysis of sediments within and upstream of the former shotfall zone for PAHs, total organic carbon [TOC], and grain size analysis. It was noted that the UFP-SAP would be finalized over the summer with sampling several months later.

Action Items:

None.

Consensus Decisions:

None.

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SAP Worksheet #10—Problem Definition

The purpose of this Expanded SI is to gather additional sediment data to further evaluate the presence of PAH constituents identified during the May 2009 site inspection. This worksheet presents general description of the Skeet Range location, site setting and site history, as well as site-specific problem definitions for the Skeet Range.

Site Description, Release History, and Conceptual Site Model

MCAS Cherry Point is a 13,164-acre military reservation north of the town of Havelock, in southeastern Craven County, North Carolina. Commissioned in 1942, MCAS Cherry Point currently provides support facilities and services for the Second Marine Aircraft Wing, the Fleet Readiness Center - East (FRC-East), Service Support Detachment 21 of the Second Force Service Support Group, the Naval Air Maintenance Training Group Detachment, and the Defense Reutilization and Marketing Office (DRMO). MCAS Cherry Point maintains facilities for training and supporting the Atlantic Fleet Marine Force aviation units and is designated as a primary aviation supply point.

The boundaries of MCAS Cherry Point are the Neuse River to the north, Hancock Creek to the east, North Carolina Highway 101 to the south, and an irregular boundary approximately $\frac{3}{4}$ mile west of Slocum Creek to the west. The former Skeet Range is located along the Neuse River adjacent to the MCAS Cherry Point golf course (**Figure 1**). The shooting station was located in an area that is currently a forested riparian buffer zone between the golf course greenway and the Neuse River. The shooting station was oriented to the north with the shotfall zone located almost entirely in the Neuse River.

According to the Range Identification and Preliminary Range Assessment (USACE, 2001), the Air Station requested six skeet or trap sets and two shotgun flexible mounts on September 8, 1943. Both skeet and trap shooting were conducted at the site. Skeet shooting consists of a shooter moving through a series of stations shooting at clay target disks which are thrown from elevated towers. Trap shooting consists of a shooter standing at one location shooting at clay target disks that are thrown from a pit house that is in front of the shooter's station with the top of the pit house located at surface grade. Shooting is done with shotguns using varying sizes of lead shot. The site was in use before the United States

SAP Worksheet #10—Problem Definition (continued)

Fish and Wildlife Service (USFWS) regulated the use of lead shot to protect waterfowl from the effects of lead poisoning. The former Skeet Range appears on maps from 1949 through 1955 and is no longer used for the firing of live ammunition. The site is now associated with the Air Station golf course (USACE, 2001).

The Range Identification and Preliminary Range Assessment (USACE, 2001) states that the types of munitions used on the range included number 7 ½ shot fired from 12-gauge shotguns. The Conceptual Site Model (CSM) identifies the potential sources of munitions constituents (MC) and exposure pathways (**Figure 2**). Potential receptors identified in the CSM include fishermen, recreational boaters and swimmers, and terrestrial and aquatic wildlife,

Skeet Range Geology

The soils along the southern bank of the Neuse River at the Skeet Range are predominantly sand with traces of clay. Soils exhibit iron oxide staining, and the clay content of the soil increases inland from the Neuse River. The ground elevation at the Skeet Range increases with distance from the shoreline to approximately 20 feet above the water level of the Neuse River. The dominant sediment type in the river bed is poorly-graded sand. Silt, clay, gravel, organic matter, and shell fragments are also common from 0 to 6 feet below the sediment surface. The sediment is generally firm, uncemented, and homogenous (Winner and Coble, 1996). Soft clay was observed beneath the sand at two areas in the eastern part of the sampling area (STR01-SD01 and STR01-SD02) during Site Inspection field activities in May 2009. Historical and proposed sediment sample locations are presented in **Figure 3**. The shoreline area was observed to be an erosional environment with a number of felled and dead trees with exposed roots along the shoreline.

Previous Investigations and Remedial Action

An initial assessment of the Skeet Range was conducted in 2005 which identified the location of the former Skeet Range shooting station and theoretical shotfall zones. Concrete debris was observed in the vicinity of the former shooting station.

A Site Inspection was conducted in May 2009 to evaluate the presence of MC and to characterize potential impacts to surface soil, surface water, and sediment related to historical activities at the Skeet Range. Concentrations of PAHs and metals exceeded screening criteria in surface soil, surface water, and sediment samples. An Expanded Site Inspection was recommended to further define the sources of PAH in sediments. Additionally, development of a Watershed Contaminated Source Document (WCSD) was recommended for the Skeet Range to evaluate PAH levels in sediment (CH2M HILL, 2010).

Previous Ecological Risk Assessment

An ecological risk screening was performed for surface soil, surface water, and sediment during the Site Inspection at the Skeet Range. Results of the ecological risk screening concluded that there are no significant risks anticipated for ecological receptors exposed to these media at the Skeet Range (CH2M HILL, 2010).

SAP Worksheet #10—Problem Definition (continued)

Previous Human Health Risk Assessment

A human health risk screening (HHRS) that included a risk ratio evaluation was performed for surface soil, sediment, and surface water during the Site Inspection at the Skeet Range. Results of the HHRS indicate that exposure to surface soil and surface water at the Skeet Range would not result in any unacceptable human health risks to current or likely future receptors. However, future exposure to sediment could potentially result in risks above acceptable levels due to PAH and arsenic concentrations (CH2M HILL, 2010).

Project Description

Sediment data will be gathered to further evaluate the presence of PAH constituents identified during the May 2009 site inspection. Additionally, data may be used to identify any potential upstream sources of PAH contamination and to evaluate the downstream dispersal of PAH constituents. Sediment samples will be analyzed for TOC and grain size analysis to evaluate transport characteristics of the PAHs in the sample medium. If available, data generated from samples of clay pigeon material will be compared with data indicating clay pigeon composition during the time frame when the Skeet Range was in use. This comparison will be used to indicate if PAHs identified at the site are consistent with PAHs used in the binding agents of clay pigeons. The sediment data collected will also be compared with human health and ecological risk screening levels, however, a full Screening Level Ecological Risk Assessment (SLERA) and Human Health Risk Assessment (HHRA) will not be conducted.

Additionally, arsenic data from samples collected during the May 2009 Site Inspection will be compared to background data from the Former Skeet & Trap Range #1 site and other MCAS Cherry Point sites where arsenic data are available. This data evaluation will be used to help determine whether or not arsenic concentrations in the May 2009 sediment samples are consistent with background concentrations. Should it be determined that arsenic in site sediment is not attributable to site background levels, the proposed sampling approach will be reevaluated with respect to additional sediment analysis for arsenic. Sampling for arsenic is not currently proposed for this Expanded Site Inspection.

The following environmental questions will be answered by the Expanded SI:

1. Are there additional upstream sources that may have impacted site media with PAHs?

Investigation activities will be conducted to evaluate the presence of PAHs in sediment upstream and within the former shotfall area and to indicate if additional PAH sources may be present at upstream locations. Sediment samples will be analyzed for PAHs (SW-846 8270_SIM).

2. Does site lithology impact transport of PAHs?

Sediment samples will be analyzed for TOC (Lloyd Khan Method) and Grain Size Analysis (ASTM D442) to determine the lithology at each sample location to evaluate PAH transport characteristics in the environment.

SAP Worksheet #10—Problem Definition (continued)

3. Do sediment constituent concentrations pose a potentially unacceptable human health or ecological risk?

PAH data will be compared to human health and ecological risk-based screening levels but will not quantitatively calculate or estimate risks to human health. A full SLERA and HHRA will not be conducted. Constituents of potential concern (COPCs) will be identified where analytes are detected that exceed their respective screening levels (and background concentrations for arsenic). Additionally for ecological receptors, COPCs also will be identified where analytes are detected that have no screening levels for comparison purposes.

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

This section presents the Project Quality Objectives (PQOs) for the Expanded SI sampling effort.

Who will use the data?

The data will be used by the Navy (and its contractors) and the regulatory agencies. Once published in the Administrative Record for the site, the data will be available to the public.

What will the data be used for?

- The data will be used to determine if there are additional sources of PAH contamination present upstream of the Skeet Range and to assess the dispersal of PAH constituents immediately downstream of the former shotfall zone. Additionally, the data will be used to confirm if the PAHs present in Neuse River and Slocum Creek sediment are consistent with PAHs used in the binding agents of clay pigeons.
- Sediment sampling data will be screened against the project action limits (PALs), which are based on the following human health and ecological screening criteria identified for the purposes of risk screening:
 - **Human Health:**
 - Sediment data will be compared with USEPA Adjusted Residential Soil Regional Screening Levels (USEPA, 2009)
 - **Ecological:**
 - Sediment data will be compared with USEPA Region 4 Recommended Ecological Screening Values (USEPA, 2001).
- See **Worksheets #15-1** through **15-4** for a detailed list of the PALs for each constituent.
- In cases where the PAL is less than the laboratory's corresponding limit of detection (LOD) and detection limit (DL), if that specific constituent is nondetect, the analyte will be considered not present. However, if it is detected, it will be considered to be an exceedance of the PAL.

What type of data are needed?

The data collected will be representative of the distribution of PAHs in the area within, upstream, and downstream from the former Skeet Range shotfall zone.

Sediment samples will be collected at a depth interval of 0 to one foot using Vibracore drilling techniques to further evaluate the presence of PAH constituents in sediment at the Skeet Range. Three sediment samples will be collected within the former Skeet Range shotfall zone, seven sediment samples will be collected upstream of the former Skeet Range within the Neuse River and Slocum Creek, and one sediment sample will be collected downstream of the former Skeet Range within the Neuse River.

Investigation activities will be performed in adherence to the standard operating procedures (SOPs) for laboratory and sampling techniques referenced in UFP-SAP **Worksheets #21** and **#23**.

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

How “good” must the data need to be in order to support the environmental decision?

The analytical data will be of the quantity and quality necessary to provide technically sound and defensible assessments of any potential sources of PAHs located upstream and within the former Skeet Range shotfall zone and risks to human and ecological receptors posed by the contaminants identified. For risk screening and further action decisions, the laboratory will follow the Measurement Performance Criteria (MPC) in **Worksheet #12** for field QC samples and **Worksheet #28** for laboratory QC samples. These MPC are consistent with the DoD 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 CH2M HILL using the procedures in **Worksheet #36**. A full level IV equivalent data package and quality control sampling are required for these data. A Level IV equivalent data package includes a case narrative, all field sample results, quality control forms, and raw data.

Quality control samples are detailed in **Worksheet #20**. QA/QC samples will be collected for data evaluation and validation.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)

Eleven sediment samples will be collected from the locations shown on **Figure 3**. All samples will be analyzed for PAHs, TOC, and Grain Size Analysis. Target analytical concentrations (i.e., quantitation limits) are listed in **Worksheet #15**.

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

The data will be collected and generated in accordance with the SOPs contained in this SAP. Fieldwork is tentatively scheduled to begin in August 2011. Validated data will be received from CH2M HILL’s internal validator approximately seven weeks after the lab receives the samples.

Who will collect and generate the data?

The Navy’s contractor CH2M HILL will collect the samples. Empirical Laboratories will analyze the samples and generate data.

How will the data be reported?

An Expanded SI Report will be prepared that presents the data, preliminary human health and ecological risk screening results, and further definition of the potential sources of contaminants in the sediment. In general, CERCLA guidance will be followed. The environmental questions that will be answered and the general plan for addressing the environmental questions identified in **Worksheet #10** are discussed below:

- Human health and ecological risk preliminary screenings will be performed using sediment sampling results.

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

- Additional investigation will be recommended if the human health and/or ecological risk screenings or other regulatory screening criteria suggest unacceptable levels of risk attributable to CERCLA-related releases are present.
- The results will be presented to the MCAS Cherry Point partnering team. The resulting Expanded SI Report, in combination with the WCSD, will document the consensus of the partnering team.

How will the data be archived?

- The data will be archived by CH2M HILL and the Navy in accordance with contract requirements.

Analytical data will be archived in Naval Installation Restoration Information Solution (NIRIS). The archived data will include analytical results, coordinates, field parameter results, boring logs, station information, etc.

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

Matrix: Sediment

Analytical Group: Semi-volatile organic compound (SVOC)

Concentration Level: Low SIM (SW-846 8270_SIM)

QC Sample ²	Analytical Group ¹	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	SVOC	One per 10 field samples	Precision	% Relative percent difference (RPD) ≤30%	S & A
Equipment Rinseate Blank	SVOC	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-1.	S
Temperature Blank	SVOC	One per cooler	Accuracy / Representativeness	2-6°C	S

¹If information varies within an analytical group, separate by individual analyte.

²MS/MSD is described on Worksheet 28.

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

Matrix: Aqueous (Blanks)

Analytical Group: SVOC

Concentration Level: SIM (SW-846 8270_SIM)

QC Sample ²	Analytical Group ¹	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Temperature Blank	SVOC	One per cooler	Accuracy / Representativeness	2-6°C	S

¹If information varies within an analytical group, separate by individual analyte.

²MS/MSD is described on Worksheet 28.

SAP Worksheet #12-3—Measurement Performance Criteria Table - Field Quality Control Samples

Matrix: Sediment

Analytical Group: WCHEM

Concentration Level: Low (Lloyd Kahn)

QC Sample	Analytical Group ¹	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Temperature Blank	WCHEM	One per cooler	Accuracy / Representativeness	2-6°C	S

¹If information varies within an analytical group, separate by individual analyte.

SAP Worksheet #12-4—Measurement Performance Criteria Table - Field Quality Control Samples

Matrix: Sediment

Analytical Group: GRAINSIZE

Concentration Level: N/A (American Society for Standards and Materials [ASTM] D422)

QC Sample	Analytical Group ¹	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
N/A: Field QC samples are not planned for grain size (sieve) analysis.					

¹If information varies within an analytical group, separate by individual analyte.

SAP Worksheet #13—Secondary Data Criteria and Limitations Table

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
MCAS Cherry Point Background Report	Tetra Tech NUS Inc., 1999. <i>Background Evaluation Report for Marine Corps Air Station Cherry Point, North Carolina. October.</i>	Tetra Tech Inc.	Data used to determine the COPCs with regard to potential human health and ecological receptors. Additionally, this data will be used to evaluate data with respect to background levels.	None known
Site Inspection Report for Former Skeet and Trap Range #1	CH2M HILL, 2010. <i>Site Inspection Report for Former Skeet and Trap Range #1. Marine Corps Air Station Cherry Point, North Carolina. October</i>	CH2M HILL	This data may be used to compare new data to historical site contaminant concentrations.	None known

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SAP Worksheet #14—Summary of Project Tasks

Project Logistics

In general, work will be performed in Level D personal protective equipment (PPE), which includes nitrile gloves, safety glasses, and safety toed boots. Optional PPE includes the use of hearing protection, hard hat, and Tyvek® coveralls as necessary. Tasks that are conducted over water will be performed while wearing a personal flotation device (PFD). Upgrades to higher levels of PPE are discussed in the Health and Safety Plan (HSP), which will be provided as a separate document from this UFP-SAP.

Field activities will take place during normal working hours.

Following the investigational activities, the site will be restored to its original condition to the furthest extent possible.

Project Tasks

Applicable SOPs for project tasks outlined in this section are listed on **Worksheet #21** and provided in **Appendix A**.

Investigational Activities

Sample locations will be collected from approximately 11 locations (**Figure 3**) within, upstream, and downstream of the Former Skeet and Trap Range #1 shotfall zone in the Neuse River. Sample locations will be identified using a global positioning system (GPS) unit, but may be modified to obtain sediment samples with similar lithology, located approximately 175 feet from the shoreline and at similar water depths (approximately 2-8 feet deep). Partnering Team concurrence with the selected upstream sample locations was documented during the March 16, 2011, Partnering Team Meeting. The downstream sample was selected at a later date by the NAVFAC RPM.

Sediment Sampling

Sediment sampling locations were selected to evaluate aquatic areas potentially impacted from upstream sources and activities at the Skeet Range. Samples will be collected and analyzed for PAHs, TOC, and Grain Size Analysis. Sediment samples will be collected using Vibracore drilling methods at a depth of 0 to 1 foot below ground surface (bgs). The coordinates of each sampling location will be documented by the sampling team. Sediment sampling will be conducted according to SOP-001, Vibracore Sediment Sampling, in **Appendix A**.

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

Equipment Decontamination

All non-disposable sampling equipment will be decontaminated before use and immediately after each use in accordance with applicable SOPs (**Appendix A**). Equipment will be scrubbed and washed withalconox, rinsed with deionized water, and sanitized with isopropyl alcohol between uses. A decontamination area will be set up to prevent runoff of the decontamination water and to allow easy collection of decontamination fluids.

Investigation-derived Waste Handling

Investigation-derived waste (IDW) generated during investigational activities at the Skeet Range will include disposable polycarbonate core liners, sediment cuttings, and solutions used to decontaminate sampling equipment. IDW will be containerized in approved 55-gallon drums and stored at MCAS Cherry Point pending disposal. Aqueous IDW will be characterized for appropriate offsite disposal and will be removed from the site within 90 days of generation.

Quality Control

- Implement SOPs for field activities (**Appendix A**) being performed.
- Summary of daily field activities will be documented in a field log book; this log book will also detail sampling activities.
- QC samples to be collected are outlined on **Worksheet #20**.

Analytical Tasks

- The laboratory will maintain, test, inspect, and calibrate analytical instruments (**Worksheets #24 and #25**).
- The laboratory will process and prepare samples for analysis.

Data Management

- See **Appendix C**, Navy CLEAN Data Management Plan for all data management procedures.
- Procedures for data tracking, storage, archiving, retrieval and security for both electronic and hardcopy data:
 - See the Navy CLEAN Data Management Plan for detailed information (**Appendix C**)
 - The Project EIS, Victoria Brynildsen, is responsible for data tracking and storage
 - Stacy Davenport of CH2M HILL will coordinate archiving and retrieval of data

Project Assessment/Audit

- **Worksheets #31 and #32**

Data Review

- DV (**Worksheets #35 and #36**)

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

Matrix: Sediment (SD)

Analytical Group: SVOC

Analyte	CAS Number	Risk-based Screening Levels (RSLs) Residential Soil x 10 for SD Adjusted (mg/kg)	ECO Marine (mg/kg)	ECO Freshwater (mg/kg)	Project Quantitation Limit (PQL) Goal ^{1,2} (mg/kg)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits ³		
						Limit of Quantitation (LOQs) (mg/kg)	LODs (mg/kg)	DLs (mg/kg)	Lower Control Limit (LCL)	Upper Control Limit (UCL)	RPD
Naphthalene	91-20-3	36	0.0346	0.176	0.0173	0.00167	0.00333	0.00167	29	106	30
2-Methylnaphthalene	91-57-6	310	0.0202	0.0202	0.0101	0.00167	0.00333	0.00167	30	111	30
Acenaphthylene	208-96-8	3400	0.0059	0.0059	0.0059	0.00167	0.00333	0.00167	23	126	30
Acenaphthene	83-32-9	3400	0.0067	0.0067	0.00335	0.00167	0.00333	0.00167	28	110	30
Fluorene	86-73-7	2300	0.0212	0.0774	0.0106	0.00167	0.00333	0.00167	27	116	30
Phenanthrene	85-01-8	17000	0.0867	0.204	0.04335	0.00167	0.00333	0.00167	32	127	30
Anthracene	120-12-7	17000	0.0469	0.0572	0.02345	0.00167	0.00333	0.00167	28	136	30
Fluoranthene	206-44-0	2300	0.113	0.423	0.0565	0.00167	0.00333	0.00167	30	142	30
Pyrene	129-00-0	1700	0.153	0.195	0.0765	0.00167	0.00333	0.00167	28	130	30
Benzo(a)anthracene	56-55-3	1.5	0.0888	0.15	0.0444	0.00167	0.00333	0.00167	31	146	30
Chrysene	218-01-9	150	0.108	0.166	0.054	0.00167	0.00333	0.00167	39	134	30
Benzo(b)fluoranthene	205-99-2	1.5	NC	0.0272	0.0136	0.00167	0.00333	0.00167	30	139	30
Benzo(k)fluoranthene	207-08-9	15	NC	0.24	0.12	0.00167	0.00333	0.00167	42	129	30
Benzo(a)pyrene	50-32-8	0.15	0.0888	0.15	0.0444	0.00167	0.00333	0.00167	28	128	30
Indeno(1,2,3-cd)pyrene	193-39-5	1.5	NC	0.017	0.0085	0.00167	0.00333	0.00167	17	164	30
Dibenz(a,h)anthracene	53-70-3	0.15	0.00622	0.033	0.00622	0.00167	0.00333	0.00167	30	138	30
Benzo(g,h,i)perylene	191-24-2	1700	NC	0.17	0.085	0.00167	0.00333	0.00167	21	149	30

NC: No screening level for this compound.

¹The Project Action Limit for SD is the lesser of "RSLs Residential Soil x 10 for SD Adjusted" (May, 2011) or "Ecological Target Quantitation Limits".

²The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific LOQ, as applicable.

³DoD QSM v. 4.1 is the basis for laboratory control sample (LCS) and matrix spike/matrix spike duplicate (MS/MSD) limits.

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

Matrix: AQ (blanks)

Analytical Group: SVOC

Analyte	CAS Number	Project Quantitation Limit Goal ^{1,2} (ug/L)	Laboratory-specific			LCS, MS, and MSD %R and %RPD Limits ³		
			LOQs (ug/L)	LODs (ug/L)	DLs (ug/L)	LCL	UCL	RPD
Naphthalene	91-20-3	0.2	0.20	0.10	0.050	39	125	30
2-Methylnaphthalene	91-57-6	0.2	0.20	0.10	0.050	36	121	30
Acenaphthylene	208-96-8	0.2	0.20	0.10	0.050	43	140	30
Acenaphthene	83-32-9	0.2	0.20	0.10	0.050	41	132	30
Fluorene	86-73-7	0.2	0.20	0.10	0.050	40	140	30
Phenanthrene	85-01-8	0.2	0.20	0.10	0.050	46	144	30
Anthracene	120-12-7	0.2	0.20	0.10	0.050	50	139	30
Fluoranthene	206-44-0	0.2	0.20	0.10	0.050	47	158	30
Pyrene	129-00-0	0.2	0.20	0.10	0.050	39	158	30
Benzo(a)anthracene	56-55-3	0.2	0.20	0.10	0.050	58	141	30
Chrysene	218-01-9	0.2	0.20	0.10	0.050	51	155	30
Benzo(b)fluoranthene	205-99-2	0.2	0.20	0.10	0.050	42	156	30
Benzo(k)fluoranthene	207-08-9	0.2	0.20	0.10	0.050	49	165	30
Benzo(a)pyrene	50-32-8	0.2	0.20	0.10	0.050	31	142	30
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	0.20	0.10	0.050	20	167	30
Dibenz(a,h)anthracene	53-70-3	0.2	0.20	0.10	0.050	28	153	30
Benzo(g,h,i)perylene	191-24-2	0.2	0.20	0.10	0.050	12	171	30

NC: No screening level for this compound.

¹There are no project action limits for AQ samples because they are blanks.

²The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific LOQ, as applicable.

³DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

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

Matrix: SD

Analytical Group: WCHEM

Analyte	CAS Number ²	Project Quantitation Limit Goal ¹ (mg/kg)	Laboratory-specific		
			LOQs (mg/kg)	LODs (mg/kg)	DLs (mg/kg)
TOC	TOC	800	800	400	200

¹Since there are no screening levels or project action limits applicable to WCHEM data, the Laboratory Specific LOQ was applied..

²These CAS numbers are contractor-specific.

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

Matrix: SD

Analytical Group: GRAINSIZE

Analyte	CAS Number ³	Project Quantitation Limit Goal ² (percent)	Laboratory-specific ¹	
			Quantitation Limit (QLs) (percent)	Method Detection Limit (MDLs) (percent)
GS09 Sieve 0.5" (12.5 mm)	SIEVE12.5	N/A	N/A	N/A
GS10 Sieve 0.375" (9.5 mm)	SIEVE9.5	N/A	N/A	N/A
Sieve No. 004 (4.75 mm)	SIEVE4.75	N/A	N/A	N/A
Sieve No. 010 (2.00 mm)	SIEVE2.0	N/A	N/A	N/A
Sieve No. 020 (850 um)	SIEVE850	N/A	N/A	N/A
Sieve No. 040 (425 um)	SIEVE425	N/A	N/A	N/A
Sieve No. 060 (250 um)	SIEVE250	N/A	N/A	N/A
Sieve No. 080 (180 um)	SIEVE180	N/A	N/A	N/A
Sieve No. 100 (150 um)	SIEVE150	N/A	N/A	N/A
Sieve No. 200 (75um)	SIEVE75	N/A	N/A	N/A
Gravel (%)	GRAVEL	N/A	N/A	N/A
Sand (%)	14808-60-7	N/A	N/A	N/A
Coarse Sand (%)	COARSESAND	N/A	N/A	N/A
Medium Sand (%)	MEDIUMSAND	N/A	N/A	N/A
Fine Sand (%)	FINESAND	N/A	N/A	N/A
Fines (%)	FINES	N/A	N/A	N/A

N/A: Not applicable

¹QLs and MDLs are not applicable to GRAINSIZE data.

²There are no screening levels or project action limits applicable to GRAINSIZE data. The project quantitation limit goal is not applicable.

³These CAS numbers are contractor-specific.

Sieve No. 010 marks the gravel to coarse sand line.

Sieve No. 030 (interpolated) marks the coarse sand to medium sand line.

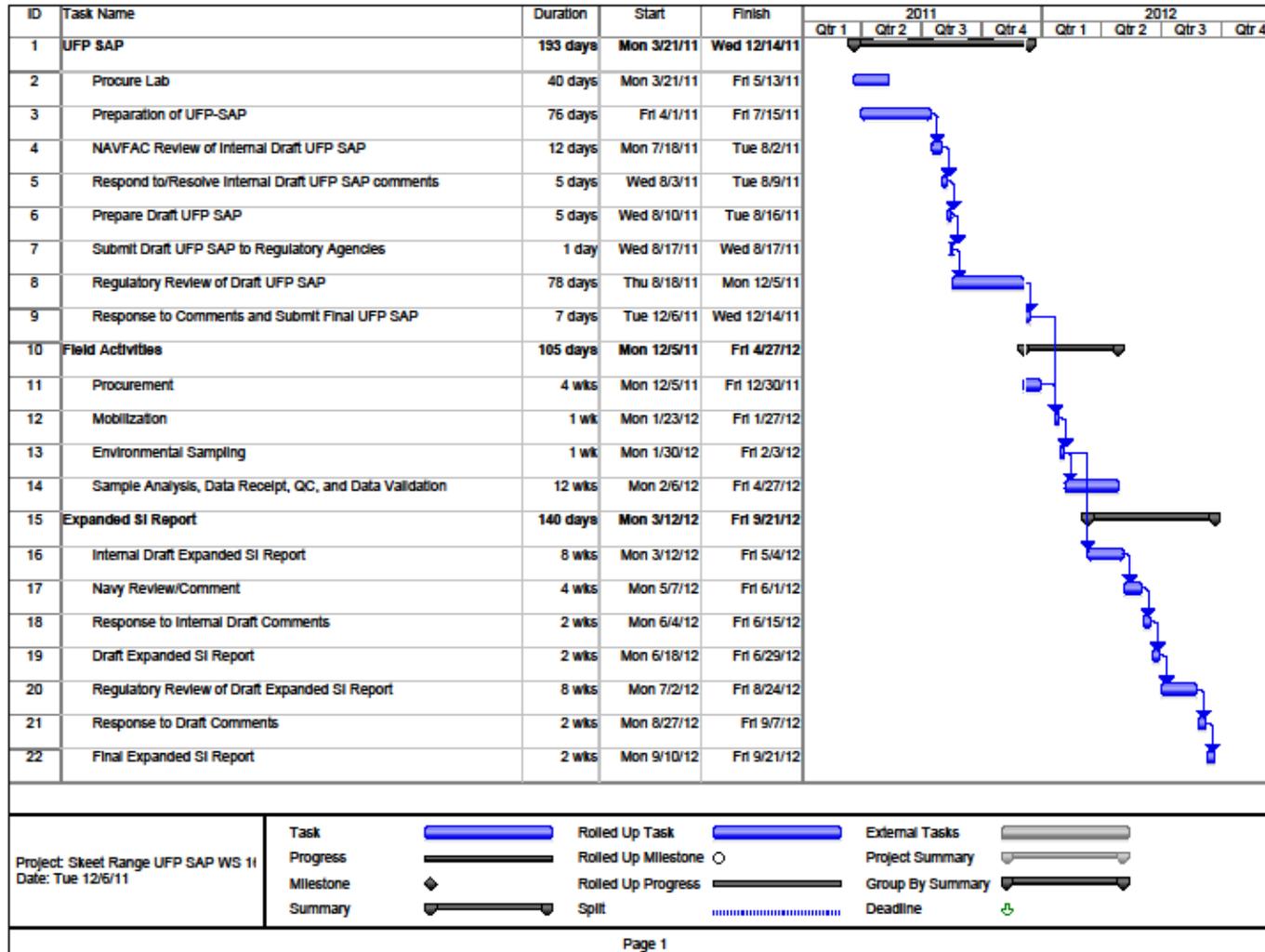
Sieve No. 040 marks the medium sand to fine sand line.

Sieve No. 200 marks the fine sand to silt line.

Sand (%) is the sum percentage of coarse sand, medium sand, and fine sand.

Fines (%) is that which is not retained by Sieve No. 200; typically, this is the sum of silt and clay.

SAP Worksheet #16—Project Schedule / Timeline Table



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SAP Worksheet #17—Sampling Design and Rationale

Matrix	Depths to Sample	Analysis	Method	Number of Samples	Rationale *	Sampling Strategy
Sediment	0-1 foot bgs	PAHs	SW846 8270_SIM	11	See footnote	See footnote
		TOC	Lloyd Khan			
		Grain Size Analysis	ASTM D422			

* Sample locations are based on the results of the May 2009 Site Investigation. Samples will be collected approximately 150 feet from the shoreline to ensure samples are collected from approximately the same depths of water. Sediment samples will be collected from 0-1 foot bgs and field staff will ensure the samples are being collected from similar lithology. If necessary, sample locations will be offset slightly to obtain samples from similar lithology. Sediment samples will extend farther upstream in the Neuse River and Slocum Creek than the May 2009 Site Investigation to determine if there may be additional sources of PAH constituents in sediment. Additionally, one sample will extend farther downstream in the Neuse River than the May 2009 Site Investigation to assess the dispersal of PAHs downstream of the shotfall zone.

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

Sampling Location / ID Number	Matrix	Depth (units)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference ²
STR1-SD13 / STR1-SD13-0-1-MMY ¹ STR1-SD13 / STR1-SD13D-0-1-MMY STR1-SD14 / STR1-SD14-0-1-MMY STR1-SD14 / STR1-SD14-0-1-MMY-MS STR1-SD14 / STR1-SD14-0-1-MMY-SD STR1-SD15 / STR1-SD15-0-1-MMY STR1-SD16 / STR1-SD16-0-1-MMY STR1-SD17 / STR1-SD17-0-1-MMY STR1-SD18 / STR1-SD18-0-1-MMY STR1-SD19 / STR1-SD19-0-1-MMY STR1-SD20 / STR1-SD20-0-1-MMY STR1-SD21 / STR1-SD21-0-1-MMY STR1-SD22 / STR1-SD22-0-1-MMY STR1-SD23/ STR1-SD23-0-1-MMY STR1-SD23/ STR1-SD23D-0-1-MMY	Sediment	0 – 1 foot bgs	PAHs/TOC/Grain Size Analysis	11 Field Samples 2 Field duplicates, 1 MS/MSDs	001_Sediment Sampling 004_Decon

¹ MMY= Month and Year in which the samples will be collected

² From **Worksheet #21**--SOP or worksheet that describes the sample collection procedures.

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SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference ¹	Containers (number, size, and type)	Sample Volume ² (units)	Preservation Requirements (chemical, temperature, light-protected)	Maximum Holding Time ³ (preparation / analysis)
SD	SVOC	SW-846 8270_SIM / SOP201, SOP343	1 of 4oz CWM soil jar	15g	(4±2) °C	14 days to prep and 40 days to analysis
	WCHEM	Lloyd Khan / SOP 221		250mg		
	GRAIN SIZE	ASTM D422 / ASTM D422	2 of 16-oz plastic	1kg	None	NA
AQ	SVOC	SW-846 8270_SIM / SOP201, SOP300	2 of 1L amber	1000 mL	(4±2) °C	7 days until extraction/40 days to analysis

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

²Provide the minimum sample volume or mass requirement if it differs from the container volume.

³Maximum 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 ²	No. of Field Duplicates	No. of MS/MSDs ¹	No. of Field Blanks ³	No. of Equip. Blanks ³	No. of VOA Trip Blanks ³	No. of Proficiency Testing (PT) Samples	Total No. of Samples to Lab
SD	SVOC	11	2	1	0	2	0	0	17
	WCHEM (TOC)	11	0	0	0	0	0	0	11
	GRAINSIZE	11	0	0	0	0	0	0	11

¹Although the MS/MSD is not typically considered a field QC, it is included here because location determination is often established in the field.

²If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.

³The number of equipment blanks, field blanks, and trip blanks is based on a fundamental assumption of the number of sampling days each site will require. It was assumed that the sediment sampling will occupy two days.

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SAP Worksheet #21—Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
001_Sediment Sampling	Vibracore Sediment Sampling, 5/2011	CH2M HILL	PFD, Nautical Charts, Marine VHF Radio, Cell phone, fathometer and bar gauge, GPS (or navigation and position recording equipment), vibratory core barrel, polycarbonate core liner, core cutter, steel tape measure, sample coolers and ice, log book, gloves, rubber boots	N	
002_BlankPrep	Equipment Blank and Field Blank Preparation, 5/2011	CH2M HILL	Blank liquid (use American Standard Testing and Materials [ASTM] Type II grade water), De-ionized water, sample bottles, gloves, preservatives	N	
003_COC	Chain-of-Custody, 5/2011	CH2M HILL	Paper chain of custody form (provided by laboratory)	N	
004_Decon	Decontamination of Personnel and Equipment, 5/2011	CH2M HILL	De-ionized water, distilled water, potable water, 2.5 percent liquinox and water solution, methanol, plastic pails, 55-gallon (gal) drum for waste, gloves, decon pad, steam cleaner	N	
005_Dispose	Disposal of Waste Fluids and Solids, 5/2011	CH2M HILL	Fluids-55 gal drum, tools to secure drum, funnel, labels, marking pen, seals for drum Solids-55 gal drum, tools to secure drum, plastic sheets, labels, marking pen	N	
006_DrumSample	Sampling Contents of Tanks and Drums, 5/2011	CH2M HILL	Drum/tank, sampling instrument, gloves, plastic sheets, labels, monitoring instrument	N	
007_LogBooks	Preparing Field Log Books, 5/2011	CH2M HILL	Log book, Indelible pen	N	
008_Ship	Packaging and Shipping Procedures for Low Concentration Samples, 5/2011	CH2M HILL	Coolers, duct tape, ice, strapping tape, packaging material, Ziploc® bags, custody seals, chain of custody	N	

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

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference ¹
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

¹ Reference from **Worksheet #21**.

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SAP Worksheet #23—Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Date Last Revisited if not Revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? ¹ (y/n)
QS10	Laboratory Sample Receiving, Log In and Storage Rev17 20110516.		N/A	Various	Not applicable	Empirical Laboratories	N
QS14	Analytical Laboratory Waste Disposal Rev6 20100831.		N/A	Various	Not applicable	Empirical Laboratories	N
SOP201	GC/MS Semivolatiles and Low-Concentration PAHs by EPA Method 625 and SW846 Method 8270C and 8270D Including Additional Appendix IX Compounds, REV21, 20110516		Definitive	SD, AQ / SVOC	GC/MS	Empirical Laboratories	N
SOP221	Total Organic Carbon (TOC) by SM5310C, SW846 Method 9060/9060A and Lloyd Kahn Method "Determination of TOC in Sediment" Rev9 20100712.		Screening	SD / WCHEM	TOC Analyzer	Empirical Laboratories	N
SOP300	GC/MS-Semi-Volatile BNA-Aqueous Matrix Extraction Using SW-846 Method 3510C for 8270C/625 Analysis, REV19 20101117		Definitive	AQ / SVOC	GC/MS	Empirical Laboratories	N
SOP343	BNA & Pesticide/PCBs & TPH Non-Aqueous Matrix (Microwave Extraction) Using SW-846 Method 3546 Rev2 20101117		Definitive	SD/SVOC	GC/MS	Empirical Laboratories	N
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils, Designation D 422-63, Reapproved 1990		Screening	SD / GRAIN SIZE	Not applicable	Beaver Engineering	N

¹If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the Navy QAO.

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SAP Worksheet #24—Analytical Instrument Calibration Table

Instrument ³	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA ²	SOP Reference ¹
GCMS-SVOCs (SW-846 8270SIM)	Tune Verification – decafluoro-triphenyl-phosphine (DFTPP)	Prior to each initial calibration (ICAL) and at the beginning of each 12-hour analytical sequence.	Must meet the ion abundance criteria required by the method (SW-846 8270D; Section 7.3.1; Table 3), dichlorodiphenyltrichloroethane (DDT) degradation $\leq 20\%$ (exclusion for LOW PAH analysis).	Retune and/or clean or replace source. No samples may be accepted without a valid tune.	Analyst, Supervisor	SOP201
	Breakdown Check (DDT only) Not applied for Low-Level PAHs	At the beginning of each 12-hour analytical sequence.	The degradation must be $\leq 20\%$ for DDT to verify inertness of the injection port.	Correct the problem then repeat breakdown check. No samples shall be run until degradation is $\leq 20\%$ for DDT.		
	ICAL – A minimum of a 5-point calibration is prepared for all target analytes	Upon instrument receipt, instrument change (new column, source cleaning, etc.), when continuing calibration verification (CCV) is out of criteria.	The average RF for SPCCs must be ≥ 0.050 . The % relative standard deviation (RSD) for RFs for CCCs must be $\leq 30\%$; and %RSD for each target analyte must be $\leq 15\%$, or r must be ≥ 0.995 , or r2 must be ≥ 0.99 (minimum of 6 points required for second order).	Correct problem then repeat ICAL. No samples may be run until ICAL has passed.		
	Initial Calibration Verification (ICV) – Second Source	Perform after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 80-120% of the true value. SPCC RFs must be ≥ 0.050 ; CCCs must be $\leq 20\%D$.	Correct problem and verify ICV. If that fails, correct problem and repeat ICAL. No samples may be run until ICV has been verified.		
	RT Window Position Establishment	Once per ICAL for each analyte and surrogate.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.		
	Evaluation of RTs	With each sample.	RT of each target analyte must be within ± 0.06 RRT units.	Correct problem, then rerun ICAL.		
	CCV	Analyze a standard at the beginning of each 12-hour shift after tune and before sample analysis.	SPCC RFs must be ≥ 0.050 ; All target analytes and surrogates must be $\leq 20\%D$.	If %D is high and sample result is non detect (ND), qualify/narrate with project approval. If %D is low or project approval not received, reanalyze all samples since the last successful CCV.		

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

Instrument ³	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA ²	SOP Reference ¹
TOC Analyzer	ICAL	Prior to sample analysis or instrument undergoes a change.	Linear regression R-Squared ≥ 0.990 ($R \geq 0.995$)	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	SOP221
	ICV	At the beginning and end of the sequence	Within $\pm 10\%$ of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.		
	CCV	Every 10 field samples or every 5 samples if analyzing in quadruplicate, and at the end of the analysis sequence.	Within $\pm 15\%$ of true value.	Check calibration standards, recalibrate if necessary. Reanalyze affected data.		
Grain Size Scale	Standard Weight	Daily or before use	+/- 0.1%	Correct problem and recalibrate	Analyst/ Supervisor	ASTM D422

Not applicable for TDS

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

²Name or title of responsible person may be used.

³DoD QSM v. 4.2 is the basis for specifications on this table. Specifications are based on the SW-846 method that will be performed. Laboratory SOPs and analytical methods are the basis for pH, TOC and grain size analysis.

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

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person ²	SOP Reference ¹
GCMS-SVOC	Check pressure and gas supply daily. Bake out column, change septa as needed, cut column as needed. Other maintenance specified in Equipment Maintenance SOP.	QC standards	Ion source, injector liner, column, column flow	Prior to initial calibration and/or as necessary	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst, Department Manager	SOP201
TOC analyzer - TOC	Replace sample tubing, clean sample boat, replace syringe	QC standards	Tubing, sample boat, syringe	As necessary	Acceptable calibration or CCV	Repeat maintenance activity or remove from service.	Analyst, Department Manager	SOP221
Grain Size - Sieves, Balance, Hydrometer	Balance scale daily, clean sieves daily, check hydrometer daily	Grain Size Analysis	Check balance, calibrate daily, check sieves for uniformity, check hydrometer daily	As necessary	Acceptable calibration or CCV	Recalibrate and/or perform necessary equip. maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Department Manager	ASTM D422

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

²Name or title of responsible person may be used.

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SAP Worksheet #26—Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FTL (TBD)/CH2M HILL
Sample Packaging (Personnel/Organization): Sample Processor or Field Team Member (TBD)/CH2M HILL
Coordination of Shipment (Personnel/Organization): Sample Processor or Field Team Member (TBD)/CH2M HILL
Type of Shipment/Carrier: Overnight/FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Receipt Personnel/ Empirical Laboratories, LLC. All fractions will be shipped to Empirical Laboratories, LLC. Empirical Laboratories will ship grain size samples directly to Beaver Engineering, Inc.
Sample Custody and Storage (Personnel/Organization): Sample Receipt Personnel/ Empirical Laboratories, LLC
Sample Preparation (Personnel/Organization): Extractions Personnel/ Empirical Laboratories, LLC
Sample Determinative Analysis (Personnel/Organization): Analyst/ Empirical Laboratories, LLC
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 days
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Extracts may be disposed of 90 days after extraction.
Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Personnel/Organization: Environmental Health and Safety Office/ Empirical Laboratories, LLC
Number of Days from Analysis: Samples may be disposed of 90 days after report mail date

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SAP Worksheet #27—Sample Custody Requirements Table

Sample Labeling

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservative, and sampler's initials. Labels will be taped to the jar to ensure that they do not separate. The following exceptions apply:

- Solid volatile organic compounds (VOCs): Sample vials are pre-weighed; therefore, the laboratory will attach labels to the vials and tape will not be used. Indelible ink will be used on a waterproof label, which will already be affixed to the jar. Sample labels will include, at a minimum, sample ID, date/time collected, preservative, and sampler's initials.

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

Samples will be collected by field team members under the supervision of the FTL. As samples are collected, they will be placed into containers and labeled, as outlined above. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4°C until they are received by the laboratory. The Chain of Custody (COC) will also be placed into the cooler. Coolers will be shipped to the laboratory via FedEx, with the airbill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples.

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

See the laboratory sample handling SOP: QS10, "Laboratory Sample Receiving, Log In and Storage" for details on sample handling.

Sample Identification Procedures:

Upon opening the cooler, the receiving clerk signs the COC and then takes the temperature using the temperature blank (if absent, then a sample container or infrared thermometer is used). The sample containers in the cooler are unpacked and checked against the client's COC and any discrepancies or breakage is noted on the COC. Next, if any water samples require preservative, the clerk will check the pH values to see if they are in the acceptable pH range. The clerk will deliver the COC (and any other paperwork; e.g. temperature or pH QA notice) to the PM for Laboratory Information Management Systems (LIMS) entry and client contact (if needed).

The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the COC. The laboratory will send sample log-in forms to EIS to check sample IDs and parameters are correct.

SAP Worksheet #27—Sample Custody Requirements Table (continued)

Chain-of-Custody Procedures:

COCs will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The COC will also have the sampler's name and signature. The COC 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.

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

Matrix: SD

Analytical Group: SVOC

Analytical Method / SOP Reference: SW-846 8270_SIM/ SOP201

QC Sample ¹	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 preparatory batch.	No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (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 analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 of DoD QSM v 4.2).
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-6. 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. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-6. 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.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-6.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-6.
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL or daily CCV standard ; EICP area within -50% to +100% of ICAL midpoint standard or daily CCV standard .	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant internal standard (IS).	Analyst	Accuracy	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Breakdown Check (Not applied for low-level PAHs)	Prior to ICAL and at the beginning of each 12-hour period	Degradation $\leq 20\%$ for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation $\leq 20\%$.	Analyst	Accuracy	Degradation $\leq 20\%$ for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.
Surrogates	6 per sample for SW-846 8270D	2-Fluorobiphenyl: 45-105%R Terphenyl-d14: 30-125%R 2,4,6-Tribromophenol: 35-125%R 2-Fluorophenol: 35-105%R Phenol-d6: 40-100%R Nitrobenzene-d5: 40-100%R	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	2-Fluorobiphenyl: 45-105%R Terphenyl-d14: 30-125%R 2,4,6-Tribromophenol: 35-125%R 2-Fluorophenol: 35-105%R Phenol-d6: 40-100%R Nitrobenzene-d5: 40-100%R
	4 per sample for SW-846 8270D (LowLevel)	2-Methylnaphthalene-d10: 10-94%R Fluorene-d10: 20-96%R Pyrene-d10: 31-128%R 2,4-Dibromophenol: 20-116%R				2-Methylnaphthalene-d10: 10-94%R Fluorene-d10: 20-96%R Pyrene-d10: 31-128%R 2,4-Dibromophenol: 20-116%R

¹DoD QSM v. 4.2 is the basis for specifications on this table.

SAP Worksheet #28-2—Laboratory QC Samples Table

Matrix: AQ (blanks)

Analytical Group: SVOC

Analytical Method / SOP Reference: SW-846 8270_SIM/ SOP201

QC Sample ¹	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 preparatory batch.	No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (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	No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 of DoD QSM v 4.2)
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 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. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 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.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-2.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-2.
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Breakdown Check	Prior to ICAL and at the beginning of each 12-hour period	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation ≤ 20%.	Analyst	Accuracy	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.
Surrogates	6 per sample for SW-846 8270D	2-Fluorobiphenyl: 50-110%R Terphenyl-d14: 50-135%R 2,4,6-Tribromophenol: 40-125%R 2-Fluorophenol: 20-110%R Phenol-d6: 40-100%R Nitrobenzene-d5: 40-110%R	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	2-Fluorobiphenyl: 50-110%R Terphenyl-d14: 50-135%R 2,4,6-Tribromophenol: 40-125%R 2-Fluorophenol: 20-110%R Phenol-d6: 40-100%R Nitrobenzene-d5: 40-110%R
	4 per sample for SW-846 8270D (LowLevel)	2-Methylnaphthalene-d10: 43-92%R Fluorene-d10: 29-101%R Pyrene-d10: 53-166%R 2,4-Dibromophenol: 10-130%R				2-Methylnaphthalene-d10: 43-92%R Fluorene-d10: 29-101%R Pyrene-d10: 53-166%R 2,4-Dibromophenol: 10-130%R

¹DoD QSM v. 4.2 is the basis for specifications on this table.

SAP Worksheet #28-3—Laboratory QC Samples Table

Matrix: SD

Analytical Group: WCHEM (TOC)

Analytical Method / SOP Reference: Lloyd Khann / SOP221

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 Blank	One per prep batch	No analyte detected > 1/2 PQL	Investigate source of contamination. Evaluate the samples and associated QC: i.e. If the blank results are above the PQL, report sample results which are <PQL or > 10X the blank concentration. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias, Contamination	No analyte detected > 1/2 PQL
Laboratory replicate	One laboratory replicate per twenty samples	RPD < 20	If lab QC in criteria and matrix interference suspected, flag data. Else, reanalyze	Analyst, Laboratory Department Manager and Data Validator	Precision	RPD < 20
Matrix Spike (MS)	One MS per prep batch	75-125% recovery	If LCS in criteria and matrix interference suspected, flag data. Else, reanalyze	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	75-125% recovery
Laboratory Control Sample (LCS)	One LCS per prep batch	80-120% recovery	Investigate source of problem. If the LCS recovery is high but the sample results are <QL, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	80-120% recovery

SAP Worksheet #28-4—Laboratory QC Samples Table

Matrix: SD

Analytical Group: GRAINSIZE

Analytical Method / SOP Reference: ASTM D422 / ASTM D422

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
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N/A: Laboratory QC samples are not planned for grain size (sieve) analysis.

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
Field Notebooks	Electronic .pdf copies in the project file. Hardcopy (bound notebook) in the project file. Archived at project closeout.
Chain-of-Custody Records	Electronic .pdf copies in the project file. Hardcopy in the data validation report. Archived at project closeout.
Air Bills	Hardcopy in the project file. Archived at project closeout.
Telephone Logs	Hardcopy in the project file. Archived at project closeout.
Corrective Action Forms	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Photo ionization detector (PID)/Flame ionization detector (FID) readings	Recorded in Field Notebook. Stored in Data Warehouse
Water quality parameters collected during groundwater sampling	Recorded in Field Notebook. Stored in Data Warehouse
Various field measurements	Recorded in Field Notebook.
All field equipment calibration information	Recorded in Field Notebook.
Pertinent telephone conversations	Recorded in Field Notebook.
Field equipment maintenance records	Inspected by Field Team Leader. Not maintained.
Sample Receipt, Custody, and Tracking Records	Electronic .pdf copies in the project file. Hardcopy in the full data package.
Standard Traceability Logs	Hardcopy in the full data package. Archived at project closeout.
Equipment Calibration Logs	Hardcopy in the full data package. Archived at project closeout.
Sample Prep Logs	Hardcopy in the full data package. Archived at project closeout.
Run Logs	Hardcopy in the full data package. Archived at project closeout.
Equipment Maintenance, Testing, and Inspection Logs	Kept on file at the laboratory. Not maintained.
Reported Field Sample Results	Electronic .pdf copies in the project file. Hardcopy in the data package. Archived at project closeout.

SAP Worksheet #29—Project Documents and Records Table (continued)

Document	Where Maintained
Reported Results for Standards, QC Checks, and QC Samples	Hardcopy in the full data package. Archived at project closeout.
Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	Hardcopy in the full data package. Archived at project closeout.
Data Package Completeness Checklists	Hardcopy in the data validation report. Archived at project closeout.
Sample Disposal Records	Maintained by the laboratory.
Extraction/Clean-up Records	Maintained by the laboratory.
Raw Data	Hardcopy in the full data package. Archived at project closeout.
Field Sampling Audit Checklists	Hardcopy in the project file. Archived at project closeout.
Fixed Laboratory Audit Checklists	If completed, hardcopy in the project file. Archived at project closeout.
Data Validation Reports	Electronic .pdf copies in the project file. Hardcopy stored with the data package. Archived at project closeout.

In general, documents are stored at a CH2M HILL project office until they are archived.

CH2M HILL Project Office:

Michael Skeean/CH2M HILL
11301 Carmel Commons Blvd. Suite 304
Charlotte, NC 28226
(704) 543-3285

Archival Location:

Iron Mountain Records Management
4555 Progress Road
Norfolk, VA 23502

SAP Worksheet #30—Analytical Services Table

Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization ¹ (name and address, contact person, and telephone number)	Backup Laboratory / Organization (name and address, contact person, and telephone number)
STR1-SD13 / STR1-SD13-0-1-MMY ¹ STR1-SD13 / STR1-SD13D-0-1-MMY STR1-SD14 / STR1-SD14-0-1-MMY STR1-SD14 / STR1-SD14-0-1-MMY-MS STR1-SD14 / STR1-SD14-0-1-MMY-SD STR1-SD15 / STR1-SD15-0-1-MMY STR1-SD16 / STR1-SD16-0-1-MMY STR1-SD17 / STR1-SD17-0-1-MMY STR1-SD18 / STR1-SD18-0-1-MMY STR1-SD19 / STR1-SD19-0-1-MMY STR1-SD20 / STR1-SD20-0-1-MMY STR1-SD21 / STR1-SD21-0-1-MMY STR1-SD22 / STR1-SD22-0-1-MMY STR1-SD23 / STR1-SD23-0-1-MMY STR1-SD23 / STR1-SD23D-0-1-MMY	Select SVOCs by SW-846 8270_SIM	28 Calendar-day TAT	Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 Sonya Gordon 615-345-1115	TBD
	TOC by Lloyd Kahn			
	Grain Size by ASTM D422		Beaver Engineering, Inc. 7378 Cockrill Bend Blvd. Nashville, TN 37209 Pat Beaver (615) 350-8124	

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SAP Worksheet #31—Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Field Performance Audit	TBD in accordance with CLEAN program requirements	Int.	CH2M HILL	TBD FTL CH2M Hill	Mike Skeeane PM/CH2M HILL	Renee Clore Task Manager CH2M HILL	Bill Hannah Activity Quality Manager CH2M HILL
Offsite Laboratory Technical Systems Audit	Laboratories must have current Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) accreditation which will identify the period of performance.	Ext.	Laboratory Accreditation Bureau in accordance with Department of Defense ELAP	TBD Laboratory Accreditation Bureau	Marcia McGinnity Laboratory QA Officer Empirical Laboratories, LLC	Marcia McGinnity Laboratory QA Officer Empirical Laboratories, LLC	Anita Dodson Program Chemist CH2M HILL

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SAP Worksheet #32—Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response (Name, Title, Org.)	Time Frame for Response
Field Performance Audit	Checklist and Written Audit Report	Mike Skeeane PM/CH2M HILL	Within 1 week of audit	Memorandum	TBD Field Team Leader CH2M HILL Bill Hannah Activity Quality Manager CH2M HILL	Within 1 week of receipt of CA Form
Offsite Laboratory Technical Systems Audit	TBD by Laboratory Accreditation Bureau	Marcia McGinnity Laboratory QA Officer Empirical Laboratories, LLC	Within 2 months of audit	Memorandum	TBD by Laboratory Accreditation Bureau	Within 2 months of receipt of initial notification.

SAP Worksheet #32-1—Laboratory Corrective Action Form

Person initiating corrective action _____ Date _____

Description of problem and when identified: _____

Cause of problem, if known or suspected: _____

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

CA implemented by: _____ Date: _____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approved by: _____ Date: _____

Information copies to:

Anita Dodson/Navy CLEAN Program Chemist

SAP Worksheet #32-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ Date: _____

Project Location: _____ Signature: _____

Team Members:

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

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

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

Sample Collection

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

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

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

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

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

SAP Worksheet #32-2—Field Performance Audit Checklist (continued)

Yes ___ No ___ 6) Are quality assurance checks performed as specified in the 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 _____

SAP Worksheet #33—Quality Assurance Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Performance CA Memorandum	After field audit	1 week after audit, if necessary	CH2M HILL FTL	Will be posted in project file.
QA Management Report/Technical Memorandum	Once results have been assessed for data usability	To be submitted with Final SI Report	CH2M HILL	Will be posted in project file.

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SAP Worksheet #34—Verification (Step I) Process Table

Verification Input	Description	Internal / External ¹	Responsible for Verification (name, organization)
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	Internal	Field Team Leader (TBD)/CH2M HILL
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 chain-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Internal / External	Field Team Leader (TBD)/CH2M HILL Project EIS: Victoria Brynildsen/CH2M HILL
Sample Condition upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project EIS in the form of laboratory logins.	External	Project EIS: Victoria Brynildsen/CH2M HILL
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.	Internal	Project Chemist: Juan Acaron/CH2M HILL
Electronic Data Deliverables	Electronic Data Deliverables will be compared against hardcopy laboratory results (10% check).	Internal	Project EIS: Victoria Brynildsen/CH2M HILL
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process. This is verification that they were generated and applicable to the data packages.	Internal	Data Validator: Ward Dickens/CH2M HILL
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Internal	Laboratory QA Officer (Empirical)
Laboratory Data	The data will be verified for completeness by an EIS specialist.	External	Project EIS: Victoria Brynildsen/CH2M HILL
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If corrective actions are required, a copy of the documented corrective action 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 corrective action forms will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the site manager will be notified to ensure action is taken.	Internal	Project Manager: Mike Skeeane/CH2M HILL Project Chemist: Juan Acaron/CH2M HILL
Corrective Action Reports	Corrective action reports will be reviewed by the project chemist or project manager and placed into the project file for archival at project closeout.	External	Project Manager: Mike Skeeane/CH2M HILL Project Chemist: Juan Acaron/CH2M HILL

¹Internal / External is with respect to the data generator.

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

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Project Chemist: Juan Acaron/ CH2M HILL
IIa	Target Compound List and Target Analyte List	Ensure the laboratory reported all analytes from each analysis group as per Worksheet 15.	Project Chemist: Juan Acaron/ CH2M HILL
IIb	Reporting Limits	Ensure the laboratory met the project-designated quantitation limits as per Worksheet 15. If quantitation limits were not met, the reason will be determined and documented.	Project Chemist: Juan Acaron/ CH2M HILL
IIa	Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Data Validator: Ward Dickens/ CH2M HILL
IIa / IIb	Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the data validator during the data validation process.	Data Validator: Ward Dickens/ CH2M HILL
IIa	Raw Data	10 percent review of raw data to confirm laboratory calculations.	Data Validator: Ward Dickens/ CH2M HILL
IIb	Onsite Screening	All non-analytical field data will be reviewed against QAPP requirements for completeness and accuracy based on the field calibration records.	Field Team Leader (TBD)
IIa	Documentation of Method QC Results	Establish that all required QC samples were run and met limits.	Data Validator: Ward Dickens/ CH2M HILL
IIb	Documentation of field QC Sample Results	Establish that all required QAPP QC samples were run and met limits.	Project Chemist: Juan Acaron/ CH2M HILL Data Validator: Ward Dickens/ CH2M HILL

¹IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]

IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

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

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	SD	SVOC ¹	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria. QA/QC criteria for field QC samples are presented in Worksheet 12, target compound lists, LOQs, LODs, DLs, and limits for precision and accuracy are presented in Worksheet 15, QA/QC criteria for calibrations are presented in Worksheet 24, and QA/QC criteria for laboratory QC samples are presented in Worksheet 28. Data may be qualified if QA/QC exceedances have occurred. The data qualifiers that may be used are those presented in <i>National Functional Guidelines for Organic Data Review (USEPA, 1999)</i> . National Functional Guidelines will not be used for DV; however, the specific qualifiers and guidance listed therein may be applied to data should non conformances against the QA/QC criteria as presented in this SAP be identified.	Data Validator: Ward Dickens/CH2M HILL
		GRAIN SIZE or WCHEM ²	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria. QA/QC criteria for field QC samples are presented in Worksheet 12, target analyte lists, LOQs, LODs, DLs, and limits for precision and accuracy are presented in Worksheet 15, QA/QC criteria for calibrations are presented in Worksheet 24, and QA/QC criteria for laboratory QC samples are presented in Worksheet 28. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in <i>National Functional Guidelines for Inorganic Data Review (USEPA, 2004)</i> .	

¹100% of the VOC data generated will undergo analytical data validation.

²GRAIN SIZE and WCHEM data will not undergo data validation; it will still be subject to the verification and validation procedures described on Worksheets 34 and 35, respectively.

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SAP Worksheet #37—Usability Assessment

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

- The data will be evaluated to see if the project required LODs listed in Worksheet #15 were achieved for non-detected constituents. If LODs were elevated, the cause will be investigated and the impact on data will be discussed in the DQE.
- If verification and validation are outside acceptance limits, the data will be qualified by a data validator. The data may be qualified for minor QC deviations that do not affect the data usability (i.e., estimated flags such as J, J+, J-, UJ, and NJ), or the data may be rejected (R-flag) for major QC deviations affecting data usability. The use and implications of estimated data will be discussed in the project report. Rejected data will not be used. The impact of data qualified as rejected due to analytical deficiencies will be discussed with the project team and will be evaluated to determine the need for any CAs. Depending on the analytical deficiency and the intended use of the data, the project team may or may not agree the data are of sufficient quality to support project decisions. In such a case, the data and deficiencies will be presented to the Tier I Partnering Team who will make the final decision on usability of such data.
- For statistical comparisons, non-detect values will be represented by a concentration equal to one-half the sample-specific LOQ or reported result. This is done when the same constituent was detected in at least one other sample in the same matrix at the same site. Where duplicates are collected, the greater of the two concentrations will be used for risk evaluation and nature and extent determinations.
- Analytical data will be checked by the project EIS to ensure data are accurately transferred to the electronic project database and GIS.
- Laboratory and field precision, as computed from duplicate samples, will be compared to acceptance limits listed on Worksheets 12 and 28. These computations will be based on calculation of RPD based on the formula: $RPD = (\text{Difference of two results}) / (\text{average of two results}) * 100\%$.
- Deviations from the procedures outlined in this SAP will be reviewed to assess whether the deviations were significant enough to compromise the attainment of project objectives.

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

- The validated data will be reconciled with the method performance criteria to assess whether sufficient data of acceptable quality are available for decision making. A series of evaluations and statistical analyses will be performed to estimate the data characteristics. The statistical evaluations will include, for each target constituent or group: maximum concentration, minimum concentration, number of samples with non-detected results, number of samples with positive results, and the proportion of samples with detected and non-detected results.

SAP Worksheet #37—Usability Assessment (continued)

- If a significant deviation, defined as that exceeding the limits listed on Worksheets 12 and 28, occurs between lab and field precision (using the method described above), the cause will be investigated, described, and interpreted for the impact on decision making. The expectation is that laboratory precision values (RPDs) will be no greater than RPDs for field duplicates of the same matrix.
- If significant biases are detected (represented by low or high matrix spike, laboratory control sample, or surrogate recoveries), this will be noted and evaluated for impact on decision making. The tendency will be to emphasize low biases more than high biases unless biased results are near action levels. Low biases will be emphasized more because these are likely to represent an inability to detect compounds that are present at the site and, on a percentage basis, generally represent a greater proportion of the reported values.

Identify the personnel responsible for performing the usability assessment:

- The CH2M HILL Project Manager and other CH2M HILL team members will compile project data and if necessary make recommendations pertaining to the usability of the data to the Tier I Partnering Team. The data will be provided to the project team for discussion and review, and the project team as a whole will weigh in on the usability of the data.

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 will be presented in tabular format in the SI report. Data qualifications such as estimation (J, J+, J-, UJ, and NJ) or rejection (R) will be applied. Written documentation will be provided to support any non-compliance or rejected data results. The RI report will identify and describe the data usability limitations and suggest CAs.
- The precision and bias evaluations described above will be documented in the SI report. This will include a summary with supporting documentation. Significant deviations or deficiencies will be conveyed to the Navy Remedial Project Manager for consideration.

References

- CH2M HILL. 2008. *Final Site Inspection Work Plan for Former Skeet and Trap Range #1, Marine Corps Air Station Cherry Point, Havelock, North Carolina*. November.
- CH2M HILL. 2010. *Final Site Inspection Report for Former Skeet and Trap Range #1, Marine Corps Air Station Cherry Point, Havelock, North Carolina*. October.
- Department of the Navy (Navy). 2008. *Navy Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP) Template*.
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- United States Army Corps of Engineers (USACE). 2001. *Final Range Identification and Preliminary Range Assessment, Marine Corps Air Station Cherry Point, Havelock, North Carolina*. December 2001.
- USEPA. 1999. *National Functional Guidelines for Organic Data Review*.
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- USEPA. 2005. *Uniform Federal Policy for Quality Assurance Project Plans*. March.
- USEPA. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*.
- USEPA. 2009. *Regional Screening Levels for Chemicals at Superfund Sites*. May.
- Winner, Jr., M. D. and R. W. Coble (Winner and Coble). 1996. *Hydrogeologic Framework of the North Carolina Coastal Plain*, USGS Professional Paper 1404-I. 1996.

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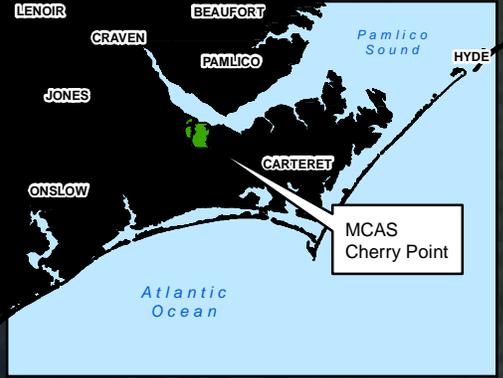
Figures



Former Skeet and Trap Range #1

Stocum Creek

Neuse River



MCAS
Cherry Point

Legend

-  Former Skeet and Trap Range #1
-  Theoretical Skeet Shotfall Zone
-  Area of Maximum Skeet Shotfall
-  Buildings
-  Runway
-  Base Boundary

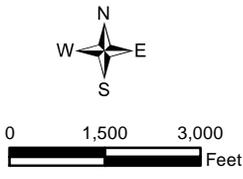


Figure 1
Site Location Map
Former Skeet and Trap Range #1
MCAS Cherry Point
North Carolina



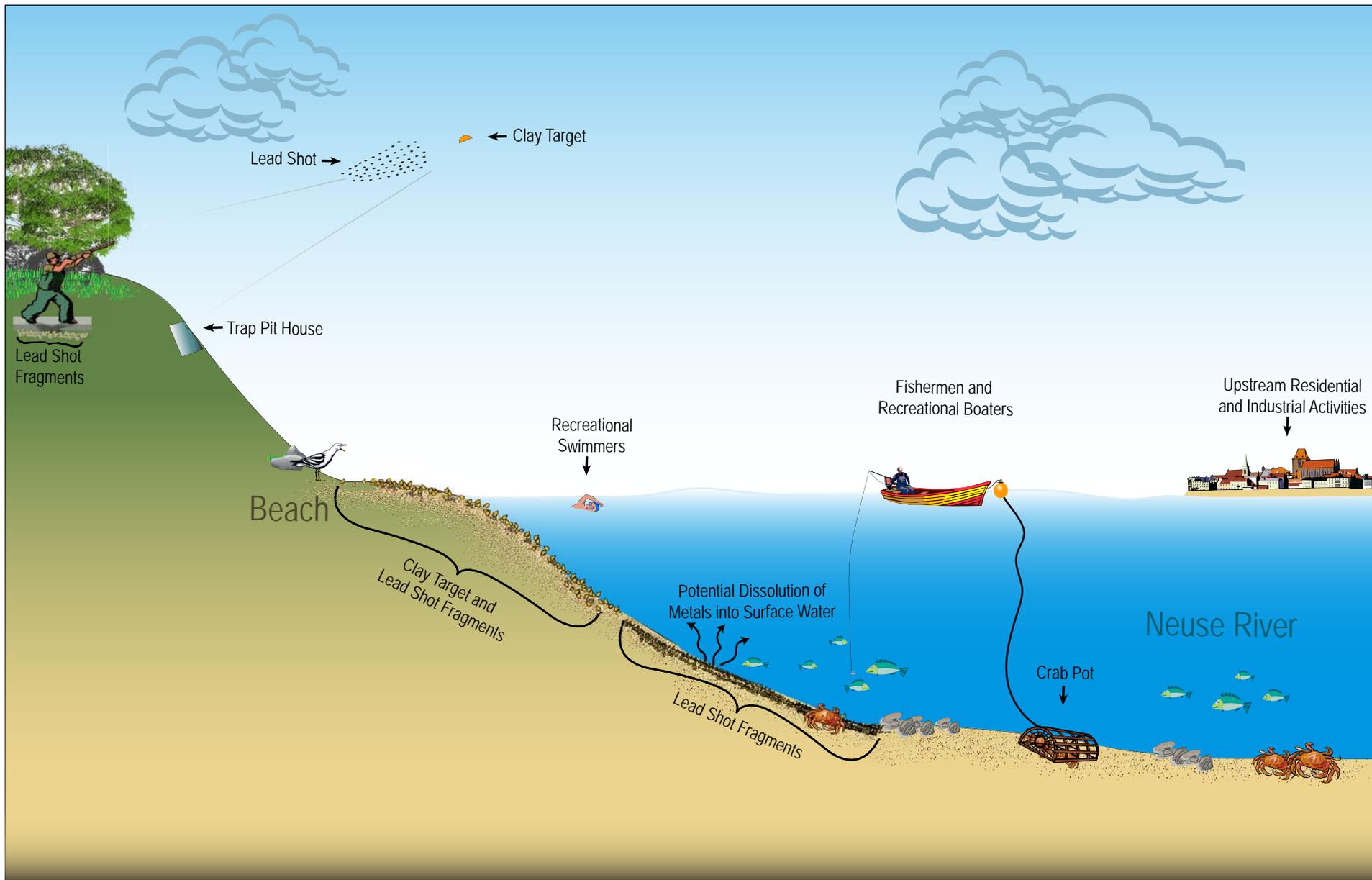
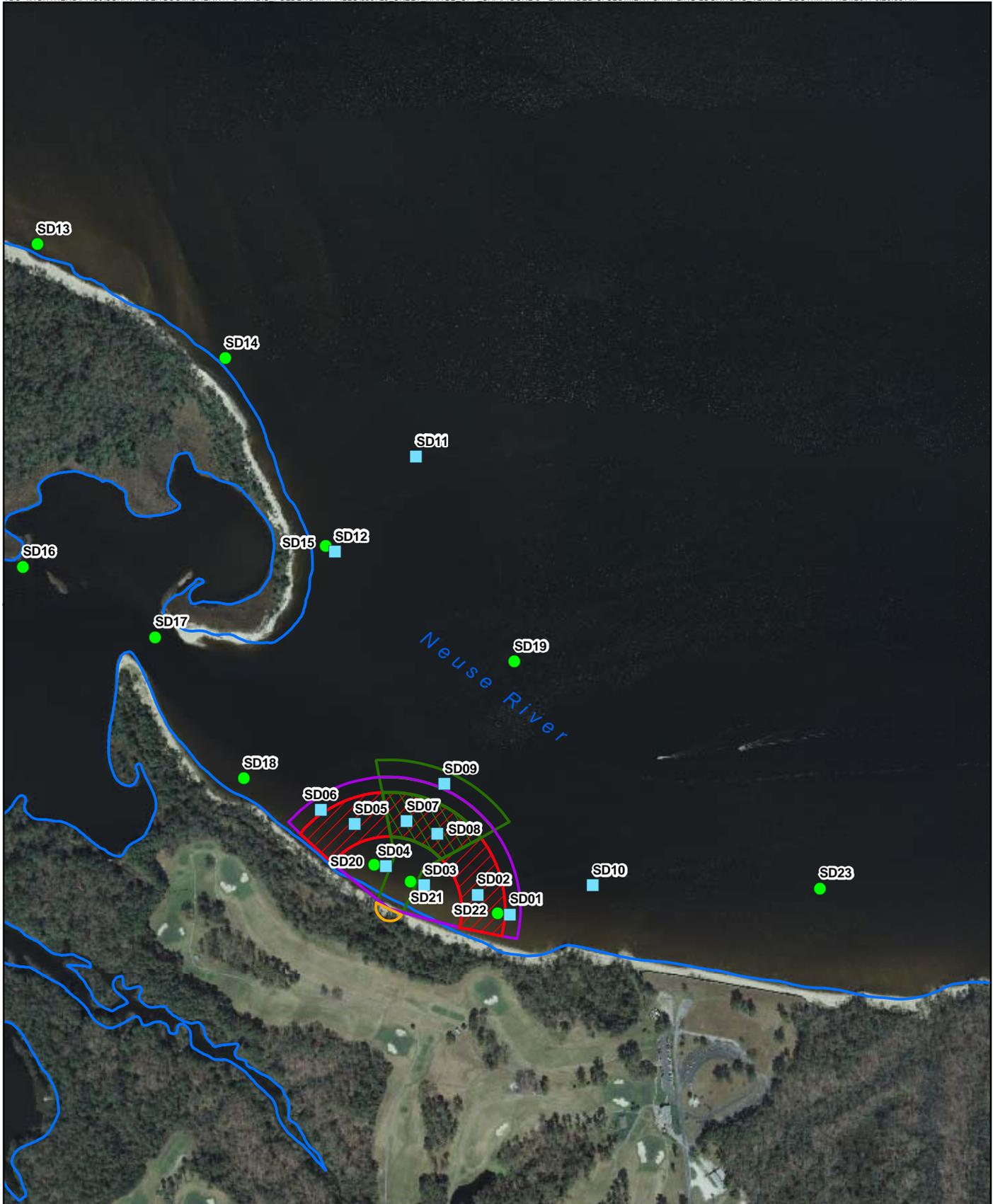


Figure 2
 Conceptual Site Model
 Former Skeet & Trap Range #1
 MCAS Cherry Point
 North Carolina



Legend

- May 2009 SI Sediment Sampling Location
- Proposed Expanded SI Sediment Sampling Location
- Theoretical Trap Shotfall Zone
- Theoretical Skeet Shotfall Zone
- Installation Boundary
- Area of Maximum Skeet Shotfall
- Former Skeet and Trap Range #1

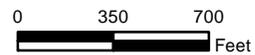


Figure 3

Expanded SI Sediment Sampling Locations
Former Skeet and Trap Range #1
MCAS Cherry Point
North Carolina



Appendix A
Field Standard Operating Procedures

Equipment Blank and Field Blank Preparation

I. Purpose

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

II. Scope

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

III. Equipment and Materials

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

IV. Procedures and Guidelines

- A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment*.
- B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook as well as the type and lot number of the water used.

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

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

- C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.
- D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.
- E. Document and ship samples in accordance with the procedures for other samples.
- F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

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

Chain-of-Custody

I Purpose

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

II Scope

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

III Definitions

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

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

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

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

IV Responsibilities

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

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

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

V Procedures

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

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

V.1 Sample Identification

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

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

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

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

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

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

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

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

V.2 Chain-of-Custody Procedures

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

V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.
- A Chain-of-Custody Record will be prepared for each individual cooler shipped and will include *only* the samples contained within that particular cooler. The Chain-of-Custody Record for that cooler will then be sealed in a zip-log bag and placed in the cooler prior to sealing. This ensures that the laboratory properly attributes trip blanks with the correct cooler and allows for easier tracking should a cooler become lost during transit.
- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample/location number should be included.
- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

V.2.2 Transfer of Custody and Shipment

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

- Enter header information (CTO number, samplers, and project name).
- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).
- Sign, date, and enter the time under “Relinquished by” entry.

- Have the person receiving the sample sign the “Received by” entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).
- If a carrier is used, enter the airbill number under “Remarks,” in the bottom right corner;
- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.
- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.
- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.
- Complete other carrier-required shipping papers.

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

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

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

VI Quality Assurance Records

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

VII Attachments

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

VIII References

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

Attachment A
Example Sample Label



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

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

**CEIMIC
CORPORATION**

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

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

SAMPLE TYPE

Grab Composite Other _____

COLLECTED BY: _____

Attachment B
Example Chain-of-Custody Record

CH2M Hill Project # □□□□□□□□□□□□□□□□		Purchase Order #		# O F C O N T A I N E R S	LAB TEST CODES										SHADED AREA- FOR LAB USE ONLY		
Project Name															Lab 1 #		Lab 2 #
Company Name CH2M HILL Office															Quote #		Kit Request #
Project Manager & Phone # Mr. [] Ms. [] Dr. []		Report Copy to:			ANALYSES REQUESTED										Project #		
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input type="checkbox"/> RCRA <input type="checkbox"/> OTHER _____			Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		No. of Samples		Page	of		Login			LIMS Ver		
Sampling Date Time		Type C O M P G R A B	Matrix W A T E R S O I L A I R		CLIENT SAMPLE ID (9 CHARACTERS)					REMARKS					LAB 1 ID	LAB 2 ID	
Sampled By & Title (Please sign and print name)					Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____				
Received By (Please sign and print name)					Date/Time		Relinquished By (Please sign and print name)				Date/Time		COC Rec	ICE			
Received By (Please sign and print name)					Date/Time		Relinquished By (Please sign and print name)				Date/Time		Ana Req	TEMP			
Received By (Please sign and print name)					Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other _____				Shipping #						
Work Authorized By (Please sign and print name)				Remarks													

Attachment C
Example Custody Seal



CUSTODY SEAL

Date

Signature

Decontamination of Personnel and Equipment

I. Purpose

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

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

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

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

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

1. Wash boots in Liquinox[®] solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox[®] solution, remove, and discard into DOT-approved 55-gallon drum.
2. Wash outer gloves in Liquinox[®] solution, rinse, remove, and discard into DOT-approved 55-gallon drum.
3. Remove disposable coveralls (“Tyveks”) and discard into DOT-approved 55-gallon drum.
4. Remove respirator (if worn).
5. Remove inner gloves and discard.
6. At the end of the work day, shower entire body, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION – GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Spread plastic on the ground to keep equipment from touching the ground
3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.
4. Turn pump back on and pump 1 gallon of Liquinox[®] solution through the sampling pump.
5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).
6. Rinse with 1 gallon of tap water.
7. Rinse with 1 gallon of deionized water.
8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.
9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in either DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

C. SAMPLING EQUIPMENT DECONTAMINATION – OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

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

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

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

E. SAMPLE CONTAINER DECONTAMINATION

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

1. Wipe container with a paper towel dampened with Liquinox[®] solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.
2. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

F. HEAVY EQUIPMENT AND TOOLS

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

1. Set up a decontamination pad in area designated by the Facility
2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

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

Disposal of Waste Fluids and Solids

I. Purpose and Scope

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

II. Equipment and Materials

A. Fluids

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

B. Solids

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

III. Procedures and Guidelines

A. Methodology

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

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

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

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

B. Labels

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

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

C. Fluids

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

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

D. Solids

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

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

E. Storage and Disposal

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

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

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

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

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

Sampling Contents of Tanks and Drums

I. Scope and Application

This procedure provides an overview approach and guidelines for the routine sampling of drums and tanks. Its purpose is to describe standard procedures and precautions which are applied in sampling drums and tanks. Procedures for opening drums with the individual instruments are included in Attachment D.

The samples obtained may be used to obtain physical chemical or radiological data. The resulting data may be qualitative or quantitative in nature, and are appropriate for use in preliminary surveys as well as confirmatory sampling.

II. References

- A. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, U.S. Environmental Protection Agency, Washington, D.C., 1987.
- B. *Data Quality Objectives for Remedial Activities - Development Process*, EPA/540/G-87/003, U.S. Environmental Protection Agency, Washington, D.C., 1987.
- C. *Annual Book of ASTM Standards, Standard Recommended Practices for Sampling Industrial Chemicals*, ASTM-E-300, 1986.
- D. *Test Method for Evaluating Solid Waste, SW-846, Volume II, Field Methods*, Second Edition, U.S. Environmental Protection Agency, Washington, D.C., 1982.
- E. U.S. Environmental Protection Agency, *Characterization of Hazardous Waste Sites – A Method Manual: Volume II, Available Sampling Methods*, USEPA Environmental Monitoring Systems Laboratory, Las Vegas, EPA-600/4-84-076, December, 1984.
- F. *Environmental Surveillance Procedures, Quality Control Program*, Martin Marietta Energy Systems, ESH/Sub/87-21706/1, Oak Ridge, TN, September 1988.

III. Summary of Methods

Drums are generally sampled by means of sampling tubes such as glass sample tubes or COLIWASA samplers. In either case, the sampling tube is manually inserted into the waste material. A sample of the drum contents is withdrawn by the sampling device. Should a drum contain bottom sludge, a glass tube will be used to retrieve a sample of this as well.

Storage tank and tank trailers, because of their greater depths, require sampling devices that can be lowered from the top, filled at a particular depth, then withdrawn. Such devices are a COLIWASA, a Kemmerer depth sampler, or a Bacon Bomb. Where samples of bottom sludge are desired, a gravity corer can be utilized. This heavy tube with a tapered nose piece will penetrate the sludge as it free falls through the tank.

IV. Comments

The sampling of tanks, containers, and drums present unique problems not associated with environmental samples. Containers of this sort are generally closed except for small access ports, manways, or hatches on the larger vessels, or taps and bungs on smaller drums. The physical size, shape, construction material, and location of access limit the types of equipment and methods of collection that can be used.

When liquids are contained in sealed vessels, gas vapor pressure can build up, sludges can settle out, and density layerings (stratification) can develop. Bulging drums may be under pressure and extreme caution should be exercised. The potential exists for explosive reactions or the release of noxious gases when containers are opened. All vessels should be opened with extreme caution. Check the HSP for the level of personnel protection to be worn. A preliminary sampling of any headspace gases is warranted. As a minimum, a preliminary check with an explosimeter and an organic vapor analyzer may be of aid in selecting a sampling method.

In most cases it is impossible to observe the contents of these sealed or partially sealed vessels. Since some layering or stratification is likely in any solution left undisturbed over time, a sample must be taken that represents the entire depth of the vessel.

V. Required Equipment and Apparatus

- A. **Health and safety equipment/materials:** As listed in the site safety plan.
- B. **Sampling equipment:** COLIWASA, glass sample tubes, Kemmerer depth sampler, Bacon Bomb, gravity corer.
- C. **Tools:** Rubber mallet, bung wrench, speed wrench with socket, etc., (all non-sparking), paint marker.
- D. **Heavy equipment:** Backhoe equipped with explosion shield, drum grapppler, and 3-foot copper-beryllium (non-sparking) spike with 6-inch collar (to puncture top of drums for sampling, if necessary).
- E. **Sample Containers:** As specified in the field sampling plan.

VI. Procedures

A. Drums

NOTE: DO NOT open more than one drum at a time. Each drum must be handled and sampled as a separate entity to reduce vapors in the sampling area.

1. Drums will be sampled on an area-by-area basis. Drums will be sampled after they have been placed in overpack drums but before they are transferred from the excavation to the onsite storage area.
2. Record, in logbook, all pertinent information from visual inspection of drum (e.g., physical condition, leaks, bulges, and labels). Label each drum with a unique identifying number.
3. If possible, stage drums for easy access.
4. If necessary, attach ground strap to drums and grounding point.
5. Remove any standing material (water, etc.) from container top.
6. Using non-sparking tools, carefully remove the bung or lid while monitoring air quality with appropriate instruments. If necessary (and as a last resort), the non-sparking spike affixed to the backhoe can also be used to puncture the drum for sampling. See Attachment D for method of drum opening. Record air-quality monitoring results.
7. When sampling a previously sealed vessel, a check should be made for the presence of bottom sludge. This is accomplished by measuring the depth to apparent bottom, then comparing it to the known interior depth.
8. Agitation to disrupt the layers and rehomogenize the sample is physically difficult and almost always undesirable. If the vessel is greater than 3 feet in depth (say, a 55-gallon drum), the appropriate sampling method is to slowly lower the sampling device (i.e., suction line of peristaltic pump, glass tube) in known increments of length. Discrete samples can be collected from various depths, then combined or analyzed separately. If the depth of the vessel is greater than the lift capacity of the pump, an at-depth water sampler, such as the Kemmerer or Bacon Bomb type, may be required.
9. Extract a representative sample from the drum using a glass rod, COLIWASA, Bacon Bomb, Kemmerer bottle, or gravity corer (See Attachments). Ensure that the entire depth of material is penetrated. Depending on the size of the opening of the drum, three to four takes should be collected from random locations across the drum surface, to ensure a representative sample. Any observed stratification must be recorded in logbook, including number and thickness of the layers and a conceptualized sketch.

10. Record a visual description of the sample (e.g., liquid, solid, color, viscosity, and percent layers).
11. When possible, sampling equipment (like glass tubes) should be expendable and be left inside the drum for disposal with drum contents, once sampling is completed.
12. Place lid, bung, cap, etc., back in place on drum. Tighten hand tight. If necessary, the sampling port can be sealed using a cork.
13. Wipe up spilled material with lab wipes. Wipe off sample containers.
14. Mark the drum with a unique sample identification number and date using a paint marker.
15. Samples will be handled as high hazard samples. Samples will be placed in containers defined according to the analytical needs, wiped clean, and then packed in paint cans for shipping. Packaging, labeling, and preparation for shipment procedures will follow procedures as specified in the field sampling plan.

B. Underground Storage Tanks

1. A sampling team of at least two people is required for sampling – one will collect samples, the other will relay required equipment and implements.
2. Sampling team will locate a sampling port on the tank. Personnel should be wearing appropriate protective clothing at this time and carrying sampling gear.
3. Do not attempt to climb down into tank. Sampling **MUST BE** accomplished from the top.
4. Collect a sample from the upper, middle, and lower section of the tank contents with one of the recommended sampling devices.
5. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.
6. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

C. Tank Trailers or Above-Ground Storage Tanks

1. A sampling team of two is required. One will collect samples, the other will relay required equipment and implements.
2. Samples will be collected through the manhole (hatch) on top of the tanker or the fill port. Do not open valves at the bottom. Before opening the hatch, check for a pressure gauge or release valve. Open the release valve slowly to bring the tank to atmospheric pressure.

3. If tank pressure is too great, or venting releases large amounts of toxic gas, discontinue venting and sampling immediately. Measure vented gas with organic vapor analyzer and explosimeter.
4. If no release valve exists, slowly loosen hatch cover bolts to relieve pressure in the tank. (Again, stop if pressure is too great.)
5. Once pressure in tank has been relieved, open the hatch and withdraw sample using one of the recommended sampling devices.
6. Sample each trailer compartment.
7. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.
8. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

D. Refer to Attachment B for procedures for sampling with appropriate devices as follows:

Drum

Glass tube	–	Procedure 1
COLIWASA	–	Procedure 2

Storage Tank and Tank Trailer

COLIWASA	–	Procedure 2
Bacon Bomb	–	Procedure 3
Gravity Corer (for bottom sludge)	–	Procedure 4

VII. Contamination Control

Sampling tools, instruments, and equipment will be protected from sources of contamination prior to use and decontaminated after use as specified in SOP *Decontamination of Personnel and Equipment*. Liquids and materials from decontamination operations will be handled in accordance with the waste management plan. Sample containers will be protected from sources of contamination. Sampling personnel shall wear chemical resistant gloves when handling any samples. Gloves will be decontaminated or disposed of between samples.

VIII. Attachments

- A. Collection of Liquid-Containerized Wastes Using Glass Tubes
- B. Sampling Containerized Wastes Using the Composite Liquid Waste Sample (COLIWASA)
- C. Sampling Containerized Wastes Using the Bacon Bomb Sampler
- D. Gravity Corer for sampling Sludges in Large Containers
- E. Construction of a Typical COLIWASA
- F. Drum Opening Techniques and Equipment

IX. Field Checklist

- | | |
|--------------------------------------|--|
| _____ Sampling Instruments | _____ Labels |
| _____ Tools | _____ Sampling and Analysis Plan |
| _____ Rubber Mallet | _____ Health and Safety Plan |
| _____ Logbook | _____ Decontamination Equipment |
| _____ Safety Glasses or Monogoggles | _____ Lab Wipes |
| _____ Safety Shoes | _____ Lab Spatulas or Stainless Steel Spoons |
| _____ Ice/Cooler, as required | _____ Chemical Preservatives, as required |
| _____ Custody Seals, as required | _____ Appropriate Containers for Waste and Equipment |
| _____ Chain-of-Custody Forms | _____ Duct Tape |
| _____ Drum Labels, as required | _____ Plastic Sheeting |
| _____ Paint Marker, if drum sampling | |
| _____ Black Indelible Pen | |
| _____ Monitoring Instruments | |

Attachment A Collection of Liquid-Containerized Wastes Using Glass Tubes

Discussion

Liquid samples from opened containers (i.e., 55-gallon drums) are collected using lengths of glass tubing. The glass tubes are normally 122 centimeters long and 6 to 16 millimeters inside diameter. Larger diameter tubes may be used for more viscous fluids if sampling with the small diameter tube is not adequate. The tubing is broken and discarded in the container after the sample has been collected, eliminating difficult cleanup and disposal problems. This method should not be attempted with less than a two-person sampling team.

Uses

This method provides for a quick, relatively inexpensive means of collecting concentrated containerized wastes. The major disadvantage is from potential sample loss that is especially prevalent when sampling low-viscosity fluids. Splashing can also be a problem and proper protective clothing should always be worn.

Note: A flexible tube with an aspirator attached is an alternative method to the glass tube, and allows various levels to be sampled discretely.

Procedures for Use

1. Remove cover from sample container.
2. Insert glass tubing almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 centimeters extend above the top of the container.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Cap the top of the tube with a safety-gloved thumb or a stopper.
5. Carefully remove the capped tube from the drum. If the tube has passed through more than one layer, the boundary should be apparent in the glass tube.
6. Insert the bottom, uncapped end into the sample container.
7. Partially release the thumb or stopper on the top of the tube and allow the sample to slowly flow into the sample container. If separation of phases is desired, cap off tube before the bottom phase has completely emptied. It may be advisable to have an extra container for "waste," so that the fluid on either side of the phase boundary can be directed into a separate container, allowing collection of pure phase liquids in the sample containers. The liquid remaining after the boundary fluid is removed is collected in yet a third container. NOTE: It is not necessary to put phases in separate containers if analysis of separate phases is not desired.
8. Repeat steps 2 through 6 if more volume is needed to fill the sample container.

9. Remove the tube from the sample container and replace the tube in the drum, breaking it, if necessary, in order to dispose of it in the drum.

Optional Method (if sample of bottom sludge is desired)

1. Remove the cover from the container opening.
2. Insert glass tubing slowly almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 cm extends above the top of the container.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Gently push the tube towards the bottom of the drum into the sludge layer. Do not force it.
5. Cap the top of the tube with a safety-gloved thumb or stopper.
6. Carefully remove the capped tube from the drum and insert the uncapped end into the sample container.
7. Release the thumb or stopper on the top of the tube and allow the sample container to fill to approximately 90 percent of its capacity. If necessary, the sludge plug in the bottom of the tube can be dislodged with the aid of the stainless steel laboratory spatula.
8. Repeat if more volume is needed to fill sample container and recap the tube.

Note:

1. If a reaction is observed when the glass tube is inserted (violent agitation, smoke, light, etc.), the investigators should leave the area immediately.
2. If the glass tube becomes cloudy or smoky after insertion into the drum, the presence of hydrofluoric acid maybe indicated, and a comparable length of rigid plastic tubing should be used to collect the sample.
3. When a solid is encountered in a drum (either layer or bottom sludge) the optional method described above may be used to collect a core of the material, or the material may be collected with a disposable scoop attached to a length of wooden or plastic rod.

Attachment B: Sampling Containerized Wastes using the Composite Liquid Waste Sampler (COLIWASA)

Discussion

The COLIWASA is a much-cited sampler designed to permit representative sampling of multiphase wastes from drums and other containerized wastes. The sampler is commercially available or can be easily fabricated from a variety of materials, including PVC, glass, or Teflon. In its usual configuration it consists of a 152 cm by 4 cm (inside diameter) section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. See Attachment E: Construction of a COLIWASA.

Uses

The COLIWASA is primarily used to sample containerized liquids. The PVC COLIWASA is reported to be able to sample most containerized liquid wastes except for those containing ketones, nitrobenzene, dimethylformamide, mesityloxide, and tetrahydrofuran. A glass COLIWASA is able to handle all wastes unable to be sampled with the plastic unit except strong alkali and hydrofluoric acid solutions. Due to the unknown nature of many containerized wastes, it would therefore be advisable to eliminate the use of PVC materials and use samplers composed of glass or Teflon.

The major drawback associated with using a COLIWASA is concern for decontamination and costs. The sampler is difficult, if not impossible, to decontaminate in the field, and its high cost in relation to alternative procedures (glass tubes) makes it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

Procedures for Use

1. Check to make sure the sampler is functioning properly. Adjust the locking mechanism, if present, to make sure the neoprene rubber stopper provides a tight closure.
2. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.
3. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.
4. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

5. Slowly withdraw the sampler from the waste container with one hand while wiping the sampler tube with a laboratory wipe with the other hand. A phase boundary, if present, can be observed through the tube.
6. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
7. Unscrew the T-handle of the sampler and disengage the locking block.

Attachment C: Sampling Containerized Wastes using the Bacon Bomb Sampler

Discussion

The Bacon Bomb is designed for the withdrawal of samples from various levels within a storage tank. It consists of a cylindrical body with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger is used to open and close the valve. A removable cover provides a point of attachment for the sample line and has a locking mechanism to keep the plunger closed after sampling. The Bacon Bomb is usually constructed of chrome-plated brass and bronze with a rubber O-ring acting as the plunger-sealing surface. Stainless steel versions are also available. The volumetric capacity is 8, 16, or 32 oz (237, 473, or 946 ml).

Uses

The Bacon Bomb is a heavy sampler suited best for viscous materials held in large storage tanks or in lagoons. If a more non-reactive sampler is needed, the stainless steel version would be used, or any of the samplers could be coated with Teflon.

Procedures for Use

1. Attach the sample line and the plunger line to the sampler.
2. Measure and then mark the sampling line at the desired depth.
3. Gradually lower the sampler by the sample line until the desired level is reached.
4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill for a sufficient length of time before releasing the plunger line to seal off the sampler.
5. Retrieve the sampler by the sample line, being careful not to pull up on the plunger line, thereby accidentally opening the bottom valve.
6. Wipe off the exterior of the sampler body.
7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.

Attachment D: Gravity Corer for Sampling Sludges in Large Containers

Discussion

A gravity corer is a metal tube with a replaceable tapered nosepiece on the bottom and a ball or other type of check valve on the top. The check valve allows water to pass through the corer on descent but prevents a washout during recovery. The tapered nosepiece facilitates cutting and reduces core disturbance during penetration. Most corers are constructed of brass or steel and many can accept plastic liners and additional weights.

Uses

Corers are capable of collecting samples of most sludges and sediments. They collect essentially undisturbed samples that represent the strata profile that may develop in sediments and sludges during variations in the deposition process. Depending on the density of the substrate and the weight of the corer, penetration to depths of 75 cm (30 in.) can be attained. Exercise care when using gravity corers in vessels or lagoons that have liners because penetration depths could exceed those of the substrate; this could result in damage to the liner material.

Procedures for Use

1. Attach a precleaned corer to the required length of sample line. Solid braided 5-mm (3/16-in.) nylon line is sufficient; however, 20-mm (3/4-in.) nylon is easier to grasp during hand hoisting. An additional weight can be attached to the outside of the corer if necessary.
2. Secure the free end of the line to a fixed support to prevent accidental loss of the corer.
3. Allow corer to free fall through the liquid to the bottom.
4. Retrieve corer with a smooth, continuous, up-lifting motion. Do not bump corer because this may result in some sample loss.
5. Remove nosepiece from corer and slide sample out of corer into stainless steel or Teflon pan (preferred).
6. Transfer sample into appropriate sample bottle with a stainless steel lab spoon or laboratory spatula.

Attachment E: Construction of a Typical COLIWASA

The sampling tube consists of a 1.52-m (5-ft) by 4.13-cm (1-5/8 in) I.D. translucent plastic pipe, usually polyvinyl chloride (PVC) or borosilicate glass plumbing tube. The closure-locking mechanism consists of a short-length, channeled aluminum bar attached to the sampler's stopper rod by an adjustable swivel. The aluminum bar serves both as a T-handle and lock for the samplers' closure system. When the sampler is in the open position, the handle is placed in the T-position and pushed down against the locking block. This manipulation pushes out the neoprene stopper and opens at the sampling tube. In the closed position, the handle is rotated until one leg of the T is squarely perpendicular against the locking block. This tightly seats the neoprene stopper against the bottom opening of the sampling tube and positively locks the sampler in the closed position. The closure tension can be adjusted by shortening or lengthening the stopper rod by screwing it in or out of the T-handle swivel. The closure system of the sampler consists of a sharply tapered neoprene stopper attached to a 0.95-cm (3/8-in) O.D. rod, usually PVC. The upper end of the stopper rod is connected to the swivel of the aluminum T-handle. The sharply tapered neoprene stopper can be fabricated according to specifications by plastic-products manufacturers at an extremely high price, or it can be made in-house by grinding down the inexpensive stopper with a shop grinder.

COLIWASA samplers are typically made out of plastic or glass. The plastic type consists of translucent plastic (usually PVC) sampling tube. The glass COLIWASA uses borosilicate glass plumbing pipe as the sampling tube and a Teflon plastic stopper rod. For purpose of multiphase sampling, clear plastic or glass is desirable in order to observe the profile of the multiphase liquid.

The sampler is assembled as follows:

- a. Attach the swivel to the T-handle with the 3.18-cm (1-1/4 in) long bolt and secure with the 0.48-cm (3/16-in) National Coarse (NC) washer and lock nut.
- b. Attach the PFTE stopper to one end of the stopper rod and secure with the 0.95-cm (3/8-in) washer and lock nut.
- c. Install the stopper and stopper rod assembly in the sampling tube.
- d. Secure the locking block sleeve on the block with glue or screw. This block can also be fashioned by shaping a solid plastic rod on a lathe to the required dimension.
- e. Position the locking block on top of the sampling tube such that the sleeveless portion of the block fits inside the tube, the sleeve sits against the top end of the tube, and the upper end of the stopper rod slips through the center hole of the block.
- f. Attach the upper end of the stopper rod to the swivel of the T-handle.
- g. Place the sampler in the close position and adjust the tension on the stopper by screwing the T-handle in or out.

Attachment F: Drum Opening Techniques and Equipment ¹

I. Introduction

The opening of closed drums prior to sampling entails considerable risk if not done with the proper techniques, tools, and safety equipment. The potential for vapor exposure, skin exposure due to splash or spraying, or even explosion resulting from sparks produced by friction of the tools against the drum, necessitate caution when opening any closed container. Both manual drum opening and remote drum opening will be discussed in the following paragraphs. When drums are opened manually risks are greater than when opened remotely; for this reason, the remote opening of drums is advised whenever possible.

Prior to sampling, the drums should be staged to allow easy access. Also, any standing water or other material should be removed from the container top so that the representative nature of the sample is not compromised when the container is opened. There is also the possibility of encountering a water-reactive substance.

II. Manual Drum Opening

A. Bung Wrench

A common method for opening drums manually is using a universal bung wrench. These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of cast iron, brass, or a bronze-beryllium (a non-sparking alloy formulated to reduce the likelihood of sparks). The use of bung wrenches marked "NON SPARKING" is encouraged. However, the use of a "NON SPARKING" wrench does not completely eliminate the possibility of spark being produced. Such a wrench only prevents a spark caused by wrench-to-bung friction, but it cannot prevent sparking between the threads on the drum and the bung.

A simple tool to use, the fitting on the bung wrench matching the bung to be removed is inserted into the bung and the tool is turned counterclockwise to remove the bung. Since the contents of some drums may be under pressure (especially, when the ambient temperature is high), the bung should be turned very slowly. If any hissing is heard, the person opening the drum should back off and wait for the hissing to stop. Since drums under pressure can spray out liquids when opened, the wearing of appropriate eye and skin protection in addition to respiratory protection is critical.

B. Drum Deheader

One means by which a drum can be opened manually when a bung is not removable with a bung wrench is by using a drum deheader. This tool is

¹ Taken from EPA Training Course: "Sampling for Hazardous Materials," U.S. Environmental Protection Agency, Office of Emergency and Remedial Response Support Division, March 24, 1987.

constructed of forged steel with an alloy steel blade and is designed to cut the lid of a drum off or part way off by means of a scissors-like cutting action. A limitation of this device is that it can be attached only to closed head drums (i.e., DOT Specification 17E and 17F drums); drums with removable heads must be opened by other means.

Drums are opened with a drum deheader by first positioning the cutting edge just inside the top chime and then tightening the adjustment screw so that the deheader is held against the side of the drum. Moving the handle of the deheader up and down while sliding the deheader along the chime will enable the entire top to be rapidly cut off if so desired. If the top chime of a drum has been damaged or badly dented it may not be possible to cut the entire top off. Since there is always the possibility that a drum may be under pressure, the initial cut should be made very slowly to allow for the gradual release of any built-up pressure. A safer technique would be to employ a remote pressure release method prior to using the deheader.

C. Hand Pick or Spike

When a drum must be opened and neither a bung wrench nor a drum deheader is suitable, then it can be opened for sampling by using a hand pick, pickaxe, or spike. These tools are usually constructed of brass or a non-sparking alloy with a sharpened point that can penetrate the drum lid or head when the tool is swung. The hand picks or pickaxes that are most commonly used are commercially available, whereas the spikes are generally uniquely fabricated 4-foot long poles with a pointed end. Often the drum lid or head must be hit with a great deal of force in order to penetrate it. Because of this, the potential for splash or spraying is greater than with other opening methods and therefore this method of drum opening is not recommended, particularly when opening drums containing liquids. Some spikes used for drum opening have been modified by the addition of a circular splash plate near the penetrating end. This plate acts as a shield and reduces the amount of splash in the direction of the person using the spike. Even with this shield, good splash gear is essential.

Since drums, some of which may be under pressure, cannot be opened slowly with these tools, "sprayers" may result and appropriate safety measures must be taken. The pick or spike should be decontaminated after each drum is opened to avoid cross contamination and/or adverse chemical reaction from incompatible materials.

III. Remote Opening

A. Backhoe Spike

The most common means used to open drums remotely for sampling is the use of a metal spike attached or welded to a backhoe bucket. In addition to being very efficient, this method can greatly reduce the likelihood of personnel exposure.

Drums should be "staged," or placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums can be quickly opened by punching a hole in the drum head or lid with the spike.

The spike should be decontaminated after each drum is opened to prevent cross contamination. Even though some splash or spray may occur when this method is used, the operator of the backhoe can be protected by mounting a large shatter-resistant shield in front of the operator's cage. This, combined with the normal sampling safety gear, should be sufficient to protect the operator. Additional respiratory protection can be afforded by providing the operator with an on-board airline system. The hole in the drum can be sealed with a cork.

B. Hydraulic Devices

Recently, remotely operated hydraulic devices have been fabricated to open drums remotely. One such device is discussed here. This device uses hydraulic pressure to pierce through the wall of a drum. It consists of a manually operated pump that pressurizes oil through a length of hydraulic line. A piercing device with a metal point is attached to the end of this line and is pushed into the drum by the hydraulic pressure. The piercing device can be attached so that a hole for sampling can be made in either the side or the head/lid of the drum. Some of the metal piercers are hollow or tube-like so that they can be left in place, if desired, and serve as a permanent tap or sampling port. The piercer is designed to establish a tight seal after penetrating the container.

C. Pneumatic Devices

Pneumatically-operated devices utilizing compressed air have been designed to remove drum bungs remotely. A pneumatic bung remover consists of a compressed air supply (usually SCBA cylinders) that is controlled by a heavy-duty, 2-stage regulator. A high pressure air line of desired length delivers compressed air to a pneumatic drill that is adapted to turn a bung fitting (preferably, a bronze-beryllium alloy) selected to fit the bung to be removed. An adjustable bracketing system has been designed to position and align the pneumatic drill over the bung. This bracketing system must be attached to the drum before the drill can be operated. Once the bung has been loosened, the bracketing system must be removed before the drum can be sampled. This attachment and removal procedure is time-consuming and is the major drawback of this device. This remote bung opener does not permit the slow venting of the container, and therefore appropriate precautions must be taken. It also requires the container to be upright and relatively level. Bungs that are rusted shut cannot be removed with this device.

IV. Summary

The opening of closed containers is one of the most hazardous site activities. Maximum efforts would be made to ensure the safety of the sampling team. Proper protective equipment and a general wariness of the possible dangers will minimize the risk inherent to sampling operations. Employing proper drum opening techniques and equipment will also safeguard personnel. The use of remote sampling equipment whenever feasible is highly recommended.

Flat Bottom Boat Sampling Operations

I. Purpose

Flat bottom boat sampling operations are a non-standard practice of RCRA/CERCLA investigations. The objective of these operations is to access those sample locations inaccessible to larger, deeper draft, motorized water craft.

II. Scope

The provisions of this SOP apply to all program and project personnel engaged directly in technical boating operations, whether planning or executing those operations. These provisions apply whenever technical boating equipment or activities are used or included in project operations.

III. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans for boating operations and federal and state boating safety regulations are in accordance with these procedures, where applicable, or that other approved procedures are developed.

Field Team Leader - The Field Team Leader is responsible for ensuring that these boating procedures are implemented in the field, and for ensuring that personnel performing these activities have been briefed and trained to execute these procedures.

Sampling Personnel - It is the responsibility of the sampling personnel to follow these procedures or to follow documented, project-specific procedures as directed by the Field Team Leader and/or the Project Manager. The sampling personnel are responsible for the proper sampling procedures, proper operation of the boat and adherence to waterborne health and safety procedures.

IV. Procedures

The following procedures outline the planning and execution of flat bottom boat sampling operations:

1. All operations involving technical boating will be directed by a qualified and experienced boater as the team leader.
2. All persons participating in boating operations will be directed by the Field Team Leader.

3. All persons participating in boating operations will have been trained by the Field Team Leader or provide proof of experience in operating such water craft.
4. All water craft shall operate on a "line of sight" rule. No water craft will go out of sight of each other.
5. All personnel shall wear their Personnel Flootation Devices at all times while they are on the water.
6. The boating team will include at least one person qualified in First Aid/CPR for nonstandard conditions (for example: fire rescue, air/land/sea rescue).
7. All personnel shall wear bright colors (for example: hunter orange, yellow, etc.) to enhance their visibility to one another.
8. All personnel shall collect one sample at a time, and return that sample to the "lead ship," the dock, or other location as determined by site conditions and situation.
9. Field Team Leader has final authority on operations with regards to weather and water conditions.

Preparing Field Log Books

I. Purpose

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

II. Scope

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

III. Equipment and Materials

- Log book
- Indelible pen

IV. Procedures and Guidelines

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

A. PROCEDURES FOR COMPLETING FIELD LOG BOOKS

1. Field notes commonly are kept in bound, hard-cover logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and SESCO, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.
2. On the inside cover of the log book the following information should be included:
 - Company name and address
 - Log-holders name if log book was assigned specifically to that person
 - Activity or location

- Project name
 - Project manager's name
 - Phone numbers of the company, supervisors, emergency response, etc.
3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."
 4. If errors are made in the log book, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.
 5. Daily entries will be made chronologically.
 6. Information will be recorded directly in the field log book during the work activity. Information will not be written on a separate sheet and then later transcribed into the log book.
 7. Each page of the log book will have the date of the work and the note takers initials.
 8. The final page of each day's notes will include the note-takers signature as well as the date.
 9. Only information relevant to the subject project will be added to the log book.
 10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

1. Entries into the log book should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.
2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.
3. Scope: Describe the general scope of work to be performed each day.
4. Weather: Record the weather conditions and any significant changes in the weather during the day.
5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified,

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

6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.
7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.
8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.
9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.
10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.
11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.
12. Health and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.
13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.
14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.
15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.
16. Any conditions that might adversely affect the work or any data obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

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

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

1. Use the left side border to record times and the remainder of the page to record information (see attached example).
2. Use tables to record sampling information and field data from multiple samples.
3. Sketch sampling locations and other pertinent information.
4. Sketch well construction diagrams.

V. Attachments

Example field notes.

Packaging and Shipping Procedures for Low-Concentration Samples

I. Purpose and Scope

The purpose of this guideline is to describe the packaging and shipping of low-concentration samples of various media to a laboratory for analysis.

II. Scope

The guideline only discusses the packaging and shipping of samples that are anticipated to have low concentrations of chemical constituents. Whether or not samples should be classified as low-concentration or otherwise will depend upon the site history, observation of the samples in the field, odor, and photoionization-detector readings.

If the site is known to have produced high-concentration samples in the past or the sampler suspects that high concentrations of contaminants might be present in the samples, then the sampler should conservatively assume that the samples cannot be classified as low-concentration. Samples that are anticipated to have medium to high concentrations of constituents should be packaged and shipped accordingly.

If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling. As a result only employees who are trained under CH2M HILL Dangerous Goods Shipping course may ship or transport dangerous goods. Employees should utilize the HAZMAT ShipRight tool on the Virtual Office and/or contact a designated CH2M HILL HazMat advisor with questions.

III. Equipment and Materials

- Coolers
- Clear tape
- "This Side Up" labels
- "Fragile" labels
- Vermiculite
- Ziplock bags or bubble wrap
- Ice
- Chain-of-Custody form (completed)
- Custody seals

IV. Procedures and Guidelines

Low-Concentration Samples

- A. Prepare coolers for shipment:
 - Tape drains shut.
 - Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
 - Place mailing label with laboratory address on top of coolers.
 - Fill bottom of coolers with about 3 inches of vermiculite or absorbent pads.
- B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.
- C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.
- D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.
- E. Arrange sample bottles in coolers so that they do not touch.
- F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.
- G. Fill remaining spaces with vermiculite or absorbent pads.
- H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.
- J. Close lid and latch.
- K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.
- L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Cover custody seals with tape to avoid seals being able to be peeled from the cooler.
- M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with potential additional restrictions. If applicable, the sample handler must refer to instructions associated with the shipping of dangerous goods for the necessary procedures for shipping by Federal Express or other overnight carrier. If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling. As a result only employees who are trained under CH2M HILL Dangerous Goods Shipping course may ship or transport dangerous goods. Employees should utilize the HAZMAT ShipRight tool on the Virtual Office and/or contact a designated CH2M HILL HazMat advisor with questions.

V. Attachments

None.

VI. Key Checks and Items

- Be sure laboratory address is correct on the mailing label
- Pack sample bottles carefully, with adequate vermiculite or other packaging and without allowing bottles to touch
- Be sure there is adequate ice
- Include chain-of-custody form
- Include custody seals

Vibracore Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples using a vibracore over water during field operations.

II. Scope

The procedures herein describe necessary equipment procedures, and documentation for the collection of representative sediment from a vibracore sample.

III. Equipment and Materials

- Ensure that the sampling vessel is appropriate for anticipated sampling conditions (mooring, core deployment and recovery system, vessel draft).
- Nautical charts and tide tables
- Marine VHF radio and cellular telephone
- US Coast Guard (USCG) required vessel safety device, including personal flotation device (PFD)
- Appropriate vessel navigation and position recording equipment, including shore side reference station beacon and tide staff gage installed onsite
- Fathometer and bar gauge or equivalents for recording depth to sediment
- Vibratory core barrel of appropriate sampling length, and polycarbonate core liner material, if required
- Decontaminated core cutter (nose cone) and sample retainer (catcher) assemblies
- Decontaminated core cutting and sample processing equipment
- Decontamination supplies, including wash down pump and hoses
- Steel tape measure
- Sample coolers and ice
- Log book
- Personal protective equipment (nitrile gloves, rubber boots, rain gear, etc.)

IV. Procedures and Guidelines

1. Inspect decontaminated core cutter and core retainer assemblies prior to vessel departure.
2. Conduct tailgate health and safety meeting at the launch site, prior to vessel departure. Review day's planned sampling activities to ensure that all required equipment is onboard the vessel, and that the planned sampling order is appropriate. Program sample location coordinates into onboard navigation system and confirm that they were determined in the proper coordinate system and datum for the site.
3. Sampling will begin downstream and work upstream to prevent contamination of unsampled areas. For tidally influenced sites, sampling will be scheduled to coincide with low tide and under low flow conditions when possible to minimize the dilution of possible contaminants.
4. Confirm that land based reference beacon (if used) and differential GPS (DGPS) links have been established, and GPS antenna is over sample location, and antenna offsets have been measured to correct for the actual sampling location.
5. Inspect tide staff gage and record water surface level to the nearest 0.1'.
6. Navigate to sampling location and anchor in position, securing the mooring to minimize the effects of current and wind. Follow all vessel crew instructions, remaining clear of equipment and moorage rigging.
7. Once vessel is in position; at the direction of the vessel crew, record sampling station ID, depth to sediment from the vessel decking using a bar gauge and fathometer, depth to water from vessel deck, position coordinates, position relative to fixed reference points, weather, and water surface conditions.
8. Prior to the advancement of the core, ensure that winch cable, push rod, or vibracore barrel have been measured and clearly marked in order to record penetration depth and note changes in drilling advancement or effort.
9. Core assembly is lowered or pushed until penetrative depth or refusal has been encountered. Record depth of penetration, vessel position, time, and apparent sampling conditions. As soon as is practicable following sampling, record water surface level reading from the staff gage. In the event of sample refusal relocate within 5' and repeat procedure from Step 6.
10. Observe vessel crew instructions, and clear the sampling portal or boom area as core is retrieved, monitor worker breathing space air quality.
11. Once vessel crew has secured the core barrel inspect the barrel cutter head. Provide qualitative description of cutter head catch condition, or soil if retained.

12. Ensure that external sampling equipment is decontaminated using site water and a decontaminated brush, while not disturbing the open end of the core barrel.
13. Label sample end cap for base of sample, remove cutter head assembly, affix end cap, and decontaminate cutter head assembly.
14. Once suspended sediment has had adequate time to settle following sample staging (15-30 minutes), measure total recovery, using a decontaminated tape, calculate and record recovered percentage.
15. Cut or drill a small drain slit above the water-sediment interface, above the depth of recovered sediment and decant supernatant water. Once water has been decanted cut excess sample barrel or liner approximately 1" above the water-sediment interface, label end cap and affix to barrel. Dry barrel and label with an indelible marker. Sample labeling should include up and down designations with the sample number on the end caps, and directional arrows on the barrel or liner body. Cut barrel sections to fit staging coolers, transfer labeled samples to coolers immediately post-processing.

V. Attachments

ASTM D4823 Core Sampling Submerged, Unconsolidated Sediments

VI. Key Checks and Items

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Beware of hidden hazards.

Appendix B
Laboratory DoD ELAP Letters



**LABORATORY
ACCREDITATION
BUREAU**

Certificate of Accreditation

ISO/IEC 17025:2005

Certificate Number L2226

Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation Granted through: November 30, 2012

**R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 30th of November 2009**

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements
Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

Scope of Accreditation For Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228
Marcia K. McGinnity
877-345-1113

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Empirical Laboratories, LLC to perform the following tests:

Accreditation granted through: **November 30, 2012**

Testing - Environmental

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	EPA 8260B	1,1,2-Trichloroethane
GC/MS	EPA 8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	EPA 8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	EPA 8260B	1,1-Dichloropropene
GC/MS	EPA 8260B	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B	1,2,3-Trichloropropane
GC/MS	EPA 8260B	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B	1,2-Dichlorobenzene
GC/MS	EPA 8260B	1,2-Dichloroethane (EDC)
GC/MS	EPA 8260B	1,2-Dichloropropane
GC/MS	EPA 8260B	1,3,5-Trimethylbenzene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,3-Dichlorobenzene
GC/MS	EPA 8260B	1,3-Dichloropropane
GC/MS	EPA 8260B	1,4-Dichlorobenzene
GC/MS	EPA 8260B	1,4-Dioxane
GC/MS	EPA 8260B	1-Chlorohexane
GC/MS	EPA 8260B	2,2-Dichloropropane
GC/MS	EPA 8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	EPA 8260B	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B	2-Chlorotoluene
GC/MS	EPA 8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	EPA 8260B	4-Chlorotoluene
GC/MS	EPA 8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	EPA 8260B	Acetone
GC/MS	EPA 8260B	Acetonirile
GC/MS	EPA 8260B	Acrolein
GC/MS	EPA 8260B	Acrylonitrile
GC/MS	EPA 8260B	Allyl chloride
GC/MS	EPA 8260B	Benzene
GC/MS	EPA 8260B	Bromobenzene
GC/MS	EPA 8260B	Bromochloromethane
GC/MS	EPA 8260B	Bromodichloromethane
GC/MS	EPA 8260B	Bromoform
GC/MS	EPA 8260B	Bromomethane
GC/MS	EPA 8260B	Carbon Disulfide
GC/MS	EPA 8260B	Carbon Tetrachloride
GC/MS	EPA 8260B	Chlorobenzene
GC/MS	EPA 8260B	Chloroethane
GC/MS	EPA 8260B	Chloroform
GC/MS	EPA 8260B	Chloromethane
GC/MS	EPA 8260B	Chloroprene
GC/MS	EPA 8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	EPA 8260B	cis-1,3-Dichloropropene
GC/MS	EPA 8260B	cis-1,4-Dichloro-2-butene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	Cyclohexane
GC/MS	EPA 8260B	Dibromochloromethane
GC/MS	EPA 8260B	Dibromomethane
GC/MS	EPA 8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	EPA 8260B	Di-isopropyl ether
GC/MS	EPA 8260B	ETBE
GC/MS	EPA 8260B	Ethyl methacrylate
GC/MS	EPA 8260B	Ethylbenzene
GC/MS	EPA 8260B	Hexachlorobutadiene
GC/MS	EPA 8260B	Hexane
GC/MS	EPA 8260B	Iodomethane
GC/MS	EPA 8260B	Isobutyl alcohol
GC/MS	EPA 8260B	Isopropylbenzene (Cumene)
GC/MS	EPA 8260B	Methacrylonitrile
GC/MS	EPA 8260B	Methyl Acetate
GC/MS	EPA 8260B	Methyl methacrylate
GC/MS	EPA 8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	EPA 8260B	Methylcyclohexane
GC/MS	EPA 8260B	Methylene Chloride, or Dichloromethane
GC/MS	EPA 8260B	Naphthalene
GC/MS	EPA 8260B	n-Butylbenzene
GC/MS	EPA 8260B	n-Propylbenzene
GC/MS	EPA 8260B	p-Isopropyltoluene
GC/MS	EPA 8260B	Propionitrile
GC/MS	EPA 8260B	sec-Butylbenzene
GC/MS	EPA 8260B	Styrene
GC/MS	EPA 8260B	t-Butyl alcohol
GC/MS	EPA 8260B	tert-Amyl methyl ether
GC/MS	EPA 8260B	tert-Butylbenzene
GC/MS	EPA 8260B	Tetrachloroethene (PCE; PERC)
GC/MS	EPA 8260B	Tetrahydrofuran
GC/MS	EPA 8260B	Toluene
GC/MS	EPA 8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	trans-1,3-Dichloropropene
GC/MS	EPA 8260B	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B	Trichloroethene (TCE)
GC/MS	EPA 8260B	Trichlorofluoromethane (CFC-11)
GC/MS	EPA 8260B	Vinyl acetate
GC/MS	EPA 8260B	Vinyl Chloride (VC)
GC/MS	EPA 8260B	Xylenes (Total)
GC/MS	EPA 8270C/D	1,1'-Biphenyl
GC/MS	EPA 8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dioxane
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	EPA 8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	EPA 8270C/D	2,4-Dimethylphenol
GC/MS	EPA 8270C/D	2,4-Dinitrophenol
GC/MS	EPA 8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	EPA 8270C/D	2,6-Dichlorophenol
GC/MS	EPA 8270C/D	2,6-Dinitrotoluene
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 (o-Cresol)
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol (ONP)
GC/MS	EPA 8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	EPA 8270C/D	3-Methylphenol

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
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 phenyl ether
GC/MS	EPA 8270C/D	4-Methylphenol (p-Cresol)
GC/MS	EPA 8270C/D	4-Nitroaniline (PNA)
GC/MS	EPA 8270C/D	4-Nitrophenol (PNP)
GC/MS	EPA 8270C/D	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetaphenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 8270C/D	Benzdine
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	EPA 8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	EPA 8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran (DBF)
GC/MS	EPA 8270C/D	Diethyl phthalate (DEP)
GC/MS	EPA 8270C/D	Dimethyl phthalate (DMP)
GC/MS	EPA 8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	EPA 8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene (HCB)
GC/MS	EPA 8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	EPA 8270C/D	Hexachloroethane (HCE)
GC/MS	EPA 8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	EPA 8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/ECD	EPA 8081A/B	4,4'-DDD
GC/ECD	EPA 8081A/B	4,4'-DDE
GC/ECD	EPA 8081A/B	4,4'-DDT
GC/ECD	EPA 8081A/B	Aldrin
GC/ECD	EPA 8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	EPA 8081A/B	alpha-Chlordane
GC/ECD	EPA 8081A/B	beta-BHC (beta-HCH)
GC/ECD	EPA 8081A/B	delta-BHC (delta-HCH)

Non-Potable Water		
Technology	Method	Analyte
GC/ECD	EPA 8081A/B	Dieldrin
GC/ECD	EPA 8081A/B	Endosulfan I
GC/ECD	EPA 8081A/B	Endosulfan II
GC/ECD	EPA 8081A/B	Endosulfan sulfate
GC/ECD	EPA 8081A/B	Endrin
GC/ECD	EPA 8081A/B	Endrin aldehyde
GC/ECD	EPA 8081A/B	Endrin ketone
GC/ECD	EPA 8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	EPA 8081A/B	gamma-Chlordane
GC/ECD	EPA 8081A/B	Heptachlor
GC/ECD	EPA 8081A/B	Heptachlor epoxide
GC/ECD	EPA 8081A/B	Methoxychlor
GC/ECD	EPA 8081A/B	Chlordane
GC/ECD	EPA 8081A/B	Toxaphene
GC/ECD	EPA 8082 /A	Aroclor-1016
GC/ECD	EPA 8082 /A	Aroclor-1221
GC/ECD	EPA 8082 /A	Aroclor-1232
GC/ECD	EPA 8082 /A	Aroclor-1242
GC/ECD	EPA 8082 /A	Aroclor-1248
GC/ECD	EPA 8082 /A	Aroclor-1254
GC/ECD	EPA 8082 /A	Aroclor-1260
GC/ECD	EPA 8082 /A	Aroclor-1262
GC/ECD	EPA 8082 /A	Aroclor-1268
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4,5-TP (Silvex)
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	Dichlorprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP (Mecoprop)

Non-Potable Water		
Technology	Method	Analyte
HPLC/UV	EPA 8330A/B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330A/B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330A/B	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330A/B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	3-Nitrotoluene
HPLC/UV	EPA 8330A/B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/B	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330A/B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330A/B	Nitrobenzene
HPLC/UV	EPA 8330A/B	Nitroglycerin
HPLC/UV	EPA 8330A/B	Nitroguanidine
HPLC/UV	EPA 8330A/B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	EPA 8015B	TPH DRO
GC/FID	EPA 8015B	TPH GRO
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/ECD	EPA 8011	1,2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1,2-Dibromo-3-chloropropane (DBCP)
HPLC/MS	EPA 6850	Perchlorate
ICP	EPA 6010B/C	Aluminum
ICP	EPA 6010B/C	Antimony
ICP	EPA 6010B/C	Arsenic
ICP	EPA 6010B/C	Barium
ICP	EPA 6010B/C	Beryllium

Non-Potable Water		
Technology	Method	Analyte
ICP	EPA 6010B/C	Boron
ICP	EPA 6010B/C	Cadmium
ICP	EPA 6010B/C	Calcium
ICP	EPA 6010B/C	Chromium, total
ICP	EPA 6010B/C	Cobalt
ICP	EPA 6010B/C	Copper
ICP	EPA 6010B/C	Iron
ICP	EPA 6010B/C	Lead
ICP	EPA 6010B/C	Magnesium
ICP	EPA 6010B/C	Manganese
CVAA	EPA 7470A	Mercury
ICP	EPA 6010B/C	Molybdenum
ICP	EPA 6010B/C	Nickel
ICP	EPA 6010B/C	Potassium
ICP	EPA 6010B/C	Selenium
ICP	EPA 6010B/C	Silver
ICP	EPA 6010B/C	Sodium
ICP	EPA 6010B/C	Strontium
ICP	EPA 6010B/C	Thallium
ICP	EPA 6010B/C	Tin
ICP	EPA 6010B/C	Titanium
ICP	EPA 6010B/C	Vanadium
ICP	EPA 6010B/C	Zinc
IC	EPA 300.0	Chloride
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Sulfate
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 9056A	Sulfate

Non-Potable Water		
Technology	Method	Analyte
Titration	SM 2320B 20 th /21 st edition	Alkalinity
Colorimetric	SM 4500 B, G, 20 th /21 st edition	Ammonia
Colorimetric	EPA 410.4	COD
UV/Vis	EPA 7196A	Hexavalent Chromium
Colorimetric	EPA 353.2	Nitrocellulose
Colorimetric	EPA 353.2	Nitrate/Nitrite
Gravimetric	EPA 1664A	O&G
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	SM 4500 S-2CF, 20 th /21 st edition	Sulfide
UV/Vis	SM 4500 P B5, E, 20 th /21 st edition	Total Phosphorus (as P)
UV/Vis	SM 4500 PE, 20 th /21 st edition	Ortho-Phosphate (as P)
TOC	9060A/SM5310C, 20 th /21 st edition	Total Organic Carbon
Gravimetric	SM 2540C, 20 th /21 st edition	TDS
Gravimetric	SM 2540D, 20 th /21 st edition	TSS
Colorimetric	EPA 9012A/B	Cyanide
Physical	EPA 1010A	Ignitability
Physical	EPA 9095B	Paint Filter
Probe	EPA 9040B/C	pH
Preparation	Method	Type
Preparation	EPA 1311	TCLP
Preparation	EPA 3005A	Metals digestion
Preparation	EPA 3010A	Metals digestion
Preparation	EPA 3510C	Organics Liquid Extraction
Preparation	EPA 5030A/B	Purge and Trap Water

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1-Trichloroethane (1,1,1-TCA)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	EPA 8260B	1,1,2-Trichloroethane
GC/MS	EPA 8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	EPA 8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	EPA 8260B	1,1-Dichloropropene
GC/MS	EPA 8260B	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B	1,2,3-Trichloropropane
GC/MS	EPA 8260B	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B	1,2-Dichlorobenzene
GC/MS	EPA 8260B	1,2-Dichloroethane (EDC)
GC/MS	EPA 8260B	1,2-Dichloropropane
GC/MS	EPA 8260B	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B	1,3-Dichlorobenzene
GC/MS	EPA 8260B	1,3-Dichloropropane
GC/MS	EPA 8260B	1,4-Dichlorobenzene
GC/MS	EPA 8260B	1,4-Dioxane
GC/MS	EPA 8260B	2,2-Dichloropropane
GC/MS	EPA 8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	EPA 8260B	2-Chlorotoluene
GC/MS	EPA 8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	EPA 8260B	4-Chlorotoluene
GC/MS	EPA 8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	EPA 8260B	Acetone
GC/MS	EPA 8260B	Acetonitrile
GC/MS	EPA 8260B	Acrolein
GC/MS	EPA 8260B	Acrylonitrile
GC/MS	EPA 8260B	Allyl chloride

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	Benzene
GC/MS	EPA 8260B	Bromobenzene
GC/MS	EPA 8260B	Bromochloromethane
GC/MS	EPA 8260B	Bromodichloromethane
GC/MS	EPA 8260B	Bromoform
GC/MS	EPA 8260B	Bromomethane
GC/MS	EPA 8260B	Carbon Disulfide
GC/MS	EPA 8260B	Carbon Tetrachloride
GC/MS	EPA 8260B	Chlorobenzene
GC/MS	EPA 8260B	Chloroethane
GC/MS	EPA 8260B	Chloroform
GC/MS	EPA 8260B	Chloromethane
GC/MS	EPA 8260B	Chloroprene
GC/MS	EPA 8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	EPA 8260B	cis-1,3-Dichloropropene
GC/MS	EPA 8260B	cis-1,4-Dichloro-2-butene
GC/MS	EPA 8260B	Cyclohexane
GC/MS	EPA 8260B	Dibromochloromethane
GC/MS	EPA 8260B	Dibromomethane
GC/MS	EPA 8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	EPA 8260B	Ethyl methacrylate
GC/MS	EPA 8260B	Ethylbenzene
GC/MS	EPA 8260B	Hexachlorobutadiene
GC/MS	EPA 8260B	Hexane
GC/MS	EPA 8260B	Iodomethane
GC/MS	EPA 8260B	Isobutyl alcohol
GC/MS	EPA 8260B	Isopropylbenzene (Cumene)
GC/MS	EPA 8260B	Methacrylonitrile
GC/MS	EPA 8260B	Methyl Acetate
GC/MS	EPA 8260B	Methyl methacrylate
GC/MS	EPA 8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	EPA 8260B	Methylcyclohexane

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	Methylene Chloride, or Dichloromethane
GC/MS	EPA 8260B	Naphthalene
GC/MS	EPA 8260B	n-Butylbenzene
GC/MS	EPA 8260B	n-Propylbenzene
GC/MS	EPA 8260B	p-Isopropyltoluene
GC/MS	EPA 8260B	Propionitrile
GC/MS	EPA 8260B	sec-Butylbenzene
GC/MS	EPA 8260B	Styrene
GC/MS	EPA 8260B	tert-Butylbenzene
GC/MS	EPA 8260B	Tetrachloroethene (PCE; PERC)
GC/MS	EPA 8260B	Toluene
GC/MS	EPA 8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	EPA 8260B	trans-1,3-Dichloropropene
GC/MS	EPA 8260B	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B	Trichloroethene (TCE)
GC/MS	EPA 8260B	Trichlorofluoromethane (CFC-11)
GC/MS	EPA 8260B	Vinyl acetate
GC/MS	EPA 8260B	Vinyl Chloride (VC)
GC/MS	EPA 8260B	Xylenes (Total)
GC/MS	EPA 8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	EPA 8270C/D	1,1'-Biphenyl
GC/MS	EPA 8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dioxane
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D	2,4,6-Trichlorophenol (TCP)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	EPA 8270C/D	2,4-Dimethylphenol
GC/MS	EPA 8270C/D	2,4-Dinitrophenol
GC/MS	EPA 8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	EPA 8270C/D	2,6-Dichlorophenol
GC/MS	EPA 8270C/D	2,6-Dinitrotoluene
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 (o-Cresol)
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol (ONP)
GC/MS	EPA 8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	EPA 8270C/D	3-Methylphenol
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
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 phenyl ether
GC/MS	EPA 8270C/D	4-Methylphenol (p-Cresol)
GC/MS	EPA 8270C/D	4-Nitroaniline (PNA)
GC/MS	EPA 8270C/D	4-Nitrophenol (PNP)
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetaphenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
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

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	EPA 8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran (DBF)
GC/MS	EPA 8270C/D	Diethyl phthalate (DEP)
GC/MS	EPA 8270C/D	Dimethyl phthalate (DMP)
GC/MS	EPA 8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	EPA 8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene (HCB)
GC/MS	EPA 8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	EPA 8270C/D	Hexachloroethane (HCE)
GC/MS	EPA 8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/D	N-Nitroso-di-n-propylamine (NDPA)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/ECD	EPA 8081A/B	4,4'-DDD
GC/ECD	EPA 8081A/B	4,4'-DDE
GC/ECD	EPA 8081A/B	4,4'-DDT
GC/ECD	EPA 8081A/B	Aldrin
GC/ECD	EPA 8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	EPA 8081A/B	alpha-Chlordane
GC/ECD	EPA 8081A/B	beta-BHC (beta-HCH)
GC/ECD	EPA 8081A/B	delta-BHC (delta-HCH)
GC/ECD	EPA 8081A/B	Chlordane
GC/ECD	EPA 8081A/B	Dieldrin
GC/ECD	EPA 8081A/B	Endosulfan I
GC/ECD	EPA 8081A/B	Endosulfan II
GC/ECD	EPA 8081A/B	Endosulfan sulfate
GC/ECD	EPA 8081A/B	Endrin
GC/ECD	EPA 8081A/B	Endrin aldehyde
GC/ECD	EPA 8081A/B	Endrin ketone
GC/ECD	EPA 8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	EPA 8081A/B	gamma-Chlordane
GC/ECD	EPA 8081A/B	Heptachlor
GC/ECD	EPA 8081A/B	Heptachlor epoxide
GC/ECD	EPA 8081A/B	Methoxychlor
GC/ECD	EPA 8081A/B	Toxaphene
GC/ECD	EPA 8082 /A	Aroclor-1016
GC/ECD	EPA 8082 /A	Aroclor-1221
GC/ECD	EPA 8082 /A	Aroclor-1232
GC/ECD	EPA 8082 /A	Aroclor-1242

Solid and Chemical Materials		
Technology	Method	Analyte
GC/ECD	EPA 8082 /A	Aroclor-1248
GC/ECD	EPA 8082 /A	Aroclor-1254
GC/ECD	EPA 8082 /A	Aroclor-1260
GC/ECD	EPA 8082 /A	Aroclor-1262
GC/ECD	EPA 8082 /A	Aroclor-1268
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4,5-TP (Silvex)
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	Dichlorprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP (Mecoprop)
HPLC/UV	EPA 8330A	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330A	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330A	3-Nitrotoluene
HPLC/UV	EPA 8330A	3,5-Dinitroaniline
HPLC/UV	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330A	Nitroglycerin
HPLC/UV	EPA 8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330A	Nitrobenzene
HPLC/UV	EPA 8330A	Nitroguanidine

Solid and Chemical Materials		
Technology	Method	Analyte
HPLC/UV	EPA 8330A	PETN
HPLC/UV	EPA 8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330B	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330B	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330B	3-Nitrotoluene
HPLC/UV	EPA 8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330B	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330B	Nitroglycerin
HPLC/UV	EPA 8330B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330B	Nitrobenzene
HPLC/UV	EPA 8330B	Nitroguanidine
HPLC/UV	EPA 8330B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	EPA 8015B	TPH DRO
GC/FID	EPA 8015B	TPH GRO
HPLC/MS	EPA 6850	Perchlorate
ICP	EPA 6010B/C	Aluminum
ICP	EPA 6010B/C	Antimony
ICP	EPA 6010B/C	Arsenic
ICP	EPA 6010B/C	Barium
ICP	EPA 6010B/C	Beryllium
ICP	EPA 6010B/C	Boron
ICP	EPA 6010B/C	Cadmium
ICP	EPA 6010B/C	Calcium
ICP	EPA 6010B/C	Chromium, total

Solid and Chemical Materials		
Technology	Method	Analyte
ICP	EPA 6010B/C	Cobalt
ICP	EPA 6010B/C	Copper
ICP	EPA 6010B/C	Iron
ICP	EPA 6010B/C	Lead
ICP	EPA 6010B/C	Magnesium
ICP	EPA 6010B/C	Manganese
CVAA	EPA 7471A/B	Mercury
ICP	EPA 6010B/C	Molybdenum
ICP	EPA 6010B/C	Nickel
ICP	EPA 6010B/C	Potassium
ICP	EPA 6010B/C	Selenium
ICP	EPA 6010B/C	Silver
ICP	EPA 6010B/C	Sodium
ICP	EPA 6010B/C	Strontium
ICP	EPA 6010B/C	Tin
ICP	EPA 6010B/C	Titanium
ICP	EPA 6010B/C	Thallium
ICP	EPA 6010B/C	Vanadium
ICP	EPA 6010B/C	Zinc
UV/Vis	EPA 7196A	Hexavalent Chromium
TOC	Lloyd Kahn	Total Organic Carbon
Colorimetric	EPA 353.2	Nitrocellulose
Colorimetric	EPA 9012A/B	Cyanide
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	EPA 9034	Sulfide
Probe	EPA 9045C/D	pH
Preparation	Method	Type
Preparation	EPA 1311	TCLP
Preparation	EPA 1312	SPLP
Preparation	NJ Modified 3060A	Hexavalent Chromium
Preparation	EPA 3050B	Metals Digestion
Preparation	EPA 3546	Organics Microwave Extraction



Solid and Chemical Materials		
Technology	Method	Analyte
Preparation	EPA 3550B/C	Organics Sonication
Preparation	SM 2540B 20 th /21 st edition	Percent Solids (Percent Moisture)
Preparation	EPA 5035 /A	Purge and Trap Solid

Notes:

- 1) This laboratory offers commercial testing service.



Approved By: _____

R. Douglas Leonard
Chief Technical Officer

Date: April 8, 2011

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Appendix C
Navy CLEAN Data Management Plan

Final

**Data Management Process Overview
for the
Navy CLEAN and Joint Venture Programs**

Prepared 15 April 2008

Prepared by



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Introduction

This Data Management Plan (DMP) was developed to provide operating guidelines to satisfy the data management requirements for large quantities of data in support of the Navy CLEAN and Joint Venture (JV) Programs. The DMP is broadly applicable to the management and dissemination of data generated during environmental investigations. It is intended to be a living document and will be amended or revised to accommodate changes in the scope of environmental investigation or data management requirements.

During field investigations, CH2M HILL will collect a variety of environmental information that will support data analysis, reporting, and presentation. To ensure quality assurance/quality control (QA/QC) and meet current regulatory requirements, a complete audit trail of the information flow must be established. Each step in the data management process (data collection, storage, and analysis) must be adequately planned, executed, and documented. The DMP provides the processes and guidelines for sample tracking, storage, access, delivery, and reporting of new chemical analytical, geologic, biologic and spatial data generated by investigation operations. Additionally, this plan addresses the management of historical data. Key data management objectives are identified and listed below.

- Provide data users with tools that allow simple and rapid access to stored data of various types
- Provide methods of data entry and data loading with known accuracy and efficiency
- Apply well-documented data validation modifications to the electronic database
- Manage sample data using a unique sample identification number
- Establish a sample inventory of new data collected, and provide methods of sample inventory reconciliation
- Store and provide sample-specific attributes, including location identifier, sample type, sample media, depth, date, and target study area
- Provide reporting and delivery formats from a single database source to support data analysis, site characterization, risk assessment, modeling, and spatial analysis
- Provide the ability to electronically compare results to project-specific reference or screening criteria
- Identify needs for incorporating historical data and establish a database of this information when possible; otherwise, establish a data inventory plan that identifies and catalogues historical data not suited for database entry

To facilitate information utilization and decision-making, a set of guidelines and specifications is presented for personnel qualifications, elements of the data management system (DMS), and activities related to data management. The following specifications are provided to ensure

compatibility with the Navy CLEAN and JV Programs' goals and requirements. These specifications include the routines, processes, and guidelines for sample tracking, storage, access, delivery, and reporting of chemical analytical, geologic, biologic and spatial data generated during site characterization, remedial investigation, and remedial action activities at the sites.

Data Management Activities

This section describes data management activities for new data and historical data. It also discusses the responsibilities of the data team members, coordination and administration of the database, integration with the geographic information system (GIS), and reporting of data from the database.

2.1 New Data Management

For new data being generated as part of field and laboratory operations, the DMP revolves around nine overlapping phases of activity.

- 1. Project Planning and Setup:** A Kick-off Meeting is held to review project instructions, assign sample nomenclature, and detail the EIS level of effort and budget required for the project. Initial communication with the laboratory, data validator, and field crew is established to ensure that all project materials, deliverables, and specifications will be met.
- 2. Sample Collection and Tracking:** Field efforts are carried out according to information detailed in the Project Instructions and Sampling and Analysis Plan (SAP). Sample information and field measurements are collected and catalogued for loading into the project database. Lab login reports are received from labs, entered into the Sample Tracking Sheet (STS) and compared to information from the Project Instructions in order to track the completeness and timeliness of sample handling and processing.
- 3. Lab Analysis and Reporting:** Analyses are performed in accordance with the Laboratory Scope of Work (SOW) and the Uniform Federal Policy Sampling and Analysis Plan (UFP SAP). Hard copy and electronic data deliverables (EDDs) are delivered to the data management team in the agreed-upon format. Lab electronic data are checked for completeness and consistency with hard copy data reports.
- 4. Data Validation and Reporting:** Validation or review is performed in accordance with the Data Validation SOW and the Uniform Federal Policy Sampling and Analysis Plan (UFP SAP). Hard copy and electronic data deliverables (EDDs) are delivered to the data management team in the agreed-upon format. Validated electronic data are checked for completeness and consistency with hard copy data reports.
- 5. Project Data Loading and Storage:** Data from all phases of the data collection and analysis process are stored in a relational project repository database. Post Load reports are reviewed to verify that data was loaded correctly. Following data loading, reports are generated and reviewed to verify that data was loaded correctly. Updates and/or corrections are made to the data as necessary. All hard copy and electronic data are catalogued and sent for archiving as appropriate. Hardcopy and electronic data are sent for archiving. All documentation generated during the projects is filed into the appropriate project notebooks.

6. **Reporting and Delivery of Results:** Data are exported to one or more exterior applications for generating geographic data maps, summary statistics, data tables, and other reports.

2.2 Historical Data Management

There have been a substantial number of previous studies and investigations conducted at Naval Bases. Managing historical data from these studies is complicated by the fact that the agencies and contractors performing these studies have used various data sampling, analysis, and management procedures. The variety of historical data sources and formats – including ecological reports, field data, and analytical data – must be addressed.

To manage historical data in a manner that addresses the variety of sources and formats, along with concerns regarding data validation, the following procedures will be implemented:

1. All source data received will be logged and saved to CH2M HILL servers. Electronic data received to support data from approved documents on original data collection forms, logs, or laboratory reporting sheets will undergo a limited check against accompanying written reports to ensure their accuracy.
2. If only hard copy files exist for desired results, these files will be used to perform manual entry of all data into electronic database files, following a “double blind” protocol for data entry. Any discrepancies found between the two versions of each entered record will be reviewed and corrected by the Data Management Coordinator (DMC).
3. When electronic data gaps occur, the DMC will make the data set as complete as possible by consulting the appropriate approved documents or completed laboratory reporting sheets, through direct communication with the appropriate environmental contractor or laboratory staff, or communication with the Program Chemist. To the greatest possible extent, data will not be entered without a reliable source.
4. After data clean up by the DMC has been completed, the data will be reviewed by a Project Chemist (PC) using all available information. If this process finds no errors, the data will be loaded into the data repository. Any assumptions or corrections made during the cleanup and review process will be noted and tracked in an Error Resolution file

2.3 Data Management Team Members

The CH2M HILL data management team will work together to properly execute the data management process. The team model presented here is based on a Project Manager supported directly by key technology staff. The functional responsibilities of the team are described below. The responsibilities are identified by titles but not necessarily individual staff positions. The workflow among the members of the data management team is shown in Figure 1.

The Activity Manager (AM) and the Project Manager (PM) are responsible for preparing the work plan, schedule, milestones, and coordinating efforts with the client. The AM/PM may or may not have adequate skills to guide the data management driven aspects of their project. While the AM/PM must be willing to accept guidance from the technology leaders, they do not need to possess the technology skills as a background. The PM is also responsible for ensuring

data quality and is brought into the team to perform data QA/QC at various times during the data management process.

The Environmental Information Specialist (EIS) assigned to the project team is responsible for the coordination of new or existing data generated by field activities or provided by laboratory analyses. The EIS oversees contracted analytical and data validation services, ensures that analytical data are complete and consistent, enters field data results into the **Field Data Entry Tool (FDETool)**, and assists the Database Specialist in resolving any data ambiguities. The EIS will conduct verification activities following receipt of electronic data and participate in QA/QC activities to resolve inconsistencies as necessary. The EIS acts as a liaison between the Database Specialist, the PM, and the PC.

The Database Specialist has overall responsibility for the design, operation, and maintenance of the Environmental Database. The DBC is responsible for the implementation, and evaluation of standard operating procedures to ensure integrity of the enterprise-wide database system. The Database Specialist coordinates the different activity data and enhances the database tools, and structure as required to increase performance and efficiency for the entire program. Additional duties include loading data into the Environmental database. This includes analytical results from laboratory electronic data deliverables and field data results that have been entered by the EIS into the **FDETool**. The Database Specialists work with the EIS and Program Data Management Coordinator to ensure that the data are loaded successfully and following established program standards and procedures.

The Field Team Leaders (FTLs) help prepare the work plan and implement the plan in the field. FTLs assign staff members to sampling teams; assign responsibilities to team members; prepare for and coordinate sampling activities; oversee the collection, recording, and documentation of the field data; and ensure that the chain-of-custody form is completed correctly.

The Project Chemist (PC) prepares the laboratory and data validation subcontracts, ensures that the electronic data deliverable was provided in accordance with the contract, assists the EIS in communicating with laboratories and data validators as needed, assists the EIS in interpreting analytical results, assists in designating CAS Numbers to new analytes, and maintains the regulatory criteria in the database.

The Program Data Management Coordinator (DMC) is responsible for the CH2M HILL data management process at all Navy bases. The DMC manages and tracks data management personnel schedules and deliverables for the Navy program; interacts with the EIS on all aspects of data management activities; provides guidance and coordination to the EIS during resolution of data inconsistencies; coordinates completion of data queries for reports; coordinates database modification efforts with the DBC; is responsible for designing, developing, and implementing standard data entry and data retrieval tools; and leads the data management continuous process improvement investigation.

The IS Operations Lead monitors workload across all IS activities (GIS, Web, and Database) for resource and schedule conflicts, and works with IS resources to make recommendations for process change and improvement.

The IS Program Lead serves as the primary point of contact for the Navy regarding IS issues, coordinates resource requirements with the regional IS Staffing Lead, and provides direction and management to the DBC, DMC, and IS Operations Lead.

2.4 Database Management and Administration

Database management and administration will be coordinated and conducted by the Database Specialist. Activities will be conducted using a suite of previously developed tools and products: Field Data Entry Tool (FDETool) for field data loading; EDD and Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD) formats for analytical data loading; formatting macros for data table creation, Archive and Load Prep Tool (ALPTool) for electronic file QC and generation, EnDat and/or NIRIS for long-term storage; and EnStat for rendering, reporting, and presentation of results. The data management team will focus their efforts on providing rapid data loading, entry, and retrieval, while promoting data integrity through various standardized procedures. Database administration, at the minimum, will consist of:

- Allocating system storage for the database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting the database for more efficient operation
- Upgrading database software as necessary
- Providing routine backup of the database
- 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

In addition to electronic tools, all required paper documentation, including hard copy of laboratory results, field notebooks, and COC sheets, will be matched to EDD files, logged, and filed in project paper files.

2.5 GIS Integration

To the greatest degree possible, spatial coordinate data will be captured and associated with all field sampling events. This will be done to facilitate the creation of spatial data maps of the sampling activities and results, which will be rendered using GIS software tools. Various data management tools used in the DMS process will provide a means of storing geospatial coordinate data.

GIS integration will allow the project team to couple results information with geospatially correct images of water bodies, topography, building and transportation infrastructure, and other types of analytical maps. More detailed information on the requirements and specifications for GIS can be found in the project documentation for that activity.

2.6 Reporting and Submittals

The project repository database will be the analytical data source for all reports presented to the Navy CLEAN and JV Programs by CH2M HILL. Data for the reports will be extracted and aggregated using standard software tools.

As mentioned above, the EnStat application will be provided to project EISs. EnStat will allow users to electively query results from the project repository database. Internally developed table formatting macros will present the results in a variety of pre-formatted tabular reports.

Database Management System

The following sections identify the required project database tools and their relationships to each other. In addition, they discuss the procedures that maintain data integrity and security through standardized tasks, data verification through valid values and redundancy control, security and controlled access to the stored data, and file backup.

3.1 Project Database Requirements

The project repository database will be a relational database system that stores information in a series of data tables. Relational database systems are designed so that each piece of information is stored only once. Data tables can then be linked so that duplication of fields in multiple tables is avoided and consistent nomenclature is enforced between related sets of data. This architecture ensures relatively high data quality and information integrity, saves storage space on the data server, and speeds up data manipulation for large data files.

It is essential that the DMS provide features to enhance data management, including the following:

- Tools preloaded with drop down menus and valid values to limit data entry errors
- Built-in QA/QC routines to protect against data redundancy and errors
- Routines that electronically compare results to project-specific reference or screening criteria
- A project repository database that securely stores all historical and present project data
- Standard but flexible reporting and delivery formats from a single database source

3.2 Tools for Data Management System Requirements

This section describes the required data management tools to be utilized. The software tools described are internally developed applications that will provide a fully integrated solution for meeting the requirements listed above.

TABLE 3-1
DMS Tools

Tools	Description
Checklist - Data Management Process	Standardized checklist to ensure that all phases data management are completed.
Checklist - EDD Prep for Load and Archive Files	Standardized checklist to ensure that Load and Archive Files are generated correctly.
Checklist - EDD Prep for Raw and Detects Tables for Unvalidated or Validated Data	Standardized checklist to ensure that reporting tables are generated and formatted appropriately.
Checklist - EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data	Standardized checklist detailing QC checks to be performed on data

TABLE 3-1
DMS Tools

Tools	Description
Form - Data Request/Needs	Form detailing data loading into the database repository
Form - EIS DM Budget Tracking	Form to track EIS budget allotted on project
Form - EIS Questions to Ask at Start of Project	Standardized list of questions that EISs should posed at project startup to ensure appropriate data management related project planning and implementation
Macro - EcoRisk Tables from EnStat Output	Macro to format EcoRisk data tables
Macro - HHRA Tables from EnStat Output	Macro to format HHRA data tables
Macro - Raw & Detects Tables from Unvalidated or Validated EDD	Macro to generate and format Unvalidated or Validated data tables
Macro - Raw, Detects, & Exceedance Tables from EnStat Output	Macro to format final Raw, Detects, and Exceedances data tables pulled from EnStat
Template - Corrections to File Letter	General template for the generation of Corrections to File Letters
Template - Data Archiving (List of Contents) Form	Template to generate Data Archiving forms to affix to laboratory and data validation reports
Template - EnDat Post Load Reports	Used to assess and QC data loaded into EnDat to ensure data load accuracy and completeness
Template - IS Costing LOE	Template to generate the level of effort and overall data management budget for projects
Template - QC Association Table	General template for the generation of QC Association tables used in data validation
Template - Sample Tracking Sheet	General template for the set up of project Sample Tracking Sheets
Template - Station and Sample Nomenclature	Program template outlining the Station and Sample Nomenclature rules to be used on environmental projects
Tool - ALPTool	Internally developed tool for performing an Analyte ID QC on SNEDD files, and generating EnDat Archive, EnDat Load, and NIRIS Analytical NEDD files.
Tool - EnDat	Internally developed relational database repository
Tool - EnStat	Internally developed tool for querying and reporting data from EnDat
Tool - FDETool	Internally developed tool for the input and loading of sample and field data.

TABLE 3-1
DMS Tools

Tools	Description
Tool - NIRIS	Navy developed relational database repository
Tool - Projects Currently in DM Tracking Table	Internal tool for tracking the status of all current data management projects
Tool - EDD	Standardized internal CH2M HILL electronic deliverable format for loading data into only EnDat
Tool - SNEDD	Standardized internal CH2M HILL electronic deliverable format for loading data into EnDat and NIRIS
Tool - Valid Value Reference Tables	Reference tables detailing all valid values utilized in the DMS

3.3 Data Integrity

3.3.1 Valid Values and Referential Integrity

Applications and tools throughout the DMS will use the same reference 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, detection limits, analyte names, etc. The use of these reference tables is critical for maintaining the completeness and accuracy of data sets and how they are grouped and categorized.

All data must be loaded and stored in such a manner that relationships between 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 all collection, analysis, and reporting tools used in the DMS are designed to enforce, for any project data record entered, entries in fields that refer to other types of data as required by the overall data model.

Note that the DMS has numerous features that reduce or eliminate manual data entry and manipulation. Automation generally promotes the integrity of data by eliminating the need for manual keystrokes and, hence, key stroke errors. These features include look-up lists on data entry forms to ensure the values of key reference information, and standardized QA/QC routines on lab and validated data.

3.3.2 Electronic Data Deliverable Requirements

Tables 3-2 and 3-3 provide the format standards for laboratory electronic data. The SNEDD format depicted in Table 3-2 is intended for use by all laboratories supplying electronic data deliverables for newly acquired Contract Task Orders (CTOs). The format depicted in Table 3-3 is an auxiliary file intended for use on previous CTOs that were established before the SNEDD process was implemented.

Laboratories and Data Validators will be provided with comprehensive Reference and Lookup tables detailing the most current valid values to be entered into all EDDs submitted to CH2M HILL. Laboratories and Validators may submit requests for the addition of new valid values if values had not been previously established.

3.4 Security and Access

The EnDat project repository database implements controlled access to data through password-protected user accounts. These accounts, with Read, Write, and Modify access, are maintained by the Database Specialist. EISs can access the project repository database, with Read Only access, using established querying tools.

The NIRIS database is hosted and maintained by NITC. Access is strictly controlled and granted on a case by case basis. An ORC ECA Digital Certificate must be obtained before requesting access. Once access is granted, the database can only be accessed through querying tools, unless the user is a Regional Data Manager.

3.5 File Backup

All internal CH2M HILL electronic files (including data management project files) that reside on servers are automatically backed up nightly. An export file is created for the EnDat database nightly and that file is also automatically backed up. This allows for the ability to recover all data and the database structure in event of media failure.

TABLE 3-2
SNEDD Format

CH2M HILL SNEDD Format			
Field Name	Field Format	REQ	Field Description
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office: format is UIC (6 char.) + FY (2 char.) + FAR code (1 char.) + Number (4 char.). (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012)
Phase	A8	RA	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)
Installation_ID	A20**	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20**	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15**	R	NIRIS code for the analytical method category (e.g. LEACH)
Lab_Code	A10**	R	CH2M HILL Code assigned to the laboratory (e.g. SHEA)
Lab_Name	A50**	R	The name of the laboratory that conducted the analysis.
Leachate_Method	A16**	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	RA	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*	RA	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	RA	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. 02/13/07 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab. (e.g. 03/24/07)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock. (e.g. 14:30:05)
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample.
Extraction_Time	HH:MM:SS	RA	Time of day that the lab extracted the sample. Use 24 hour clock.
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.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.
Dilution	N10,2	R	Dilution factor used. (e.g. 10)
Run_Number	N4	RA	Number distinguishing multiple or repeat analyses by the same method, on the same day. Must be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A45*	R	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	A3*	R	Type of analysis performed (allowed: TIC 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 included. (eg. CLPA)
QC_Accuracy_Upper	N6,3	RA	Accuracy Upper Limit. 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	Accuracy Lower Limit. 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 EnDat EDD's DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit
Detection_Limit	N18,7	RA	Reported Detection Limit
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.
Validator_Name	A50**	R	Leave Blank. Name of Validator. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.

TABLE 3-3
Auxiliary EDD Format

CH2M HILL EDD Format			
Field Name	Field Format	Req'd	Description
Sample_ID	A25	R	CH2M HILL sample ID (taken from the chain of custody).
Analysis_Group *	A9	R	The CH2M HILL code for the analysis performed on the sample.
DateTime_Collected	00/00/0000 00:00:00	R	The date the sample was collected (from the chain of custody). Use 24-hour clock
Date_Received	00/00/0000	R	The date the sample was received in the lab.
Date_Extracted	00/00/0000	RA	Extraction or preparation date.
Date_Analyzed	00/00/0000	R	The date the sample was analyzed.
Lab_Sample_ID	A15	R	The laboratory sample ID.
Dilution_Factor	N5	R	The dilution factor used. Use 1 if not diluted.
SDG_Number	A15	R	Laboratory code for the group of samples in a data deliverable package.
Chem_Code	A12	R	The ERPIMS parameter code.
Chem_Name *	A45	R	The compound being analyzed.
CAS_Number *	A6-A2-A1	R	CAS Number (Note dashes).
Ana_Value	N11	R	The analytical result. It should match the number of significant digits on the hard copy. Use detection limit when not detected.
Lab_Qual *	A5	RA	The lab qualifiers, if any (e.g., U, UJ, B); there may be a qualifier not on the valid value table in special cases.
DV_Qual	A5		Left blank for data validation qualifiers.
DV_Qual_Code*	A5		Left blank for data validation qualifier codes. Use valid values.
Units *	A15	R	The unit of the result (e.g., mg/L).
Detect_Limit	N5	R	The minimum available sample-specific detection limit for the compound, the laboratory reporting limit.
MDL	N10,3	R	Method detection limit.
Preparation	A15	R	ERPIMS code used for the preparation method of the sample fraction.
Analysis_Method	A15	R	Analytical method used to analyze the sample fraction. Use ERPIMS codes.
Result_Type *	A15	RA	The laboratory QC type for single compounds (e.g., SURR, IS) All surrogates and internal standard results are to be reported in % recovery units.
Lab_QC_Type *	A15	RA	Laboratory samples (lab blanks, dups., LCS, etc.).
PCT_Moisture	N3,3	RA	Percent moisture for soil samples; not applicable for aqueous samples.
Basis	A3	RA	Concentrations are reported on a wet or dry weight basis. Use ERPIMS codes.
Batch	A12	R	Laboratory code for the batch of samples analyzed together.
Lab_Code	A10	R	The ERPIMS code for the name of the laboratory.
ReRun*	A9	RA	To report dilutions, re-extractions, and/or re-analyses.
QC_Limits	AAA-AAA	RA	Laboratory QC limits in percent recovery for surrogates, internal standards, laboratory control spikes, calibration checks, interference check standards, serial dilutions, and MS/MSDs.
Comment	A 30	RA	For the laboratory to note exceptions.
<p><u>Notes:</u> * - See valid value list TICs are not reported on the EDD R - Required field NR - Not Required RA - Required as Appropriate EDD to be submitted in Excel</p>			

Phases of Data Management

As outlined in Section 2.1, the movement of data from the planning stage to the repository database follows six phases, as detailed in Figure 4-1. The following sections describe for each phase how data are managed and the responsibilities of team members.

4.1 Project Planning and Setup

An initial Kick-off meeting will be held to review project instructions, subcontractor information, sample logistics, nomenclature, and project level of effort and budgets. Activities will be supported by EIS Questions to Ask at Start of Project Form, Projects Currently in DM Tracking Table, IS Costing LOE Template, STS and the Station and Sample Nomenclature Template.

The EIS will be responsible for coordinating with the laboratory to discuss the sampling schedule, required turn around times, bottle orders, sample labels, etc. If requested, order bottle ware and create sample labels. If requested, once the bottles have arrived, the order will be reviewed to ensure the proper amount and type of equipment has arrived.

4.2 Sample Collection and Tracking

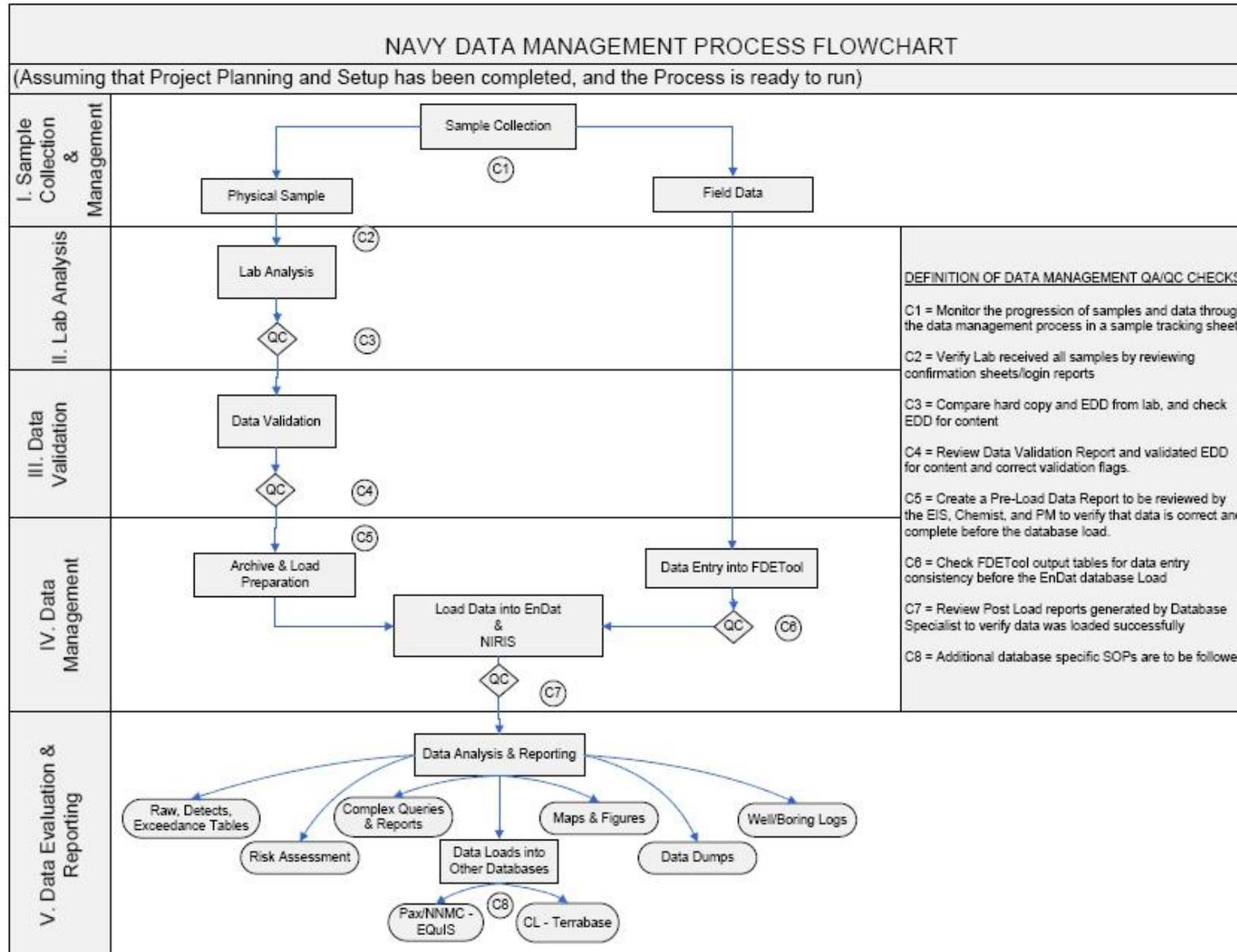
Sample control during the sampling phase is required to ensure the integrity of the associated analyte. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented through the use of field log books 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.

4.2.1 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 DM at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

Communication with field and laboratory staff will occur daily during the field event. The EIS will resolve issues that arise in the field (bottle ware shortage, equipment failure, etc). The lab will be informed of the shipment dates and the number of coolers or samples being sent. Laboratory login reports will be reviewed to ensure samples were received in good condition (no breakage, within holding time, within designated temperature). The field crew and PM will be notified if there were problems with shipment.

FIGURE 4-1



4.2.2 Field Data Collection

The FDETool can be completed at any time during the sampling event timeline, and will be turned in with the data load. After the lab has received the samples and submitted login reports, data will be entered into the FDETool using the STS, field log books and COCs. Once all field data has been entered, FDETool output reports will be generated and QC'd

In projects utilizing the SNEDD format deliverable, the NIRIS field-related NEDDs should be generated by the FDETool. These files will be reserved for use after the data has been loaded into EnDat and is ready for archiving.

4.2.3 Sample and Document Tracking

A STS will be generated and updated as samples are collected using Project Instruction Tables, Chains of Custody (COC), and Lab Login Reports. The Sample Tracking Sheet should be updated and kept current throughout the data management process. 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 the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter. All samples collected will be tracked throughout the data management process

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.

4.3 Laboratory Analysis and Reporting

4.3.1 Sample Analysis

Upon receipt of samples from the field, the laboratory will check that the COC forms correctly cover all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged into the Laboratory Information Management System (LIMS) using information from the COC forms and the project instructions.

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 or EIS.

4.3.2 Laboratory Reporting

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 turn around time.

4.3.3 Laboratory Data QC

Hard copy data and EDDs will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data

Form. A 10% QC check will be performed on the analysis results to ensure that the hard copy data matches the EDD. All detected errors should be resolved with the laboratory.

Preliminary raw and detects will be generated by running the EDD through the Raw & Detects Tables from Unvalidated or Validated EDD Macro to assist the PM with a preliminary data analysis. A separate table must be created for each matrix.

Data archiving forms will be generated and affixed to each laboratory report received, for cataloguing, tracking, and archiving purposes.

4.4 Data Validation and Reporting

The data validator will be notified 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). The hard copy data, **EDDs**, and a **QC Association Table** will be mailed or emailed to the data validator. The EIS will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

4.4.1 Data Validation

Upon receipt of data from CH2M HILL, data validation will be performed in accordance with the Data Validation SOW, UFP SAP, and any other documents required. Generally, questions or noted inconsistencies identified by the validator should be addressed directly to laboratory, with the EIS notified of issues and resolutions identified.

4.4.2 Validated Data Reporting

The Data Validator will provide a hardcopy and electronic version of the Data Validation Report, as well as a validated version of the EDD to the data management team in the agreed-upon format within the required turn around time.

4.4.3 Validated Data QC

The validated data will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data Form. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the EDD. All detected errors should be resolved with the data validator. .

Validated raw and detects tables will be generated by running the EDD through the Raw & Detects Tables from Unvalidated or Validated EDD Macro to assist the PM with a validated data analysis. A separate table must be created for each matrix.

Data archiving forms will be generated and affixed to each Data Validation Report received, for cataloguing, tracking, and archiving purposes.

4.4.4 Chemist PreLoad Check

All data must be submitted to the PC for a Chemist PreLoad check prior to data loading. All EDDs will be compiled into a single excel Archive file. If data were not validated, the hardcopy data, Archive or PreLoad EDDs, QC association table, and Unvalidated Raw and Detects tables will be provided to the PC for a PreLoad Check that will ensure the hard copy data and EDDs are complete and acceptable. If data

were validated, the hardcopy data validation report, validated EDDs, QC association table and Validated Raw and Detects tables will be provided to the PC for a PreLoad Check that will ensure the hard copy data and EDDs are complete and acceptable.

4.5 Project Data Loading and Storage

All fully evaluated data will be stored in the project repository database(s). This includes other field data acquired with the tools described in the previous sections.

4.5.1 Data Loading

EDDs will be formatted into Load and Archive files with or without the use of the ALPTool, as specified on the EDD Prep for Load and Archive Files Checklist. The Load EDD and FDETool will then be provided to the Database Specialist, who will load the data into the project repository database(s).

4.5.2 Quality Assurance/Quality Control (QA/QC)

Following data loading, the Database Specialist will generate Post Load reports and provide them to the EIS for review and QC. The EIS will review these reports to verify that all data was loaded into the project repository database(s) correctly. Updates or corrections to loaded data will be coordinated with the Database Specialist as necessary. Any changes made to the data by the Database Specialist prior to load, or that will be completed after the load should be tracked, and incorporated into the hard copy and EDD files that are to be archived after project completion.

4.5.3 Invoice Review

Laboratory invoices should be submitted once the laboratory has completed requested analyses, and submitted all results and requested corrections. Data validation invoices should be submitted shortly after the validation has been completed, and the report submitted to CH2M HILL. Invoices will be submitted to the PM through AP Workflow for approval. After all data has been loaded into the data repository and corrections made, the PM should submit all laboratory and data validator invoices to the EIS for review and approval. The EIS will compare costs billed to CH2M HILL to the STS, project instructions, and EDD to ensure that the company is billed correctly for the sample, analysis, and cost totals.

4.5.4 Storage of Deliverables and Documentation

After all corrections identified through the data management process have been completed (if any), the final report written, and the project determined complete, the PM can grant approval to archive the EDD and hard copy data.

Electronic files should be provided to the DMC for archiving on the project servers. The hardcopy reports for any data that was not validated should be sent to the Data Archiving Specialist. For validated data, efforts will be coordinated with the Data Validator to ensure that both the hardcopy Data Validation Report and Laboratory Report are sent to the Data Archiving Specialist. The data will be prepped for archiving and filed within the building until the Data Archiving Specialist has received authorization to send the data to storage.

All project-related documentation generated, such as the STS, Corrections to File Letters, Login Reports, COCs, etc, should be filed into the appropriate project binder for future reference.

4.6 Reporting and Delivery of Results

EnStat will be the primary tool for project staff to access project data. EnStat provides options for querying different types of data and reports, including: raw tables, detects tables, Exceedance tables, regulatory criteria, etc. Adhoc queries or special requests will need to be coordinated with the Database Specialist.

Data requests should be coordinated with the project EIS. The PM will specify the data needs, requirements and formatting (i.e. headers, footers, or other special needs) to be applied to their requests. Raw, detects, and exceedance tables must be queried with EnStat and formatted separately with the Raw, Detects, & Exceedance Tables from EnStat Output Macro for EACH matrix (solid/aqueous). Other macro templates that can be utilized to assist with the formatting of EnStat output files include the HHRA Tables from EnStat Output Macro and EcoRisk Tables from EnStat Output Macro.