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MCB CAMP LEJEUNE
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FINAL SAMPLING AND ANALYSIS PLAN FOR INTRUSIVE INVESTIGATION UXO 11 AND 17
MCB CAMP LEJEUNE NC
11/1/2011
CH2M HILL

SAP Worksheet #1 Title and Approval Page

Final

**Sampling and Analysis Plan
Intrusive Investigation for Military Munitions Response
Program; Sites Unexploded Ordnance (UXO)-11 - Former
B-5 Practice Hand Grenade Course (ASR #2.81) and
UXO-17 - Former Firing Position 2 (ASR #2.12)**

**Marine Corps Base Camp Lejeune
Jacksonville, North Carolina**

CTO-WE41

November 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**

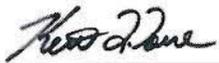
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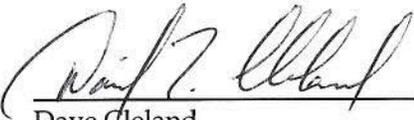


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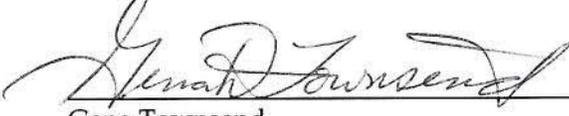
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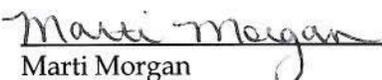
Other Approval Signature:



Dave Cleland Date
NAVFAC Mid-Atlantic - Remedial Project Manager



Gena Townsend Date
USEPA Region 4 - Remedial Project Manager



Marti Morgan Date
NCDENR - Remedial Project Manager

Executive Summary

This document presents the plan for the intrusive investigation including environmental sampling at Site Unexploded Ordnance (UXO)-11, Former B-5 Practice Hand Grenade Course (Archive Search Report [ASR] #2.81), and Site UXO-17 - Former Firing Position 2 (ASR #2.12), herein referred to as Site UXO-11 and UXO-17, located at MCB Camp Lejeune (MCB CamLej) in Jacksonville, North Carolina.

CH2M HILL prepared this document under the U.S. Navy, Naval Facilities Engineering Command (NAVFAC) Atlantic Division, Comprehensive Long-Term Environmental Action - Navy (CLEAN) 1000 Contract N62470-08-D-1000, Contract Task Order (CTO) WE41 in accordance with the Navy's Uniform Federal Policy Sampling Analysis Plan (UFP-SAP) policy guidance to ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable for intended uses. The *Site Management Plan, Fiscal Year 2010, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (CH2M HILL, 2010a) provides additional information and background on MCB CamLej. This intrusive investigation will be conducted under Contract Task Order WE41, Modification 1 and Modification 3.

Environmental Conservation Laboratories, Jacksonville and Orlando, Florida, and GEL Laboratories, Charleston, South Carolina will be responsible for analyzing environmental samples from Site UXO-11 and UXO-17. If additional laboratory services are requested requiring modification to the existing SAP, revised SAP worksheets will be submitted to the Navy and regulatory agencies for approval.

The primary objective of this sampling and analysis plan (SAP) is to further characterize previously identified potential human health and ecological risks at Site UXO-11 and UXO-17. At Site UXO-11, surface and subsurface soil, sediment, surface water, and groundwater sampling will be performed to collect additional data regarding the distribution of explosives residues and chromium within environmental media at the site. At Site UXO-17, groundwater sampling will be performed to evaluate whether a leaking 55-gallon drum containing an unknown substance, found during the 2011 expanded Site Inspection, has impacted groundwater at the site. If MEC is identified and disposed at either site during this investigation, surface soil samples will be collected to evaluate impact by munitions constituents (MC) resulting from demolition. Analytical data from these sampling efforts will be used to determine if additional assessment or interim action is warranted.

UFP-SAP Outline

This SAP consists of 37 worksheets specific to the UFP-SAP. All tables are embedded within the worksheets.

Field standard operation procedures (SOPs) are included in **Attachment 1**. Data management guidelines are included in **Attachment 2** and Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) Accreditation Letters are included in **Attachment 3**. The Environmental Protection Plan (EPP) is contained in **Chapter 8 of the Work Plan**. The Accident Prevention Plan/Health and Safety Plan (APP/HSP) is **Appendix A of the Work Plan**. Upon approval of this Draft UFP-SAP, the sampling activities will be scheduled and executed.

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- 2 Data Management Guidelines
- 3 DoD Environmental Laboratory Accreditation Program Certification

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- 10-3 Site UXO-11 Surface and Subsurface Soil Sampling Locations
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- 10-5 UXO-17 Site Location
- 10-6 Groundwater Sampling Locations at Site UXO-17

Acronyms and Abbreviations

AES	atomic emission spectrometer
AHA	activity hazard analysis
AM	activity manager
APP	accident prevention plan
AQM	activity quality manager
ASR	archive search report
bgs	below ground surface
BIP	blow-in-place
CA	corrective action
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	chain of custody
CSM	conceptual site model
CTO	Contract Task Order
DGM	digital geophysical mapping
DMM	discarded military munitions
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct push technology
DQI	data quality indicator
DQO	data quality objective
DU	decision unit
DV	data validation
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EMD	Environmental Management Division
EPP	Environmental Protection Plan
ERS	ecological risk screening
ft	feet
FTL	field team leader
GC	gas chromatograph
gpm	gallons per minute
GPS	Global Positioning System
GW	groundwater
HHRS	human health risk screening
H&S	health and safety
HPLC	high performance liquid chromatograph

HSM	health and safety manager
HSP	health and safety plan
ICAL	initial calibration
ICP	inductively coupled plasma
ICV	initial calibration verification
IDL	instrument detection limit
IDW	investigation-derived waste
IS	internal standard
kg	kilogram
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LODV	Limit of Detection Verification
m	meter
MC	munitions constituents
MCB CamLej	Marine Corps Base Camp Lejeune
MCL	maximum contaminant level
MDL	method detection limit
MEC	munitions and explosives of concern
mg	milligram
MPPEH	material potentially presenting and explosive hazard
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolt
NAVFAC	Naval Facilities Engineering Command, Mid-Atlantic
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	NCAC 2L Groundwater Quality Standards
NIRIS	Naval Installation Restoration Information Solution
NRWQC	Nationally Recommended Water Quality Criteria
ORP	oxidation-reduction potential
ORR	Operational Readiness Review
PA/SI	preliminary assessment/site inspection
PAL	project action limit
PC	project chemist
PE	Professional Engineer
PETN	pentaerythritol tetranitrate
PG	Professional Geologist
PM	Project Manager
POC	point of contact
PQL	project quantitation limit
PQO	project quality objective
PVC	polyvinyl chloride

QA	quality assurance
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
RRT	relative retention time
RSD	relative standard deviation
RSLs	Regional Screening Levels
SAP	sampling and analysis plan
SB	subsurface soil
SBO	safe behavior observation
SD	sediment
SOP	standard operating procedure
SS	surface soil
SSC	site safety coordinator
SSL	Soil Screening Level
SVOC	semivolatile organic compounds
SW	surface water
TAL	target analyte list
TBD	to be determined
TOC	total organic carbon
UFP	Uniform Federal Policy
ug	microgram
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compounds
WQP	water quality parameter

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SAP Worksheet #2: Sampling and Analysis Plan Identifying Information

Site Name/Number: Site UXO-11 and Site UXO-17

Operable Unit: N/A

Contractor Name: CH2M HILL

Contract Number: N62470-08-D-1000

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

Work Assignment

Number (optional): CTO WE41

1. This sampling and analysis plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (EPA 2005) and United States (U.S.) Environmental Protection Agency (EPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (EPA 2002).
2. Identify regulatory program:
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
3. This SAP is a **project-specific** SAP.
4. List organizational partners (stakeholders) and identify the connection with lead organization:
 - North Carolina Department of Environment and Natural Resources (NC DENR)- regulatory stakeholder
 - U.S. Environmental Protection Agency (USEPA) Region 4 - regulatory stakeholder
 - NAVFAC Mid-Atlantic - lead organization
 - MCB Camp Lejeune - site owner
5. Lead organization: U.S. Department of Navy - Lead Agency
6. If any required SAP elements and 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:

Crosswalk table is excluded, as all required information is provided in this SAP.

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SAP Worksheet #3: Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Dave Cleland	Navy Technical Representative (NTR)	NAVFAC Mid-Atlantic	(757) 322-4851	david.t.cleland@navy.mil
Charity Rychak	Environmental Engineer	MCB CamLej - Environmental Management Division (EMD)	(910) 451-9386	charity.rychak@usmc.mil
Gena Townsend	Remedial Project Manager (RPM)	USEPA Region 4	(404) 562-8538	townsend.gena@epamail.epa.gov
Marti Morgan	RPM	North Carolina Department of Environment and Natural Resources (NCDENR)	(919) 707-8342	martha.morgan@ncdenr.gov
Matt Louth	Activity Manager (AM)	CH2M HILL	(757) 671-6240	matt.louth@ch2m.com
Tom Roth	Senior MR Consultant	CH2M HILL	(404) 474-7640	tom.roth@ch2m.com
Chris Bozzini	Activity Quality Manager (AQM)	CH2M HILL	(704)-544-5163	chris.bozzini@ch2m.com
Teg Williams	Senior Technical Consultant	CH2M HILL	(704) 543-3297	tegwyn.williams@ch2m.com
Keith LaTorre	Project Manager (PM)	CH2M HILL	(865) 769-3204	keith.latorre@ch2m.com
Lael Feist	Task Manager	CH2M HILL	(256) 529-7671	laelruth.feist@ch2m.com
Paul Favara	UFP-SAP Reviewer	CH2M HILL	(352) 384-7067	paul.favara@ch2m.com
Carl Woods	Health & Safety (H&S) Manager	CH2M HILL	(513) 889-5771	carl.woods@ch2m.com
Roni Warren	Human Health Risk Assessor (HHRA)	CH2M HILL	(814) 364-2454	roni.warren@ch2m.com
Jonathon Weier	Ecological Risk Assessor (ERA)	CH2M HILL	(770) 485-7503	jonathon.weier@ch2m.com
David Seed	Field Team Leader (FTL)	CH2M HILL	(865) 560-2983	David.seed@ch2m.com
Keith Dobson	Site Safety Coordinator (SSC)	CH2M HILL	(865) 560-2983	Keith.dobson@ch2m.com
Anita Dodson	Navy Program Chemist	CH2M HILL	(757) 671-6218	anita.dodson@ch2m.com
Bianca Kleist	Project Chemist	CH2M HILL	(704) 543-3274	bianca.kleist@ch2m.com
Troy Horn	Project Data Manager	CH2M HILL	(757) 671-6288	troy.horn@ch2m.com
Ronnie Wambles	Laboratory PM	ENCO Laboratories	(407) 826-5314	rwambles@encolabs.com
Lori Mangram	Laboratory Quality Assurance Officer (QAO)	ENCO Laboratories	(407) 826-5314	lmangram@encolabs.com

SAP Worksheet #3: Distribution List (continued)

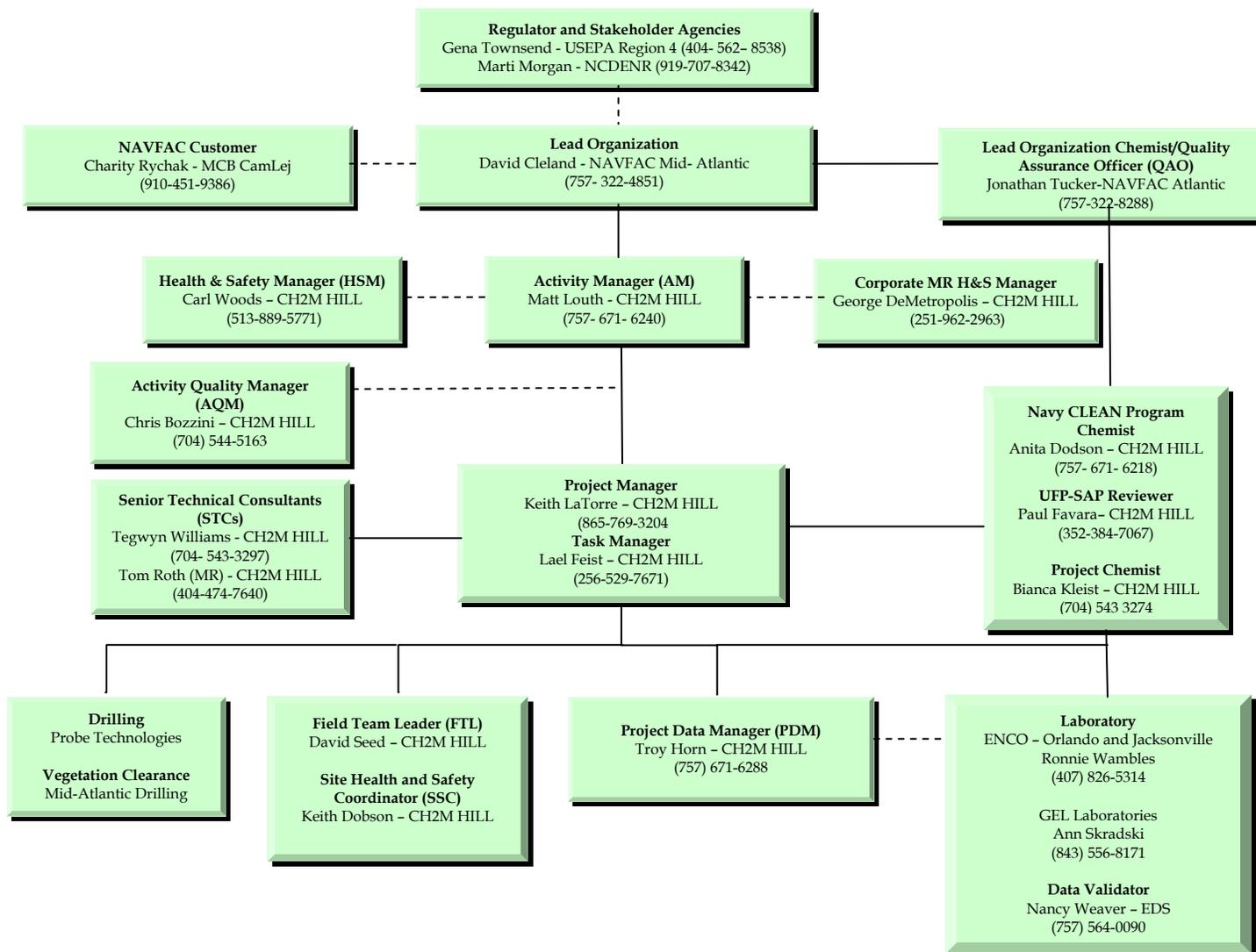
Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Ann Skradski	Laboratory PM	GEL Laboratories	(843)-556-8171	ann.skradski@gel.com
Robert Pullano	Laboratory QAO	GEL Laboratories	(843)-556-8171	bob.pullano@gel.com
Nancy Weaver	Data Validator	Environmental Data Services	(757) 564-0090	nwaeaver@env-data.com

SAP Worksheet #4: Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number	Signature/ email receipt	SAP Section Reviewed	Date SAP Read
Charity Rychak	MCB Camp Lejeune/ EMD	(910) 451-9386			
Matt Louth	CH2M HILL/ AM	(757) 671-6240			
Paul Favara	CH2M HILL / Navy CLEAN Program UFP-SAP Reviewer	(352) 384-7067			
Teg Williams	CH2M HILL/ Senior Technical Consultant	(704) 543-3297			
Keith LaTorre	CH2M HILL/PM	(865) 769-3204			
Lael Feist	CH2M HILL/Task Manager	(256) 529-7671			
Roni Warren	CH2M HILL/ HHRA	(814) 364-2454			
Jonathon Weier	CH2M HILL/ ERA	(770) 485-7503			
Carl Woods	CH2M HILL/ H&S Manager	(513) 889-5771			
Anita Dodson	CH2M HILL / Navy CLEAN Program Chemist	(757) 671-6218			
Bianca Kleist	CH2M HILL / Project Chemist	(704) 543-3274			
Troy Horn	CH2M HILL/ Project Data Manager	(757) 671-6288			
Ronnie Wambles	ENCO/PM	(407) 826-5314			
Lori Mangram	ENCO/QAO	(407) 826-5314			
Ann Skradski	GEL/ PM	(843) 556-8171			
Robert Pullano	GEL/QAO	(843) 556-8171			
Nancy Weaver	EDS / Validator	(757) 564-0090			

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SAP Worksheet #5: Project Organizational Chart



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SAP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication with Navy (lead agency)	Navy NTR/RPM	Dave Cleland	david.t.cleland@navy.mil (757) 322-4851	Primary point of contact (POC) for Navy; can delegate communication to other internal or external POCs. RPM will notify USEPA and NCDENR via email or telephone call within 24 hours for field changes effecting the scope or implementation of the design occur. Navy will have 30 days for work plan review. All sampling data will be presented and discussed during partnering meetings.
Communication with USEPA Region 4	USEPA Region 4 RPM	Gena Townsend	townsend.gena@epamail.epa.gov (404) 562-8538	Primary POC for USEPA; can delegate communication to other internal or external POCs. Upon notification of field changes, USEPA will have 24 hours to approve or comment on the field changes. All data results will be presented and discussed during partnering meetings
Communication with NCDENR	NCDENR RPM	Marti Morgan	martha.morgan@ncdenr.gov (919) 707-8342	Project POC for NCDENR; can delegate communication to other internal or external POCs. Upon notification of field changes, NCDENR will have 24 hours to approve or comment on the field changes.
Communication regarding overall project status and implementation and primary POC with Navy RPM, USEPA, and NCDENR	CH2M HILL AM	Matt Louth	matt.louth@ch2m.com (757) 671-6240	Oversees project and will be informed of project status by the PM. If field changes occur AM will work with the Navy RPM to communicate in field changes to the team via email within 24hrs. All data results will be communicated to the project team during the first partnering meeting following data receipt.
Technical communications for project implementation, and data interpretation	CH2M HILL Senior MR Consultant	Tom Roth	tom.roth@ch2m.com (404)-474-7640	Contact senior consultant regarding questions/issues encountered in the field, input on data interpretation, as needed. Sr. Consultant will have 24 hrs to respond to technical field questions as necessary. Additionally, Sr. consultant will review of the data as necessary prior to partnering team discussion and reporting review.
Technical communications for project implementation, and data interpretation	CH2M HILL Senior Technical Consultant	Teg Williams	tegwyn.williams@ch2m.com (704-543-3297)	Contact senior consultant regarding questions/issues encountered in the field, input on data interpretation, as needed. Sr. Consultant will have 24 hrs to respond to technical field questions as necessary. Additionally, Sr. consultant will review of the data as necessary prior to partnering team discussion and reporting review.

SAP Worksheet #6: Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Quality issues during project implementation and data interpretation	CH2M HILL AQM	Chris Bozzini	chris.bozzini@ch2m.com (704-544-5163)	Contact the AQM regarding quality issues during project implementation. The AQM will report to the AM and the NAVFAC Mid-Atlantic QAO.
Communications regarding project management and implementation	PM	Keith LaTorre	keith.latorre@ch2m.com (865-769-3204)	All information and materials about the project will be forwarded to the Navy, AM, and Senior Consultants as necessary. POC for field sampling team.
Coordinate activities between PM and Field Team / Sub-contractors	Task Manager	Lael Feist	laelruth.feist@ch2m.com (256-529-7671)	All field team and reporting activities will be forwarded to PM for further dissemination if necessary. Responsible for field team members' and subcontractors adherence to work plan.
Health and Safety (H&S)	CH2M HILL SSC	Keith Dobson	keith.dobson@ch2m.com (865-560-2983)	Responsible for the adherence of team members to the site safety requirements described in the Health and Safety Plan (HSP). Will report H&S incidents and near losses to PM.
Work Plan or Quality Assurance Project Plan (QAPP) changes in field/ Field Progress Reports	FTL	David Seed Kristin Rogers	David.seed@ch2m.com (919-760-1770) Kristin.rogers@ch2m.com (919-760-1789)	Documentation of deviations from the Work Plan will be made in the field logbook (made with the approval of AM and/or QAO) and the PM will be notified immediately. Provide daily progress reports to PM. Deviations will be made only with approval from the PM.
Communication regarding risk assessments	Human Health and Ecological Risk Assessors	Roni Warren (Human Health) Jonathan Weier (Ecological)	roni.warren@ch2m.com (814) 364-2454 jonathon.weier@ch2m.com (770) 485-7503	Responsible for conducting risk assessments. Technical questions regarding this project must be answered within 24 hours.
Data tracking from field collection to database upload	PDM	Troy Horn	troy.horn@ch2m.com (757) 671-6288	Tracking data from sample collection through database upload.
Reporting Lab Data Quality Issues	Laboratory QAO	Lori Mangrum (ENCO) and Robert Pullano (GEL)	lmangrum@encolabs.com (407) 826-5314 Bob.pullano@gel.com (834) 556-8171	All quality assurance (QA)/quality control (QC) issues with project field samples will be reported within 2 days to the project chemist (PC) by the laboratory.
Reporting Data Validation (DV) Issues	DV PM	Nancy Weaver	dataqual@charter.net (314) 330-1327	All data validation issues regarding resubmissions from the laboratory will be communicated to the CH2M HILL project chemist and PDM.

SAP Worksheet #6: Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Field and analytical corrective actions (CAs) Release of Analytical Data	Project Chemist	Bianca Kleist	bianca.kleist@ch2m.com (704) 543-3274	Any CAs for field and analytical issues will be determined by the FTL and/or the PC and reported to the PM within 4 hours. No analytical data can be released until validation of the data is completed and has been approved by the PC. The PC will review analytical results within 7 days of receipt for release to the project team.

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SAP Worksheet #7: Personnel Responsibilities Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Dave Cleland	Navy Technical Representative	NAVFAC Mid-Atlantic	Oversees project
Charity Rychak	Environmental Engineer, Base Environmental Management Division	MCB Camp Lejeune	Oversees project
Gena Townsend	USEPA RPM	USEPA	USEPA POC
Marti Morgan	NCDENR RPM	NCDENR	NCDENR POC
Matt Louth, PG	Activity Manager	CH2M HILL	Oversees project activities
Chris Bozzini	Activity Quality Manager	CH2M HILL	Oversees project quality
Paul Favara	Navy CLEAN Program UFP-SAP Reviewer	CH2M HILL	Navy CLEAN Program UFP-SAP Reviewer
Tom Roth, PE	Senior MR Consultant	CH2M HILL	Provides senior MR technical support for remedial action design and implementation
Tim Garretson	Senior MR Technical Consultant	CH2M HILL	Provides senior MR technical support for munitions and explosives of concern (MEC)
Tegwyn Williams, PG	Senior Technical Consultant	CH2M HILL	Provides senior technical support for field investigations and implementation
Carl Woods	H&S Manager	CH2M HILL	Prepares H&S Plan; manages H&S for all field activities
Keith LaTorre	Project Manager	CH2M HILL	Manages Project and coordinates project tasks and project staff
Lael Feist, PE	Task Manager	CH2M HILL	Manages project tasks and coordinates between field Team and PM
David Seed	FTL	CH2M HILL	Coordinates all field activities and sampling
Keith Dobson	Site Manager/SSC	CH2M HILL	Manages all subcontractor and field activities/ Oversees H&S for all field activities
Anita Dodson	Navy CLEAN Program Chemist	CH2M HILL	Provides UFP-SAP project delivery support, provides senior review of UFP-SAP prior to submittal to Navy, and performs data evaluation and QA oversight
Bianca Kleist	Project Chemist	CH2M HILL	Communicates with laboratory and data validator
Troy Horn	Project Data Manager	CH2M HILL	Data Management, manages sample tracking

SAP Worksheet #7: Personnel Responsibilities Table (continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Ronnie Wambles	PM	ENCO	Manages sample tracking and maintains good communication with PC and PDM
Lori Mangrum	Laboratory QA Officer	ENCO	Responsible for audits, CA, checks of QA performance within the laboratory
Ann Skradski	PM	GEL	Manages sample tracking and maintains good communication with PC and PDM
Robert Pullano	Laboratory QA Officer	GEL	Responsible for audits, CA, checks of QA performance within the laboratory
Nancy Weaver	DV	EDS	Validate data received from laboratory prior to data use

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
UXO Safety	UXO Safety (unexploded ordnance) Training Package	Registered training CH2M HILL online (UXO Safety- USAF)	Annually	PM and all field staff	FTL, field team members/ CH2M HILL	CH2M HILL HSE

^a - Training records for field personnel are available on the CH2M HILL Virtual Office

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SAP Worksheet #9: Project Scoping Session Participants Sheet

Project Name: CTO-WE41 Intrusive Investigation of Site UXO-11 and Site UXO-17					
Projected Date(s) of Sampling: July-August 2011				Site Name: Camp Lejeune	
PM: Keith LaTorre				Site Location: Camp Lejeune, Jacksonville, North Carolina	
Dates of Session: May 19, 2011					
Scoping Session Purpose: The purpose of the scoping session was to present a summary of Site UXO-11 and UXO-17 Preliminary Assessment/Site Inspection and expanded Site Inspection results to the Camp Lejeune Project Team and to reach a consensus on the project approach for additional environmental sampling and intrusive investigation.					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Dave Cleland	RPM	NAVFAC Mid-Atlantic	757-322-4851	david.t.cleland@navy.mil	Primary Navy POC
Charity Rychak	RPM	EMD EMC Camp Lejeune	910-451-9386	charity.rychak@usmc.mil	Camp Lejeune Navy POC
Gena Townsend	RPM	USEPA	404-562-8538	townsend.gena@epamail.epa.gov	EPA oversight lead
Marti Morgan	RPM	NCDENR	919- 508-8447	martha.morgan@ncdenr.gov	NCDENR MMRP oversight lead
Matt Louth	Camp Lejeune Activity Manager	CH2M HILL	757 671-8311 x417	matt.louth@ch2m.com	Activity Manager for Camp Lejeune projects. Coordinates CH2M HILL projects at Camp Lejeune with Navy contacts.
Kim Henderson	Deputy Camp Lejeune Activity Manager	CH2M HILL	757-671-8311	kim.henderson@ch2m.com	Deputy Activity Manager for Camp Lejeune projects
Chris Bozzini	Camp Lejeune Quality Activity Manager	CH2M HILL	704-544-5163	chris.bozzini@ch2m.com	Activity Quality Manager for Camp Lejeune projects
Comments/Decisions:					
Consensus:					
<p>The Team will receive and comment on work plan associated with Site UXO-11. The partnering team requested additional environmental sampling at Site UXO-11 because explosives residues were detected in surface and subsurface soil, surface water and groundwater, and chromium was detected above screening levels in surface and subsurface soil, sediment, and groundwater.</p> <p>The Team will receive and comment on work plan associated with Site UXO-17. The partnering team requested groundwater well installation and sampling at Site UXO-17, to evaluate whether groundwater has been impacted by a liquid slurry filled drum discovered 4/25/11 during the intrusive investigation in the interior 4-acre portion of the site.</p>					
Action Items: Prepare a Work Plan and UFP-SAP for review by the Project Team					
Consensus Decisions: The Team agreed that the general approach for investigating UXO-11 and UXO-17 is acceptable.					

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SAP Worksheet #10-1: Conceptual Site Model- Site UXO-11

The objective of this SAP is to guide the assessment of potential environmental impacts related to explosives residues and chromium resulting from munitions use within Site UXO-11 and to evaluate whether potential impacts warrant further assessment at Site UXO-11. This objective will be addressed by sampling and analysis of environmental media for explosives residues (including nitroglycerin and pentaerythritol tetranitrate [PETN]), perchlorate, chromium, and hexavalent chromium, followed by human health and ecological risk screening (ERS).

Site Description

Site UXO-11 is a 2-acre area located north of Sixth Street and east of Seventh Street and the Marine Corps Air Station New River (**Figure 10-1**). The site is undeveloped and covered with landscaped grass. No historical structures or remnants of a practice hand grenade course are present. Current use of Site UXO-11 includes weekly athletic training exercises and occasional graduation ceremonies.

Site History

CH2M HILL HILL completed an Archival Records Search Report for this site as part of the Preliminary Assessment/Site Inspection (PA/SI) (CH2M HILL, 2011a). Historical range overlay maps show Site UXO-11 first appearing as a practice hand grenade course in 1954 (United States Army Corps of Engineers [USACE], 2001). This document also references a map from September 1, 1953 and states that while the range appeared on the 1954 range overlay map, Site UXO-11 was in use only during 1953. To date, no other historical reference to this area being used as a practice hand grenade course has been identified. Existing conditions maps from 1947 and 1953 include the area designated as Site UXO-11. These maps show a mockup structure (Building 507), presumably used for training exercises, within the site boundaries. This building is also seen on aerial photographs from 1946, 1948, and 1951. Building 507 does not appear on maps after 1953. All aerial photographs from 1946, 1948, 1951, 1962, and 1989 show that the area designated as Site UXO-11 was clear of all vegetation except grass.

Previous Site Investigations

A PA/SI was conducted in 2009 for Site UXO-11 to evaluate the potential presence and nature of impacts to environmental media resulting from historical munitions use at the site, and to determine whether additional investigation and/or remediation activities were necessary. The May 2009 digital geophysical mapping (DGM) survey covered approximately 11.5 percent (approximately 0.23 acre) of Site UXO-11. The DGM survey, which utilized a single-coil EM61-MK2 system, resulted in the selection of 70 anomalies representing potential subsurface MEC.

Environmental sampling for MC analysis within Site UXO-11 consisted of:

- Five surface soil samples (0 to 2 inches below ground surface [bgs]) collected from four decision units (DUs) using the incremental sampling technique (twenty samples total)
- Twenty subsurface soil samples (co-located with the surface soil samples) from soil cores collected using a direct push technology (DPT) rig

SAP Worksheet #10-1: Conceptual Site Model- Site UXO-11 (continued)

- Two sediment and two surface water samples each were collected at co-located sites from the unnamed drainage swale in the southeastern portion of the site
- One groundwater sample was collected from each of the five temporary well locations

Samples were analyzed for explosives residues (including PETN and nitroglycerin), perchlorate, and target analyte list (TAL) metals. Surface water and groundwater samples were additionally analyzed for dissolved metals.

Explosives residues and metals were detected in site media and compared to applicable screening criteria, resulting in the following exceedances:

- Surface soil - nitroglycerin, arsenic, and chromium
- Subsurface soil - aluminum, arsenic chromium, and iron
- Sediment - Aluminum, arsenic, and chromium exceeded one or more comparison criteria
- Groundwater - nitrobenzene, arsenic, chromium, and cobalt

The preliminary human health risk screening (HHRS) indicated that potential contact with sediment and potable use of groundwater by current and future receptors could result in carcinogenic risks greater than the target level (primarily associated with chromium). Sediment and groundwater were both evaluated using screening values for hexavalent chromium, the more toxic (and carcinogenic) form of chromium for human receptors, and assuming residential type exposures to both media.

The HHRS determined that if the shallow groundwater for the area were used as a residential potable water supply, there could be unacceptable risks associated with the chromium detected in groundwater. However, this was primarily associated with the assumption that all of the chromium detected in the groundwater is in the hexavalent form, which is unlikely, as discussed in the PA/SI. It should also be noted that the shallow groundwater is not currently used as a potable water supply at Site UXO-11 or MCB CamLej, and it is unlikely that it would be in the future. The HHRS evaluated the more likely exposure scenario, exposure to the shallow groundwater by construction workers during excavation activities. Because the exposure to groundwater for a construction worker is much lower than that for residential potable use, the risk to the construction worker would be within acceptable risk levels. The ERS indicated that there were no unacceptable risks to environmental receptors from exposure to site media.

Based on the DGM results, the draft report recommended that an intrusive investigation be performed to assess the nature of the identified geophysical anomalies.

Conceptual Site Model- Site UXO-11

A conceptual site model (CSM) is critical to the development of an investigation strategy. The following sections describe the site features, potential source areas and release mechanisms, and their relationship with surrounding environmental media and receptors. A hypothetical three-dimensional CSM for generic UXO sites is provided as **Figure 10-2**.

SAP Worksheet #10-1: Conceptual Site Model- Site UXO-11 (continued)

Physical Characteristics

The site is undeveloped, but covered with landscaped grass. The site gently slopes southwest towards Sixth and Seventh Streets. There is little topographic relief at the site, with elevations ranging from approximately 18 to 19 feet above mean sea level. A small drainage swale is located in the southeast corner of the site and several other drainage swales surround the site. The drainage swale on the southeast corner of the site drains southwest towards the traffic circle.

Active supply well PSWTC-600 is approximately 800 feet (ft) from Site UXO-11. The well is screened from 48-70 ft below ground surface (ft bgs), in the Castle Hayne Aquifer, and runs at a rate of 100 gallons per minute (gpm) (AHEC, 2002). The MCB CamLej Wellhead Protection Plan (AHEC, 2002) cites that the cone of influence created from this well pumping at 100 gpm for 10 years, extends under Site UXO-11.

Site UXO-11 is underlain by laterally discontinuous clay and silt to very fine to fine-grained sands of the surficial aquifer up to 15 ft bgs based on description of PA/SI soil cores.

Site-specific hydrogeologic information was also derived from the installation of five shallow temporary monitoring wells screened above the Castle Hayne confining unit in the undifferentiated surficial aquifer, as detailed in the PA/SI. The temporary well depths for Site UXO-11 ranged from 12 to 15 ft bgs. In December 2009, shallow groundwater flow was toward the center of the site at a horizontal hydraulic gradient of approximately 0.02 ft/ft. Shallow groundwater is not reported to be in contact with deep groundwater associated with the water supply well.

Surface water from Site UXO-11 flows to an unnamed tributary of Edwards Creek and then into the New River. The New River flows into the Atlantic Ocean via New River inlet (MCB CamLej, 2002).

Potential Sources of Release

Intact, expended, or discarded practice hand grenades may be a potential source of MCs. These munitions items may be on the surface or near surface of the site.

Fate and Transport

MCs may be present on the surface and in the shallow subsurface and could potentially release into surface water (when present) and underlying sediments. The explosives residue nitroglycerin was present in soil at concentrations greater than screening criteria and chromium was present in soil and sediments concentrations greater than screening criteria. MCs could be transported by erosional forces (surface water runoff and wind) to drainage features on and offsite (e.g., wetlands) and deposited as sediments.

MCs may also be present and transported in groundwater in the surficial aquifer. The explosive residue nitrobenzene and chromium were identified in groundwater above screening criteria.

SAP Worksheet #10-1: Conceptual Site Model- Site UXO-11 (continued)

Potential Receptors

The potential receptors for Site UXO-11 include: visitors, trespassers, Base/industrial workers, and maintenance workers. The current receptors may come in contact with surface soil, surface water, and sediment. Exposure routes may include incidental ingestion of and dermal contact with the surface soil, surface water, and sediment, and inhalation of particulate emissions from the surface soil.

Potable water supplies for MCB CamLej and the surrounding residential area are provided by water supply wells that pump groundwater from the Castle Hayne Aquifer; as a result, there are no current receptors to shallow groundwater at Site UXO-11. There is an active water supply well within 1,500 feet of the site, screened from 48-70 ft below ground surface. However, this well is screened in the Castle Hayne aquifer, not the surficial aquifer. The groundwater use patterns are already established for the Base and area around Site UXO-11, so use of shallow groundwater from Site UXO-11 for industrial or residential purposes is unlikely. Additionally, the surficial aquifer at MCB CamLej is not suitable for potable water use due to high dissolved solids and hardness levels and fluctuating water levels that negatively affect water yields. Base/industrial workers and maintenance workers could come into contact with groundwater, if construction were to occur at the site in the future.

Problem Definition

Although the PA/SI screening level assessment identified no unacceptable human health or ecological risks from exposure to site media, additional environmental sampling is necessary to characterize explosives residues and chromium. Explosives residues were detected in all media except sediment. The explosives residues nitroglycerin and nitrobenzene exceeded screening criteria in surface soil and groundwater, respectively. Discrete grab samples would provide better delineation of the extent of impact by explosives residues. Chromium was detected above screening values in all media. Speciation of chromium would indicate whether chromium was present onsite as hexavalent chromium, the most toxic form.

The environmental questions and problems to be addressed by the investigation are:

1. **Have there been releases of MCs to soil?** This question will be addressed by collecting 20 surface and 20 subsurface soil samples as shown on **Figure 10-3**. Surface soil samples will be collected as grab samples; whereas subsurface soil samples will be collected by hand auger, from unsaturated soil immediately above the water table (estimated at 5 feet bgs). Soil samples will be analyzed for explosives residues (including nitroglycerin and PETN), perchlorate, chromium, and hexavalent chromium.
2. **Have there been releases of MCs to sediment?** This question will be addressed by collecting two sediment samples from the unnamed drainage swale in the southeastern portion of the site, as shown on **Figure 10-4**. Sediment samples will be analyzed for explosives residues (including nitroglycerin and PETN), perchlorate, chromium, and hexavalent chromium.

SAP Worksheet #10-1: Conceptual Site Model –Site UXO-11 (continued)

3. **Have there been releases of MCs to surface water?** This question will be addressed by collecting two surface water samples from the unnamed drainage swale in the southeastern portion of the site, as shown on **Figure 10-4**. Samples will be collected first from the downstream location and then the upstream location. If no surface water is present at the planned locations, the samples will be collected from the nearest available surface water within the drainage swale. Surface water samples will be analyzed for explosives residues (including nitroglycerin and PETN), perchlorate, total chromium, dissolved chromium, total hexavalent chromium and dissolved hexavalent chromium.
4. **Have there been releases of MCs to groundwater?** This question will be addressed by collecting and analyzing groundwater samples from five new permanent monitoring wells screened within the surficial aquifer. The five new monitoring wells will be constructed at the locations shown on **Figure 10-4** to evaluate transport of potential MCs on and offsite. Groundwater samples will be analyzed for explosives residues (including nitroglycerin and PETN), perchlorate, total chromium, dissolved chromium, total hexavalent chromium, and dissolved hexavalent chromium. The dissolved chromium and dissolved hexavalent chromium analyses will be used to assess transport pathways to surface water and sediment and availability to receptors.
5. **If MEPPH/MEC is disposed via detonation onsite or is observed with filler that appears to have leaked into adjacent soil, has a release of MC occurred?** To address this question, samples will be collected at locations where controlled detonations/blow-in-place (BIP) operations are conducted and at locations where MEC/material potentially presenting and explosive hazard (MPPEH) filler appears to have leaked into the adjacent soil. Composite surface soil samples will be collected using the TR-02-1 sampling approach in the resulting crater, and the incremental sampling method will be utilized to collect a sample from outside of the crater. For the TR-02-1 sampling approach, a 1 meter (m) x 1m, and soil samples will be collected by compositing 30 sample increments from random locations within each sampling location, from depths of 0 to 2 inches bgs. In the instances where MEC/MPPEH is consolidated for controlled detonation and where it the MEC/MPPEH filler appears to have leaked to the adjacent soil, composite soil samples will be collected using the TR-02-01 sampling approach. Samples will be analyzed for explosives residues (including nitroglycerin and PETN), perchlorate, and TAL metals.
6. **If releases are identified through environmental sampling and analysis, what is the appropriate next step?**

This determination will be made based on an evaluation of the analytical data in accordance with the decision analysis tree shown in Worksheet #11.

SAP Worksheet #10-2: Conceptual Site Model- Site UXO-17

The objective of this SAP is to guide the assessment of potential environmental impacts to groundwater related to a liquid slurry filled 55-gallon drum containing an unknown substance. This objective will be addressed by installation of temporary monitoring wells and groundwater sampling and analysis of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) from new and existing wells.

Site Description

Site UXO-17 is approximately 16 acres in area and is located east of Piney Green Road and north of the current base landfill (**Figure 10-5**). This site is accessible from Old Bear Creek Road, which crosses the southern portion of the investigation area. In addition, a fence associated with the Base landfill is located in the southeast portion of Site UXO-17.

The site is located approximately 23 feet above msl. The site topography gently slopes to the southeast, with little relief besides manmade earthen mounds and "foxholes". Construction debris is found in piles and pits onsite. Surface water runoff at Site UXO-17 flows into localized drainage ditches which in turn drain to Wallace Creek. Surface water also ponds in the south-central portion of the site. Portions of the site have been cleared of vegetation for SI activities.

Site History

Site UXO-17 (ASR#2.212) was reportedly used as a firing position from the 1950s through at least 1985. 105-mm and 155-mm howitzers were used at this site to fire practice rounds into the K-2 and G-10 Impact Areas (CH2M HILL, 2010c). In addition, 4.2-inch mortars, 175-mm guns, 8-inch howitzers, and 120-mm mortars also may have been fired from this location, with unused projectile propellant being burnt on the ground. No CWM was reported to have been used at this site. Based on concrete, metal drums, and other scrap metal encountered during intrusive investigation, the site has also been used for disposal of construction debris.

Previous Investigations

2008 Focused PA/SI

A focused PA/SI was conducted in September and October 2008 over the central 4-acres of Site UXO-17 that included DGM and environmental sampling. DGM was conducted over the entire 4-acre portion of the site using an EM61-MK2A, with the exception of areas that could not be accessed due to irregular terrain, dense trees, or construction debris. A total of 1,310 anomalies and 21 saturated response areas with a signal greater than 3 millivolts (mV) were identified from the DGM data as representing potential subsurface MEC. A saturated response area is where a subsurface anomaly or multiple subsurface anomalies are present for which the signal is so strong that one cannot distinguish between individual anomalies. Reinforced concrete, metallic debris, and soil mounds were observed on the ground surface throughout a high anomaly concentration area.

SAP Worksheet #10-2: Conceptual Site Model- Site UXO-17 (continued)

Sampling during the focused PA/SI included collection of:

- Three composite surface soil samples from each of three 40 m × 70 m decision units
- Four subsurface soil samples at depths ranging from 3 to 7 feet bgs
- Four groundwater samples from temporary monitoring wells installed during the focused PA/SI.

All samples were analyzed for explosives residues, perchlorate, and total TAL metals. Chromium in groundwater samples was the only metal that exceeded both Base background concentrations and regulatory screening criteria.

A HHRS including a risk ratio evaluation was performed based on surface soil, subsurface soil, and groundwater analytical results. Results of the HHRS indicate that there are no unacceptable risks identified for current or likely future receptors exposed to site media. An ERS was performed based on surface soil and groundwater analytical results. Results of the ERS indicate that there are no unacceptable risks identified for ecological receptors exposed to site media.

Based on the results of the HHRS and ERS, no further evaluation of surface soil, subsurface soil, and groundwater was recommended within the 4-acre Focused PA/SI investigation area (CH2M HILL, 2010d).

Based on the DGM results, an intrusive investigation of the anomalies identified within the Focused PA/SI investigation area was recommended to assess the nature of the sources of the identified anomalies. An evaluation of the presence and nature of any subsurface anomalies and MC contamination that may exist was also recommended for the surrounding 12 acres of Site UXO-17, to complete a site-wide PA/SI.

2010 Expanded PA/SI

Additional DGM and environmental sampling field activities were completed over the remaining 12 acres of Site UXO-17 in November and December 2010 as a continuation of the PA/SI.

Approximately 9% of the 12-acre portion of the site was geophysically mapped using an EM61-MK2 system. A total of 656 anomalies greater than 3 mV were identified as representing potential subsurface MEC (CH2M HILL, 2010c). Metal and reinforced concrete debris was observed at multiple locations and may constitute a portion of the selected anomalies.

Environmental sampling within the 12-acre portion of Site UXO-17 consisted of:

- Three surface soil samples each collected from three 30m × 30m DUs at depths of 0 to 2 inches bgs using incremental sampling.
- Nineteen surface soil samples were collected using the TR-02-1 sampling method from a depth of 0 to 2 inches bgs.

SAP Worksheet #10-2: Conceptual Site Model- Site UXO-17 (continued)

- Ten subsurface soil samples from soil cores collected using a DPT rig
- One sediment and one surface water sample collected from a co-located site.
- Seven groundwater samples collected from temporary groundwater monitoring wells

Soil and sediment samples were analyzed for explosives residues (including PETN and nitroglycerin), perchlorate, and TAL metals. Surface water and groundwater samples were analyzed for explosives residues, total TAL metals and dissolved metals; three groundwater samples were analyzed additionally for total chromium and hexavalent chromium.

In collected surface soil samples:

- Arsenic, chromium, cobalt, iron, and manganese were detected at concentrations greater than twice the Base background values and at least one regulatory screening level.

In collected subsurface soil samples:

- Aluminum, arsenic, chromium and iron were detected at concentrations greater than twice the Base background values and at least one regulatory screening level.

In the collected sediment sample:

- Aluminum, arsenic, and chromium were detected at concentrations greater than at least one regulatory screening level in the sample.

In collected groundwater samples:

- Chromium, cobalt, potassium, and dissolved potassium were detected at concentrations exceeding Base background groundwater concentrations and at least one regulatory screening criterion.

Human health and ERS did not identify any unacceptable risks for human or ecological receptors from any media in the investigation area and further investigation of Site UXO-17 for MCs was not recommended. For the 12-acre portion of the site, it was recommended that the anomalies selected as representing potential subsurface MEC be intrusively investigated.

2011 Expanded SI

An Expanded SI for UXO-17 was performed in 2011 that included intrusive investigation of 1,310 anomalies and 21 saturated response areas in the 4-acre portion of the site (all target anomalies and saturated response areas identified in the 4-acre portion of the site during the PA/SI) and 70 anomalies in the in the 12-acre portion of the site (approximately 10% of the target anomalies identified in the 2010 Expanded PA/SI). Of the investigated anomalies, 38 were determined to be "no contact" (i.e. the source of the anomalies was not identified).

SAP Worksheet #10-2: Conceptual Site Model- Site UXO-17 (continued)

On March 29, 2011, a single MEC item, a ¼ lb supplemental charge, determined to be a discarded military munitions (DMM) item, was found within a saturated response area in the 4-acre portion of the site. The item was blown-in-place on March 30, 2011. Three post-detonation soil samples were collected and indicated no unacceptable risk to human or ecological receptors. MPPEH items encountered included 5.56mm and 7.62mm blank ammunition and practice land mine parts. In addition more than 263,000 pounds of cultural items (including construction debris and scrap metal) were recovered.

During the intrusive investigation, a total of six 55-gallon metal drums were identified onsite. One of these drums was partially filled with soil and another drum was filled with a liquid slurry. Upon disturbance of the liquid slurry filled drum, liquid leaked onto the ground surface. A sample collected from its contents was found to contain detectable concentrations of metals (arsenic, barium, cadmium, chromium, and lead), VOCs (n-butylbenzene, sec-butylbenzene, iso-propylbenzene, p-isopropyltoluene, naphthalene, n-propylbenzene, 1,2,4-trichlorobenzene, 1,3,5-trimethylbenzene, and o-xylene), and SVOCs (2,4-dimethylphenol, 1-methylnaphthalene, 2-methylnaphthalene). Impacted soil from the spill was containerized into 35 55-gallon drums and is currently awaiting analysis prior to disposal. The Partnering Team concurred that a shallow groundwater investigation should be conducted in the vicinity of the former location of the liquid slurry-filled drum.

Conceptual Site Model

The following sections describe the site features, potential source areas and release mechanisms, and their relationship with surrounding environmental media and receptors for Site UXO-17. A hypothetical three-dimensional CSM for generic UXO sites is provided as **Figure 10-2**.

Physical Characteristics

Former Firing Position 2 is located approximately 23 feet above msl. The site topography gently slopes to the southeast, with little relief besides manmade earthen mounds and pits. Surface water ponds in the south-central portion of the site. Surface water runoff in the northern part of the site ultimately flows into localized drainage ditches which in turn drain to Wallace Creek. Prior to investigation activities, approximately 60 percent of the site was wooded with the remainder of the site cleared of vegetation.

Based on soil cores collected during the PA/SI, subsurface geology at the site consists of shallow deposits at the site consist of discontinuous layers of fine-grained sands to fine-grained silty sands and discontinuous layers of clay consistent with the undifferentiated formation. The water table was encountered at depths ranging from 3 to 11 feet bgs.

Site-specific hydrogeologic information was derived from the installation of four shallow temporary monitoring wells in the 4-acre portion of the site and seven shallow temporary monitoring wells in the 12-acre portion of the site during the PA/SI. The temporary well depths for Site UXO-17 ranged from 13 to 17 ft bgs which were screened above the Castle Hayne confining unit in the surficial aquifer. In December 2010, groundwater flow generally flowed toward the northeast, based on groundwater elevations measured in the 12-acre portion of the site.

SAP Worksheet #10-2: Conceptual Site Model- Site UXO-17 (continued)

Potential Sources of Release

The Potential source of VOCs and/or SVOCs may include the leaking drum discovered during anomaly investigation in the 4-acre portion of the site, as shown on **Figure 10-6**.

Fate and Transport

VOCs and/or SVOCs may be present in shallow groundwater and could potentially release into offsite surface water bodies and underlying sediments.

Potential Receptors

The potential receptors for Site UXO-17 include: visitors, trespassers, Base/industrial workers, and maintenance workers. Current receptors may come in contact with surface soil. Exposure routes may include incidental ingestion of and dermal contact with the surface soil and inhalation of volatile and particulate emissions from the surface soil.

Future site use is not expected to change significantly from current site use; therefore, potential future receptors include current receptors and construction workers who perform any future construction projects at the site. Additionally, although unlikely, future residents are included as a worst-case scenario, to evaluate unrestricted future site use. Future receptors could be exposed to surface, subsurface soil, and groundwater if future construction at the site were to result in re-working the soil and exposing the subsurface soil and groundwater. Exposure routes for future exposure to the surface and subsurface soil are the same as those for current surface soil: incidental ingestion of and dermal contact with the soil, and inhalation of volatile and particulate emissions from the soil. Exposure routes for groundwater include dermal contact and ingestion.

Problem Definition

A 55-gallon drum filled with a liquid slurry containing metals, VOCs, and SVOCs was discovered in the 4-acre portion of the site during the expanded Site Inspection in April 2011. If one or more releases of VOCs or SVOCs have occurred to groundwater, it is unknown the nature and extent of area which presents potentially unacceptable risk to human health and/or ecological receptors; therefore, further assessment of groundwater is warranted.

SAP Worksheet #10-2: Conceptual Site Model- Site UXO-17 (continued)

The environmental questions and problems to be addressed by the investigation are:

1. **Have there been releases of VOCs or SVOCs to groundwater?** This question will be addressed by installing three new temporary monitoring wells near and immediately down gradient of location where the leaking 55-gallon drum was found. Eight groundwater samples will be collected from new and existing monitoring wells and submitted for laboratory analysis. Groundwater sampling locations are shown on **Figure 10-6**. Groundwater samples will be analyzed for VOCs and SVOCs.
2. **If MEPPH/MEC is disposed via detonation onsite or is observed with filler that appears to have leaked into adjacent soil, has a release of MC occurred?** To address this question, samples will be collected at locations where controlled detonations/BIP operations are conducted and at locations where MEC/MPPEH filler appears to have leaked into the adjacent soil. Composite surface soil samples will be collected using the TR-02-1 sampling approach in the resulting crater, and the incremental sampling method will be utilized to collect a sample from outside of the crater. In the instances where MEC/MPPEH is consolidated for controlled detonation and where it the MEC/MPPEH filler appears to have leaked to the adjacent soil, composite soil samples will be collected using the TR-02-01 sampling approach. Samples will be analyzed for explosives residues, PETN, nitroglycerin, perchlorate, and TAL metals.
3. **If releases are identified through environmental sampling and analysis, what is the appropriate next step?**

This determination will be made based on an evaluation of the analytical data in accordance with the decision analysis tree shown in Worksheet #11.

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

This section presents the project quality objectives for the investigations at Site UXO-11 and UXO-17.

Who will use the data?

At Site UXO-11, the data will be used by the MCB CamLej project team to evaluate the extent of explosives residues and chromium impacts to surface and subsurface soil, sediment, surface water and groundwater potentially from munitions use. At site UXO-17, the data will be used to evaluate VOCs and SVOCs impacts to groundwater potentially resulting from drum disposal at the site. The data at both sites will be used to assess whether the potential releases warrant further assessment or action.

What are the project action limits?

The project action limits (PALs) were developed by the project team and are based on established criteria, as summarized below:

Site UXO-11

Surface and Subsurface Soil

1. Surface and subsurface soil analytical results for metals will be compared to two times the mean base background concentrations for soil (Baker, 2002).
2. Surface and subsurface soil analytical results also will be compared to the adjusted USEPA Regional Screening Levels (RSLs) for industrial and residential soil (USEPA, 2011). The RSLs based on noncarcinogenic effects will be adjusted by dividing by 10 to account for exposure to multiple constituents; the RSLs based on carcinogenic effects will be used as presented in the USEPA RSL table.
3. Surface and subsurface soil analytical results also will be compared to the NCDENR Soil Screening Levels (SSLs) (NCDENR, 2010a).

Sediment

Concentrations of target analytes detected in sediment samples will be compared to the USEPA RSLs for residential soil. The adjusted (as defined above) USEPA soil RSLs are the established screening criteria for sediment at MCB CamLej.

Surface Water

1. Surface water analytical results will be compared to the North Carolina Administrative Code (NCAC) 2B surface water quality standards for human health and water supply, if available.
2. Concentrations of surface water constituents also will be compared to the Nationally Recommended Water Quality Criteria (NRWQC) for human health, if available.
3. If a NCAC 2B surface water standard or an NRWQC are not available for a detected constituent, the adjusted (as defined above) USEPA tap water RSL will be used for comparison, as agreed by the Partnering Team.

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

Site UXO-11 continued

Groundwater

1. In accordance with policy developed by the Project Team, groundwater analytical results for metals will be compared to two times the mean base background concentrations (Baker, 2002).
2. Groundwater analytical results will be compared to NCAC 2L Groundwater Quality Standards (NCGWQS) (NCDENR, 2010b).
3. If a standard for a substance is less than the laboratory practical quantitation limit, the detection of that substance at or above the practical quantitation limit shall constitute a violation of the NCGWQS. The practical quantitation limit for this project is set at the laboratory limit of quantitation (LOQ).
4. Groundwater analytical results also will be compared to the adjusted (as defined above) USEPA RSLs for tap water (USEPA, 2011) and drinking water maximum contaminant levels (MCLs).

Site UXO-17

Groundwater

1. In accordance with policy developed by the Project Team, groundwater analytical results for metals will be compared to two times the mean base background concentrations (Baker, 2002).
2. Groundwater analytical results will be compared to NCGWQS.
 - If a standard for a substance is less than the laboratory practical quantitation limit, the detection of that substance at or above the practical quantitation limit shall constitute a violation of the NCGWQS. The practical quantitation limit for this project is set at the laboratory limit of quantitation (LOQ).
3. Groundwater analytical results also will be compared to the adjusted (as defined above) USEPA RSLs for tap water (USEPA, 2011) and drinking water MCLs.

What will the data be used for? The data will be used to perform human health screening and ecological risk screenings and evaluate: the nature of any contamination, its significance of release, if releases took place, and if so, whether further assessment or interim action is warranted.

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

What types of data are needed?

- Worksheet #10-1 and Worksheet #10-2 define the sample media and target analyte list to be used during this investigation of Site UXO-11 and Site UXO-17, respectively. Since explosives residues were detected in surface and subsurface soil, surface water, and groundwater and total chromium was detected above screening levels in surface and subsurface soil, sediment, and groundwater, the target analytes list for Site UXO-11 includes explosives residues (including PETN and nitroglycerin), perchlorate, total chromium, and hexavalent chromium. Surface water and groundwater samples will additionally be analyzed for dissolved chromium and dissolved hexavalent chromium. The analytical results will provide additional information regarding the distribution and concentrations of explosives residues and the speciation of chromium in environmental media onsite. At Site UXO-17, a buried leaking drum was found onsite in April 2011 that contained metals, VOCs, and SVOCs. Groundwater will be sampled for VOCs and SVOCs. The analytical results will provide data regarding potential impacts to groundwater.
- Water quality parameters, including field testing for pH, conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO), temperature, and turbidity, will be measured during the purging of the monitoring wells and sampling of groundwater.
- Lithologic logging of soil cuttings will be conducted during drilling operations. The logging activities will facilitate selection of well screen intervals and will supplement the CSMs for each site.
- Surface and subsurface soil and sediment sample locations will be recorded by hand-held global positioning system (GPS) devices during environmental sampling activities. Following sample collection, monitoring well locations and elevations will be surveyed by a NC-licensed surveyor. Field activities will be recorded in a field notebook to document adherence to the approved work plan. The CH2M HILL "Preparing Field Log Books SOP" located in **Attachment 2** describes the documentation required for log book completion.

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

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

- Laboratory analytical data will be distributed to a third-party validator for data quality evaluation. Data validation procedure requirements are detailed in Worksheet #36. The data needs to be of sufficient quality for determining the concentration of constituents in media samples such that the project objectives can be achieved.
- Visual observations (soil saturation, staining etc.) will be used to determine appropriate well screen placement for groundwater sampling at Site UXO-11 and UXO-17 and to help select subsurface soil sampling intervals at Site UXO-11.
- The groundwater sampling activities must result in the collection of samples that are representative of the water-bearing formation. This will be ensured, in part, by installing and developing the groundwater monitoring wells in accordance with the CH2M HILL “Installation of Shallow Monitoring Wells SOP” (**Attachment 2**).
- In addition to correct installation procedures, monitoring wells must be purged to allow for a representative sample to be collected. Purging will be considered complete when the water quality parameters (temperature, pH, specific conductance, DO, turbidity and ORP) have stabilized for three consecutive readings (every 3 to 5 minutes), and at least 1 well volume has been purged with minimal drawdown. Stabilization is achieved when the water quality parameters meet the following criteria:
 - Temperature: within 1 degree Celsius
 - pH: within 0.1 pH units
 - Specific conductance: within 3 percent
 - Dissolved oxygen: within 10 percent
 - Turbidity: within 10 percent or as low as practicable given sampling conditions
 - ORP: within 10 mV
 - Groundwater sampling procedures are detailed in Worksheet #14.

During the investigation, QA/QC samples will be collected along with the various media samples as a check on sampling and analytical protocol. Worksheet #20 describes the QA/QC quantities and analyses for this UFP-SAP.

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

How much data should be collected?

1. For environmental sampling this question will be answered by the following. The number of samples and rationale are provided in Worksheet #17:
 - UXO-11 Surface and Subsurface Soil: 20 surface soil samples and 20 subsurface samples are proposed for collection and subsequent analysis for explosives residues (including nitroglycerin and PETN), perchlorate, chromium, and hexavalent chromium analysis.
 - UXO-11 Sediment: two sediment samples are proposed for collection and subsequent analysis for explosives residues (including nitroglycerin and PETN), perchlorate, chromium, and hexavalent chromium analysis.
 - UXO-11 Surface Water: two surface water samples are proposed for collection and subsequent analysis for explosives residues (including nitroglycerin and PETN), perchlorate, total and dissolved chromium, and total and dissolved hexavalent chromium.
 - UXO-11 Groundwater: five groundwater samples are proposed for collection and subsequent analysis for explosives residues (including nitroglycerin and PETN), perchlorate, and total and dissolved chromium, total and dissolved hexavalent chromium.
 - UXO-17 Groundwater: a total of eight samples will be collected from monitoring wells (3 newly installed and 5 existing) and subsequently analyzed for VOCs and SVOCs.

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

- The environmental samples will be collected within and nearby site boundaries as shown on **Figures 10-3** and **10-4** (Site UXO-11) and **Figure 10-6** (Site UXO-17).
- The proposed investigation will be conducted in July-August 2011.
- The environmental samples will be collected in accordance with the SOPs presented in Worksheet #21.

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

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

- CH2M HILL staff will collect environmental samples, including surface and subsurface soil, sediment, surface water, and groundwater as outlined in Worksheets #10-1, #10-2, and #18.
- Borehole drilling, monitoring well installation, and well development will be performed by a North Carolina-licensed well drilling subcontractor with oversight provided by CH2M HILL staff.
- Laboratory analytical services will be provided by a qualified analytical laboratory under subcontract to CH2M HILL.
- Once generated, analytical data will be submitted to a qualified data validation company for validation against analytical methodology requirements and measurement performance criteria presented in this UFP SAP.
- CH2M HILL will receive validated data and upload the data into a centralized electronic database used for Navy projects by project team.
- Data will be reported in the intrusive investigation report, which will be submitted to the Navy as a draft for review prior to distribution to the NCDENR and USEPA for review and approval.

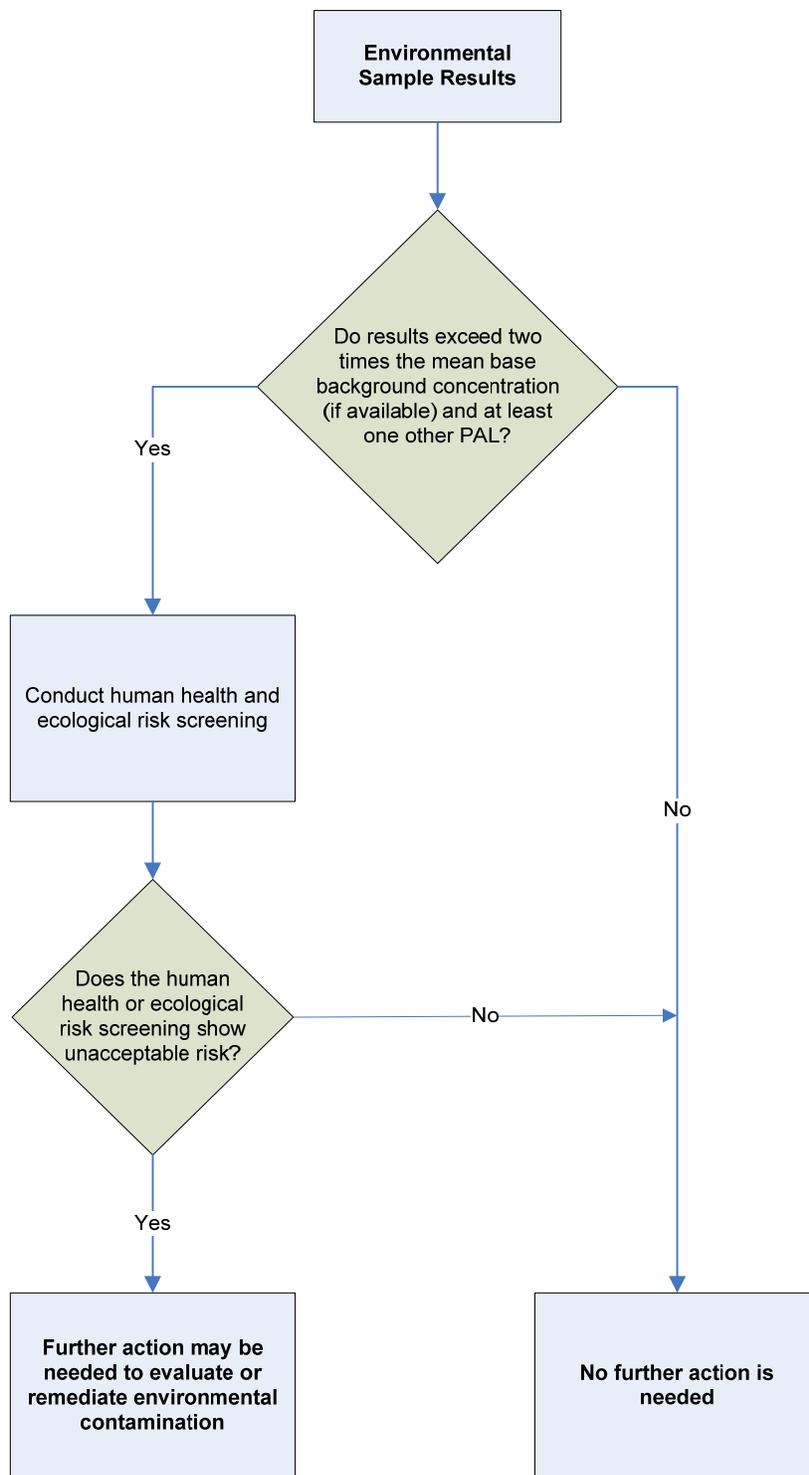
How will the data be archived?

Data will be archived according to the Navy CLEAN program/contract requirements. Data will be uploaded into a centralized database Naval Installation Restoration Information Solution (NIRIS) maintained by CH2M HILL and used for Navy projects. At the end of the project, paper copies of archived laboratory data and validation reports will be returned to the Navy.

Project quality objectives listed in the form of if/then qualitative and quantitative statements.

The decision analysis process depicted on **Figure 11-1** represents the project quality objectives (PQOs) for the environmental media sample data collected at the sites. The general objective of the decision analysis process is to evaluate whether a CERCLA-related release occurred and, if so, whether the release warrants further investigation or action.

FIGURE 11-1
Project Quality Objectives Decision Flow Chart:
Contract Task Order WE41- Sites UXO-11 and UXO-17
MCB CamLej



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SAP Worksheet #12-1A: Field Quality Control Samples- Site UXO-11

Matrix: Surface Soil, Surface Soil, Sediment¹

Analytical Group: Explosives

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Explosives	One per 10 field samples	Precision	Relative percent difference (RPD) $\leq 30\%$	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 degrees Celsius (°C)	S

¹ Surface soil, subsurface soil and sediment will each have their own associated field QC.

SAP Worksheet #12-1B: Field Quality Control Samples- Site UXO-11

Matrix: Surface Soil, Surface Soil, Sediment¹

Analytical Group: Perchlorate

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Perchlorate	One per 10 field samples	Precision	RPD ≤15%	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

¹ Surface soil, subsurface soil and sediment will each have their own associated field QC.

SAP Worksheet #12-1C: Field Quality Control Samples- Site UXO-11

Matrix: Surface Soil, Surface Soil, Sediment¹

Analytical Group: Chromium

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Chromium	One per 10 field samples	Precision	RPD ≤20%	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

¹ Surface soil, subsurface soil and sediment will each have their own associated field QC.

SAP Worksheet #12-1D: Field Quality Control Samples- Site UXO-11

Matrix: Surface Soil, Subsurface Soil, Sediment¹

Analytical Group: Hexavalent Chromium

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Hexavalent Chromium	One per 10 field samples	Precision	RPD ≤30%	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

¹ Surface soil, subsurface soil and sediment will each have their own associated field QC.

SAP Worksheet #12-1E: Field Quality Control Samples- Site UXO-11

Matrix: Surface Water, Groundwater

Analytical Group: Explosives

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Explosives	One per 10 field samples	Precision	RPD \leq 30%	S & A
Equipment Rinseate Blank ²		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 degrees Celsius (°C)	S

¹ Surface water and groundwater will each have their own associated field QC.

² Surface water samples will be collected in the clean bottleware provided by the laboratory; no equipment blank will be collected.

SAP Worksheet #12-1F: Field Quality Control Samples- Site UXO-11

Matrix: Surface Water, Groundwater ¹

Analytical Group: Perchlorate

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Perchlorate	One per 10 field samples	Precision	RPD ≤15%	S & A
Equipment Rinseate Blank ²		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

¹ Surface water and groundwater will each have their own associated field QC.

² Surface water samples will be collected in the clean bottleware provided by the laboratory; no equipment blank will be collected.

SAP Worksheet #12-1G: Field Quality Control Samples- Site UXO-11

Matrix: Surface Water, Groundwater¹

Analytical Group: Chromium

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Chromium	One per 10 field samples	Precision	RPD ≤20%	S & A
Equipment Rinseate Blank ²		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

¹ Surface water and groundwater will each have their own associated field QC.

² Surface water samples will be collected in the clean bottleware provided by the laboratory; no equipment blank will be collected.

SAP Worksheet #12-1H: Field Quality Control Samples- Site UXO-11

Matrix: Surface Water, Groundwater¹

Analytical Group: Hexavalent Chromium

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Hexavalent Chromium	One per 10 field samples	Precision	RPD ≤20%	S & A
Equipment Rinseate Blank ²		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

¹ Surface water and groundwater will each have their own associated field QC.

² Surface water samples will be collected in the clean bottleware provided by the laboratory; no equipment blank will be collected.

SAP Worksheet #12-2A: Field Quality Control Samples- Site UXO-17

Matrix: Groundwater

Analytical Group: VOCs

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DOIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	VOCs	One per 10 field samples	Precision	RPD \leq 30%	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Trip Blank		One per cooler	Bias / Contamination	Same as Equipment Blank	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

SAP Worksheet #12-2B: Field Quality Control Samples- Site UXO-17

Matrix: Groundwater

Analytical Group: SVOCs

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DOIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	SVOCs	One per 10 field samples	Precision	RPD ≤30%	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	0-6 °C	S

SAP Worksheet #12-3A: Field Quality Control Samples- Sites UXO-11 & UXO-17 Post-Detonation Sampling

Matrix: Surface Soil Composite and Surface Soil Incremental¹

Analytical Group: Explosives

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	Explosives	One per 10 field samples	Precision	RPD ≤20%	S & A
Equipment Rinseate Blank		One per day	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	2-6 °C	S

¹For Field Duplicates, surface soil composite and incremental samples will be treated as separate matrices.

SAP Worksheet #12-3B: Field Quality Control Samples- Sites UXO-11 & UXO-17 Post-Detonation Sampling

Matrix: Surface Soil Composite and Surface Soil Incremental¹

Analytical Group: Perchlorate

Concentration Level: Low

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

¹For Field Duplicates, surface soil composite and incremental samples will be treated as separate matrices.

SAP Worksheet #12-3C: Field Quality Control Samples- Sites UXO-11 & UXO-17 Post-Detonation Sampling

Matrix: Surface Soil Composite and Surface Soil Incremental¹

Analytical Group: TAL Metals, including Mercury

Concentration Level: Low

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Field Duplicate	TAL Metals, including Mercury	One per 10 field samples ¹	Precision	RPD ≤20%	S & A
Equipment Rinseate Blank		One per day ²	Bias / Contamination	Same as Method Blank, Refer to Worksheet #28	S & A
Temperature Blank		One per cooler	Accuracy / Representativeness	2-6 degrees Celsius (°C)	S

¹For Field Duplicates, surface soil composite and incremental samples will be treated as separate matrices.

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SAP Worksheet #13: Secondary Data Criteria and Limitations Table

Secondary Data	Data Source	Data Generator(s)	How The Data Will Be Used	Limitations on Data Use
Site UXO-11				
2011 Archival Report	CH2M HILL, <i>Archival Records Search Report for the Preliminary Assessment/Site Inspection of Site UXO-11 , Former B-5 Practice Hand Grenade Course (ASR #2.81)</i>	Marine Corp Library at Quantico National Archives and Records Administration Camp Lejeune Base Files Base Personnel Interviews	Planning and Sample Location Selection	Data and Archival Records range in age from 3-65 years old and may not be representative of current conditions
2011 PA/SI Report	CH2M HILL, Preliminary Assessment/Site Inspection Report MMRP Site UXO-11 , Former B-5 Practice Hand Grenade Course (ASR #2.81)	CH2M HILL DGM, soil, sediment surface water and groundwater data 2009	Planning and Sample Location Selection	Data is limited to total chromium, , explosives (including PETN and nitroglycerin), and perchlorate results were from composite surface soil samples
Site UXO-17				
2009 Archival Report	CH2M HILL, <i>Archival Records Search Report for the Preliminary Assessment/Site Inspection of Site UXO-17, Former Firing Position #2 (ASR #2.12)</i>	Marine Corp Library at Quantico National Archives and Records Administration Camp Lejeune Base Files Base Personnel Interviews	Planning and Sample Location Selection	Data and Archival Records range in age from 3-61 years old and may not be representative of current conditions
2011 PA/SI Report	CH2M HILL, Preliminary Assessment/Site Inspection Report MMRP Site UXO-14 Former Indoor Pistol Range(ASR #2.199) and Gas Chamber (ASR #2.200) (Rifle Range Area)	CH2M HILL. DGM, soil, sediment surface water and groundwater data 2010	Planning and Sample Location Selection	Data is limited to explosives residues (including nitroglycerin and PETN), perchlorate, and TAL metals analyses. Groundwater samples were potentially collected prior to a release from the leaking drum discovered in April 2011.

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SAP Worksheet #14: Summary of Project Tasks

Pre-Field Tasks

- Procure subcontractors.
- Schedule field and support staff.
- Procure or rent all equipment and bottleware.
- Conduct an Operational Readiness Review (ORR) to determine that all Standard Operating Procedures (SOPs) and the Accident Prevention Plan/Health and Safety Plan (APP/HSP) are in place for field tasks.

Field Tasks

The field investigation will accomplish the project objectives through the following activities, which will be conducted in accordance with CH2M HILL SOPs and the MMRP Master Project Plans. MEC anomaly avoidance will be conducted by a UXO technician as described in the APP/HSP (**Appendix A of the Work Plan**) during all field tasks.

Mobilization

A mobilization period will include identifying, briefing, and mobilizing staff, as well as securing and deploying equipment. Mobilization activities include general activities and a kickoff and site safety meeting

General Activities

- Identify/procure, package, ship, and inventory project equipment, including GPS equipment, hand tools, and supplies.
- Coordinate with local agencies, including the Marine Corps, Base staff, police, and fire department, as appropriate.
- Coordinate communications and other logistical support.
- Finalize operating schedules.
- Test and inspect equipment.
- Conduct site-specific training on the UFP SAP, APP/HSP, and MEC avoidance procedures and hazards.
- Review subcontractor Activity Hazard Analysis (AHA) forms.
- Verify that all forms and other project documentation are in order and that project team members understand their responsibilities regarding project-reporting requirements

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

Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted. This meeting will include a review of this UFP SAP and review and acknowledgment of the APP/HSP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

Land Surveying

Land surveying services will be conducted in accordance with Section 7.4 of the MMRP Master Project Plans. MEC anomaly avoidance will be practiced as described in the APP/HSP (**Appendix A of the Work Plan**). A survey will be conducted at each site after environmental sampling activities have concluded and will include surveying the coordinates and elevations of the newly installed monitoring well locations.

Vegetation Clearance

If necessary, limited vegetation clearance will be conducted to provide access for sampling activities. Vegetation less than 6 inches in diameter will be removed to within approximately 6 inches of the ground surface. Vegetation clearing will be accomplished using a combination of mechanical and manual methods.

UXO technicians will conduct MEC avoidance activities in the vegetation removal areas according to the MEC avoidance procedures included in the APP/HSP (**Appendix A of the Work Plan**). The brush and trees will be mulched and left in place. Trees greater than 6 inches in diameter will not be removed.

In the event that plant species are encountered that are listed by the United States Fish and Wildlife Service as threatened or endangered, steps will be taken to manage site activities in accordance with the Environmental Protection Plan (**Chapter 8 of the Work Plan**).

Geospatial Information and Electronic Submittals

Methods, equipment, accuracy, and submittal requirements for survey locations and mapping are described in Section 7.4 of the MMRP Master Project Plans.

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

Environmental Site Sampling

- Anomaly avoidance will be practiced during all sampling activities as described in the **Appendix A of the Work Plan**.
- Surface Soil Sampling- Site UXO-11
 - Grab surface soil samples will be collected from depths of 0-2 inches.
 - The location of each sample will be pre-populated in a handheld GPS prior to the sampling event. The field team will make every effort to locate the coordinates; however, the sample location may be slightly adjusted to a field-suitable location (i.e. poison ivy free area, etc.). The actual coordinates of the sampling locations will then be logged into the GPS and will be based on the center of the sampling area.
- Subsurface Soil Sampling- UXO-11
 - Subsurface soil samples will be collected from the unsaturated zone immediately above the water table (estimated at 5 feet below ground surface) by hand augering.
 - The location of each sample will be pre-populated in a handheld GPS prior to the sampling event. The field team will make every effort to locate the coordinates; however, the sample location may be slightly adjusted to a field-suitable location (i.e. poison ivy free area, etc.). The actual coordinates of the sampling locations will then be logged into the GPS.
- Surface Water and Sediment Sampling- Site UXO-11
 - Field parameters (e.g., DO, temperature, specific conductance, and pH) will be measured prior to sample collection. Surface water samples will then be collected by submersing the sampling container directly into the surface water body or by using a “thief” type sampler and then transferring the sample to the sample container. If the volume of surface water encountered is insufficient to allow the direct submersion of the sampling containers, a glass interim vessel will be used to transfer the surface water sample to the sample containers. The glass interim vessel will be laboratory cleaned to the same specifications as the sample containers.
 - Sediment samples will be collected in the same location as surface water samples. Sediment and surface water sampling will follow the SOP protocols located in Worksheet #21. Surface water samples will always be collected first at each location to minimize increased turbidity and agitation caused by sediment collection. Sediment will be collected using a pre-washed trowel and bowl, drained of excess water and placed into the appropriate sample containers.
 - Actual surface water and sediment sample location coordinates will be determined using a handheld GPS in the field. All coordinates will be recorded in the field logbook.

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

- Monitoring Well Installation- Site UXO-11 and UXO-17
 - Shallow groundwater monitoring wells will be constructed to allow collection of groundwater samples. Each well will be constructed of 2-inch Schedule 40 polyvinyl chloride (PVC). Wells will be constructed using 10 feet of 2-inch inside diameter, 0.010-inch machine slotted Schedule 40 PVC screen with a bottom cap. The wells will be installed by auger in accordance with the “Monitoring Well Installation SOP” located in Worksheet #21. The well screen will be installed to bracket the water table. Each well will be completed with a #2 filter pack from the bottom of the well to 2 feet above the top of the screen interval. A 2-foot hydrated bentonite seal will be installed above the filter pack and allowed to hydrate for 30 minutes prior to grouting with bentonite /Portland cement slurry to ground surface. Each well will be completed with a flush-mounted, traffic-rated well monument and locking well cap.
 - The monitoring wells will be developed by the drilling contractor. The primary purpose of well development is to reduce turbidity.
 - Static groundwater elevations will be measured in all monitoring wells using a water level indicator or oil/water interface probe, as appropriate. The depth from the top of casing to fluid level will be recorded to the nearest 0.01 foot. The indicator will be decontaminated after use in each well.
- Groundwater Sampling- Site UXO-11 and UXO-17
 - Groundwater samples will be collected using a peristaltic or bladder pump following low-flow sampling protocol, and analyzed for parameters as detailed on Worksheet #20 and the “Groundwater Sampling SOP” located in Worksheet #21. All groundwater samples will be collected by placing the sample tubing or pump intake in the middle of the water column.
 - Water quality parameters (WQPs), including specific conductance, pH, turbidity, temperature, DO, and ORP, will be measured and recorded prior to sampling using a multi-parameter water quality meter. The meter will be calibrated on a daily basis and thereafter as warranted. Sampling will begin when the WQPs have stabilized: pH within 0.1 pH units, specific conductance within 3 percent, DO within 10 percent, ORP within 10 mV and turbidity within 10 percent or as low as practicable for three consecutive readings. Depth to water, purge volume, WQPs, and total well depth measurements will be recorded in the field logbook.

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

- Post-detonation Soil Sampling- Sites UXO-11 and UXO-17 (as applicable)
 - Soil samples will be collected at locations where controlled detonations/BIP operations are conducted and at locations where MEC/MPPEH filler appears to have leaked into the adjacent soil. Composite surface soil samples will be collected using the TR-02-1 sampling approach in the resulting crater, and the incremental sampling method will be utilized to collect a sample from outside of the crater (as described in **Section 3.4 of the Work Plan**). In the instances where MEC/MPPEH is consolidated for controlled detonation and where it the MEC/MPPEH filler appears to have leaked to the adjacent soil, composite soil samples will be collected using the TR-02-01 sampling approach.
 - The coordinates of the sampling locations will be logged into the GPS.

Decontamination and Investigation-Derived Waste (IDW) Handling

- All non-disposable sampling equipment will be decontaminated before use and immediately after each use in accordance with applicable SOPs referenced in Worksheet #21. The water level indicator will be cleaned with analconox solution spray and rinsed with deionized water between each measurement.
- Wastes generated during the investigation of potentially contaminated sites are classified as IDW and will be managed to protect human health and the environment, as well as to meet legal requirements. IDW will be managed in accordance with the Waste Management Plan. The Field Team Leader (FTL) will be responsible for the documentation, containerization, and transportation to the appropriate on-base storage facility. The containers will be labeled in accordance with the Waste Management Plan either with an indelible marker or preprinted label. Trash will be placed in opaque, black garbage bags and placed into on-base trash receptacles.

Demobilization

Full demobilization will occur when the project is completed and appropriate quality assurance (QA)/QC checks have been performed at each site. The following activities will occur prior to demobilization:

- Anomaly removal verification is complete.
- Chain-of-custody records will be reviewed to ensure that all field and QC samples were collected as planned and were submitted for appropriate analyses.
- Verification of adequate site restoration at each MRS.
- All field equipment will be inspected, packaged, and shipped to the appropriate location.

Analyses and Testing Tasks

- The analytical laboratories will process and prepare samples for analyses and will analyze all samples for various groups of parameters in accordance with Worksheet #20.

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

Quality Control Tasks

- SOPs for field and laboratory activities will be implemented.
- QC samples are described on Worksheet #20.

Secondary Data

- Secondary data (Worksheet #13) provided by CH2M HILL will be incorporated into subsequent reports, as needed.

Data Validation, Review, and Management Tasks

- Procedures for recording data, including guidelines for recording and correcting data:
 - See the Navy **CLEAN Data Management Plan** in the **Data Management Guidelines** presented in **Attachment 2** of this UFP-SAP.
- Computerized and manual procedures for data from generation to final use and storage and QC checks for error detection to ensure data integrity:
 - See the Navy **CLEAN Data Management Plan** in the **Data Management Guidelines** presented in **Attachment 2** of this UFP-SAP.
- Guidance on data management steps such as data recording, data transformation, data reduction, data transfer and transmittal, data analysis, and data review:
 - See the Navy **CLEAN Data Management Plan** in the **Data Management Guidelines** presented in **Attachment 2** of this UFP-SAP.
- Procedures for data tracking, storage, archiving, retrieval, and security for both electronic and hardcopy data:
 - See the Navy **CLEAN Data Management Plan** in the **Data Management Guidelines** presented in **Attachment 2** of this UFP-SAP for more information.
 - The Project Data Manager, Troy Horn, is responsible for data tracking and storage.
 - CH2M HILL will coordinate archiving and retrieval of data.
- Perform data validation via third party subcontractor (EDS) as per Worksheets #35 and #36.

Documentation and Reporting

- Work and data will be documented in the draft Intrusive Investigation Report.

Assessment/Audit Tasks

- See Worksheets #31 and #32.

SAP Worksheet #15-1: Reference Limits and Evaluation Tables – UXO-11

Matrix: Surface Soil, Subsurface Soil, Sediment

Analytical Group: Metals

Concentration Level: Medium

Analyte	CAS No.	CLEAN MCB CamLej Background Surface Soil (SS) 2X Mean (mg/kg)	CLEAN MCB CamLej Background Subsurface Soil (SB) 2X Mean (mg/kg)	NCSSL (Jun. 2011) (mg/kg)	RSLs Industrial for soil (June 2011) (mg/kg)	RSLs Residential for soil (June 2011) (mg/kg)	PQL Goal (mg/kg)	Laboratory-specific (mg/kg)			Laboratory Control Sample (LCS), MS, and MSD %R Limits ³	
								LOQ	LOD	DL	LCL	UCL
Chromium	7440-47-3	6.05	14.5	3.8	5.6	0.29	0.145	0.5	0.25	0.05	80	120
Chromium VI (Hexavalent)	18540-29-9	NC	NC	3.8	5.6	0.29	0.145	1.0	0.40	0.16	70	130

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs.

² Project quantitation limit (QL) Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD Quality Systems Manual (QSM) v.4.1 is the basis for LCS and matrix spike/matrix spike duplicate (MS/MSD) limits.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-2: Reference Limits and Evaluation Tables – UXO-11

Matrix: Surface Soil, Subsurface Soil, Sediment
 Analytical Group: Explosives, including Perchlorate
 Concentration Level: Medium

Analyte	CAS No.	CLEAN RSLs Industrial Soil Adjusted, (June 2011) (ug/kg)	CLEAN RSLs Residential Soil Adjusted, (June 2011) (ug/kg)	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific (ug/kg)			LCS, MS, and MSD %R Limits ³	
					LOQ	LOD	DL	LCL	UCL
1,3,5-Trinitrobenzene	99-35-4	2700000	220000	110000	500	200	100	75	125
1,3-Dinitrobenzene	99-65-0	6200	610	305	500	200	100	80	125
2,4,6-Trinitrotoluene	118-96-7	42000	3600	1800	500	200	100	55	140
2,4-Dinitrotoluene	121-14-2	5500	1600	800	500	200	100	80	125
2,6-Dinitrotoluene	606-20-2	62000	6100	3050	500	200	100	80	120
2-Amino-4,6-dinitrotoluene	35572-78-2	200000	15000	7500	500	300	150	80	125
2-Nitrotoluene	88-72-2	13000	2900	1450	2000	1460	730	80	125
3-Nitrotoluene	99-08-1	6200	610	305	500	300	150	75	120
4-Amino-2,6-dinitrotoluene	19406-51-0	190000	15000	7500	500	200	100	80	125
4-Nitrotoluene	99-99-0	110000	24000	12000	500	300	150	75	125
HMX	2691-41-0	4900000	380000	190000	500	300	100	70	125
Nitrobenzene	98-95-3	24000	4800	2400	500	200	100	75	125
Nitroglycerin	55-63-0	6200	610	305	1000	500	250	60	120
Pentaerythritol tetranitrate (PETN)	78-11-5	120000	12000	6000	1000	500	250	60	120
RDX	121-82-4	24000	5600	2800	500	200	100	70	135
Tetryl	479-45-8	250000	24000	12000	500	200	100	10	150
Perchlorate	14797-73-0	72000	5500	2750	2	1	0.5	80	120

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no background values for explosives at MCB CamLej. There are no NCSSLs for explosives.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-3: Reference Limits and Evaluation Tables – UXO-11

Matrix: Groundwater

Analytical Group: Total and Dissolved Metals

Concentration Level: Medium

Analytes	CAS No.	MCB CamLej Background Groundwater (GW) 2X Mean (ug/L)	NC2L (Jan. 2010) (ug/L)	CLEAN RSLs Tapwater Adjusted (June 2011) (ug/L)	MCL (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
							LOQ	LOD	DL	LCL	UCL
Chromium	7440-47-3	3.13	10	0.043	100	0.0215	6.0	3.0	0.450	80	120
Chromium (Hexavalent)	18540-29-9	NC	10	0.043	NC	0.0215	30	15	5.4	80	120

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no NC2B criteria for these analytes.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-4: Reference Limits and Evaluation Tables – UXO-11

Matrix: Surface Water

Analytical Group: Total and Dissolved Metals

Concentration Level: Medium

Analytes	CAS No.	NRWQC (Jan. 2010) (ug/L)	CLEAN RSLs Tapwater Adjusted (June 2011) (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
					LOQ	LOD	DL	LCL	UCL
Chromium	7440-47-3	100	0.043	0.0215	6.0	3.0	0.450	80	120
Chromium (Hexavalent)	18540-29-9	NC	0.043	0.0215	30	15	5.4	80	120

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no NC2B criteria for these analytes.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

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

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-5: Reference Limits and Evaluation Tables – UXO-11

Matrix: Surface Water, Groundwater
 Analytical Group: Explosives, including Perchlorate
 Concentration Level: Medium

Analyte	CAS No.	NRWQC (Jan. 2010) (ug/L)	CLEAN RSLs Tapwater Adjusted (June 2011) (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
					LOQ	LOD	DL	LCL	UCL
1,3,5-Trinitrobenzene	99-35-4	NC	110	55	0.325	0.208	0.104	69	114
1,3-Dinitrobenzene	99-65-0	NC	0.37	0.185	0.325	0.208	0.104	77	109
2,4,6-Trinitrotoluene	118-96-7	NC	1.8	0.9	0.325	0.208	0.104	70	126
2,4-Dinitrotoluene	121-14-2	0.11	NA	0.055	0.325	0.208	0.104	76	117
2,6-Dinitrotoluene	606-20-2	NC	3.7	1.85	0.325	0.156	0.078	78	109
2-Amino-4,6-dinitrotoluene	35572-78-2	NC	7.3	3.65	0.325	0.208	0.104	70	125
2-Nitrotoluene	88-72-2	NC	0.31	0.155	0.325	0.208	0.104	59	113
3-Nitrotoluene	99-08-1	NC	0.37	0.185	0.325	0.208	0.104	58	114
4-Amino-2,6-dinitrotoluene	19406-51-0	NC	7.3	3.65	0.325	0.208	0.104	68	126
4-Nitrotoluene	99-99-0	NC	4.2	2.1	0.65	0.208	0.104	60	120
HMX	2691-41-0	NC	180	90	0.325	0.208	0.104	55	120
Nitrobenzene	98-95-3	17	NA	8.5	0.325	0.208	0.104	63	110
Nitroglycerin	55-63-0	NC	0.37	0.185	1.3	0.65	0.325	45	134
Pentaerythritol tetranitrate (PETN)	78-11-5	NC	7.3	3.65	1.3	0.26	0.13	56	139
RDX	121-82-4	NC	0.61	0.305	0.325	0.208	0.104	65	132
Tetryl	479-45-8	NC	15	7.5	0.65	0.26	0.13	59	123
Perchlorate	14797-73-0	NC	2.6	1.3	0.2	0.1	0.05	80	120

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no NC2B Standards for explosives.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-6: Reference Limits and Evaluation Tables – UXO-17

Matrix: Groundwater
 Analytical Group: VOCs
 Concentration Level: Medium

Analyte	CAS No.	NC2L (Jan. 2010) (ug/l)	CLEAN RSLs Tapwater Adjusted (Jan. 2010) (ug/l)	MCL (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
						LOQ	LOD	DL	LCL	UCL
1,1,1-Trichloroethane	71-55-6	200	910	200	100	1.0	1.0	0.59	65	130
1,1,2,2-Tetrachloroethane	79-34-5	0.2	0.067	NC	0.0335	1.0	1.0	0.54	65	130
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	76-13-1	200000	5900	NC	2950	1.0	1.0	0.73	47	173
1,1,2-Trichloroethane	79-00-5	NC	0.042	5	0.021	1.0	1.0	0.63	75	125
1,1-Dichloroethane	75-34-3	6	2.4	NC	1.2	1.0	1.0	0.57	70	135
1,1-Dichloroethene	75-35-4	7	34	7	3.5	1.0	1.0	0.94	70	130
1,2,4-Trichlorobenzene	120-82-1	70	0.41	70	0.205	1.0	1.0	0.70	65	135
1,2-Dibromo-3-chloropropane	96-12-8	0.04	0.00032	0.2	0.00016	1.0	1.0	0.96	50	130
1,2-Dibromoethane	106-93-4	0.02	0.0065	0.05	0.00325	1.0	1.0	0.78	80	120
1,2-Dichlorobenzene	95-50-1	20	37	600	10	1.0	1.0	0.57	70	120
1,2-Dichloroethane	107-06-2	0.4	0.15	5	0.075	1.0	1.0	0.50	70	130
1,2-Dichloropropane	78-87-5	0.6	0.39	5	0.195	1.0	1.0	0.80	75	125
1,3-Dichlorobenzene	541-73-1	200		NC	100	1.0	1.0	0.53	75	125
1,4-Dichlorobenzene	106-46-7	6	0.43	75	0.215	1.0	1.0	0.46	75	125
2-Butanone	78-93-3	4000	710	NC	355	5.0	2.5	4.5	30	150
2-Hexanone	591-78-6	NC	4.7	NC	2.35	5.0	2.5	1.4	55	130
4-Methyl-2-pentanone	108-10-1	NC	200	NC	100	5.0	2.5	2.8	60	135
Acetone	67-64-1	6000	2200	NC	1100	5.0	2.5	1.8	40	140
Benzene	71-43-2	1	0.41	5	0.205	1.0	1.0	0.58	80	120
Bromodichloromethane	75-27-4	0.6	0.12	80	0.06	1.0	1.0	0.49	75	120
Bromoform	75-25-2	4	8.5	80	2	1.0	1.0	0.75	70	130
Bromomethane	74-83-9	NC	0.87	NC	0.435	1.0	1.0	0.95	30	145
Carbon disulfide	75-15-0	700	100	NC	50	5.0	5.0	1.9	35	160
Carbon tetrachloride	56-23-5	0.3	0.44	5	0.15	1.0	1.0	0.65	65	140
Chlorobenzene	108-90-7	50	9.1	100	4.55	1.0	1.0	0.51	80	120
Chloroethane	75-00-3	3000	2100	NC	1050	1.0	1.0	0.98	60	135
Chloroform	67-66-3	70	0.19	80	0.095	1.0	1.0	0.54	65	135
Chloromethane	74-87-3	3	19	NC	1.5	1.0	1.0	0.82	40	125
cis-1,2-Dichloroethene	156-59-2	70	7.3	70	3.65	1.0	1.0	0.49	70	125
cis-1,3-Dichloropropene	10061-01-5	0.4	0.43	NC	0.2	1.0	1.0	0.59	70	130
Cyclohexane	110-82-7	NC	1300	NC	650	2.0	1.0	0.93	70	130
Dibromochloromethane	124-48-1	0.4	0.15	80	0.075	1.0	1.0	0.44	60	135
Dichlorodifluoromethane (Freon-12)	75-71-8	1000	20	NC	10	1.0	1.0	0.74	30	155

SAP Worksheet #15-6: Reference Limits and Evaluation Tables – UXO-17 (continued)

Matrix: Groundwater
 Analytical Group: VOCs
 Concentration Level: Medium

Analyte	CAS No.	NC2L (Jan. 2010) (ug/l)	CLEAN RSLs Tapwater Adjusted (Jan. 2010) (ug/l)	MCL (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
Ethylbenzene	100-41-4	600	1.5	700	0.75	1.0	1.0	0.69	75	125
Isopropylbenzene	98-82-8	70	68	NC	34	1.0	1.0	0.67	75	125
Methyl Acetate	79-20-9	NC	3700	NC	1850	2.0	1.0	0.95	70	130
Methyl-tert-butyl ether (MTBE)	1634-04-4	20	12	NC	6	1.0	1.0	0.60	65	125
Methylcyclohexane	108-87-2	NC	NC	NC	Lab LOD	2.0	1.0	0.59	70	130
Methylene chloride	75-09-2	5	4.8	5	2.4	5.0	5.0	0.69	55	140
Styrene	100-42-5	70	160	100	35	1.0	1.0	0.49	65	135
Tetrachloroethene	127-18-4	0.7	0.11	5	0.055	1.0	1.0	0.76	45	150
Toluene	108-88-3	600	230	1000	115	1.0	1.0	0.58	75	120
trans-1,2-Dichloroethene	156-60-5	100	11	100	5.5	1.0	1.0	0.72	60	140
trans-1,3-Dichloropropene	10061-02-6	0.4	0.43	NC	0.2	1.0	1.0	0.64	55	140
Trichloroethene	79-01-6	3	2	5	1	1.0	1.0	0.55	70	125
Trichlorofluoromethane(Freon-11)	75-69-4	2000	130	NC	65	1.0	1.0	0.68	60	145
Vinyl chloride	75-01-4	0.03	0.016	2	0.008	1.0	1.0	0.71	50	145
Xylene, total	1330-20-7	500	20	10000	10	2.0	2.0	1.3	75	130

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no base background values for VOCs.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-7: Reference Limits and Evaluation Tables – UXO-17

Matrix: Groundwater
 Analytical Group: SVOCs
 Concentration Level: Medium

Analyte	CAS No.	NC2L (Jan. 2010) (ug/l)	CLEAN RSLs Tapwater Adjusted (Jan. 2010) (ug/l)	MCL (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
						LOQ	LOD	DL	LCL	UCL
1,1-Biphenyl	92-52-4	400	0.083	NC	0.0415	10	5.0	2.50	46	83
2,2'-Oxybis(1-chloropropane)	108-60-1	NC	0.32	NC	0.16	10	6.0	2.40	25	130
2,4,5-Trichlorophenol	95-95-4	NC	370	NC	185	10	3.0	1.50	50	110
2,4,6-Trichlorophenol	88-06-2	NC	3.7	NC	1.85	10	6.0	3.30	50	115
2,4-Dichlorophenol	120-83-2	NC	11	NC	5.5	10	6.0	4.00	50	105
2,4-Dimethylphenol	105-67-9	100	73	NC	36.5	10	6.0	3.00	30	110
2,4-Dinitrophenol	51-28-5	NC	7.3	NC	3.65	10	6.0	3.30	15	140
2,4-Dinitrotoluene	121-14-2	NC	0.22	NC	0.11	10	3.0	2.10	50	120
2,6-Dinitrotoluene	606-20-2	NC	3.7	NC	1.85	10	3.0	2.40	50	115
2-Chloronaphthalene	91-58-7	NC	290	NC	145	10	3.0	1.90	50	105
2-Chlorophenol	95-57-8	NC	18	NC	9	10	6.0	3.60	35	105
2-Methylnaphthalene	91-57-6	30	15	NC	7.5	10	3.0	2.1	45	105
2-Methylphenol	95-48-7	NC	180	NC	90	10	6.0	1.60	40	110
2-Nitroaniline	88-74-4	NC	37	NC	18.5	10	6.0	2.50	50	115
2-Nitrophenol	88-75-5	NC	18	NC	9	10	6.0	4.20	40	115
3,3'-Dichlorobenzidine	91-94-1	NC	0.15	NC	0.075	10	3.0	2.30	20	110
3-Nitroaniline	99-09-2	NC	NC	NC	Lab LOD	10	3.0	2.10	25	125
4,6-Dinitro-2-methylphenol	534-52-1	NC	0.29	NC	0.145	10	6.0	4.30	40	130
4-Bromophenyl-phenylether	101-55-3	NC	NC	NC	Lab LOD	10	3.0	1.40	50	115
4-Chloro-3-methylphenol	59-50-7	NC	370	NC	185	10	6.0	3.10	45	110
4-Chloroaniline	106-47-8	NC	0.34	NC	0.17	10	6.0	2.40	15	110
4-Chlorophenyl-phenylether	7005-72-3	NC	18	NC	9	10	3.0	1.90	50	110
3&4-Methylphenol	106-44-5	40	18	NC	9	10	6.0	3.50	30	110
4-Nitroaniline	100-01-6	NC	3.4	NC	1.7	10	3.0	2.20	35	120
4-Nitrophenol	100-02-7	NC	0.12	NC	0.06	10	3.0	1.80	0	125
Acenaphthene	83-32-9	80	220	NC	40	10	3.0	2.1	45	110
Acenaphthylene	208-96-8	200	220	NC	100	10	3.0	2.3	50	105
Acetophenone	98-86-2	NC	370	NC	185	10	6.0	4.80	70	130
Anthracene	120-12-7	2000	1100	NC	550	10	3.0	1.8	55	110
Atrazine	1912-24-9	NC	0.29	3	0.145	10	5.0	2.60	70	130
Benzaldehyde	100-52-7	NC	370	NC	185	10	5.0	2.60	43	87
Benzo(a)anthracene	56-55-3	0.05	0.029	NC	0.0145	10	3.0	2.3	55	110
Benzo(a)pyrene	50-32-8	0.005	0.0029	0.2	0.00145	10	3.0	2.2	55	110
Benzo(b)fluoranthene	205-99-2	0.05	0.029	NC	0.0145	10	3.0	2.0	45	120
Benzo(g,h,i)perylene	191-24-2	200	110	NC	55	10	3.0	2.2	40	125

SAP Worksheet #15-7: Reference Limits and Evaluation Tables – UXO-17 (continued)

Matrix: Groundwater
 Analytical Group: SVOCs
 Concentration Level: Medium

Analyte	CAS No.	NC2L (Jan. 2010) (ug/l)	CLEAN RSLs Tapwater Adjusted (Jan. 2010) (ug/l)	MCL (ug/L)	Project Quantitation Limit Goal (ug/L)	Laboratory-specific (ug/L)			LCS, MS, and MSD %R Limits ³	
						10	3.0	2.2	45	125
Benzo(k)fluoranthene	207-08-9	0.5	0.29	NC	0.145	10	3.0	2.2	45	125
bis(2-Chloroethoxy)methane	111-91-1	NC	11	NC	5.5	10	6.0	2.40	45	105
bis(2-Chloroethyl)ether	111-44-4	0.03	0.012	NC	0.006	10	6.0	2.40	35	110
bis(2-Ethylhexyl)phthalate	117-81-7	3	4.8	6	1.5	10	3.0	2.70	40	125
Butylbenzylphthalate	85-68-7	1000	35	NC	17.5	10	3.0	3.40	45	115
Caprolactam	105-60-2	4000	1800	NC	900	10	4.0	0.920	13	24
Carbazole	86-74-8	NC	NC	NC	Lab LOD	10	3.0	1.90	50	115
Chrysene	218-01-9	5	2.9	NC	1.45	10	3.0	2.5	55	110
Dibenz(a,h)anthracene	53-70-3	0.005	0.0029	NC	0.00145	10	3.0	1.9	40	125
Dibenzofuran	132-64-9	NC	3.7	NC	1.85	10	3.0	2.30	55	105
Diethylphthalate	84-66-2	6000	2900	NC	1450	10	3.0	2.10	40	120
Dimethyl phthalate	131-11-3	NC	NC	NC	Lab LOD	10	3.0	2.00	25	125
Di-n-butylphthalate	84-74-2	700	370	NC	185	10	3.0	2.50	55	115
Di-n-octylphthalate	117-84-0	100	4.8	NC	2.4	10	3.0	2.30	35	135
Fluoranthene	206-44-0	300	150	NC	75	10	3.0	2.5	55	115
Fluorene	86-73-7	300	150	NC	75	10	3.0	2.1	50	110
Hexachlorobenzene	118-74-1	0.02	0.042	1	0.01	10	3.0	1.20	50	110
Hexachlorobutadiene	87-68-3	0.4	0.86	NC	0.2	10	3.0	1.40	25	105
Hexachlorocyclopentadiene	77-47-4	NC	22	50	11	10	3.0	1.10	13	120
Hexachloroethane	67-72-1	NC	3.7	NC	1.85	10	6.0	1.60	30	100
Indeno(1,2,3-cd)pyrene	193-39-5	0.05	0.029	NC	0.0145	10	3.0	2.2	45	125
Isophorone	78-59-1	40	71	NC	20	10	6.0	2.70	50	110
Naphthalene	91-20-3	6	0.14	NC	0.07	10	6.0	2.1	40	100
Nitrobenzene	98-95-3	NC	0.12	NC	0.06	10	6.0	2.60	45	110
n-Nitroso-di-n-propylamine	621-64-7	NC	0.0096	NC	0.0048	10	6.0	2.60	35	130
n-Nitrosodiphenylamine	86-30-6	NC	14	NC	7	10	6.0	3.80	50	110
Pentachlorophenol	87-86-5	0.3	0.17	1	0.085	10	3.0	3.50	40	115
Phenanthrene	85-01-8	200	1100	NC	100	10	3.0	1.5	50	115
Phenol	108-95-2	30	1100	NC	15	10	6.0	1.70	40	115
Pyrene	129-00-0	200	110	NC	55	10	3.0	2.6	50	130

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no base background values for SVOCs.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-8: Reference Limits and Evaluation Tables – UXO-11 and 17 Post-Detonation Sampling

Matrix: Surface Soil Composite, Surface Soil Incremental
 Analytical Group: Metals
 Concentration Level: Medium

Analyte	CAS No.	CLEAN MCB CamLej Background SS 2X Mean (mg/kg)	CLEAN MCB CamLej Background SB 2X Mean (mg/kg)	NCSSL (June 2011) (mg/kg)	RSLs Industrial for soil (June 2011) (mg/kg)	RSLs Residential for soil (June 2011) (mg/kg)	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific (mg/kg)			LCS, MS, and MSD %R Limits ³	
								LOQ	LOD	DL	LCL	UCL
Aluminum	7429-90-5	5487	10369	NC	99000	7700	2743.5	10	5	2.7	80	120
Antimony	7440-36-0	0.447	0.36	6.43	41	3.1	0.18	2	1	0.49	80	120
Arsenic	7440-38-2	0.626	2.12	5.8	1.6	0.39	0.195	2	1	0.39	80	120
Barium	7440-39-3	14.5	16.6	580	19000	1500	7.25	5	0.25	0.019	80	120
Beryllium	7440-41-7	0.103	0.165	63	200	16	0.0515	0.05	0.025	0.007 1	80	120
Cadmium	7440-43-9	0.033	0.023	3	80	7	0.0115	0.2	0.1	0.014	80	120
Calcium	7440-70-2	6360	441	NC	NC	NC	220.5	25	12.5	0.67	80	120
Chromium	7440-47-3	6.05	14.5	3.8	5.6	0.29	0.145	0.5	0.25	0.05	80	120
Cobalt	7440-48-4	0.294	0.822	0.9	30	2.3	0.147	0.5	0.25	0.03	80	120
Copper	7440-50-8	4.83	2.56	700	4100	310	1.28	0.5	0.25	0.16	80	120
Iron	7439-89-6	3245	5439	150	72000	5500	75	10	5	1.4	80	120
Lead	7439-92-1	12.3	8.49	270	800	400	4.245	1	0.5	0.24	80	120
Magnesium	7439-95-4	238	363	NC	NC	NC	119	25	12.5	1.4	80	120
Manganese	7439-96-5	13.7	9.25	65	2300	180	4.625	1	0.5	0.045	80	120
Mercury	7439-97-6	0.081	0.071	1	31	2.3	0.0355	0.001 9	0.008 1	0.016 2	80	120
Nickel	7440-02-0	1.21	2.27	130	2000	150	0.605	0.5	0.25	0.08	80	120
Potassium	7440-09-7	116	361	NC	NC	NC	58	25	12.5	7.9	80	120
Selenium	7782-49-2	0.563	0.505	2.1	510	39	0.2525	2	1	0.48	80	120
Silver	7440-22-4	0.14	0.129	3.4	510	39	0.0645	0.5	0.25	0.063	80	120
Sodium	7440-23-5	80.9	68.3	NC	NC	NC	34.15	25	12.5	9	80	120
Thallium	7440-28-0	0.36	0.38	0.28	1	0.078	0.039	1	0.5	0.32	80	120
Vanadium	7440-62-2	8.9	17.2	6	520	39	4.45	0.5	0.25	0.072	80	120
Zinc	7440-66-6	10.8	6.59	1200	31000	2300	3.295	0.5	0.25	0.19	80	120

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

SAP Worksheet #15-9: Reference Limits and Evaluation Tables – UXO-11 and 17 Post-Detonation Sampling

Matrix: Surface Soil Composite, Surface Soil Incremental
 Analytical Group: Explosives, including Perchlorate
 Concentration Level: Medium

Analyte	CAS No.	CLEAN RSLs Industrial Soil Adjusted, (June 2011) (ug/kg)	CLEAN RSLs Residential Soil Adjusted, (June 2011) (ug/kg)	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific (ug/kg)			LCS, MS, and MSD %R Limits ³	
					LOQ	LOD	DL	LCL	UCL
1,3,5-Trinitrobenzene	99-35-4	2700000	220000	110000	500	200	100	75	125
1,3-Dinitrobenzene	99-65-0	6200	610	305	500	200	100	80	125
2,4,6-Trinitrotoluene	118-96-7	42000	3600	1800	500	200	100	55	140
2,4-Dinitrotoluene	121-14-2	5500	1600	800	500	200	100	80	125
2,6-Dinitrotoluene	606-20-2	62000	6100	3050	500	200	100	80	120
2-Amino-4,6-dinitrotoluene	35572-78-2	200000	15000	7500	500	300	150	80	125
2-Nitrotoluene	88-72-2	13000	2900	1450	2000	1460	730	80	125
3-Nitrotoluene	99-08-1	6200	610	305	500	300	150	75	120
4-Amino-2,6-dinitrotoluene	19406-51-0	190000	15000	7500	500	200	100	80	125
4-Nitrotoluene	99-99-0	110000	24000	12000	500	300	150	75	125
HMX	2691-41-0	4900000	380000	190000	500	300	100	70	125
Nitrobenzene	98-95-3	24000	4800	2400	500	200	100	75	125
Nitroglycerin	55-63-0	6200	610	305	1000	500	250	60	120
Pentaerythritol tetranitrate (PETN)	78-11-5	120000	12000	6000	1000	500	250	60	120
RDX	121-82-4	24000	5600	2800	500	200	100	70	135
Tetryl	479-45-8	250000	24000	12000	500	200	100	10	150
Perchlorate	14797-73-0	72000	5500	2750	2	1	0.5	80	120

¹ PALs were developed to be protective of human health and the environment. Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs. There are no background values for explosives at MCB CamLej. There are no NCSSLs for explosives.

² Project QL Goals are equal to half of the minimum of the applicable criteria (PALs).

³ DoD QSM v.4.1 is the basis for LCS and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v.4.1 limits do not exist.

Shading represents cases where the PAL or project QL goal is lower than the laboratory LOD. Non-detects will be reported at the LOD but will not be considered an exceedance of the PAL.

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SAP Worksheet #16: Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Work Plan preparation	CH2M HILL	5/19/11	7/5/11	Draft Work Plan Draft UFP SAP	7/5/11
UFP-SAP reviewed by Navy	Navy	7/7/11	7/8/11	Comments	
UFP-SAP– address Navy comments	CH2M HILL	7/11/11	7/11/11	Draft Work Plan Draft UFP SAP	7/11/11
UFP-SAP Review and Approval by Regulatory Agencies	NC DENR, EPA Region IV	7/12/11	7/15/11	Comments	
Comment resolution	Navy, CH2M HILL	7/18//11	7/19/11	Final Work Plan Final UFP SAP	7/19/11
Final acceptance	Navy, NC DENR, EPA Region IV	7/20/11	7/25/11	Final Work Plan Final UFP SAP	7/25/11
Subcontracting	CH2M HILL	5/19/11	7/11/11	Subcontractor Contracts	
Site UXO-11 Intrusive Anomaly Investigation	Subcontractor w/ CH2M HILL	8/2/11	8/2/11	Anomaly Investigation	
Site UXO-11 Field Sampling Activities	CH2M HILL	7/11/11	7/22/11	Environ. Samples	
Site UXO-17 Vegetation Clearance	Subcontractors w/ CH2M HILL	7/13/11	7/18/11	Vegetation Clearance	
Site UXO-17 Intrusive Anomaly Investigation	Subcontractor w/ CH2M HILL	7/25/11	7/29/11	Anomaly Investigation	
Site UXO-17 Field Sampling Activities	CH2M HILL, Subcontractor for drilling/well installation	7/14/11	7/26/11	Environ. Samples	
Laboratory analyses and data validation	CH2M HILL	7/25/11	8/16/11	Analytical and DV Reports	8/16/11
Site UXO-11 Data management and report preparation	CH2M HILL	8/16/11	9/12/11	Site UXO-11 Draft Expanded SI Report	9/12/11
Site UXO-17 Data management and report preparation	CH2M HILL	8/18/11	9/14/11	Site UXO-17 Draft Expanded SI Report	9/14/11

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SAP Worksheet #17: Sampling Design and Rationale

General Approach: The general approach for sampling was developed to meet Navy, USEPA, and NCDENR requirements for the expanded site inspection. One of the objectives of this investigation is to further characterize potential human health and ecological risks at Site UXO 11 and UXO-17.

At Site UXO-11, the explosives residue nitroglycerin exceeded screening criteria in surface soil and nitrobenzene exceeded screening criteria in groundwater. Chromium was detected above screening values in all media. Speciation of chromium would indicate whether chromium was present onsite as hexavalent chromium, the most toxic form. Grab surface soil, subsurface soil, sediment, surface, water, and groundwater samples will be collected and analyzed for explosives residues (including nitroglycerin and PETN), perchlorate, chromium, and hexavalent chromium. Surface water and groundwater samples will be additionally analyzed for dissolved chromium and dissolved hexavalent chromium to assess transport pathways to surface water and sediment and availability to receptors.

At Site UXO-17, previous investigations were limited to MCs. In April 2011, a buried 55-gallon drum was found within the 4-acre portion of the site that was leaking an unknown substance. A sample collected from the drum indicated it contained VOCs, SVOCs, and metals. Impacted soil was removed. To evaluate impact to groundwater, three new monitoring wells will be installed and eight groundwater samples will be collected and analyzed for VOCs and SVOCs.

The site investigation will draw upon historical information and the results of the previous and ongoing investigations to guide the selection of areas for sample collection. The sample locations at Site UXO-17 are based upon the discovery of a leaking, buried 55-gallon drum in April 2011.

Sample Matrices: Sample matrices at Site UXO-11 will include surface soil, subsurface soil, sediment, surface water, and groundwater. The sample matrix at Site UXO-17 includes only groundwater.

Analytical Groups: The target analytical groups for Site UXO-11 will be explosives residues (including nitroglycerin and PETN), perchlorate, chromium, and hexavalent chromium (for surface and subsurface soil and sediment); explosives residues (including nitroglycerin and PETN), perchlorate, total chromium, dissolved chromium, total hexavalent chromium, and dissolved hexavalent chromium (for surface water), and explosives residues (including nitroglycerin and PETN), perchlorate, total chromium, dissolved chromium, total hexavalent chromium, and dissolved hexavalent chromium (for groundwater).

The target analytical groups for Site UXO-17 will be VOCs and SVOCs. The rationale for the selection of the target analytes was based on the analytical results from characterization sampling of the buried drum.

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

Site Sample Numbers and Locations: The sampling approach, the rationale for the matrices to be sampled, the number of samples per matrix, the analytical groups, and the relevant concentration action levels are discussed in Worksheets #10-1 (Site UXO-11), #10-2 (Site UXO-17), #11, #14 and #15. Sample location figures are provided in Worksheets #10-1 and #10-2. Exact sampling locations will be determined in the field during the site reconnaissance conducted by CH2M HILL staff, and may be re-located to avoid site obstructions, if present. Site sampling locations were agreed upon by the project team.

Sampling Frequency and Seasonal Considerations: The field sampling activities will be completed in a single mobilization for each site. Since the objective of this investigation is only to identify the presence of potential environmental impacts, the assessment activities will not evaluate seasonal influences.

SAP Worksheet #18-1: Location-Specific Sampling Methods/SOP Requirements Table - UXO-11

Sample Location	Screening Interval / QA/QC type	Sample ID	Explosive Residues, including PETN and Nitroglycerin	Perchlorate	Total Chromium	Total Hexavalent Chromium	Dissolved Chromium	Dissolved Hexavalent Chromium
MR11-MW01		MR11-GW01-11C	X	X	X	X	X	X
MR11-MW02		MR11-GW02-11C	X	X	X	X	X	X
MR11-MW03		MR11-GW03-11C	X	X	X	X	X	X
MR11-MW04		MR11-GW04-11C	X	X	X	X	X	X
MR11-MW05		MR11-GW05-11C	X	X	X	X	X	X
MR11-MW##	Duplicate	MR11-GW##D-11C	X	X	X	X	X	X
MR11-MW##	MS	MR11-GW##-11C-MS	X	X	X	X	X	X
MR11-MW##	MSD	MR11-GW##-11C-SD	X	X	X	X	X	X
MR11-IS05	0-2" bgs	MR11-SS05-11C	X	X	X	X		
MR11-IS06	0-2" bgs	MR11-SS06-11C	X	X	X	X		
MR11-IS07	0-2" bgs	MR11-SS07-11C	X	X	X	X		
MR11-IS08	0-2" bgs	MR11-SS08-11C	X	X	X	X		
MR11-IS09	0-2" bgs	MR11-SS09-11C	X	X	X	X		
MR11-IS10	0-2" bgs	MR11-SS10-11C	X	X	X	X		
MR11-IS11	0-2" bgs	MR11-SS11-11C	X	X	X	X		
MR11-IS12	0-2" bgs	MR11-SS12-11C	X	X	X	X		
MR11-IS13	0-2" bgs	MR11-SS13-11C	X	X	X	X		
MR11-IS14	0-2" bgs	MR11-SS14-11C	X	X	X	X		
MR11-IS15	0-2" bgs	MR11-SS15-11C	X	X	X	X		
MR11-IS16	0-2" bgs	MR11-SS16-11C	X	X	X	X		
MR11-IS17	0-2" bgs	MR11-SS17-11C	X	X	X	X		
MR11-IS18	0-2" bgs	MR11-SS18-11C	X	X	X	X		
MR11-IS19	0-2" bgs	MR11-SS19-11C	X	X	X	X		
MR11-IS20	0-2" bgs	MR11-SS20-11C	X	X	X	X		
MR11-IS21	0-2" bgs	MR11-SS21-11C	X	X	X	X		
MR11-IS22	0-2" bgs	MR11-SS22-11C	X	X	X	X		
MR11-IS23	0-2" bgs	MR11-SS23-11C	X	X	X	X		
MR11-IS24	0-2" bgs	MR11-SS24-11C	X	X	X	X		

Sample Location	Screening Interval / QA/QC type	Sample ID	Explosive Residues, including PETN and Nitroglycerin	Perchlorate	Total Chromium	Total Hexavalent Chromium	Dissolved Chromium	Dissolved Hexavalent Chromium
MR11-IS##	Duplicate	MR11-SB##D-11C	X	X	X	X		
MR11-IS##	Duplicate	MR11-SB##D-11C	X	X	X	X		
MR11-IS##	MS	MR11-SB##-11C-MS	X	X	X	X		
MR11-IS##	MSD	MR11-SB##-11C-SD	X	X	X	X		
MR11-IS05	approx. 5' bgs	MR11-SB05-11C	X	X	X	X		
MR11-IS06	approx. 5' bgs	MR11-SB06-11C	X	X	X	X		
MR11-IS07	approx. 5' bgs	MR11-SB07-11C	X	X	X	X		
MR11-IS08	approx. 5' bgs	MR11-SB08-11C	X	X	X	X		
MR11-IS09	approx. 5' bgs	MR11-SB09-11C	X	X	X	X		
MR11-IS10	approx. 5' bgs	MR11-SB10-11C	X	X	X	X		
MR11-IS11	approx. 5' bgs	MR11-SB11-11C	X	X	X	X		
MR11-IS12	approx. 5' bgs	MR11-SB12-11C	X	X	X	X		
MR11-IS13	approx. 5' bgs	MR11-SB13-11C	X	X	X	X		
MR11-IS14	approx. 5' bgs	MR11-SB14-11C	X	X	X	X		
MR11-IS15	approx. 5' bgs	MR11-SB15-11C	X	X	X	X		
MR11-IS16	approx. 5' bgs	MR11-SB16-11C	X	X	X	X		
MR11-IS17	approx. 5' bgs	MR11-SB17-11C	X	X	X	X		
MR11-IS18	approx. 5' bgs	MR11-SB18-11C	X	X	X	X		
MR11-IS19	approx. 5' bgs	MR11-SB19-11C	X	X	X	X		
MR11-IS20	approx. 5' bgs	MR11-SB20-11C	X	X	X	X		
MR11-IS21	approx. 5' bgs	MR11-SB21-11C	X	X	X	X		
MR11-IS22	approx. 5' bgs	MR11-SB22-11C	X	X	X	X		
MR11-IS23	approx. 5' bgs	MR11-SB23-11C	X	X	X	X		
MR11-IS24	approx. 5' bgs	MR11-SB24-11C	X	X	X	X		
MR11-IS##	Duplicate	MR11-SB##D-11C	X	X	X	X		
MR11-IS##	Duplicate	MR11-SB##D-11C	X	X	X	X		
MR11-IS##	MS	MR11-SB##-11C-MS	X	X	X	X		
MR11-IS##	MSD	MR11-SB##-11C-SD	X	X	X	X		
MR11-SW/SD03		MR11-SW03-11C	X	X	X	X	X	X
MR11-SW/SD04		MR11-SW04-11C	X	X	X	X	X	X
MR11-SW/SD##	Duplicate	MR11-SW##D-11C	X	X	X	X		
MR11-SW/SD##	MS	MR11-SW##-11C-MS	X	X	X	X		
MR11-SW/SD##	MSD	MR11-SW##-11C-SD	X	X	X	X		
MR11-SW/SD03		MR11-SD03-11C	X	X	X	X		
MR11-SW/SD04		MR11-SD04-11C	X	X	X	X		
MR11-SW/SD##	Duplicate	MR11-SD##D-11C	X	X	X	X		
MR11-SW/SD##	MS	MR11-SD##-11C-MS	X	X	X	X		

Sample Location	Screening Interval / QA/QC type	Sample ID	Explosive Residues, including PETN and Nitrolycerin	Perchlorate	Total Chromium	Total Hexavalent Chromium	Dissolved Chromium	Dissolved Hexavalent Chromium
MR11-SW/SD##	MSD	MR11-SD##-11C-SD	X	X	X	X		
N/A	Equipment Blank	MR11-EB##-MMDDYY-GW	X	X	X	X	X	X
N/A	Equipment Blank	MR11-EB##-MMDDYY-SO	X	X	X	X		
N/A	Equipment Blank	MR11-EB##-MMDDYY-SW	X	X	X	X	X	X
N/A	Equipment Blank	MR11-EB##-MMDDYY-SD	X	X	X	X		

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SAP Worksheet #18-2: Location-Specific Sampling Methods/SOP Requirements Table - UXO-17

Sample Location	Screening Interval / QA/QC type	Sample ID	VOCs	SVOCs
MR17-TW09	3-13 ft	MR17-MW09-11C	X	X
MR17-TW11	4-14 ft	MR17-MW11-11C	X	X
MR17-TW13	7-17 ft	MR17-MW13-11C	X	X
MR17-TW14	6-16 ft	MR17-MW14-11C	X	X
MR17-TW15	3-13 ft	MR17-MW15-11C	X	X
MR17-TW16	TBD	MR17-MW16-11C	X	X
MR17-TW17	TBD	MR17-MW17-11C	X	X
MR17-TW18	TBD	MR17-MW18-11C	X	X
MR17-TW##	Duplicate	MR17-GW##D-11C	X	X
MR17-TW##	MSD	MR17-MW##-11C-MS	X	X
MR17-TW##	MSD	MR17-MW##11C-SD	X	X
N/A	Equipment Blank	MR17-EB##-MMDDYY	X	X

SAP Worksheet #18-3: Location-Specific Sampling Methods/SOP Requirements Table – Post Detonation Sampling UXO-11 and UXO-17

Site	Matrix	Sample Location	Screening Interval	Sample ID ¹	Sampling SOP Reference	Analytical Group		
						AL Metals (SW-846 6010C & 7470A/7471B)	Explosives (SW-846 8330B)	Perchlorate (SW-846 6850)
Composite Surface Soil³								
UXO-11	SS	MR11-SS25	0-2" bgs	MR11-SS25-IC-11C	See Worksheet #21	X	X	X
<i>UXO-11 QA/QC - Duplicate²</i>	SS		0-2" bgs	<i>MR11-SS25D-IC-11C</i>		X	X	X
UXO-11	SS		0-2" bgs	MR11-SS25-OC-11C		X	X	X
<i>UXO-11 QA/QC - Duplicate²</i>	SS		0-2" bgs	<i>MR11-SS25D-OC-11C</i>		X	X	X
UXO-17	SS	MR17-SS26	0-2" bgs	MR17-SS26-IC-11C		X	X	X
<i>UXO-17- MS/SD²</i>	SS		0-2" bgs	<i>MR17-SS26-IC-11C-MS</i>		X	X	X
<i>UXO-17- MS/SD²</i>	SS		0-2" bgs	<i>MR17-SS26-IC-11C-MSD</i>		X	X	X
UXO-17	SS		0-2" bgs	MR17-SS26-OC-11C		X	X	X
<i>UXO-17- MS/SD²</i>	SS		0-2" bgs	<i>MR17-SS26-OC-11C-MS</i>		X	X	X
<i>UXO-17- MS/SD²</i>	SS		0-2" bgs	<i>MR17-SS26-OC-11C-MSD</i>		X	X	X
Non-Well Location QA/QC Samples								
QA/QC	AQ	N/A	N/A	MR17-EB##-MMDDYY	See Worksheet #21	X	X	X
QA/QC	AQ	N/A	N/A	MR17-FB##-MMDDYY	#21	X	X	X

The number of QA/QC samples collected is dependent on the total number of samples collected and therefore will be adjusted as the number of sampling locations is adjusted. QA/QC sample IDs include additional identifiers; D = Duplicate; EB = Equipment Blank; FB = Field Blank.

¹ For EB and FB samples, the actual number of equipment and field blanks to be collected will be based upon the number of days it takes to perform sampling. Refer to **Worksheet #12** for field QC sampling frequency.

² QA/QC samples consisting of Duplicates and MS/MSD are identified with sample locations for nomenclature purposes only. The actual number and location of these samples may vary between sampling events. Duplicate collection frequency is designated in **Worksheet #12**; MS/MSD collection frequency is designated in **Worksheet #28**.

³ Post-detonation Composite samples are samples collected Inside and Outside Crater of a denotation location. Sample ID's provided indicate the sample name for the first post-detonation inside crater and outside crater samples. Sampling of zero or more than one post-detonation location may occur, pending the results of the investigation.

SAP Worksheet #19: Field Sampling Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time
UXO-11						
Surface Soil, Subsurface Soil, Sediment	Explosives	SW-846 8330 / GL-OA-E-068	4 oz. glass jar	20g	Cool to 0-6°C	14 days
	Perchlorate	SW-846 6850 / GL-OA-E-067		20g		
	Chromium	SW-846 6010C / MET-05	4 oz. glass jar	10g	Cool to 0-6°C	6 months; 28 days for mercury
	Hexavalent Chromium	SW-846 7196A / WETS-64		10g		28 days
Groundwater, Surface Water	Explosives	SW-846 8330 / GL-OA-E-068	1L Amber	750mL	Cool to 0-6°C	14 days
	Perchlorate	SW-846 6850 / GL-OA-E-067	250mL plastic	10mL	Cool to 0-6°C	28 days
	Total Chromium	SW-846 6010C / MET-05	250mL plastic	80mL	pH < 2 with HNO ₃ and cool to 0-6 °C	6 months; 28 days for mercury
	Total Hexavalent Chromium	SW-846 7196A / WETS-64	250mL plastic	25mL	Cool to 0-6°C	24 hours
	Dissolved Chromium	S SW-846 6010C / MET-05	250mL plastic	80mL	pH < 2 with HNO ₃ and cool to 0-6 °C	6 months; 28 days for mercury
	Dissolved Hexavalent Chromium	SW-846 7196A / WETS-64	250mL plastic	25mL	Cool to 0-6°C	24 hours

SAP Worksheet #19: Field Sampling Requirements Table (continued)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time
UXO-17						
Groundwater	VOCs	SW-846 8260B / VGCMS-05	3, 40mL Vials, Glass	3 X 40mL (no headspace)	HCl to pH<2, Cool to 0-6°C	14 days
	SVOCs	SW-846 8270D, 8270D-SIM / SVGCMS-03	1, 1 Liter, Amber Glass	500mL	Cool to 0-6°C	7 days to extraction / 40 days to analysis
UXO-11 and UXO-17 Post-Detonation Sampling						
Surface Soil Composite	Explosives	SW-846 8330B / GL-OA-E-068	4oz. glass jar	20g	Cool to 0-6°C	14 days
	Perchlorate	SW-846 6850 / GL-OA-E-067		20g		28 days
	TAL Metals	SW-846 6010C and 7471B / MET-05 and MET-16	4oz. glass jar	2g	Cool to 0-6 °C	6 months; 28 days for mercury

SAP Worksheet #20: Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations ¹	No. of Field Duplicates	No. of MS/MSDs ²	No. of Field Blanks ³	No. of Equip. Blanks ³	No. of Trip Blanks ³	Total No. of Samples to Lab
UXO-11 Sampling								
Surface Soil	Explosives	20	2	1	-	4	-	28
	Perchlorate	20	2	1	-	4	-	28
	Chromium	20	2	1	-	4	-	28
	Hexavalent Chromium	20	2	1	-	4	-	28
Subsurface Soil	Explosives	20	2	1	-	4	-	28
	Perchlorate	20	2	1	-	4	-	28
	Chromium	20	2	1	-	4	-	28
	Hexavalent Chromium	20	2	1	-	4	-	28
Sediment	Explosives	2	1	1	-	1	-	6
	Perchlorate	2	1	1	-	1	-	6
	Chromium	2	1	1	-	1	-	6
	Hexavalent Chromium	2	1	1	-	1	-	6
Surface Water	Explosives	2	1	1	-	1	-	6
	Perchlorate	2	1	1	-	1	-	6
	Chromium	2	1	1	-	1	-	6
	Hexavalent Chromium	2	1	1	-	1	-	6
	Filtered Chromium	2	1	1	-	1	-	6
	Filtered Hexavalent Chromium	2	1	1	-	1	-	6
Groundwater	Explosives	5	1	1	-	2	-	10
	Perchlorate	5	1	1	-	2	-	10
	Chromium	5	1	1	-	2	-	10
	Hexavalent Chromium	5	1	1	-	2	-	10
	Filtered Chromium	5	1	1	-	2	-	10
	Filtered Hexavalent Chromium	5	1	1	-	2	-	10

SAP Worksheet #20: Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	No. of Sampling Locations ¹	No. of Field Duplicates	No. of MS/MSDs ²	No. of Field Blanks ³	No. of Equip. Blanks ³	No. of Trip Blanks ³	Total No. of Samples to Lab
UXO-17 Sampling								
Groundwater	VOC	8	1	1	-	4	4	19
	SVOC	8	1	1	-	4	-	15
UXO-11 and UXO-17 Post-Detonation Sampling								
Surface Soil Composite	Explosives	2	1	1	-	1	-	6
	Perchlorate	2	1	1	-	1	-	6
	TAL Metals	2	1	1	-	1	-	6

¹ If samples will be collected at different depths at the same location, each discrete sampling depth is counted as a separate sampling location or station.

² Although the MS/MSD is not typically considered a field QC, it is included here because location determination is often established in the field.

³ The number of field, equipment and trip blanks is based on a fundamental assumption of the number of sampling days each event will require. Refer to **Worksheet #12** for field QA/QC sampling frequencies.

SAP Worksheet #21: Project Sampling SOP References Table

Reference Number	Title, Revision Number and / or Date	Originating Organization	Equipment Type	Modified for Project Work?	Comments
SOP-001	Completing Log Books, rev. 5/2011	CH2M HILL	Log Book Indelible Pen	No	
SOP-002	Locating and Clearing Underground Utilities, rev. 5/2011		Electromagnetic Inductance		
SOP-004	Sediment Sampling, rev. 5/2011		Stainless Steel Spoon and Bowls		
SOP-005	Soil Boring and Abandonment, rev. 5/2011		Drill rig		
SOP-06	Installation of Shallow Monitoring Wells, rev. 5/2011		Drill rig	Yes	Monitoring Well Installation through HSA drilling techniques
SOP-07	Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using a multi parameter water quality meter with Flow through Cell, rev. 5/2011		Water quality meter with flow-through cell	Yes	
SOP-08	Low-Flow Groundwater Sampling from Monitoring Wells, rev. 5/2011		Peristaltic Pump or Bladder pump, Plastic Tubing		Include purging a minimum of one well volume per NCDENR
SOP-09	Decontamination of Personnel and Equipment, rev. 5/2011		reusable sampling equip.	No	
SOP-010	Decontamination of Drilling Rigs and Equipment, rev. 5/2011		steam cleaner and decon pad		
SOP-011	Disposal of Waste Solids and Fluids, rev. 5/2011		5-gallon buckets with on-base disposal		
SOP-012	Equipment Blank and Field Blank Preparation, rev. 5/2011		Lab provided blank liquid and sample bottles		
SOP-013	Packaging and Shipping Procedures for Low-Concentration Samples, rev. 5/2011		Lab supplied coolers		
SOP-014	Chain-of-Custody, rev. 5/2011		Chain-of-Custody Form		
SOP-015	UXO Contacts		Staff Form		
SOP-016	DPT Soil Sample Collection 5/2011		Direct-push rig		

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

Field Equipment	Activity ¹	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference ²	Comments
Peristaltic Pump/ ProActive Mini- Monsoon Submersible Pump/ Bladder pump	Maintenance	As Needed, Regularly	Specific per model/instruction manual	Rental and/or manufacturer support for pump malfunctions	Field Team Leader	SOP-08	
Water quality meter	Calibrate probes	Daily, As Needed	Parameter specific per model/instruction manual For example: Horiba U22: pH = 4.0 +/- 3%, conductivity 4.49 mS/cm +/- 3%, and turbidity = 0 NTU +/- 3%.	Manufacturer technical support for calibration errors	Field Team Leader	SOP-07	

¹ Activities may include calibration, verification, testing, and maintenance.

² See Worksheet #21.

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SAP Worksheet #23: Analytical SOP References Table

Lab SOP Number	Title, Revision Date and/or Number	Last Reviewed	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to QSM	Modified for Project Work (Y/N)
LOGINS-03	RECEIVING SAMPLES (Rev. 10, Effective 1/23/2010)	4/20/2011	NA	NA	NA	ENCO - Orlando	None	N
ADMIN-14	WASTE DISPOSAL AND CHARACTERIZATION (Rev. 5, 12/1/2009)	1/4/2011	NA	NA	NA	ENCO - Orlando	None	N
EXMT-09	Acid Digestion of Soil and Waste Samples for Analysis by ICP and ICP-MS, Dec. 4, 2009 (Rev. 5, 12/04/09)	3/30/2011	NA	Soil Metals Prep	NA	ENCO - Jacksonville	None	N
EXMT-12	Acid Digestion of Aqueous Samples for Analysis by ICP and ICP-MS (Rev. 4, 11/30/2009)	11/30/2010	NA	Aqueous Metals Prep	NA	ENCO - Orlando	None	N
EXSV-16	Extraction of Soil/Solid Samples Using Sonication, (Rev. 6, 3/23/2010)	4/14/2011	NA	Soils SVOC Prep	NA	ENCO - Orlando	None	N
EXSV-27	Extraction of Samples Using Separatory Funnel Techniques (Rev. 4, 3/2/2010)	4/14/2011	NA	Aqueous SVOC Prep	NA	ENCO - Orlando	None	N
MET-03	Mercury in Waters by Digestion/CVAA (Rev. 4, 12/4/2009)	01/11/2011	Definitive	Water/Mercury	CVAA	ENCO - Jacksonville	None	N
MET-05	Metals Analysis using ICP-AES (Rev. 7, 10/30/2009)	5/17/2011	Definitive	Soil, Aqueous Metals	ICP/AES	ENCO - Jacksonville	ENCO does not perform Method of Standard Additions (MSA)	N
MET-16	Mercury in Soils by Digestion/CVAA (Rev. 4, Effective Date 3/1/2010)	12/1/2010	Definitive	Soil/Mercury	CVAA	ENCO - Jacksonville		N
WETS-64	Hexavalent Chromium (Colorimetric), Revision No. 8 (1/23/2010)	04/21/2011	Definitive	Aqueous Hexavalent Chromium	UV-VIS	ENCO - Orlando		N

SAP Worksheet #23: Analytical SOP References Table (continued)

Lab SOP Number	Title, Revision Date and/or Number	Last Reviewed	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to QSM	Modified for Project Work (Y/N)
SVGCMS-03	Analysis of Semivolatile Organic Compounds by GCMS (Rev. 16, Effective 11/29/2010)	NA	Definitive	Soil, Aqueous SVOC	GC/MS	ENCO - Orlando	None	N
VGCMS-05	Analysis of Volatile Organic Compounds by GCMS (Rev.16, Effective 11/5/2010)	NA	Definitive	Soil, Aqueous VOC	GC/MS	ENCO - Orlando	None	N
GL-LB-G-001	Laboratory Waste Management Plan, Revision No. 19 (Feb 2011)	--	NA	All	NA	GEL Laboratories	None	N
GL-OA-E-033	Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC), Revision No. 19 (Jan. 2011)	--	Definitive	Solid Explosives	HPLC/DAD	GEL Laboratories	None	N
GL-OA-E-067	Definitive Low Level Perchlorate Analysis Utilizing LC/MS/MS by EPA Method 6850 Modified, Revision No. 7 (Oct 2010)	--	Definitive	Solid Perchlorate	LC/MS/MS	GEL Laboratories	None	N
GL-OA-E-068	The Extraction and Analysis of Nitroaromatics, Nitramines, and Nitrate Esters by SW-846 8330B, Revision No. 3 (October 2010)	--	Definitive	Solid Explosives	NA (prep method)	GEL Laboratories	None	N
GL-SR-E-001	Sample Acceptance Policy, Sample Login and Storage, Revision No. 32 (March 2011)	--	NA	All	NA	GEL Laboratories	None	N

SAP Worksheet #24-1: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
GC-MS (VOCs, SVOCs)	Tuning	Prior to initial calibration (ICAL) and at the beginning of each 12-hour period.	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Analyst	VGCMS-05 VGCMS-03
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane; VOCs ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050 . 2. RSD for RFs for CCCs: VOCs and SVOCs $\leq 30\%$ and one option below: <u>Option 1</u> : RSD for each analyte $\leq 15\%$; <u>Option 2</u> : linear least squares regression $R \geq 0.995$; <u>Option 3</u> : non-linear regression coefficient of determination (COD) $R^2 \geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within $\pm 20\%$ of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	Retention time window position establishment for each analyte and surrogate.	Once per ICAL.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial continuing calibration verification (CCV) is used.	NA.		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average RF for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050 . 2. %Difference/Drift for all target compounds and surrogates: VOCs $\leq 20\%D$ (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	DoD project level approval must be obtained for each of the failed analytes or corrective action must be taken. Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.		

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

SAP Worksheet #24-2: Analytical Instrument Calibration Table

Instrument ²	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
LC/MS/MS(SW-846 8330B)	Initial Calibration (ICAL) - minimum five-points for all analytes	ICAL prior to sample analysis. Once calibration curve or line is generated, the lowest calibration standard must be reanalyzed.	The apparent signal-to-noise ratio at the RL must be at least 5:1. If linear regression is used, $r \geq 0.995$. If using Internal Standardization, $RSD \leq 15\%$.	Correct problem then repeat ICAL.	Analyst	GL-OA-E-068
	Second Source Calibration Verification (ICV)	Immediately following ICAL.	All project analytes and surrogates within $\pm 20\%$ of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.		
	Continuing Calibration Verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All target analytes and surrogates within $\pm 20\%$ of the expected value from the ICAL.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.		

¹Referenced SOPs are listed in **Worksheet #23**.

²DoD QSM v. 4.1 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, and total organic carbon (TOC) methods.

SAP Worksheet #24-3: Analytical Instrument Calibration Table

Instrument ²	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
LC/MS/MS (SW846 6850)	Initial Calibration (ICAL)	Minimum of five calibration standards to establish linearity at method set-up and after major maintenance.	$r \geq 0.995$ or $RSD \leq 20\%$. The concentration corresponding to the absolute value of the calibration curve's Y-intercept must be \leq LOD.	Correct problem then repeat ICAL.	Analyst	GL-OA-E-067
	Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard at the midpoint of the calibration.	Within $\pm 15\%$ of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.		
	Continuing Calibration Verification (CCV)	Analysis of mid-level standard after every 10 field samples. All samples must be bracketed by the analysis of a standard demonstrating that the system was capable of accurately detecting and quantifying perchlorate.	Within $\pm 15\%$ of true value.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.		
	Tuning	Prior to ICAL and after any mass calibration or maintenance is performed.	Tuning standards must contain the analytes of interest and meet acceptance criteria outlined in the laboratory SOP.	Retune instrument. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone.		
LC/MS/MS (SW846 6850) (cont.)	Limit of Detection Verification (LODV) (per batch)	Prior to sample analysis and at the end of the analysis sequence. It can be analyzed after every 10 samples in order to reduce the reanalysis rate.	Within $\pm 30\%$ of true value.	Correct problem and rerun LODV and all samples analyzed since last successful LODV. If a sample with perchlorate concentration at or between the LOD and RL is bracketed by a failing LODV, it must be reanalyzed. A sample with concentration above the RL can be reported.		
	Mass Calibration	Instrument must have a valid mass calibration prior to any sample analysis. The mass calibration is updated on an as-needed basis (e.g., QC failures, ion masses show large deviations from known masses, major instrument maintenance is performed, or the instrument is moved).	Mass calibration range must bracket the ion masses of interest without greatly exceeding the range. The most recent mass calibration must be used for an analytical run, and the same mass calibration must be used for all data files in an analytical run. Mass calibration must be verified by acquiring a full scan continuum mass spectrum of a perchlorate stock standard. Perchlorate ions should be within ± 0.3 m/z of mass 99, 101, and 107 or their respective daughter ion masses (83, 85, and 89), depending on which ions are quantitated.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance.		

¹Referenced SOPs are listed in **Worksheet #23**.

²DoD QSM v. 4.1 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, and TOC methods.

SAP Worksheet #24-4: Analytical Instrument Calibration Table

Instrument ²	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
ICP-AES (SW-846 6010C)	Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix.	IDLs shall be ≤ LOD	N/A	Analyst	MET-05
	Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of true value.	N/A		
	Initial Calibration (ICAL) - minimum one high standard and a calibration blank for all analytes	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r \geq 0.995$.	Correct problem, then repeat ICAL. Flagging criteria are not appropriate. No samples may be run until an ICAL is analyzed that meets acceptance criteria.		
	Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes(s) within ±10% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.		
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	Within ± 10% of true value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		
	Low-level calibration check standard	Daily, after one-point ICAL.	Within ±20% of true value.	Correct problem, then reanalyze. Flagging criteria are not appropriate. No samples may be analyzed without a valid low-level calibration check standard.		
	Calibration Blank	Before beginning a sample run.	No analytes > LOD.	Correct problem.		

¹Referenced SOPs are listed in **Worksheet #23**.

²DoD QSM v. 4.1 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 TOC methods.

SAP Worksheet #24-5: Analytical Instrument Calibration Table

Instrument ²	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
CVAA (SW-846 7470A/7471B)	Initial Calibration (ICAL) - minimum three standards and a calibration blank	For all analytes, daily ICAL prior to sample analysis.	$r \geq 0.995$.	Correct the problem, then repeat ICAL.	Analyst	MET-03 and MET-16
	Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes(s) within $\pm 10\%$ of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.		
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	Within $\pm 10\%$ of true value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		
	Calibration Blank	Before beginning a sample run.	No analytes > LOD.	Correct problem.		

¹Referenced SOPs are listed in **Worksheet #23**.

²DoD QSM v. 4.1 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, and TOC methods.

SAP Worksheet #24-6: Analytical Instrument Calibration Table

Instrument ²	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference ¹
UV-VIS (SW-846 7196A)	Initial Calibration (ICAL) - minimum three standards and a calibration blank	Daily ICAL prior to sample analysis.	$r \geq 0.995$	Correct problem and repeat ICAL. Flagging criteria are not appropriate.	Analyst	WETS-64
	Second Source Calibration Verification (ICV)	Before beginning a sample run.	Value of second source within $\pm 10\%$ of true value.	Correct problem and verify second source standard. Rerun ICV, if that fails, correct problem and repeat calibration. Flagging criteria are not appropriate.		
	Continuing Calibration Verification (CCV)	After every 15 field samples and at the end of the analysis sequence.	Value of CCV within of $\pm 10\%$ the true value.	Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		

¹Referenced SOPs are listed in **Worksheet #23**.

²DoD QSM v. 4.1 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, and TOC methods.

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	SOP Reference
GC/MS (VOCs and SVOCs)	Clean sources, maintain vacuum pumps.	Tuning.	Instrument performance and sensitivity.	Service vacuum pumps twice per year, other maintenance as needed.	Tune and CCV pass criteria.	Recalibrate instrument.	Analyst/ Supervisor	VGCMS-05 and SVGCMS-03
	Change septum, clean injection port, change or clip column, install new liner, change trap.	Sensitivity check.	Instrument performance and sensitivity.	Daily or as needed.	Tune and CCV pass criteria.	Re-inspect injector port, cut additional column, re-analyze CCV, and re-calibrate instrument.		
HPLC/DAD (Explosives)	Change analytical column as needed; change mobile phase when insufficient for run or contamination; change inlet filters as needed for contamination.	Calibration, ICV, CCV.	Check pump pressure; check for leaks; check for adequate mobile phase.	Prior to initial calibration or as necessary.	Calibration criteria are met.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	GL-OA-E-033
LC/MS (Perchlorate)	Change analytical column as needed; change mobile phase when insufficient for run or contamination; change inlet filters as needed for contamination.	Calibration, ICV, CCV, Interference Check and LODV.	Check pump pressure; check for leaks; check for adequate mobile phase.	Instrument receipt; instrument change (new column, etc.); when continuing calibration verification (CCV) does not meet criteria.	Calibration criteria are met.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	GL-OA-E-067

SAP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (cont.)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP-AES (Metals)	Change tubing.	None.	None	Every other run.	None.	None.	Analyst/ Supervisor	MET-05
	Clean air filter.	Look at air filters.	Visual	Monthly.	Filter looks clean.	Clean air filters and monitor instrument.		
	Clean injector.	Look at injector to see if dirty.	Visual, but may show with increased carry-over.	As needed.	None.	None.		
	Clean lenses.	Look at lenses.	Monitor peak intensities, look at lenses.	As needed.	Lenses are clean.	Clean lenses.		
CVAA (Mercury)	Replace disposables, flush lines.	Sensitivity check.	Instrument performance and sensitivity.	Daily or as needed.	CCV pass criteria.	Recalibrate.	Analyst/ Supervisor	MET-16
	Clean lens.	Sensitivity check.	Instrument performance and sensitivity.	Daily or as needed.	Method Blank passes criteria.	Recalibrate.		
	Replace pump tubing.	Flow Rate Check.	Instrument performance and sensitivity.	As needed.	Monitor flow rate for variation.	Replace windings, recalibrate and re-analyze.		
Spectrophotometer (Hexavalent Chromium)	Clean reagent tubes. Change lamp.	Initial Calibration Verification	Check wavelength	At the beginning of every run.	CCV pass criteria.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	WETS-065

SAP Worksheet #26: Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Team/CH2M HILL
Sample Packaging (Personnel/Organization): FTL/ CH2M HILL
Coordination of Shipment (Personnel/Organization): FTL/ CH2M HILL
Type of Shipment/Carrier: Overnight Carrier/ FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custody Personnel / ENCO-Orlando, ENCO-Jacksonville and GEL Labs
Sample Custody and Storage (Personnel/Organization): Sample Custody Personnel / ENCO-Orlando, ENCO-Jacksonville and GEL Labs
Sample Preparation (Personnel/Organization): Sample Preparation Personnel / ENCO-Orlando, ENCO-Jacksonville and GEL Labs
Sample Determinative Analysis (Personnel/Organization): Analysts / ENCO-Orlando, ENCO-Jacksonville and GEL Labs
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 45 days
Biological Sample Storage (No. of days from sample collection): Not Applicable
SAMPLE DISPOSAL
Personnel/Organization: Sample Disposal Personnel / ENCO-Orlando, ENCO-Jacksonville and GEL Labs
Number of Days from Analysis: 30 days from issuance of report

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SAP Worksheet #27: Sample Custody Requirements

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. Labels will be taped to the jar to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples 0-6 °C until they are received by the laboratory.

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

See **Worksheet #21** for CH2M HILL SOPs containing sample custody guidance.

The CH2M HILL field team will ship all samples directly to the laboratory performing the analysis, refer to **Worksheet #30**.

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

Laboratory custody procedures can be found in SOP LOGIN-03 and GL-SR-E-001, which are referenced in **Worksheet #23**.

Sample Identification Procedures:

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

Chain-of-custody Procedures:

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

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SAP Worksheet #28-1: Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Soil Composite, Surface Soil Incremental

Analytical Group: Explosives

Analytical Method/SOP Reference: SW-846 8330A / GL-OA-E-033

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	Target analytes must be < ½ LOQ or < 1/10 the concentration found in the sample or < 1/10th the regulatory limit. Blank results must not otherwise affect sample results.	Correct the problem, then see Department of Defense (DoD) Quality Standards Manual (QSM) v4.1 Box D-1. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst/ Laboratory Area Supervisor	Contamination/ Bias	Same as Method Acceptance Limits
Laboratory Control Sample (LCS)		Contains all target analytes. Percent recoveries must meet the control limits listed in Worksheet #15.	Re-prepare and analyze all associated samples if holding time remains. Discuss qualification with client.		Accuracy/ Bias	Same as Method Acceptance Limits
Matrix Spike/Matrix Spike Duplicate (MS/MSD)		Contains all target analytes. For matrix evaluation only. Percent recoveries must meet the LCS limits. Relative Percent Difference (RPD) <30%	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	Same as Method Acceptance Limits
Confirmation of positive results	All positive results must be confirmed on second column	Calibration and QC criteria same as for initial or primary column analysis; Results between two columns RPD ≤ 40%	Narrate and qualify the results		Accuracy	Same as Method Acceptance Limits
Surrogates	All field and QC samples.	1-chloro-3-nitrobenzene 55%-140%	Re-prepare and reanalyze all failed samples in the associated preparatory batch for confirmation of matrix interference.		Accuracy / Bias	Same as Method Acceptance Limits

SAP Worksheet #28-2: Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Soil Composite, Surface Soil Incremental

Analytical Group: Perchlorate

Analytical Method/SOP Reference: SW-846 6850/ GL-OA--067

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Isotope ratio	Each sample, QC sample, and standard	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85. Must fall within 2.3 - 3.8	Re-extract using cleanup procedures or alternate techniques to confirm the presence of perchlorate such as post spikes or dilutions to reduce interference.	Analyst, Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method Acceptance Limits
Internal Standard (IS)	One per sample	Relative retention times for internal standard must be 0.98-1.02 and the responses within $\pm 50\%$ of the average response of the initial calibration (ICAL).	Reanalyze samples at increasing dilutions until the $\pm 50\%$ criteria can be met		Precision / Accuracy / Bias	Same as Method Acceptance Limits
Lab reagent blank	One per batch of 20 or less	Target analytes must be $< \frac{1}{2}$ LOQ or $< 1/10$ the concentration found in the sample or $< 1/10$ th the regulatory limit.	Re-clean, retest, re-extract, reanalyze, and/or qualify data		Bias / Contamination	Same as Method Acceptance Limits
Method blank			Re-clean, retest, re-extract, reanalyze, and/or qualify data		Bias / Contamination	Same as Method Acceptance Limits
LCS		Percent recoveries must meet control limits 80%-120%	Evaluate and re-prepare/ reanalyze the LCS and associated samples.		Precision / Accuracy / Bias	Same as Method Acceptance Limits
MS/MSD		Percent recoveries must meet control limits 80%-120% and RPD of 15%.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	Same as Method Acceptance Limits

SAP Worksheet #28-3: Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil, Sediment, Surface Soil Composite, Surface Soil Incremental

Analytical Group: Metals, except mercury

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

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	One is performed for each batch of up to 20 samples.	Target analytes must be $\leq \frac{1}{2}$ LOQ	Correct the problem; if required, reprep and reanalyze the method blank and all samples processed with the contaminated blank	Analyst/ Laboratory Area Supervisor	Contamination/ Bias	Same as Method Acceptance Limits	
LCS		Percent recoveries must meet control limits 80%-120%	Re-prepare and analyze all associated samples.		Accuracy/ Bias	Same as Method Acceptance Limits	
MS/MSD		Percent recoveries must meet control limits 80%-120% and RPD of 20%.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	Same as Method Acceptance Limits	
Serial Dilution		One is performed for each preparation batch with sample concentration(s) > 50x LOQ.	The 5-fold dilution result must agree within $\pm 10\%$ of the original sample result.		Perform Post Digestion Spike	Precision / Accuracy	Same as Method Acceptance Limits
Post Digestion Spike (PDS)		One is performed when serial dilution fails or analyte concentration(s) in all samples < 50x LOD.	The result must agree within $\pm 25\%$ of expected result.		Run all associate samples in the preparatory batch by method of standard additions or qualify results.	Precision / Accuracy	Same as Method Acceptance Limits

SAP Worksheet #28-4: Laboratory QC Samples Table

Matrix: Surface Soil, Surface Soil Composite, Subsurface Soil, Surface Soil Composite, Surface Soil Incremental

Analytical Group: Mercury

Analytical Method / SOP Reference: SW-846 7471B / MET-16

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.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, re-prepare and reanalyze method blank and all samples processed with the contaminated blank.	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.
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOQ.	Correct problem. Re-prepare and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOQ.
LCS	One per preparatory batch.	Recovery 80-120%. Limits are as per DoD QSM v. 4.1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1.	Analyst	Accuracy/Bias	Recovery 80-120%. Limits are as per DoD QSM v. 4.1.
MS	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects.	Analyst	Accuracy/Bias	Same as LCS.
MSD	One per preparatory batch per matrix.	Same as MS and RPD ≤ 20%.	Same as MS.	Analyst	Accuracy/Bias, Precision	Same as MS and RPD ≤ 20%.

¹ DoD QSM v. 4.1 is the basis for specifications on this table.

SAP Worksheet #28-5: Laboratory QC Samples Table

Matrix: Surface Soil, Surface Soil Composite, Subsurface Soil
 Analytical Group: Hexavalent Chromium
 Analytical Method / SOP Reference: SW-846 7196A / WETS-64

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
Reference Blank (Reagent Water)	Before beginning standards or sample analysis.	N/A	N/A	Analyst	N/A	Same as QC Acceptance Limits.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, re-prepare and reanalyze method blank and all samples processed with the contaminated blank.	Analyst	Accuracy/Bias, Contamination	Same as QC Acceptance Limits.
LCS	One per preparatory batch	Recovery within 70-130%.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated batch for the failed analyte in all samples in the associated preparatory batch, if sufficient sample material is available.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.
MS	Once for every sample matrix analyzed.	Same as LCS.	If check indicates interference, dilute and reanalyze sample; persistent interference indicates the need to use alternative method or analytical conditions, or to use method of standard additions.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.
MSD	One per preparatory batch per matrix.	Same as MS and \leq RPD 30%.	Examine the project-specific DQOs. Contact the client as to additional measure to be taken. Flagging criteria are not appropriate.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.
PDS	One per preparatory batch.	Same as LCS.	Correct problem and re-homogenize, re-digest, and reanalyze samples. Persistent interference indicates the need to use an alternative method or analytical conditions, or to use method of standard additions.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.

¹ DoD QSM v. 4.1 is the basis for specifications on this table.

SAP Worksheet #28-6: Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: VOA

Analytical Method/SOP Reference: SW-846 8260B / VGCMS-05

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparatory batch	No target analytes > 1/2 LOQ; no common laboratory contaminants > LOQ.	Correct problem; then repeat. If the method blank still fails, repeat initial calibration.	Analyst	Bias/Contamination	Same as QC Acceptance Limits.
LCS		Refer to Worksheet #15.	LCS is reanalyzed. If still fails, samples along with QC, are re-prepped and re-analyzed. Client will be contacted for guidance about whether to re-prepare samples. In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MS		Same as LCS.	In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MSD		Same as LCS and RPD ≤30%.	In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
IS	Spiked in Every Sample	Retention time within 30 seconds from retention time of the midpoint standard in the ICAL; areas within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.		Precision and Accuracy	Same as QC Acceptance Limits.
Surrogates		Dibromofluoromethane 85-115%, Toluene-d ₈ 85-120%, 1,2-Dichloroethane-d ₄ 70-120%, 4-Bromofluorobenzene 75-120%	Re-prepare and re-analyze sample unless objective evidence of suspected or confirmed sample matrix effects are available. If insufficient sample exists for reanalysis, client will be contacted for instructions. In the absence of client instruction, data will be qualified.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.

SAP Worksheet #28-7: Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: SVOA

Analytical Method/SOP Reference: SW-846 8270D/ SVGCMS-03

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No target analytes > 1/2 LOQ; no common laboratory contaminants > LOQ.	Correct problem. If required, re-prepare and re-analyze method blank and all samples processed with the contaminated blank.	Analyst	Bias/Contamination	Same as QC Acceptance Limits.
LCS		See Worksheet #15.	LCS is reanalyzed. If still fails, samples, along with QC, are re-prepped and re-analyzed. Client will be contacted for guidance about whether to re-prepare samples. In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MS		Same as LCS.	In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MSD		Same as LCS and RPD ≤30%.	In the absence of client specific requirements, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
Surrogate Spike	Spiked in every sample.	2-Fluorobiphenyl 50-110%, Terphenyl-d ₁₄ 50-155%, Nitrobenzene-d ₅ , 40-110%.	Re-prepare and re-analyze sample unless objective evidence of suspected or confirmed sample matrix effects are available. If insufficient sample exists for reanalysis, client will be contacted for instructions. In the absence of client instruction, data will be qualified.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
IS	Spiked in every sample.	Retention time within 30 seconds from retention time of the midpoint standard in the ICAL; areas within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning.		Precision and Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-8: Laboratory QC Samples Table

Matrix: Surface water, Groundwater

Analytical Group: Explosives

Analytical Method/SOP Reference: SW-846 8330A/ GL-OA-E-033

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Method Blank	One is performed for each batch of up to 20 samples.	Target analytes must be < ½ LOQ or < 1/10 the concentration found in the sample or < 1/10th the regulatory limit. Blank results must not otherwise affect sample results.	Correct the problem, then see Department of Defense (DoD) Quality Standards Manual (QSM) v4.1 Box D-1. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst/ Laboratory Area Supervisor	Contamination/ Bias	Same as Method Acceptance Limits	
LCS		Contains all target analytes. Percent recoveries must meet the control limits listed in Table 5B-1	Re-prepare and analyze all associated samples if holding time remains. Discuss qualification with client.		Accuracy/ Bias	Same as Method Acceptance Limits	
MS/MSD		Contains all target analytes. For matrix evaluation only. Percent recoveries must meet the LCS limits. Relative Percent Difference (RPD) <30%	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	Same as Method Acceptance Limits	
Confirmation of positive results		All positive results must be confirmed on second column	Calibration and QC criteria same as for initial or primary column analysis; Results between two columns RPD ≤ 40%		Narrate and qualify the results	Accuracy	Same as Method Acceptance Limits
Surrogates		All field and QC samples.	1-chloro-3-nitrobenzene 40%-145%		Re-prepare and reanalyze all failed samples in the associated preparatory batch for confirmation of matrix interference.	Accuracy / Bias	Same as Method Acceptance Limits

SAP Worksheet #28-9: Laboratory QC Samples Table

Matrix: Surface Water, Groundwater

Analytical Group: Perchlorate

Analytical Method/SOP Reference: SW-846 6850/ GL-OA--067

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Isotope ratio	Each sample, QC sample, and standard	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85. Must fall within 2.3 - 3.8	Re-extract using cleanup procedures or alternate techniques to confirm the presence of perchlorate such as post spikes or dilutions to reduce interference.	Analyst, Laboratory Supervisor	Precision / Accuracy / Bias	Same as Method Acceptance Limits
IS	One per sample	Relative retention times for internal standard must be 0.98-1.02 and the responses within $\pm 50\%$ of the average response of the initial calibration (ICAL).	Reanalyze samples at increasing dilutions until the $\pm 50\%$ criteria can be met		Precision / Accuracy / Bias	Same as Method Acceptance Limits
Lab reagent blank	One per batch of 20 or less	Target analytes must be $< \frac{1}{2}$ LOQ or $< 1/10$ the concentration found in the sample or $< 1/10$ th the regulatory limit.	Re-clean, retest, re-extract, reanalyze, and/or qualify data		Bias / Contamination	Same as Method Acceptance Limits
Method blank			Re-clean, retest, re-extract, reanalyze, and/or qualify data		Bias / Contamination	Same as Method Acceptance Limits
LCS		Percent recoveries must meet control limits 80%-120%	Evaluate and re-prepare/ reanalyze the LCS and associated samples.		Precision / Accuracy / Bias	Same as Method Acceptance Limits
MS/MSD		Percent recoveries must meet control limits 80%-120% and RPD of 15	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	Same as Method Acceptance Limits

SAP Worksheet #28-10: Laboratory QC Samples Table

Matrix: Surface Water, Groundwater

Analytical Group: Total and Dissolved Chromium

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

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 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1 . If required, re-prepare and reanalyze method blank and all samples processed with the contaminated blank.	Analyst	Accuracy/Bias, Contamination	Same as QC Acceptance Limits.
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOQ.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Analyst	Accuracy/Bias, Contamination	Same as QC Acceptance Limits.
Interference Check Solutions (ICS)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.
LCS	One per preparatory batch.	Recovery 80-120%. Limits are as per DoD QSM v. 4.1.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.
MS	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects.	Analyst	Accuracy/Bias	Same as QC Acceptance Limits.
MSD	One per preparatory batch per matrix.	Same as MS and RPD ≤ 20%.	Same as MS.	Analyst	Accuracy/Bias, Precision	Same as QC Acceptance Limits.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Same as QC Acceptance Limits.
PDS	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #28-11: Laboratory QC Samples Table

Matrix: Surface Water, Groundwater

Analytical Group: Total and Dissolved Hexavalent Chromium

Analytical Method / SOP Reference: SW-846 7196A / WETS-64

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
Reference Blank (Reagent Water)	Before beginning standards or sample analysis.	N/A	N/A	Analyst	N/A	Same as Method/SOP QC Acceptance Limits.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, re-prepare and reanalyze method blank and all samples processed with the contaminated blank.	Analyst	Accuracy/Bias, Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparatory batch	RPD ≤15 %. Limits are as per DoD QSM v.4.1, which states that when no DoD limits are provided, statistical in-house limits are to be used.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated batch for the failed analyte in all samples in the associated preparatory batch, if sufficient sample material is available.	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS	Once for every sample matrix analyzed.	Same as LCS.	If check indicates interference, dilute and reanalyze sample; persistent interference indicates the need to use alternative method or analytical conditions, or to use method of standard additions.	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MSD	One per preparatory batch per matrix.	Same as MS and ≤ RPD 20%.	Examine the project-specific DQOs. Contact the client as to additional measure to be taken. Flagging criteria are not appropriate.	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
PDS	One per preparatory batch.	Same as LCS.	Correct problem and re-homogenize, re-digest, and reanalyze samples. Persistent interference indicates the need to use an alternative method or analytical conditions, or to use method of standard additions.	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

¹ DoD QSM v. 4.1 is the basis for specifications on this table.

SAP Worksheet #29: Project Documents and Records Table

Document	Where Maintained
<ul style="list-style-type: none"> • Field Notebooks • Chain-of-Custody Records • Air Bills • Custody Seals • CA Forms • Electronic Data Deliverables (EDDs) • Identification of QC Samples • Meteorological Data from Field • Sampling instrument calibration logs • Sampling locations and sampling plan • Sampling notes and drilling logs • Water quality parameters • Sample Receipt, Chain-of-Custody, and Tracking Records • Standard Traceability Logs • Equipment Calibration Logs • Sample Prep Logs • Run Logs • Equipment Maintenance, Testing, and Inspection Logs • CA Forms • Reported Field Sample Results • Reported Result for Standards, QC Checks, and QC Samples • Instrument printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples • Data Package Completeness Checklists • Sample disposal records • Extraction/Clean-up Records • Raw Data (archived per Navy CLEAN contract) • DV Reports • CA Forms • Laboratory QA Plan • Method detection limit (MDL) Study Information 	<ul style="list-style-type: none"> • Field data deliverables such as logbooks entries, chain of custodies, air bills, EDDs, etc will be kept on CH2M HILL's local internet server. • Field parameter data will be loaded with the analytical data into the Navy database. • Analytical laboratory hardcopy deliverables and DV reports will be saved on the network server and archived per the Navy CLEAN contract. • Electronic data from the laboratory will be loaded into the Navy database. • Off-site analysis documents and records will be archived after a period of 6 months. Hardcopy deliverables from the data validator as well as other data assessment documents and records will be archived. All archived documents will be archived with Iron Mountain Inc., headquartered at 745 Atlantic Avenue, Boston, MA 02111.

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SAP Worksheet #30: Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical SOPs	Data Package Turnaround Time	Laboratory/Organization ¹	Backup Laboratory/Organization ²
UXO-11						
Surface Soil, Subsurface Soil, Sediment, Surface Water, Groundwater	Explosives	Refer to Worksheet #18	Refer to Worksheet #23	7 Calendar Days	GEL Laboratories Ann Skradski 2040 Savage Road Charleston, SC (843) 566-8171	To be determined (TBD)
	Perchlorate					
	Hexavalent Chromium (total and dissolved)				ENCO - Orlando Ronnie Wambles 10775 Central Port Drive Orlando, FL (407)-826 5314	
	Chromium (total and dissolved)				ENCO - Jacksonville Ronnie Wambles 4810 Executive Park Court, Suite 111 Jacksonville, FL 32216 (407)-826 5314	
UXO-17						
Groundwater	VOCs SVOCs	Refer to Worksheet #18	Refer to Worksheet #23	7 Calendar Days	ENCO – Jacksonville	TBD
UXO-11 and UXO-17 Post-Detonation Sampling						
Surface Soil Composite, Surface Soil Incremental	TAL Metals	Refer to Worksheet #18	Refer to Worksheet #23	7 Calendar Days	ENCO – Jacksonville	TBD
	Explosives				GEL Laboratories Ann Skradski 2040 Savage Road Charleston, SC (843) 566-8171	
	Perchlorate					

¹ Laboratories meet accreditation requirements to support project needs, the respective DoD ELAP acceptance letters are provided in **Attachment 4**.

² A backup laboratory has not been determined. If circumstances render the subcontracted laboratory unable to perform analytical services, another laboratory will be determined at that time.

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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 CA (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Offsite Laboratory Technical Systems Audit	Laboratory must have current Department of Defense (DoD) ELAP accreditation, which will identify the period of performance. The laboratory must be re-evaluated prior to expiration of period of performance	External	Third party accrediting body	TBD, Third party accrediting body	Lori Mangrum / ENCO QAO Robert Pullano / GEL QAO	Lori Mangrum / ENCO QAO Robert Pullano / GEL QAO	Anita Dodson, Navy Program Chemist
Field Performance Audit	One during additional investigation field activities	Internal	CH2M HILL	Keith LaTorre Project Manager / CH2M HILL	Field Team Leader / CH2M HILL	Keith LaTorre Project Manager / CH2M HILL	Keith LaTorre PM CH2M HILL
Safe Work Observation	One per week during field activities	Internal	CH2M HILL	Keith Dobson Site Safety Coordinator CH2M HILL	Field Team Member observed / CH2M HILL	Carl Woods Health and Safety Manager (HSM) CH2M HILL	Keith Dobson Site Safety Coordinator CH2M HILL

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SAP Worksheet #32: Assessment Findings and Corrective Action Responses Table

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Field Performance Audit	Checklist and Written Audit Report	Field Team Leader CH2M HILL	Within one day of audit	Verbal and Memorandum	Field Team Leader CH2M HILL	Within one day of receipt of Correction Action Form
Laboratory Performance and Systems Audits	Written Audit Report	ENCO Laboratories QAO GEL Laboratories QAO	Within 2 months of audit	Memorandum	DoD ELAP Auditor	Within two months of receipt of initial notification
Safe Behavior Observation (SBO)	Safe Behavior Observation Form	Carl Woods H&S Manager CH2M HILL	Within one week of SBO.	Memorandum	Field Team Member CH2M HILL	Immediately

SAP Worksheet #32-1—Laboratory CA Form

Person initiating corrective action _____ Date _____

Description of problem and when identified: _____

Cause of problem, if known or suspected: _____

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

CA implemented by: _____ Date: _____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approved by: _____ Date: _____

Information copies to:

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 _____
_____ |
| 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 #32-3—SBO Form

Safe Behavior Observation Form				
Project:		Observer:		Date:
Position/Title of worker observed:		Background Information/comments:		
Task/Observation Observed:				
<ul style="list-style-type: none"> ❖ Identify and reinforce safe work practices/behaviors ❖ Identify and improve on at-risk practices/acts ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?) ❖ Positive, corrective, cooperative, collaborative feedback/recommendations 				
Actions & Behaviors	Safe	At-Risk	Observations/Comments	
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			Positive Observations/Safe Work Practices:	
Properly trained/ qualified/ experienced				
Tools/equipment available and adequate				
Proper use of tools			Questionable Activity/Unsafe Condition Observed:	
Barricades/work zone control				
Housekeeping				
Communication				
Work Approach/Habits				
Attitude			Observer's Corrective Actions/Comments	
Focus/ attentiveness				
Pace				
Uncomfortable/ unsafe position				
Inconvenient/ unsafe location				
Position/ Line of fire			Observed Worker's Corrective Actions/Comments:	
Apparel (hair, loose clothing, jewelry)				
Repetitive motion				
Other...			None:	

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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 Audit Report	One during additional investigation field activities and one during treatability study field activities	Submitted with Final Report	Keith LaTorre Project Manager / CH2M HILL	Included in project files

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SAP Worksheets #34: Verification (Step I)¹ Process Table

Verification Input	Description	Internal / External	Responsible for Verification
Planning Documents	Evidence of approval and completeness of UFP-SAP.	Internal	PM: Keith LaTorre / CH2M HILL
Chain-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. See chain-of-custody SOP (on CD) for further details.	Internal	FTL: David Seed/CH2M HILL PC: Bianca Kleist / CH2M HILL
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, and sample collection times, etc. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and UFP-SAP.	Internal	PM: Keith LaTorre / CH2M HILL
Sample Login/ Receipt	Upon their arrival at the laboratory, the samples will be cross-referenced against the chain-of-custody records. All sample labels will be checked against the chain-of-custody, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.	Internal	ENCO – Jacksonville, ENCO – Orlando and GEL Employees
QC Summary Report	A summary of all QC sample results will be verified for completeness once the data is received from the laboratory.	External	PC: Bianca Kleist CH2M HILL
Field Investigation Interpretive Data	Immediately following receipt of the analytical data from the laboratory and prior to submittal to the data validator, a population to population comparison will be conducted comparing site results and the results from the background sample set. The background population to population comparison for will be used to determine the likelihood of a release relative to background. The data will also be compared to screening criteria (Worksheet #15).	Internal	PM: Keith LaTorre CH2M HILL

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

Ilb=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 Worksheets #35: Verification (Step II) Process Table

Step IIa / IIb ¹	Validation Input	Description	Responsible for Validation
IIa	SOPs	Review field logbooks, laboratory case narratives, data deliverables for compliance to methods and signatures.	FTL: David Seed/ CH2M HILL PM: Keith LaTorre / CH2M HILL
IIa	QC Results	Establish that all field and lab QC samples were run and compliant with method-required limits as specified in Worksheets #12 and #28 .	DV: Nancy Weaver / EDS
IIb	QC Results	Verify that QC samples were run and compliant with limits established in the UFP-SAP.	PC: Bianca Kleist / CH2M HILL Data Validator: Nancy Weaver / EDS
IIb	Project QLs	Ensure all sample results met the project quantification and action limits specified in Worksheet #15 .	PC: Bianca Kleist / CH2M HILL
		Verify precision and bias at the LOD by analyzing four standards at the QL to establish percent recovery and percent relative standard deviation.	QAO: Lori Mangrum / ENCO, Robert Pullano / GEL
IIb	Raw data	10% review of raw data to confirm laboratory calculations.	Data Validator: Nancy Weaver / EDS

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SAP Worksheets #36: Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa and IIb	Surface Soil, Subsurface Soil, Sediment, Surface Water, Groundwater	Explosives	Analytical methods and laboratory SOPs as presented in this SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers that may be used are those presented in <i>National Functional Guidelines for Organic Data Review</i> (USEPA, 1999) or <i>National Functional Guidelines for Inorganic Data Review</i> (USEPA, 2004), as appropriate. National Functional Guidelines will not be used for validation; however, the specific qualifiers listed therein may be applied to data should non-conformances against the QA/QC criteria as presented in this SAP be identified.	Nancy Weaver / EDS
		Perchlorate		
		Total Chromium		
		Total Hexavalent Chromium		
	Surface Water and Groundwater	Dissolved Chromium		
		Dissolved Hexavalent Chromium		
	Groundwater	VOCs		
		SVOCs		
	Surface Soil Composite, Surface Soil Incremental	Explosives		
		Perchlorate		
TAL Metals				

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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:

- Non-detected site contaminants will be evaluated to ensure that project required QLs in **Worksheet #15** were achieved. If project quantitation limits (PQLs) were achieved and the verification and validation steps yielded acceptable data, then the data is considered usable.
- During verification and validation steps, data may be qualified as estimated with the following qualifiers: J, J+, J-, or UJ. These qualifiers represent minor QC deficiencies which will not affect the usability of the data. When major QC deficiencies are encountered, data will be qualified with an R and in most cases is not considered usable for project decisions.
 - J - Analyte present. Reported value may or may not be accurate or precise
 - J- - Analyte present. Reported value may be biased low
 - J+ - Analyte present. Reported value may be biased high
 - UJ - Analyte not detected. Quantitation limit may be inaccurate or imprecise
 - R - Rejected result. Result not reliable.
- Additional qualifiers that may be given by the validator are:
 - N - Tentative Identification. Consider Present. Special methods may be needed to confirm its presence or absence in future sampling efforts
 - NJ - Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity
 - U - Not Detected
- For statistical comparisons non-detect values will be represented by a concentration equal to one-half the sample reporting limit. For duplicate sample results, the most conservative value will be used for project decisions.
- Analytical data will be checked to ensure the values and any qualifiers are appropriately transferred to the electronic database. These checks include comparison of hardcopy data and qualifiers to the electronic data deliverable. Once the data has been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be compared as RPD between the two results.
- Deviations from the SAP will be reviewed to assess whether CA is warranted and to assess impacts to achievement of project objectives.

SAP Worksheet #37—Usability Assessment (continued)

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

- To assess whether a sufficient quantity of acceptable data are available for decision making, the data will be reconciled with measurement performance criteria following validation and review of data quality indicator (DQI).
- If significant biases are detected with laboratory QA/QC samples it will be evaluated to assess impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between lab and field precision the cause will be further evaluated to assess impact on decision making.

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

The following will be prepared by CH2M HILL and presented to and submitted to the MCB CamLej Partnering Team for review and decisions on the path forward for the site.

- Data tables will be produced to reflect detected and non-detected site COCs and geochemical parameters. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.
- Graphical representations will be produced to reflect increasing and/or decreasing concentrations of COCs.
- A data quality evaluation considering all of the above will be provided as part of presentations to the Tier I Partnering Team, followed by the technical memorandum prepared to assess remedy effectiveness. The technical memorandum will identify any data usability limitations and make recommendations for CA if necessary.

Identify the personnel responsible for performing the usability assessment.

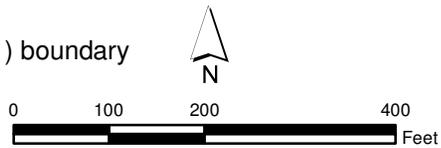
The CH2M HILL Team, including the PM and PC, will review the data and compile a presentation for the Partnering Team. The MCB CamLej Partnering Team as a whole will assess the usability of the data.

Figures



Legend

-  Site UXO-11 - Former B-5 Hand Grenade Course (ASR #2.81) boundary
-  Installation Boundary



1 inch = 200 feet

Figure 10-1
UXO-11 Site Location
Intrusive Investigation Work Plan Addendum
MCB CamLej
North Carolina



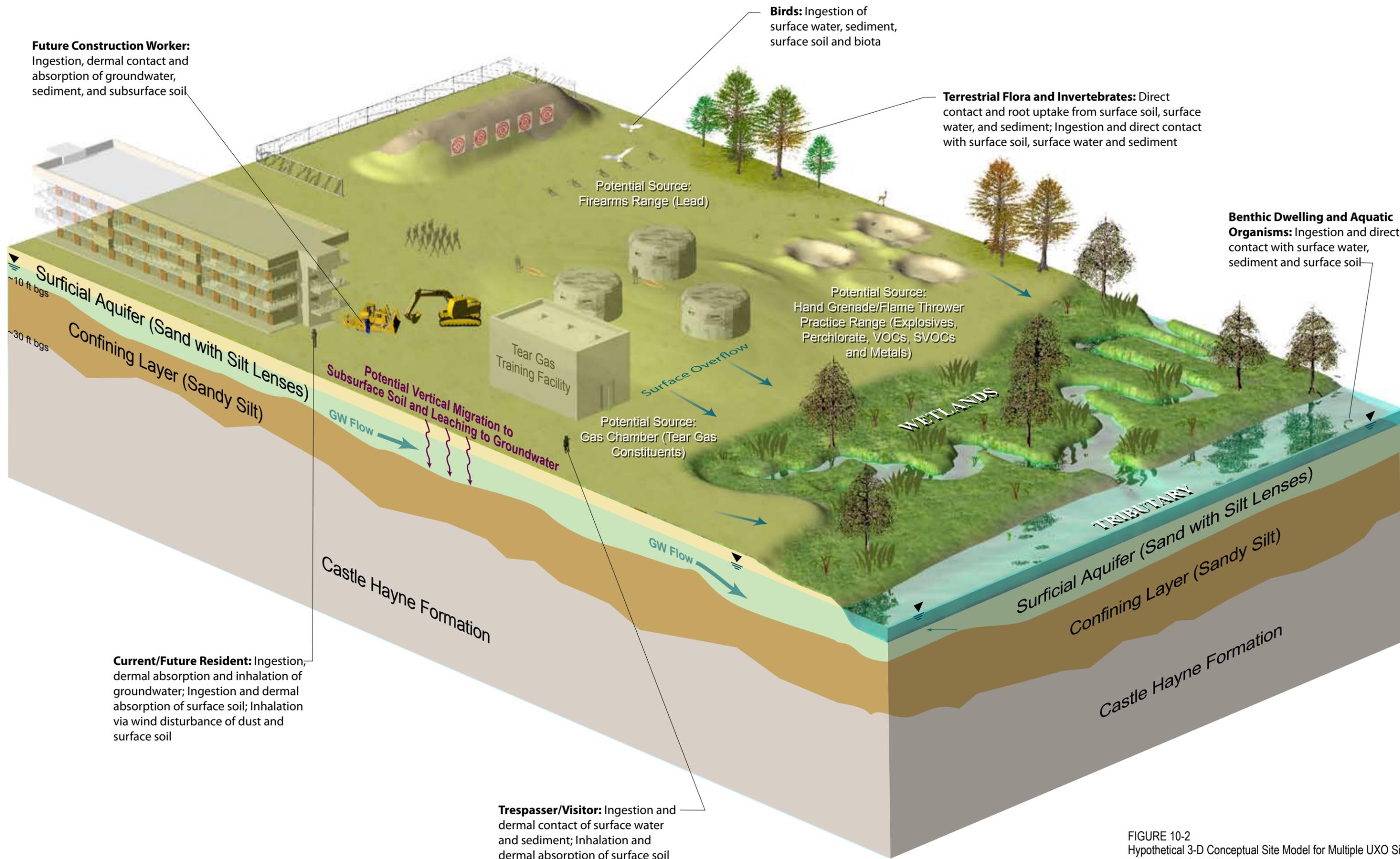


FIGURE 10-2
 Hypothetical 3-D Conceptual Site Model for Multiple UXO Sites
 Multi-site UXO PA/SI
 MCB Camp Lejeune, NC



MR11-SS02/IS07	MR11-SS03/IS08	MR11-SS04/IS09
MR11-SS01/IS06	MR11-DU01	MR11-SS05/IS10
MR11-DU02	MR11-SS06/IS11	
MR11-SS08/IS13	MR11-SS09/IS14	MR11-SS10/IS15
MR11-SS07/IS12		
MR11-SS12/IS17	MR11-SS13/IS18	MR11-SS14/IS19
MR11-SS11/IS16	MR11-DU03	MR11-SS15/IS20
	MR11-DU04	MR11-SS16/IS21
MR11-SS18/IS23	MR11-SS19/IS24	MR11-SS20/IS25
MR11-SS17/IS22		

- Legend**
- Proposed Surface and Subsurface Soil Sampling Location
 - Site UXO-11 Boundary
 - Sampling Decision Unit (120 ft x190 ft)
 - Jurisdictional Wetland Area

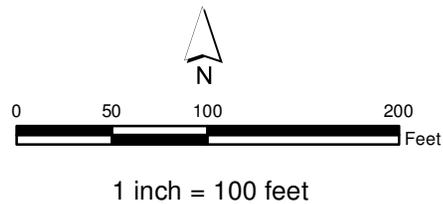
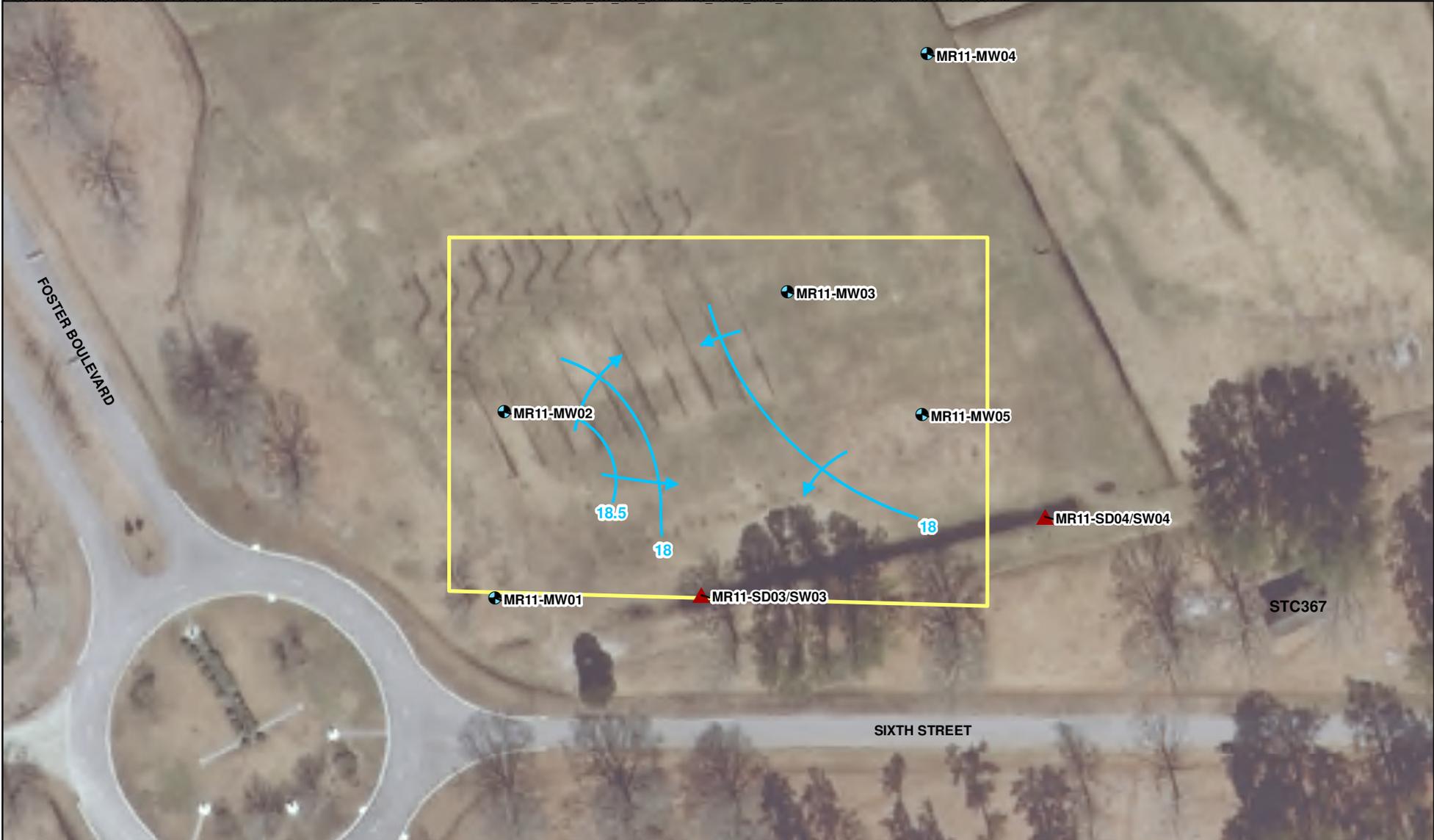


Figure 10-3
 Site UXO-11 Surface and Subsurface Soil Sampling Locations
 Intrusive Investigation Work Plan Addendum
 MCB CamLej
 North Carolina





Legend

- Proposed Monitoring Well
- Proposed Sediment/Surface Water Sampling Location
- Potentiometric Contour
- Groundwater Flow Direction
- Site UXO-11 Boundary

Note: Potentiometric surface contours have been inferred between temporary well locations. Actual conditions may differ from those shown here.
 17.74 - groundwater elevation in feet above mean sea level
 Water levels gauged December 2009

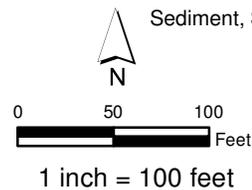


Figure 10-4
 Sediment, Surface Water, and Groundwater Sampling Locations at UXO-11
 Intrusive Investigation Work Plan Addendum
 MCB CamLej
 North Carolina





Legend
Site UXO-17 Boundary
Base Boundary

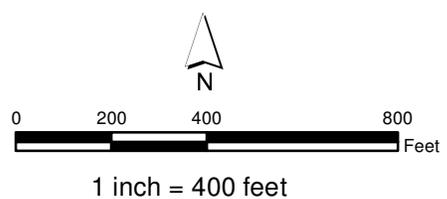
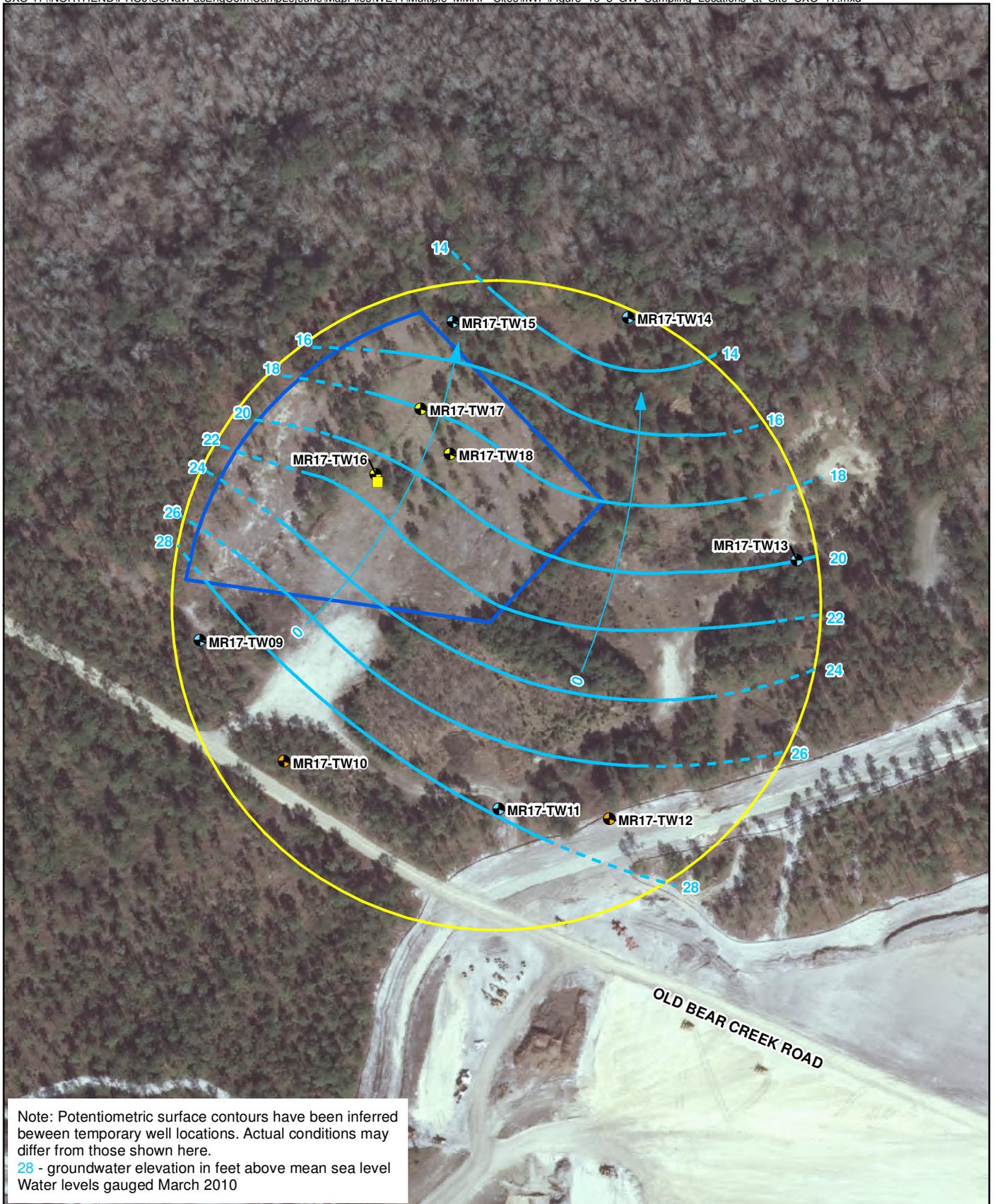


Figure 10-5
UXO-17 Site Location
Intrusive Investigation Work Plan Addendum
MCB CamLej
North Carolina





Legend

- Liquid Slurry Filled Drum Discovery Location
- Existing Monitoring Well
- Proposed Monitoring Well
- Water level measurements only
- Potentiometric Contour (dashed where inferred)
- Groundwater Flow Direction
- Focused MILCON PA/SI Investigation (4-acre area)
- Site UXO-17 Boundary

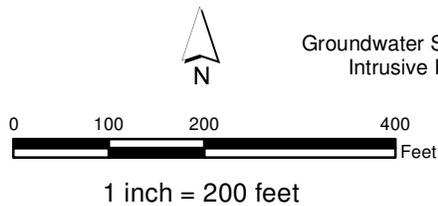


Figure 10-6
 Groundwater Sampling Locations at Site UXO-17
 Intrusive Investigation Work Plan Addendum
 MCB CamLej
 North Carolina



Attachment 1
Standard Operating Procedures – CH2M HILL

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.

Locating and Clearing Underground Utilities

I. Purpose

The purpose of this SOP is to provide general guidelines and specific procedures that must be followed on Navy CLEAN projects for locating underground utilities and clearing dig locations in order to maximize our ability to avoid hitting underground utilities and to minimize liabilities to CH2M HILL and its subcontractors and health and safety risks to our project staff.

This SOP shall be used by Activity Managers and Project Managers to, in-turn, develop Activity-specific and project-specific utility location procedures. The activity and project-specific procedures will become part of work plans and project instructions and will be used to prepare scopes of work (SOWs) for the procurement of utility location subcontractors to meet the needs of individual projects.

This SOP also identifies the types of utility locating services that are available from subcontractors and the various tools that are used to locate utilities, and discusses when each type of service and tool may or may not be applicable.

II. Scope

Depending on the Navy/Marine Activity we typically find ourselves in one of two scenarios:

Scenario 1

The Activity provides utility locating (or dig clearance) services through the public works department or similar organization, or has a contract with an outside utility clearance service. Some of these services are provided in the form of dig permits which are required before you can dig or drill. In other cases no official permit is required and the process is somewhat vague.

Scenario 2

The Activity does not get involved in any utility locating processes aside from possibly providing the most recent utility maps, and relies on CH2M HILL to clear the dig locations.

Table 1 provides an up to date summary of which scenarios apply to the various primary Activities served under the Navy CLEAN program.

Scenario 1 is preferred because under this scenario the Navy tends to assume the responsibility if the location is improperly cleared, a utility is struck, and property damage results. However, our experience has been that the clearance services provided

by the Navy do not meet the standards that we consider to be adequate, in that they often simply rely on available base maps to mark utilities and do not verify locations using field geophysics. And if they do use locating tools, they do not provide adequate documentation or marking to confirm that a location has been cleared. So while the Navy's process may protect us from liability for property damage, it does not adequately protect our staff and subcontractors from health risks nor does it compensate us for down time, should a utility be hit.

Therefore, regardless of what services the Navy provides, in most cases we still need to supplement this effort with clearance services from our own third party utility location subcontractor following the procedures and guideline outlined in Section IV of this SOP. The cost implications of providing this service will range from \$500 to several \$1,000 depending on the size of the project.

The scope of services that we ask our subcontractors to provide can involve utility marking/mapping or the clearing of individual dig locations. In the former we ask our subs to mark all utilities within a "site" and often ask them to prepare a map based on their work. In the later, we ask them to clear (identify if there are any utilities within) a certain radius of a proposed dig/drill location.

The appropriate requested scope of services for a project will depend on the project. Clearing individual boreholes is often less expensive and allows the sub to concentrate their efforts on a limited area. However if the scope of the investigation is fluid (all borehole locations are not predetermined) it may be best to mark and map an entire site or keep the subcontractor on call.

Clearance of individual dig locations should be done to a minimum 20 foot radius around the location.

An example SOW for a utility subcontractor procurement is provided in Attachment A.

III. Services and Equipment

This section provides a general description of the services available to help us locate subsurface utilities and describes the types of equipment that these services may (or may not) use to perform their work. It identifies the capabilities of each type of equipment to help the PM specify what they should require from our utility location subs.

Services

The services that are available to us for identifying and marking underground utilities are:

- The local public/private utility-run service such as Miss Utility
- Utility location subcontractors (hired by us)

Attachment B provides a detailed description of each type of organization. It also provides contact numbers and web sites for the various Miss-Utility-type organizations in the areas where we do work for the Navy and contacts and services provided by several subcontractors that we have used or spoken to in the past.

Equipment

Attachment C provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the PM determine if the equipment being used by a subcontractor is adequate.

It is important to make the potential subcontractors aware of the possible types of utilities (and utility materials) that are at the site, and to have them explain in their bid what types of equipment they will use to locate utilities / clear dig locations, and what the limitations of these equipment are.

A list of in-house experts that can be used to help you evaluate bids or answer questions you may have is provided in Appendix C.

IV. Procedures and Guidelines

This section presents specific procedures to be followed for the utility location work to be conducted by CH2M HILL and our subcontractors. In addition, a PM will have to follow the procedures required by the Activity to obtain their approvals, clearances and dig permits where necessary. These “dig permit” requirements vary by Activity and must be added to the project-specific SOP, or project instructions. It is preferable that the Activity perform their clearance processes before we follow up with our clearance work.

Activity Notification and Dig Permit Procedures

Identify Activity-specific permit and/or procedural requirements for excavation and drilling activities. Contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Activity Specific: To be provided by Activity or Project Manager

CH2M HILL Utility Clearance Procedures

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted by CH2M HILL as a follow-up to the services provided by the Navy. The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor (subcontracted to CH2M HILL) to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include (these are further described in Attachment C):

- **Ground Penetrating Radar (GPR)**, which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF)**, involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be

detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.

- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers**, are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- Contact utility companies or the state/regional utility protection service (such as Miss Utility) at least two (2) working days prior to intrusive activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation: this is a law. These services will only mark the location of public-utility-owned lines and not Navy-owned utilities. In many cases there will not be any public-utility-owned lines on the Activity. There may also be Base-access issues to overcome.
- Procure and schedule the independent survey.
- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project site, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions. *The types of utilities must be provided to the bidding subcontractors in the SOW and procedures to be used must be specified by the bidder in their bid. It is extremely helpful to provide the sub with utility maps, with the caveat that all utilities are not necessarily depicted.*
- The survey subcontractor shall employ the same geophysical techniques used to identify the buried utilities, to survey the proposed path of subsurface investigation/construction work to confirm no buried utilities are present.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances provided by both the "Miss Utility" service and the CH2M HILL-subcontracted service are to be in writing, signed by the party conducting the clearance. The Miss Utility service will have standard notification forms/letters which typically simply state that they have been to the site and have done their work. The CH2M HILL subcontractor shall be required to fill out the form provided in Attachment D (this can be modified for a particular project) indicating that each dig/drill location has been addressed. *This documentation requirement (with a copy of the form) needs to be provided in the subcontractor SOW.*

- Marking shall be done using the color coding presented in Attachment E. The type of material used for marking must be approved by the Activity prior to marking. Some base commanders have particular issues with persistent spray paint on their sidewalks and streets. *Any particular marking requirements need to be provided in the subcontractor SOW.*
- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Perform a field check prior to drilling/digging (preferably while the utility location sub is still at the site) to see if field utility markings coincide with locations on utility maps. Look for fire hydrants, valves, manholes, light poles, lighted signs, etc to see if they coincide with utilities identified by the subcontractor.
- Underground utility locations must be physically verified (or dig locations must be physically cleared) by hand digging using wood or fiberglass-handled tools, air knifing, or by some other acceptable means approved by CH2M HILL, when the dig location (e.g. mechanical drilling, excavating) is expected to be within 5 feet of a marked underground system. Hand clearance shall be done to a depth of four feet unless a utility cross-section is available that indicates the utility is at a greater depth. In that event, the hand clearance shall proceed until the documented depth of the utility is reached.
- Conduct a site briefing for employees at the start of the intrusive work regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

IV. Attachments

- A- Example SOW for Utility Location Subcontractor Procurement
- B - Services Available for Identifying and Marking Underground Utilities
- C - Equipment Used for Identifying Underground Utilities
- D - Utility Clearance Documentation Form
- E - Utility Marking Color Codes

Attachment A – Example SOW for Subcontracting Underground Utilities Locating Services

CTO-XXX

Scope of Work

Subsurface Utility Locating

Site XX

Navy Activity

City, State

A licensed and insured utility locator will be subcontracted to identify and mark out subsurface utilities for an environmental investigation/remediation project at Site XX of <<insert name of base, city, and state>>. The subcontractor will need to be available beginning at <<insert time>> on <<insert date>>. It is estimated that the work can be completed within XX days.

Proposed Scope of Work

The subcontractor will identify and mark all subsurface utilities (CHOOSE 1) that lie within a radius of 20 feet of each of XX sampling locations at Site XX shown on the attached Figure 1; (OR) that lie within the bounds of Site XX as delineated on the attached Figure 1. (If multiple sites are to be cleared, provide maps of each site with sample locations or clearance boundaries clearly delineated and a scale provided.)

Utilities will be identified using all reasonably available as-built drawings, electronic locating devices, and any other means necessary to maintain the safety of drilling and sampling personnel and the protection of the base infrastructure. The location of utilities identified from as-built drawings or other maps must be verified in the field prior to marking.

Base utility drawings for the Site(s) (CHOOSE 1) can be found at <<insert specific department and address or phone number on the base>> and should be reviewed by the subcontractor and referenced as part of the utility locating. (OR), will be provided to the subcontractor by CH2M HILL upon the award of the subcontract. (OR), are not available. Utility drawings shall not be considered definitive and must be field verified.

Field verification will include detection using nonintrusive subsurface detection equipment (magnetometers, GPR, etc) as well as opening manhole covers to verify pipe directions. As part of the bid, the Subcontractor shall provide a list of the various subsurface investigation tools they propose to have available and use at the site and what the limitations are of each tool.

A CH2M HILL representative shall be present to coordinate utility clearance activities and identify points and features to be cleared.

Field Marking and Documentation

All utilities located within **(CHOOSE 1) a 20-ft radius of the XX proposed soil boring locations (OR) within the boundary of the site(s)** as identified on the attached figure(s) will be marked using **paint (some Bases such as the WNY may have restrictions on the use of permanent paint)** and/or pin flags color coded to indicate electricity, gas, water, steam, telephone, TV cable, fiber optic, sewer, etc. The color coding shall match the industry standard as described on the attached form. In addition, the **Buried Utility Location Tracking Form** (attached) will be completed by the Subcontractor based upon what is identified in the field during the utility locating and submitted back to CH2M HILL (field staff or project manager) within 24 hours of completing the utility locating activities.

(OPTIONAL) The subcontractor shall also provide a map (or hand sketch) of the identified utilities to the Engineer within XX days of field demobilization. The map shall include coordinates or ties from fixed surface features to each identified subsurface utility.

Bid Sheet/Payment Units

The subcontractor will bid on a time and materials basis for time spent on site and researching utility maps. Mobilization (including daily travel to the site) should be bid as a lump sum, as well as the preparation of the AHA **and any required mapping**. The per diem line item should be used if the field crew will require overnight accommodations at the project site.

Health and Safety Requirements

The utility locating subcontractor is to provide and assume responsibility for an adequate corporate Health and Safety Plan for onsite personnel. Standard personal safety equipment including: hard hat, safety glasses, steel-toed boots, gloves are recommended for all project activities. Specific health and safety requirements will be established by the Subcontractor for each project. The health and safety requirements will be subject to the review of CH2M HILL.

The subcontractor shall also prepare and provide to the Engineer, at least 48 hours prior to mobilization, an acceptable Activity Hazard Analysis (AHA) using the attached AHA form or similar.

It is also required that all subcontractor personnel who will be on site attend the daily 15-minute health and safety tailgate meeting at the start of each day in the field.

Subcontractor personnel showing indications of being under the influence of alcohol or illegal drugs will be sent off the job site and their employers will be notified. Subcontractor personnel under the influence of prescription or over-the-counter medication that may impair their ability to operate equipment will not be permitted to do so. It is expected that the subcontractor will assign them other work and provide a capable replacement (if necessary) to operate the equipment to continue work.

Security

The work will be performed on US Navy property. CH2M HILL will identify the Subcontractor personnel who will perform the work to the appropriate Navy facility point-of-contact, and will identify the Navy point-of-contact to the Subcontractor crew. The Subcontractor bears final responsibility for coordinating access of his personnel onto Navy property to perform required work. This responsibility includes arranging logistics and providing to CH2M HILL, in advance or at time of entry as specified, any required identification information for the Subcontractor personnel. Specifically, the following information should be submitted with the bid package for all personnel that will perform the work in question (this information is required to obtain a base pass):

- Name
- Birth Place
- Birth Date
- Social Security Number
- Drivers License State and Number
- Citizenship

Please be advised that no weapons, alcohol, or drugs will be permitted on the Navy facility at any time. If any such items are found, they will be confiscated, and the Subcontractor will be dismissed.

Quality Assurance

The Subcontractor will be licensed and insured to operate in the State of <<state>> and will comply with all applicable federal, state, county and local laws and regulations. The subcontractor will maintain, calibrate, and operate all electronic locating instruments in accordance with the manufacturer's recommendations. Additionally, the Subcontractor shall make all reasonable efforts to review as-built engineering drawings maintained by Base personnel, and shall notify the CH2M HILL Project Manager in writing (email is acceptable) whenever such documentation was not available or could not be reviewed.

Subcontractor Standby Time

At certain periods during the utility locating activities, the Subcontractor's personnel may be asked to stop work and standby when work may normally occur. During such times, the Subcontractor will cease activities until directed by the CH2M HILL representative to resume operations. Subcontractor standby time also will include potential delays caused by the CH2M HILL representative not arriving at the site by the agreed-upon meeting time for start of the work day. Standby will be paid to the

Subcontractor at the hourly rate specified in the Subcontractor's Bid Form attached to these specifications.

Cumulative Subcontractor standby will be accrued in increments no shorter than 15 minutes (i.e., an individual standby episode of less than 15 minutes is not chargeable).

During periods for which standby time is paid, the surveying equipment will not be demobilized and the team will remain at the site. At the conclusion of each day, the daily logs for the Subcontractor and CH2M HILL representative will indicate the amount of standby time incurred by the Subcontractor, if any. Payment will be made only for standby time recorded on CH2M HILL's daily logs.

Down Time

Should equipment furnished by the Subcontractor malfunction, preventing the effective and efficient prosecution of the work, or inclement weather conditions prevent safe and effective work from occurring, down time will be indicated in the Subcontractor's and CH2M Hill representative's daily logs. No payment will be made for down time.

Schedule

It is anticipated that the subsurface utility locating activities will occur on <<insert date>>. It is estimated that the above scope will be completed within XXX days.

Attachment B - Services Available for Identifying and Marking Underground Utilities

The services that are available to us for identifying and marking underground utilities are:

- The Activity's PWC (or similar organization)
- The local public/private utility -run service such as Miss Utility
- Utility location subcontractors (hired by CH2M HILL)

Each are discussed below.

Navy Public Works Department

A Public Works Department (PWD) is usually present at each Activity. The PWD is responsible for maintaining the public works at the base including management of utilities. In many cases, the PWD has a written permit process in place to identify and mark-out the locations of Navy-owned utilities [Note: The PWD is usually NOT responsible for the locations/mark-outs of non-Navy owned, public utilities (e.g., Washington Gas, Virginia Power, municipal water and sewer, etc.). Therefore, it is likely that we will have to contact other organizations besides the PWD in order to identify non-Navy owned, public utilities].

At some Activities, there may not be a PWD, the PWD may not have a written permit process in place, or the PWD may not take responsibility for utility locating and mark-outs. In these cases, the PWD should still be contacted since it is likely that they will have the best understanding of the utility locations at the Activity (i.e., engineering drawings, institutional knowledge, etc.). Subsequently, the PWD should be brought into a cooperative arrangement (if possible) with the other services employed in utility locating and mark-out in order to have the most comprehensive assessment performed.

At all Activities we should have a contact (name and phone number), and preferably an established relationship, with PWD, either directly or through the NAVFAC Atlantic, Midlant, or Washington NTR or Activity Environmental Office that we can work with and contact in the event of problems.

Miss Utility or "One Call" Services for Public Utility Mark-outs

Miss Utility or "One Call" service centers are information exchange centers for excavators, contractors and property owners planning any kind of excavation or digging. The "One Call" center notifies participating public utilities of the upcoming excavation work so they can locate and mark their underground utilities in advance to prevent possible damage to underground utility lines, injury, property damage and service outages. In some instances, such with southeastern Virginia bases, the Navy has entered into agreement with Ms. Utilities and is part of the response process for Miss

Utilities. Generally, a minimum of 48 hours is required for the public utility mark-outs to be performed. The "One Call" services are free to the public. Note that the "One Call" centers only coordinate with participating public utilities. There may be some public utilities that do NOT participate in the "One Call" center which may need to be contacted separately. For example, in Washington, DC, the Miss Utility "One Call" center does not locate and mark public sewer and water lines. Therefore, the municipal water and sewer authority must be contacted separately to have the sewer and water lines marked out. The AM should contact the appropriate one-call center to determine their scope of services.

A national listing of the "One Call" service centers for each state is presented on the web at <http://www.underspace.com/refs/ocdir.htm>. For the Mid-Atlantic region, the following "One Call" service centers are available.

Name	Phone	Website	Comments
Miss Utility of DELMARVA	800-257-7777	www.missutility.net	Public utility mark-outs in Delaware, Maryland, Washington, DC, and Northern Virginia
Miss Utility of Southern Virginia (One Call)	800-552-7001	not available	Public utility mark-outs in Southern Virginia
Miss Utility of Virginia	800-257-7777 800-552-7007	www.missutilityofvirginia.com	General information on public utility mark-outs in Virginia, with links to Miss Utility of DELMARVA and Miss Utility of Southern Virginia (One Call)
Miss Utility of West Virginia, Inc	800-245-4848	none	Call to determine what utilities they work with in West Virginia
North Carolina One Call Center	800-632-4949	www.ncocc.org/ncocc/default.htm	Public Utility Markouts in North Carolina

Private Subcontractors

- Utility-locating support is required at some level for most all CH2M HILL field projects in "clearing" proposed subsurface boring locations on the project site. Utility location and sample clearance can include a comprehensive effort of GIS map interpretation, professional land surveying, field locating, and geophysical surveying. Since we can usually provide our own GIS-related services for projects and our professional land surveying services are normally procured separately, utility-locating subcontractors will normally only be required for some level of geophysical surveying support in the field. This level of geophysical surveying support can range widely from a simple electromagnetic (EM) survey over a known utility line, to a blind geophysical effort, including a ground-penetrating radar (GPR) survey and/or a comprehensive EM survey to delineate and characterize all unknown subsurface anomalies.

The level of service required from the subcontractor will vary depending on the nature of the site. At sites where utility locations are well defined on the maps and

recent construction is limited, CH2M HILL may be confident with a limited effort from a traditional utility-locating subcontractor providing a simple EM survey. At sites where utility locations are not well defined, where recent constructions may have altered utility locations, or the nature of the site makes utility location difficult, CH2M HILL will require the services of a comprehensive geophysical surveying subcontractor, with a wide range of GPR and EM services available for use on an "as-needed" basis. Typical costs for geophysical surveying subcontractors will range from approximately \$200 per day for a simple EM effort (usually one crew member and one instrument) to approximately \$1,500 per day for a comprehensive geophysical surveying effort (usually a two-person crew and multiple instruments). Comprehensive geophysical surveying efforts may also include field data interpretation (and subsequent report preparation) and non-destructive excavation to field-verify utility depths and locations.

The following table provides a list of recommended geophysical surveying support subcontractors that can be used for utility-locating services:

Company Name and Address	Contact Name and Phone Number	Equipment ¹					Other Services ²		
		1	2	3	4	5	A	B	C
US Radar, Inc.* PO Box 319 Matawan, NJ 07747	Ron LaBarca 732-566-2035			4					
Utilities Search, Inc.*	Jim Davis 703-369-5758	4				4	4	4	4
So Deep, Inc.* 8397 Euclid Avenue Manassas Park, VA 20111	703-361-6005	4					4	4	4
Accurate Locating, Inc. 1327 Ashton Rd., Suite 101 Hanover, MD 21076	Ken Shipley 410-850-0280	4	4						
NAEVA Geophysics, Inc. P.O. Box 7325 Charlottesville, VA 22906	Alan Mazurowski 434-978-3187	4	4	4	4	4	4	4	4
Earth Resources Technology, Inc. 8106 Stayton Rd. Jessup, MD 20794	Peter Li 240-554-0161	4	4	4	4	4	4	4	
Geophex, Ltd 605 Mercury Street Raleigh, NC 27603	I. J. Won 919-839-8515	4	4	4	4	4	4	4	4

Notes:

*Companies denoted with an asterisk have demonstrated reluctance to assume responsibility for damage to underground utilities or an inability to accommodate the insurance requirements that CH2M HILL requests for this type of work at many Navy sites.

¹Equipment types are:

1. Simple electromagnetic instruments, usually hand-held
2. Other, more innovative, electromagnetic instruments, including larger instruments for more area coverage
3. Ground-penetrating radar systems of all kinds
4. Audio-frequency detectors of all kinds
5. Radio-frequency detectors of all kinds

²Other services include:

- A. Data interpretation and/or report preparation to provide a permanent record of the geophysical survey results and a professional interpretation of the findings, including expected accuracy and precision.
- B. Non-destructive excavation to field-verify the depths, locations, and types of subsurface utilities.
- C. Concrete/asphalt coring and pavement/surface restoration.

Attachment C – Equipment Used for Identifying Underground Utilities

This attachment provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the AM and PM determine if the equipment being proposed by a subcontractor or Navy is adequate. A list of in-house experts that can be used to answer questions you may have is provided below.

CH2M HILL In-house Utility Location Experts

Tamir Klaff/WDC

Home Office Phone – 703-669-9611

Electromagnetic Induction (EMI) Methods

EMI instruments, in general, induce an electromagnetic field into the ground (the primary field) and then record the response (the secondary field), if any. Lateral changes in subsurface conductivity, such as caused by the presence of buried metal or by significant soil variations, cause changes in the secondary field recorded by the instrument and thus enable detection and mapping of the subsurface features. It should be noted that EMI only works for electrically conductive materials--plastic or PVC pipes are generally not detected with EMI. Water and gas lines are commonly plastic, although most new lines include a copper “locator” strip on the top of the PVC to allow for detection with EMI.

EMI technology encompasses a wide range of instruments, each with inherent strengths and weaknesses for particular applications. One major division of EMI is between “time-domain” and “frequency-domain” instruments that differ in the aspect of the secondary field they detect. Another difference in EMI instruments is the operating frequency they use to transmit the primary field. Audio- and radio-frequencies are often used for utility detection, although other frequencies are also used. Consideration of the type of utility expected, surface features that could interfere with detection, and the “congestion” of utilities in an area, should be made when choosing a particular EMI instrument for a particular site.

One common EMI tool used for utility location is a handheld unit that can be used to quickly scan an area for utilities and allows for marking locations in “real time”. This method is most commonly used by “dig-safe” contractors marking out known utilities prior to excavation. It should be noted that this method works best when a signal (the primary field) can be placed directly onto the line (i.e., by clamping or otherwise connecting to the end of the line visible at the surface, or for larger utilities such as sewers, by running a transmitter through the utility). These types of tools also have a limited capability to scan an area for unknown utilities. Usually this requires having enough area to separate a hand held transmitter at least a hundred feet from the

receiver. Whether hunting for unknown, or confirming known, utilities, this method will only detect continuous lengths of metallic conductors.

In addition to the handheld EMI units, larger, more powerful EMI tools are available that provide more comprehensive detection and mapping of subsurface features. Generally, data with these methods are collected on a regular grid in the investigation area, and are then analyzed to locate linear anomalies that can be interpreted as utilities. These methods will usually detect *all* subsurface metal (above a minimum size), including pieces of abandoned utilities. In addition, in some situations, backfill can be detected against native soils giving information on trenching and possible utility location. Drawbacks to these methods are that the secondary signals from utilities are often swamped (i.e., undetectable) close to buildings and other cultural features, and that the subsurface at heavily built-up sites may be too complicated to confidently interpret completely.

Hand-held metal detectors (treasure-finders) are usually based on EMI technology. They can be used to locate shallow buried metal associated with utilities (e.g., junctions, manholes, metallic locators). Advantages of these tools is the ease of use and real-time marking of anomalies. Drawbacks include limited depths of investigations and no data storage capacity.

Ground Penetrating Radar (GPR)

GPR systems transmit radio and microwave frequency (e.g., 80 megaHertz to 1,000 megaHertz) waves into the ground and then record reflections of those waves coming back to the surface. Reflections of the radar waves typically occur at lithologic changes, subsurface discontinuities, and subsurface structures. Plastic and PVC pipes can sometimes be detected in GPR data, especially if they are shallow, large, and full of a contrasting material such as air in a wet soil, or water in a dry soil. GPR data are usually collected in regular patterns over an area and then analyzed for linear anomalies that can be interpreted as utilities. GPR is usually very accurate in x-y location of utilities, and can be calibrated at a site to give very accurate depth information as well. A significant drawback to GPR is that depth of investigation is highly dependant on background soil conductivity, and it will not work on all sites. It is not uncommon to get only 1-2 feet of penetration with the signal in damp, clayey environments. Another drawback to GPR is that sites containing significant fill material (e.g., concrete rubble, scrap metal, garbage) will result in complicated anomalies that are difficult or impossible to interpret.

Magnetic Field Methods

Magnetic field methods rely on detecting changes to the earth's magnetic field caused by ferrous metal objects. This method is usually more sensitive to magnetic metal (i.e., deeper detection) than EMI methods. A drawback to this method is it is more susceptible to being swamped by surface features such as fences and cars. In addition, procedures must usually be implemented that account for natural variations in the earth's background field as it changes throughout the day. One common use of the method is to measure and analyze the gradient of the magnetic field, which eliminates most of the drawbacks to the method. It should be noted this method only detects

ferrous metal, primarily iron and steel for utility location applications. Some utility detector combine magnetic and EMI methods into a single hand-held unit.

Optical Methods

Down the hole cameras may be useful in visually reviewing a pipe for empty conduits and/or vaults.

Attachment D – Utility Clearance Documentation Form

Attachment E – Utility Marking Color Codes

The following is the standard color code used by industry to mark various types of utilities and other features at a construction site.

White – Proposed excavations and borings

Pink – Temporary survey markings

Red – Electrical power lines, cables, conduits and lighting cables

Yellow – Gas, oil, steam, petroleum or gaseous materials

Orange – Communication, alarm or signal lines, cables, or conduits

Blue – Potable water

Purple – Reclaimed water, irrigation and slurry lines

Green – Sewer and storm drain lines

Subcontractor's
Signature

Date

Surface Water Sampling

I. Purpose and Scope

This procedure presents the techniques used in collecting surface water samples. Materials, equipment, and procedures may vary; refer to the Field Sampling Plan and operators manuals for specific details.

II. Materials and Equipment

Materials and equipment vary depending on type of sampling; the Field Sampling Plan should be consulted for project-specific details. Typical equipment required includes:

- Open tube sampler
- Dip sampler
- Weighted bottle sampler
- Hand pump
- Kemmerer or Van Dorn sampler
- Depth-integrating sampler
- Peristaltic pump
- Sample containers
- Meters for specific conductance, temperature, pH, and dissolved oxygen

III. Procedures and Guidelines

Before surface water samples are taken, all sampler assemblies and sample containers are cleaned and decontaminated as described in *SOP Decontamination of Personnel and Equipment*. Surface water samples collected from water bodies tidally influenced should be collected at low tide and under low flow conditions to minimize the dilution of potential contaminants. Methods for surface water sample collection are described below.

A. Manual Sampling

Surface water samples are collected manually by submerging a clean glass, stainless steel, or Teflon container into the water body. Samples may be collected at depth with a covered bottle that can be removed with a tripline. The most common sampler types are beakers, sealable bottles and jars, pond samplers, and weighted bottle samplers. Pond samplers have a fixed or telescoping pole attached to the sample container. Weighted bottle samplers are lowered below water surface, where the attached bottle is opened, allowed to fill, and pulled out of the water. When retrieved, the bottle is tightly capped and removed from the sampler

assembly. Specific types of weighted bottle samplers include dissolved oxygen, Kemmerer, or Van Dorn, and are acceptable in most instances.

A sample is taken with the following specific steps:

1. The location and desired depth for water sampling are selected.
2. The sample site is approached from downstream in a manner that avoids disturbance of bottom sediments as much as possible. The sample bottle is gently submerged with the mouth pointed upstream and the bottle tilted slightly downstream. Bubbles and floating materials should be prevented from entering the bottle. If using a Peristaltic pump, lower the tubing into the water to the desired depth.
3. For weighted bottle samplers, the assembly is slowly lowered to the desired depth. The bottle stopper is unseated with a sharp tug and the bottle is allowed to fill until bubbles stop rising to the surface.
4. When the bottle is full, it is gently removed from the water. If sample transfer is required, it should be performed at this time.
5. Measure dissolved oxygen, specific conductance, temperature, and pH at the sampling location.

IV. Attachments

None.

V. Key Checks and Items

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

STANDARD OPERATING PROCEDURE

VOC Sampling-Water

I. Purpose

To provide general guidelines for sampling aqueous volatile organic compounds.

II. Scope

Standard techniques for collecting representative samples are summarized. Site-specific details are discussed in the Field Sampling Plan.

III. Equipment and Materials

- Sample vials pre-preserved at laboratory with Hydrochloric acid (HCl)
- Surgical or latex gloves

IV. Procedures and Guidelines

1. Sample VOCs before sampling other analyte groups.
2. When sampling for VOCs, especially residential wells, evaluate the area around the sampling point for possible sources of air contamination by VOCs. Products that may give off VOCs and possibly contaminate a sample include perfumes and cosmetics, skin applied pharmaceuticals, automotive products (gasoline, starting fluid, windshield deicers, carburetor cleaners, etc.) and household paint products (paint strippers, thinners, turpentine, etc.).
3. Keep the caps off the sample vials for as short a time as possible.
4. Wear clean latex or surgical gloves.
5. Fill the sample vial immediately, allowing the water stream to strike the inner wall of the vial to minimize formation of air bubbles. **DO NOT RINSE THE SAMPLE VIALS BEFORE FILLING.**
6. Fill the sample vial with a minimum of turbulence, until the water forms a positive meniscus at the brim.

Water-Level Measurements

I. Purpose and Scope

The purpose of this procedure is to provide a guideline for the measurement of the depth to groundwater in piezometers and monitoring wells, even where a second phase of floating liquid (e.g., gasoline) is encountered, and on staff gages in surface-water bodies. This SOP includes guidelines for discrete measurements of static water levels and does not cover the use of continuously recording loggers (see SOP *Use of Data Loggers and Pressure Transducers*).

II. Equipment and Materials

- Electronic water-level meter (Solinst® or equivalent) with a minimum 100-foot tape; the tape should have graduations in increments of 0.01 feet or less
- Interface probe (Solinst® Model 122 Interface Meter or equivalent)

III. Procedures and Guidelines

Verify that the unit is turned on and functioning properly. Slowly lower the probe on its cable into the piezometer or well until the probe just contacts the water surface; the unit will respond with a tone or light signal. Note the depth from a reference point indicated on the piezometer or well riser. Typically this is the top of the PVC casing. If no reference is clearly visible, measure the depth to water from the northern edge of the PVC casing. If access to the top of the PVC casing is difficult, sight across the top of the locking casing adjacent to the measuring point, recording the position of the cable when the probe is at the water surface.

Measure the distance from this point to the closest interval marker on the tape, and record the water level reading in the logbook. Water levels will be measured to the nearest 0.01-foot. Also when specified in the project plans, measure and record the depth of the piezometer or well. The depth of the piezometer or well may be measured using the water-level probe with the instrument turned off.

Free product light or dense nonaqueous phase liquid may be present in the piezometer or well. If the presence of free product is suspected, the thickness of the product should be determined using appropriate equipment (e.g., Solinst® Model 122 Interface Meter). The depth to water also is determined with this equipment and the water-level meter should not be used in the piezometer or well as long as product is present. Typically, a constant sound is emitted from the device when free product is encountered and an alternating on/ off beep sound is emitted when water is encountered.

The apparent elevation of the water level in the well or piezometer is determined by measuring both the apparent depth to water and the thickness of free product. The corrected water-level elevation is calculated by the following equation:

$$WL_c = WL_a + (\text{Free-product thickness} \times 0.80)$$

Where WL_c = Corrected water-level elevation

WL_a = Apparent water-level elevation

0.80 = Typical value for the density of petroleum hydrocarbon products.

If free product is detected on the surface of the water in the piezometer or well, the value of sampling should be reconsidered because of the potential for contaminating the sampling equipment.

Staff gages may be installed in some surface-water bodies. These facilities typically are constructed by attaching a calibrated, marked staff gage to a wood or metal post, driving the post into the bottom of the surface-water body, and surveying the elevation of the top of the post to a resolution or 0.01-foot. The elevation of the water in the surface-water body then can be determined by reading off the distance the water level is from the top of the post. A shield or other protection may be needed to calm the fluctuations in water level if the gage is installed at a location exposed to wind or wave.

IV. Attachments

None.

V. Key Checks

- Before each use, verify that the battery is charged by pressing the test button on the water-level meter.
- Verify that the unit is operating correctly by testing the probe in distilled or de-ionized water. Leave the unit turned off when not in use.

7. Replace the cap by gently setting it on the water meniscus. Tighten firmly, but DO NOT OVERTIGHTEN.
8. Invert the vial and tap it lightly. If you see air bubbles in the sample, do not add more sample. Use another vial to collect another sample. Repeat if necessary until you obtain a proper sample.

V. **Attachments**

None.

VI. **Key Checks and Items**

- Check for possible sources of contamination.
- Fill slowly, with as little turbulence as possible.
- Check for air bubbles.

Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples during field operations.

II. Scope

The sediment sampling procedures generally describe the equipment and techniques needed to collect representative sediment samples. Operators manual, if available, should be consulted for specific details

III. Equipment and Materials

- Sample collection device (hand corer, scoop, dredge, grab sampler, or other suitable device)
- Stainless steel spoon or spatula or plastic disposable scoop for media transfer
- Measuring tape
- Log book
- Personal protection equipment (rubber or latex gloves, boots, hip waders, etc.)
- Materials for classifying soils, particularly the percentage of fines
- Sample jars, including jars for Total Organic Carbon and pH, as appropriate

IV. Procedures and Guidelines

1. Field personnel will start downstream and work upstream to prevent contamination of unsampled areas. In surface water bodies that are tidally influenced, sampling will be performed at low tide and under low flow conditions to minimize the dilution of possible contaminants. Sediment sampling activities will not occur immediately after periods of heavy rainfall.
2. Make a sketch of the sample area that shows important nearby river features and permanent structures that can be used to locate the sample points on a map. Whenever possible, include measured distances from such identifying features. Also include depth and width of waterway, rate of flow, type and consistency of sediment, and point and depth of sample removal (along shore, mid-channel, etc).

3. Note in the field book any possible outside sources of contamination. For example, the outlet to a drainage culvert in the water body near your sampling location.
4. Transfer sample into appropriate sample jars with a stainless steel utensil or plastic disposable scoop. Be especially careful to avoid the loss of the very fine clay/ silt particles when collecting the sample. The fine particles have a higher adsorption capacity than larger particles. Minimize the amount of water that is collected within the sample matrix. Decant the water off of the sample slowly and carefully to maximize retention of the very fine particles. The sampler's fingers should never touch the sediment since gloves may introduce organic interference into the sample. Classify the soil type of the sample using the Unified Soil Classification System, noting particularly the percentage of silt and clay.
5. Samples for volatile organics should immediately be placed in jars. Rocks and other debris should be removed before placement in jars.
6. For channel sampling, be on the alert for submerged hazards (rocks, tree roots, drop-offs, loss silt and muck) which can make wading difficult.
7. Sample sediment for TOC and pH also, to give context to organic and inorganic data during the risk assessment.
8. Follow the site safety plan designed for the specific nature of the site's sampling activities and locations.
9. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

V. Attachments

None.

VI. Key Checks and Items

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

Soil Boring Drilling and Abandonment

I. Purpose and Scope

The purpose of this guideline is to describe methods to obtain samples of subsurface soil using either hollow-stem auger, rotary or sonic drilling methods, or tripod-mounted rig and then backfill boreholes to the surface. The guideline covers both split-spoon sampling and thin-walled tube sampling and includes soil borings through surface casings installed to prevent potential contamination in shallow water-bearing units from migrating downward into deeper units.

II. Equipment and Materials

- Truck-mounted drilling rig, skid rig, or tripod rig
- Hollow-stem augers and associated equipment or either rotary-drilling or sonic-drilling equipment
- Black iron steel or Schedule 80 PVC casing, at least 6-inch inside diameter (if surface casing is required), or sonic rig with telescoping casing
- Split-spoon or thin-walled tube samplers
- Downhole compacting tool (e.g., a pipe with a flat plate attached to the bottom)
- Cement
- Bentonite

III. Procedures and Guidelines

A. Drilling

Continuous-flight hollow-stem augers (HSA) with an inside diameter of at least 3.25 inches typically are used. The use of water or other fluid to assist in hollow-stem drilling will be avoided. Rotary drilling will be with a similar minimum diameter.

The bit of the auger or drill is placed on the ground at the location to be drilled and then turned with the drilling or soil-coring rig. The drilling is advanced to a depth just above the top of the interval to be sampled. For sonic drilling, a continuous core is collected and the sample interval is selected from the length of core run.

While advancing the auger or drill to the full borehole depth, the soils removed from the boring will be screened using a portable volatile organics detector.

A tripod drilling rig is generally a tripod equipped to collect soil samples using a hammer-driven sampler. The soil sample collection will be the same as that outlined for hollow-stem and rotary drilling. Borehole collapse due to soft sediments may occur when collecting samples using a tripod drilling rig.

Temporary surface casing may be installed where soil borings will penetrate a confining layer. The surface casing will be installed to prevent potential contamination in shallow water-bearing units from migrating downward into deeper units. Typically, surface casing has a 6-inch inside diameter (ID).

If the split-spoon sampling is to be advanced with a 3.25-inch ID and 7.25-inch outside diameter (O.D.) HSA, it will be necessary to pull the 3.25-inch augers and ream the hole with a minimum 10.25-inch ID HAS for the installation of the temporary surface casing. Alternatively, if the split-spoon sampling is advanced with mud-rotary drilling, it would require a 10.25-inch rotary bit to make room for the 6-inch I.D. surface casing.

The surface casing will be seated at least 5 feet into an underlying clay or silt layer and will be sealed in place using a bentonite slurry or bentonite pellets. This seal will prevent movement of groundwater downward from the shallow water-bearing unit but will allow the casing to be removed easily when the split-spoon sampling is completed. The split-spoon sampling will then be advanced with a 6-inch mud-rotary bit.

B. Sampling

Using the drilling rig, a hole is advanced to the desired depth. For split-spoon sampling, the samples are then collected following the ASTM D 1586 standard (attached). The sampler is lowered into the hole and driven to a depth equal to the total length of the sampler; typically this is 24 inches. The sampler is driven in 6-inch increments using a 140-pound weight ("hammer") dropped from a height of 30 inches. The number of hammer blows for each 6-inch interval is counted and recorded on the boring log and/ or field notebook. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch ID sampler may be required. Blow counts obtained with a 3-inch ID spoon would not conform to ASTM D 1586 and would therefore not be used for geotechnical evaluations. Samples will be collected from the soil borings at 2-foot to 5-foot intervals. For sonic drilling, a continuous core is collected and the sample interval is selected from the length of core run.

Once retrieved from the hole, the sampler is carefully split open. Care should be taken not to allow material in the sampler to fall out of the open end of the sampler. Samples may be collected for chemical analysis. These samples are collected in either decontaminated stainless-steel split-spoon samplers or new plastic sleeves for sonic drilling. Sampling the soil for chemical analysis is described in *SOP Soil Boring Sampling – Split Spoon*.

Undisturbed fine-grained samples may be collected for analysis for geotechnical parameters such as vertical hydraulic conductivity. These samples will be collected using thin-walled sampling tubes (sometimes called Shelby tubes). Tubes will be 24- to 36 inches long and 3- to 4-inches in diameter, depending upon the quantity of sample required. Undisturbed samples will be obtained by smoothly pressing the sampling tube through the interval to be sampled using the weight of the drilling rig. Jerking the sample should be avoided. Once the sample is brought to the surface, the ends will be sealed with bees wax and then sealed with end caps and heavy tape. The sample designation, data and time of sampling, and the up direction will be noted on the sampling tube. The tube shall be kept upright as much as possible and will be protected from freezing, which could disrupt the undisturbed nature of the sample. Samples for

geochemical analysis normally are not collected from thin-walled tube samples. More details are provided in the ASTM D 1587 standard (attached).

C. Abandonment

The borehole will be grouted from total depth to the surface with bentonite-cement grout. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface. When installing grout in soil borings, the grout will be installed through a tremie pipe that is placed inside the augers or to the bottom of the borehole. The grouting will be completed before the augers or any temporary casing or drilling mud is removed.

D. Decontamination and Waste Disposal

Before sampling begins, equipment will be decontaminated according to the procedures identified in SOPs *Decontamination of Personnel and Equipment* and *Decontamination of Drilling Rig and Equipment*. The location to be sampled is cleared of debris and trash, and the location is noted in the logbook.

The soil cuttings are to be drummed and managed as described in SOP *Disposal of Waste Fluids and Soils* and the investigation-derived waste management plan.

IV. Attachments

ASTM D 1586 *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*

ASTM D 1587 *Standard Practice for Thin-Walled Tube Sampling of Soils*

V. Key Checks and Preventative Maintenance

- Check that the drilling rig or soil-coring rig is in working order.
- Check that the borehole is grouted to the ground surface at the completion of drilling and sampling.

Installation of Shallow Monitoring Wells

I. Purpose and Scope

The purpose of this guideline is to describe methods for drilling and installation of shallow monitoring wells and piezometers in unconsolidated or poorly consolidated materials using hollow stem augers, air rotary, or mud rotary. Installing monitoring wells in unconsolidated materials using sonic drilling is discussed in SOP *Installation of Monitoring Wells Using Sonic Drilling*. Methods for drilling and installing bedrock monitoring wells and deep, surface-cased wells in unconsolidated materials are presented in SOPs *Installation of Bedrock Monitoring Wells* and *Installation of Surface-Cased Monitoring Wells*, respectively.

II. Equipment and Materials

Drilling

- Drilling rig (hollow stem auger, air rotary or mud rotary) and associated tools and equipment

Well Riser/ Screen and Associated Materials

- Polyvinyl chloride (PVC), Schedule 40, minimum 2-inch ID, flush-threaded riser; alternatively, stainless-steel riser
- PVC, Schedule 40, minimum 2-inch ID, flush-threaded, factory slotted screen; alternatively, stainless-steel screen
- PVC bottom cap, threaded to match the well screen; alternatively, stainless steel
- PVC or stainless-steel centering guides (if used)
- Above-grade well completion: PVC well cap, threaded or push-on type, vented
- Flush-mount well completion: PVC well cap, locking, leak-proof seal
- Stainless steel to be used as appropriate

Sand

- Clean silica sand, provided in factory-sealed bags, well-rounded, containing no organic material, anhydrite, gypsum, mica, or calcareous material; primary (coarse – e.g., Morie #1) filter pack, and secondary (fine sand seal) filter pack. Grain size determined based on sediments observed during drilling.

Bentonite

- Pure, additive-free bentonite pellets or chips
- Pure, additive-free powdered bentonite
- Coated bentonite pellets; coating must biodegrade within 7 days
- Cement-Bentonite Grout: proportion of 6 to 8 gallons of water per 94-pound bag of Portland cement; 3 to 6 pounds of bentonite added per bag of cement to reduce shrinkage.

Protective Casing

- Above-grade well completion: 6-inch minimum ID black iron steel pipe with locking cover, diameter at least 2 inches greater than the well casing, painted with epoxy paint for rust protection; heavy duty lock; protective posts if appropriate
- Flush-mount well completion: Morrison 9-inch or 12-inch 519 manhole cover, or equivalent; rubber seal to prevent leakage; locking cover inside of road box

Well Development

- Surge block
- Well-development pump and associated equipment
- Calibrated meters to ensure pH, temperature, specific conductance, ORP, and dissolved oxygen of development water
- Containers (e.g., DOT-approved 55-gallon drums) for water produced from well.

III. Procedures and Guidelines

A. Drilling Method

Typically, continuous-flight hollow-stem augers with a minimum 4.25-inch inside diameter (ID) will be used to drill shallow monitoring well boreholes for 2-inch diameter monitoring wells. Alternatively, air or mud rotary may be used.

The bit of the auger is placed at the ground surface and then turned with the drilling rig. To collect split spoon samples, the auger is advanced to the top of the sampling depth, and the split-spoon sample is collected from below the auger head. The split spoon is advanced through repeated blows from a 140- or 300-pound hammer dropped from a height of 30 inches. Thin-walled tube samplers are advanced by pressing down on the rods with the weight of the drilling rig. Split-spoon samples may be collected at selected intervals for chemical analysis and/ or lithologic classification. Soil sampling procedures are detailed in SOPs *Soil Boring Sampling – Split Spoons* and *Soil Sampling*.

The use of water to assist in hollow-stem auger drilling for monitoring well installation will be avoided, unless required for such conditions as running sands.

Hollow-stem augers, drilling bits, rods, split-spoon samplers, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Split-spoon samplers and other downhole soil sampling equipment will also be properly decontaminated before and after each use. *SOP Decontamination of Drill Rigs and Equipment* details proper decontamination procedures.

Drill cuttings and decontamination fluids generated during well drilling activities will be contained according to the procedures detailed in the *SOP Disposal of Waste Fluids and Solids* and the Investigation Derived Waste Management Plan (IDWMP).

Air or mud rotary drilling may be used instead of hollow-stem augers. The use of added mud should be kept to a minimum.

B. Monitoring-Well Installation

Shallow monitoring wells will be constructed inside the hollow-stem augers, once the borehole has been advanced to the desired depth, or in the mudded borehole once the drilling rods have been withdrawn. If the borehole has been drilled to a depth greater than that at which the well is to be set, the borehole will be backfilled with bentonite pellets or chips or a bentonite-cement slurry to a depth approximately 1 foot below the intended well depth. Approximately 1 foot of clean sand will be placed on top of the bentonite to return the borehole to the proper depth for well installation.

The appropriate lengths of well screen, nominally 10 feet (with bottom cap), and casing will be joined watertight and lowered inside the augers to the bottom of the borehole. Centering guides, if used, will be placed at the bottom of the screen and above the interval in which the bentonite seal is placed.

Selection of the filter pack and well screen intervals for the shallow monitoring wells shall be made in the field.

A primary sand pack consisting of clean Morie No. 00 (or DSI No.1) silica sand for 10-slot screen and Morie No. 01 (or DSI No.2) for 20-slot screen silica sand will be placed around the well screen. The sand will be placed into the borehole at a uniform rate, in a manner that will allow even placement of the sand pack. The augers will be raised gradually during sand pack installation to avoid caving of the borehole wall; at no time will the augers be raised higher than the top of the sand pack during installation.

During placement of the sand, the position of the top of the sand will be continuously sounded. The primary sand pack will be extended from the bottom of the borehole to a minimum height of 2 feet above the top of the well screen. A secondary, finer-grained (fine sand seal), sand pack will be installed for a minimum of 1 foot above the coarse sand pack. Heights of the

coarse and fine sand packs and bentonite seal may be modified in the field to account for a shallow water table and a small saturated thickness of the surficial aquifer.

A bentonite seal at least 2 feet thick will be placed above the sand pack. The seal will be placed into the borehole in a manner that will prevent bridging. The position of the top of the bentonite seal will be verified using a weighted tape measure. If all or a portion of the bentonite seal is above the water table, clean water will be added to hydrate the bentonite. A hydration period of at least 30 minutes will be required following installation of the bentonite seal.

Above the bentonite seal, an annular seal of cement-bentonite grout will be placed. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface through a tremie pipe. The tremie pipe must be plugged at the bottom and have small openings along the sides of the bottom 1-foot length of pipe. This will allow the grout to diffuse laterally into the borehole and not disturb the bentonite pellet seal.

C. Well Completion

For monitoring wells that will be completed above-grade, a locking steel protective casing set in a concrete pad will be installed. The steel protective casing will extend at least 3 feet into the ground and 2 feet above ground but should not penetrate the bentonite seal. The concrete pad will be square, approximately 2 feet per side (unless otherwise specified in the project plans), and poured into wooden forms. The concrete will be sloped away from the protective casing.

Guard posts may be installed in high-traffic areas for additional protection. Four steel guard posts will be installed around the protective casing. Guard posts would be concrete-filled, at least 2 inches in diameter, and would extend at least 2 feet into the ground and 3 feet above the ground. The protective casing and guard posts will be painted with an epoxy paint to prevent rust.

For monitoring wells with flush-mount completions, Morrison 9-inch or 12-inch 519 manhole cover or equivalent, with a rubber-sealed cover and drain will be installed. The top of the manhole cover will be positioned approximately 1 inch above grade. A square concrete pad, approximately 2 feet per side (unless otherwise specified in the project plans), will be installed as a concrete collar surrounding the road box cover, and will slope uniformly downward to the adjacent grade. The road box and installation thereof will be of sufficient strength to withstand normal vehicular traffic.

Concrete pads installed at all wells will be a minimum of 6 inches below grade. The concrete pad will be 12 inches thick at the center and taper to 6-inch thick at the edge. The surface of the pad should slope away from the protective casing to prevent water from pooling around the casing.

Protective casing, guard posts, and flush mounts will be installed into this concrete.

Each well will be properly labeled on the exterior of the locking cap or protective casing with a metal stamp indicating the permanent well number.

D. Well Development

Well development will be accomplished using a combination of surging throughout the well screen and pumping, until the physical and chemical parameters of the discharge water that are measured in the field have stabilized and the turbidity of the discharge water is substantially reduced. Fine-grained materials in the surficial aquifer at the site may not allow low turbidity results to be achieved.

The surging apparatus will include a surge block. Well development will begin by surging the well screen, starting at the bottom of the screen and proceeding upwards, throughout the screened zone. Following surging, the well will be pumped to remove the fine materials that have been drawn into the well. During pumping, measurements of pH, temperature, and specific conductance will be recorded.

Development will continue by alternately surging and pumping until the discharge water is free from sand and silt, the turbidity is substantially reduced, and the pH, temperature, and specific conductance have stabilized at regional background levels, based on historical data. Development will continue for a minimum of 30 minutes and until the water removed from the well is as clear of turbidity as practicable.

Well development equipment will be decontaminated prior to initial use and after the development of each well. Decontamination procedures are detailed in *SOP Decontamination of Personnel and Equipment*. Water generated during well development will be contained and managed as detailed in the *SOP Disposal of Waste Fluids and Solids* and the Investigation Derived Waste Management Plan.

IV. Attachments

Schematic diagram of shallow monitoring-well construction (MWSingleDiag.xls)

Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using a Water Quality Parameter Meter with Flow-through Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using a water quality parameter meter (e.g., Horiba® U-22 or YSI) for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of aqueous samples. The YSI instrument does not measure turbidity. A separate turbidity meter (i.e., Hanna Turbidity Meter) will need to be used in conjunction with the YSI meter. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Water Quality Parameter Meter such as a Horiba® U-22 Water Quality Monitoring System or YSI with flow-through cell
- Auto-Calibration Standard Solution (provided by rental company)
- Distilled water in squirt bottle

III. Procedures and Guidelines

A. Parameters and Specifications:

<u>Parameter</u>	<u>Range of measurement</u>	<u>Accuracy</u>
pH	0 to 14 pH units	+/- 0.1 pH units
Specific conductance	0 to 9.99 S/m	+/- 3 % full scale
Turbidity	0 to 800 NTU	+/- 5 % full scale
Dissolved oxygen	0 to 19.99 mg/l	+/- 0.2 mg/l
Temperature	0 to 55 °C	+/- 1.0 °C
ORP	-999 to +999 mV	+/- 15 mV
Salinity	0 to 4 %	+/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water and calibrate using the Standard Solution.

Horiba U22 Calibration procedure:

1. Fill a calibration beaker with standard solution to the recommended fill line.
2. Insert the probe into the beaker. All the parameter sensors will now be immersed in the standard solution except the D.O. sensor; the D.O. calibration is done using atmospheric air.
3. Turn power on and allow some time for the machine to warm-up prior to starting the calibration. When the initial readings appear to stabilize the instrument is ready to calibrate.
4. Press CAL key to put the unit in the calibration mode.
5. Press the ENT key to start automatic calibration. Wait a moment, and the upper cursor will gradually move across the four auto-calibration parameters one by one: pH, COND, TURB, and DO. When the calibration is complete, the readout will briefly show END. The instrument is now calibrated.
6. If the unit is calibrated properly the instrument readings, while immersed in the standard solution, will match the standard solution values provided on the solution container. The typical standard solution values are: pH = 4.0 +/- 3%, conductivity 4.49 mS/cm +/- 3%, and turbidity = 0 NTU +/- 3%.
7. Record the calibration data (e.g. time, instrument ID, solution lot number and expiration date, final calibrated readings, and solution temperature in the field logbook.

YSI Calibration procedure:

1. Press the **On/off** key to display the run screen
2. Press the **Escape** key to display the main menu screen
3. Use the arrow keys to highlight the **Calibrate**
4. Press the **Enter** key. The Calibrate screen is displayed
5. Choose the parameter to calibrate

A. Conductivity Calibration:

This procedure calibrates specific conductance (recommended), conductivity and salinity. Calibrating any one option automatically calibrates the other two.

- 1) Use the arrow keys to highlight the **Conductivity** selection
- 2) Press **Enter**. The Conductivity Calibration Selection Screen is displayed.
- 3) Use the arrow keys to highlight the Specific Conductance selection.
- 4) Press **Enter**. The Conductivity Calibration Entry Screen is displayed.
- 5) Place the correct amount of conductivity standard (see Instrument Manual) into a clean, dry or pre-rinsed transport/calibration cup.

- 6) Carefully immerse the sensor end of the probe module into the solution.
- 7) Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell.

NOTE The sensor must be completely immersed past its vent hole. Using the recommended volumes from the Instrument Manual Calibration Volumes should ensure that the vent hole is covered.
- 8) Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

NOTE Do not over tighten as this could cause damage to the threaded portions.
- 9) Use the keypad to enter the calibration value of the standard you are using.

NOTE Be sure to enter the value in **mS/cm at 25°C**
- 10) Press **Enter**. The Conductivity Calibration Screen is displayed.
- 11) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
- 12) Observe the reading under Specific Conductance. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
- 13) Press **Enter**. This returns you to the Conductivity Calibrate Selection Screen
- 14) Press **Escape** to return to the calibrate menu.
- 15) Rinse the probe module and sensors in tap or purified water and dry.

B. Dissolved Oxygen Calibration:

This procedure calibrates dissolved oxygen. Calibrating any one option (% or mg/L) automatically calibrates the other.

- 1) Go to the calibrate screen as described in Section

NOTE The instrument must be on for at least 20 minutes to polarize the DO sensor before calibrating.
- 2) Use the arrow keys to highlight the **Dissolved Oxygen** selection.
- 3) Press **Enter**. The dissolved oxygen calibration screen is displayed.
- 4) DO calibration in mg/L is carried out in a water sample which has a known concentration of dissolved oxygen (usually determined by a Winkler titration).
- 5) Use the arrow keys to highlight the **DOmg/L** selection.
- 6) Press **Enter**. The DO mg/L Entry Screen is displayed.
- 7) Place the probe module in water with a known DO concentration.

NOTE Be sure to completely immerse all the sensors.
- 8) Use the keypad to enter the known DO concentration of the water.
- 9) Press **Enter**. The Dissolved Oxygen mg/L Calibration Screen is displayed.
- 10) Stir the water with a stir bar, or by rapidly moving the probe module, to provide fresh sample to the DO sensor.
- 11) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.

- 12) Observe the DO mg/L reading, when the reading is stable (shows no significant change for approximately 30 seconds), press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
- 13) Press **Enter**. This returns you to the DO calibration screen.
- 14) Press **Escape** to return to the calibrate menu.
- 15) Rinse the probe module and sensors in tap or purified water and dry.

C. pH Calibration:

- 1) Go to the calibrate screen.
- 2) Use the arrow keys to highlight the **pH** selection.
- 3) Press **Enter**. The pH calibration screen is displayed.
 - Select the **1-point** option only if you are adjusting a previous calibration. If a 2-point or 3-point calibration has been performed previously, you can adjust the calibration by carrying out a one point calibration. The procedure for this calibration is the same as for a 2-point calibration, but the software will prompt you to select only one pH buffer.
 - Select the **2-point** option to calibrate the pH sensor using only two calibration standards. Use this option if the media being monitored is known to be either basic or acidic. For example, if the pH of a pond is known to vary between 5.5 and 7, a two-point calibration with pH 7 and pH 4 buffers is sufficient. A three point calibration with an additional pH 10 buffer will not increase the accuracy of this measurement since the pH is not within this higher range.
 - Select the **3-point** option to calibrate the pH sensor using three calibration solutions. In this procedure, the pH sensor is calibrated with a pH 7 buffer and two additional buffers. The 3-point calibration method assures maximum accuracy when the pH of the media to be monitored cannot be anticipated. The procedure for this calibration is the same as for a 2-point calibration, but the software will prompt you to select a third pH buffer.
- 4) Use the arrow keys to highlight the **2-point** selection.
- 5) Press **Enter**. The pH Entry Screen is displayed.
- 6) Place the correct amount of pH buffer into a clean, dry or pre-rinsed transport/calibration cup.
 - NOTE** For maximum accuracy, the pH buffers you choose should be within the same pH range as the water you are preparing to sample.
 - NOTE** Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the pH sensor with a small amount of buffer that can be discarded. Be certain that you avoid cross-contamination of buffers with other solutions.
- 7) Carefully immerse the sensor end of the probe module into the solution.
- 8) Gently rotate and/or move the probe module up and down to remove any bubbles from the pH sensor.

NOTE The sensor must be completely immersed. Using the recommended volumes from Table 6.1 Calibration Volumes, should ensure that the sensor is covered.

- 9) Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.
NOTE Do not over tighten as this could cause damage to the threaded portions.
- 10) Use the keypad to enter the calibration value of the buffer you are using **at the current temperature**.
NOTE pH vs. temperature values are printed on the labels of all YSI pH buffers.
- 11) Press **Enter**. The pH calibration screen is displayed.
- 12) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
- 13) Observe the reading under pH, when the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
- 14) Press **Enter**. This returns you to the Specified pH Calibration Screen.
- 15) Rinse the probe module, transport/calibration cup and sensors in tap or purified water and dry.
- 16) Repeat steps 6 through 13 above using a second pH buffer.
- 17) Press **Enter**. This returns you to the pH Calibration Screen.
- 18) Press **Escape** to return to the calibrate menu.
- 19) Rinse the probe module and sensors in tap or purified water and dry.

D. ORP Calibration:

- 1) Go to the calibrate screen.
- 2) Use the arrow keys to highlight the **ORP** selection.
- 3) Press **Enter**. The ORP calibration screen is displayed.
- 4) Place the correct amount of a known ORP solution into a clean, dry or pre-rinsed transport/calibration cup.
NOTE Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the ORP sensor with a small amount of solution that can be discarded. Be certain that you avoid cross-contamination with other solutions.
- 5) Carefully immerse the sensor end of the probe module into the solution.
- 6) Gently rotate and/or move the probe module up and down to remove any bubbles from the ORP sensor.
NOTE The sensor must be completely immersed.
- 7) Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.
- 8) Use the keypad to enter the correct value of the calibration solution you are using at the current temperature.
- 9) Press **Enter**. The ORP calibration screen is displayed.

- 10) Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
- 11) Observe the reading under ORP, when the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.
- 12) Press **Enter**. This returns you to the Calibrate Screen.
- 13) Rinse the probe module and sensors in tap or purified water and dry. Record the calibration data (e.g. time, instrument ID, solution lot number and expiration date, final calibrated readings, and solution temperature in the field logbook.

C. Sample Measurement

Horiba U22 measurement procedure:

As water passes through the flow-through the flow cell, press MEAS to obtain reading; record data in a field notebook.

YSI measurement procedure:

As water passes through the flow-through the flow cell, the readings are displayed for each parameter. Record the water quality parameter data in a field notebook. In addition, the data is recorded in the YSI and can be downloaded to a computer following completion of the sampling event.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance and troubleshooting
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction.

V. References

YSI 556 Multi Probe System Operator Manual

Low-Flow Groundwater Sampling from Monitoring Wells

I. Purpose and Scope

This SOP presents general guidelines for the collection of groundwater samples from monitoring wells using low-flow purging and sampling procedures. Operations manuals should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Adjustable-rate positive-displacement pump, submersible pump, or peristaltic pump
- Horiba® U-22 or equivalent water quality meters to monitor pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature
- Flow-through cell with inlet/ outlet ports for purged groundwater and watertight ports for each probe
- Generator or alternate power source depending on pump type
- Water-level indicator
- Disposable Teflon, Teflon-lined polyethylene tubing or polyethylene tubing for metals and other inorganics
- Plastic sheeting
- Well-construction information
- Calibrated container and stopwatch to determine flow rate
- Sample containers
- In-line disposable 0.45µm filters (QED® FF8100 or equivalent)
- Shipping supplies (labels, coolers, and ice)
- Field book

III. Procedures and Guidelines

A. Setup and Purging

1. Obtain information on well location, diameter(s), depth, and screen interval(s), and the method for disposal of purged water.
2. Calibrate instruments according to manufacturer's instructions.

3. The well number, site, date, and condition are recorded in the field logbook.
4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed. To avoid cross-contamination, do not let any downhole equipment touch the ground.
5. All sampling equipment and any other equipment to be placed in the well is cleaned and decontaminated before sampling in accordance with *SOP Decontamination of Personnel and Equipment*.
6. Water level measurements are collected in accordance with the *Water Level Measurements* SOP. **Do not measure the depth to the bottom of the well at this time**; this reduces the possibility that any accumulated sediment in the well will be disturbed. Obtain depth to bottom information from well construction log.
7. Attach and secure the tubing to the low-flow pump. Lower the pump slowly into the well and set it at approximately the middle of the screen. Place the pump intake in the middle of the saturated screen length and should be at least two feet above the bottom of the well to avoid mobilization of any sediment present in the bottom.
8. Insert the measurement probes into the flow-through cell. The purged groundwater is directed through the cell, allowing measurements to be collected before the water contacts the atmosphere.
9. If using a generator, locate it 30 feet downwind from the well to avoid exhaust fumes contaminating the samples.
10. Start purging the well at 0.2 to 0.5 liters per minute. Avoid surging. Purging rates for more transmissive formations could be started at 0.5-liter to 1 liter per minute. The initial field parameters of pH, specific conductance, dissolved oxygen, ORP, turbidity, and temperature of water are measured and recorded in the field logbook.
11. The water level should be monitored during purging, and, ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well (i.e., less than 0.3-foot). The water level should stabilize for the specific purge rate. There should be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (0.1- to 0.2-liter per minute) to avoid affecting well drawdown.
12. During purging, the field parameters are measured frequently (every 5 minutes) until the parameters have stabilized. Field parameters are considered stable when measurements meet the following criteria:

- pH: within 0.1 pH units
- Specific conductance: within 3 percent
- Dissolved oxygen: within 10 percent
- Turbidity: within 10 percent for values greater than 5 NTU; if 3 turbidity values are less than 5 NTU, consider the values as stabilized
- ORP: within 10 mV
- Temperature: within 3 percent

B. Sample Collection

Once purging is complete the well is ready to sample. The elapsed time between completion of purging and collection of the groundwater sample should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in sample containers that have been cleaned to laboratory standards and are preserved in accordance with the analytical method. The containers are typically pre-preserved, if required.

VOC samples are normally collected first and directly into pre-preserved sample containers.

During purging and sampling, the centrifugal/ peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that ¼ or 3/ 8 inch inside diameter tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, collect non-VOC dissolved gasses samples first, then increase flow rate slightly until water completely fills the tubing and collect the VOC/ dissolved gases samples. Record new flow rate and drawdown depth.

The steps to be followed for sample collection are as follows:

1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
2. The sample is slowly poured from the bailer or discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs.
3. Inorganics, including metals, may be collected and preserved in the filtered form as well as the unfiltered form. Disposable in-line filters (0.45 micron filter), connected to the end of the sample tubing,, are typically used for field filtration. Samples are field filtered as the water is being placed into the sample container. If a bailer is used, filtration may be driven by a peristaltic pump.

4. A adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to the top with a positive meniscus.
5. The bottle is capped and clearly labeled.
6. Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.
7. Nondedicated equipment is cleaned and decontaminated in accordance with the *Decontamination of Personnel and Equipment SOP*.

The following information, at a minimum, will be recorded in the log book:

1. Sample identification (site name, location, and project number; sample name/ number and location; sample type and matrix; time and date; sampler's identity)
2. Sample source and source description
3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
4. Sample disposition (preservative; laboratory name, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)
5. Additional remarks

C. Additional remarks

1. If the well goes dry during purging, wait until it recovers sufficiently to remove the required volumes to sample all parameters. It may be necessary to return periodically to the well but a particular sample (e.g., large amber bottles for semivolatile analysis) should be filled at one time rather than over the course of two or more visits to the well.
2. Disposable tubing is disposed of with PPE and other site trash.

IV. Attachments

White paper on reasons and rationale for low-flow sampling.

V. Key Checks and Preventative Maintenance

- The drawdown in the well should be minimized as much as possible (preferably no more than 0.5-foot to 1 foot) so that natural groundwater-flow conditions are maintained as closely as possible.
- The highest purging rate should not exceed 1 liter per minute. This is to keep the drawdown minimized.

- Stirring up of sediment in the well should be avoided so that turbidity containing adsorbed chemicals is not suspended in the well and taken in by the pump.
- Overheating of the pump should be avoided to minimize the potential for losing VOCs through volatilization.
- Keep the working space clean with plastic sheeting and good housekeeping.
- Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:
 - Inspect sampling pump regularly and replace as warranted
 - Inspect quick-connects regularly and replace as warranted
 - Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

Attachment to the SOP on Low-Flow Sampling Groundwater Sampling from Monitoring Wells

White Paper on Low-Flow Sampling

EPA recommends low-flow sampling as a means of collecting groundwater samples in a way that minimizes the disturbance to the natural groundwater flow system and minimizes the introduction of contamination into the samples from extraneous sources. The following are details about these issues.

When a pump removes groundwater from the well at the same rate that groundwater enters the well through the screen, the natural groundwater-flow system around the well experiences a minimum of disturbance. Some disturbance is bound to occur because you are causing groundwater to flow to the well in a radial fashion that otherwise would have flowed past it. However, the resulting low-flow sample provides the most-representative indication we can get of groundwater quality in the immediate vicinity of the well.

Normally, when a well is pumped at an excessive rate that drops the water level in the well below the water level in the aquifer, the water cascades down the inside of the well screen when it enters the well. The turbulence from this cascading causes gases such as oxygen and carbon dioxide to mix with the water in concentrations that are not representative of the native groundwater and are higher than expected. This causes geochemical changes in the nature of the water that can change the concentrations of some analytes, particularly metals, in the groundwater sample, not mention it's effect on the dissolved oxygen levels that then will be measured in the flow-through cell. Such turbulence also may cause lower-than-expected concentrations of volatile organic compounds due to volatilization.

For wells in which the water level is above the top of the screen, the water up in the riser is out of the natural circulation of the groundwater and, therefore, can become stagnant. This stagnant water is no longer representative of natural groundwater quality because its pH, dissolved-oxygen content, and other geochemical characteristics change as it contacts the air in the riser. If we minimize the drawdown in the well when we pump, then we minimize the amount of this stagnant water that is brought down into the well screen and potentially into the pump. As a result, a more-representative sample is obtained.

Typically, wells contain some sediment in the bottom of the well, either as a residue from development that has settled out of the water column or that has sifted through the sand pack and screen since the well was installed. This sediment commonly has adsorbed on it such analytes as metals, SVOCs, and dioxins that normally would not be dissolved in the groundwater. If these sediments are picked up in the groundwater when the well is disturbed by excessive pumping, they can:

- Make filtering the samples for metals analysis more difficult
- Add unreasonably to the measured concentration of SVOCs and other organic compounds

The SOP for low-flow sampling has been modified recently and should be consulted for additional information about low-flow sampling and ways of dealing with wells in which the water level cannot be maintained at a constant level.

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.

Decontamination of Drilling Rigs and Equipment

I. Purpose and Scope

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

II. Equipment and Materials

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

III. Procedures and Guidelines

A. Drilling Rigs and Monitoring Well Materials

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

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

B. Downhole Drilling Tools

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

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

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

C. Field Analytical Equipment

1. Water Level Indicators

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

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

2. Probes

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

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

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

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 rollofs 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.

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.

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

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.21 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.22 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.



Explosives Usage and Munitions Response (MR) Enterprise Standard Operating Procedure HSE -610

1.0 Applicability and Scope

1.1 Applicability

This Standard Operating Procedure (SOP) applies to:

- (1) CH2M HILL employees who enter areas known or suspected of having munitions,
- (2) Areas where explosives are used for construction or demolition purposes, and
- (3) Managers who may be responsible for oversight of a subcontractor's explosives usage, MR operations, or Controlled Detonation Chamber (CDC) operations.

Explosives usage or MR operations may be conducted on active, inactive, closed, transferring, or transferred ranges; former battlefields; disposal sites; munitions manufacturing and storage sites; and construction sites.

1.2 Scope

This SOP provides information regarding the spectrum of hazards and issues to be addressed during each phase of a project associated with operations involving the use of explosives. Hazardous situations addressed in this SOP include exposure to explosives used for construction or demolition work; munitions and explosives of concern (MEC), which include unexploded ordnance (UXO), discarded military munitions (DMM), and material potentially presenting an explosive hazard (MPPEH); chemical warfare materiel (CWM), or munitions constituents (MC) contaminated soil and groundwater; munitions demilitarization operations; Controlled Detonation Chamber (CDC) operations; and operations to locate, identify, remove, and dispose of munitions.

CH2M HILL employees who enter areas where explosives may be encountered or used must take precautions to avoid these hazards and be aware of associated safe work practices.

As described in [SOP HSE-215, Contracts, Subcontracts, & HSE Management Practices](#), responsibilities for health, safety, and environmental (HS&E) protection are expressly defined through subcontract terms and conditions. CH2M HILL's HS&E practices in the field are determined on the basis of these defined responsibilities. Consistent with HSE -215, the subcontractor must determine how to operate safely, comply with applicable HS&E regulations and industry standards, and correct any deficiencies.

1.3 Regulatory Review

Projects involving the use of explosives are often complex (may require the acquisition, receipt, storage, and use of explosives to include insurance, permits/license, public safety, etc.) and have a myriad of regulatory requirements to ensure safety. A brief description of the major requirements follows:

U.S. Department of Defense (DOD) Ammunition and Explosives Safety Standards, DOD 6055.9-STD, establishes uniform safety standards that apply to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives during their development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal. Additional regulatory requirements are: Title 18 U. S. Code, 842, Safe Explosives Act, 27 CFR Part 555.1 Explosives, 29 CFR 1910.109 Explosives and Blasting Agents, National Fire Protection Association 495 Explosive Materials Code, 49 CFR Parts 100–199, Hazardous Materials Transportation.

The U.S. Environmental Protection Agency (EPA) regulates the disposal of military munitions, and of waste that contains military munitions, through the Military Munitions Rule (MMR) (62 Federal Register [Fed. Reg.] 6621, February 12, 1997; 40 Code of Federal Regulations [CFR] Part 260 et seq.) under authority of the Resource Conservation and Recovery Act (RCRA). The rule has two functions: (1) it identifies when conventional and chemical military munitions become a solid waste, and (2) it provides criteria for storing and transporting such waste, including a conditional exemption if the munitions are managed under DOD rules.

This SOP incorporates by reference the guidelines and requirements for MR operations that are published by the U.S. Army Corps of Engineers (USACE) Engineering Support Center, Huntsville, Alabama. These are accepted industry standards, similar to voluntary consensus standards published by such organizations as the National Fire Protection Association (NFPA) and the American National Standards Institute (ANSI).

2.0 Project Planning

2.1 Planning Requirements

Compliance with the applicable governing laws and regulations is the responsibility of the Project Manager. The Project Manager will contact the MR Operations Manager, or in his absence the MR Safety/Quality Officer or the Munitions Response Market Segment Director, prior to and post MR (paragraph 17) of the ORE approval and subsequent GO/NO GO decision for determination of applicable governing laws and regulations and to assist with planning and executing support for such activities as blasting operations, hazardous toxic radiological waste (HTRW) support, construction support, MR actions, handling of CWM or explosive-contaminated soils, and munitions demilitarization. The following types of support may be needed for MR operations:

- For on-site visits with known or suspected MEC, an Abbreviated Accident Prevention Plan (AAPP) (See **Attachment 1**) must be prepared. This AAPP is to be used only for non-intrusive site visits, and it must be approved by the MR Safety/Quality Officer, or

in his absence either the MR Operations Manager or MR Market Segment Director, before the field visit starts. All team members must read and comply with the AAPP and attend the safety briefings. The UXO Safety Officer (UXOSO) shall ensure that the Safety Briefing Checklist and the Plan Acceptance forms are filled out before the site visit begins.

- On an HTRW site with known or suspected MEC, MEC support involves implementing anomaly avoidance techniques to avoid any potential surface MEC and any subsurface anomalies. A Site Safety & Health Plan (SSHP) must be prepared. This SSHP is to be used only for non-intrusive anomaly avoidance activities, and it must be approved by the MR Safety/Quality Officer, or in his absence the MR Operations Manager or the MR Market Segment Director prior to the start of fieldwork. All team members must read and comply with the SSHP and attend the safety briefings. The UXOSO shall ensure that the Safety Briefing Checklist and Plan Acceptance Form are filled out prior to the start of the site work.
- On a construction site with known or suspected MEC, support must be provided by qualified UXO personnel during construction activities. The level of MEC support required depends on the probability of encountering MEC, determined on a project-by-project basis. This will be identified during the MR (paragraph 17) of the ORE.
- MR actions in which the intent is to locate, identify, excavate, remove, and dispose of MEC may require a Senior UXO Supervisor, UXO Safety Officer, and UXO Quality Control Specialist, to oversee UXO contractor teams performing operations.
- On an MR site that has MC contamination of soil or groundwater, MEC support may include both anomaly avoidance techniques and MEC construction support for excavating and/or treating MC-contaminated soil and groundwater.
- On munitions demilitarization projects, MEC support is required to identify, handle, disassemble, process, certify, transport, and treat or dispose of munitions components.
- On projects where explosives waste is transported or disposed of offsite, the MR Operations Manager and the BG Environmental Compliance Coordinator (ECC) may assist in identifying the applicable regulations and permits required.
- On projects where munitions debris (MD), material potentially presenting an explosive hazard (MPPEH), or inert munitions is recovered and processed for disposal as scrap, the MR Operations Manager and the BG ECC may determine whether treatment and certification is required, along with any permitting requirements.
- For drilling activities at project sites suspected of MEC contamination, the UXO team shall conduct a reconnaissance and MEC avoidance to provide clear access routes to each site before drilling crews enter the area. Down hole avoidance support shall be conducted at intervals every one foot until the depth that was determined during the MR ORE was reached. The procedures listed in [HSE-204, Drilling](#), apply and shall be implemented.
- For excavation activities at project sites suspected of MEC contamination, the UXO team shall conduct a reconnaissance and MEC avoidance to provide clear access routes to

each site before excavation crews enter the area. The procedures listed in [HSE-307, Excavations](#), apply and shall be implemented.

- Safety and quality control (QC) audits shall be included in developing cost estimates for any MR or explosives usage project that will last more than two weeks.
- On projects that include intrusive activities to investigate MEC or use of explosives (blasting), an Explosive Safety Submission (ESS), an Explosive Siting Plan (ESP), and an Explosive Management Plan (EMP) may be required. The MR Operations Manager, or in his absence the MR Safety/Quality Officer or MR Market Segment Director, shall assist in evaluating project requirements and coordinate with others as appropriate.

The project UXOQCS or in his/her absence, one the following, MR Program Quality Manager, MR Safety/Quality Officer or the MR Market Segment Director, shall verify subcontractor training, personnel qualifications, and current medical examinations prior to the start of field operations. Any identified shortfalls in qualifications should be reported to the MR Operations Manager or in his absence to the MR Safety/Quality Officer or the Market Segment Director for resolution.

2.2 Opportunity and Risk Evaluation (ORE)

Every project or task involving the usage of explosives or a Munitions Response (MR) requires completion of the Munitions Response ORE form in **Attachment 2**. The most current form and assistance in filling out the form can be obtained from the MR Safety/Quality Officer, MR Operations Manager, or MR Market Segment Director. This document is a living form and should be updated as a project is developed and executed or upon change of scope of work (SOW), identification of previously unknown hazards, etc. Final acceptance of the MR ORE is done by the MR Safety/Quality Officer. Upon acceptance of the MR ORE, the Project Delivery Team (PDT) is required to perform the Go/No Go decisions making process per the ESG Authority Matrix.

2.3 Alcohol, Tobacco, Firearms, and Explosives (ATF&E) Background Investigation

The "Safe Explosives Act of 2002" requires the employer (CH2M HILL) to submit to ATF&E identifying information, fingerprints, and photographs for all "Responsible Persons" and "Possessors of Explosives."

All personnel designated as Responsible Persons or Possessors of Explosives involved in explosives usage and MR projects must provide a 2-inch by 2-inch color picture and an ATF Form 5400.28 filled out for submission by the ATF&E License Holder (contact MR Operations for assistance) who will forward them to ATF&E so that a background investigation can be conducted to establish eligibility to work with explosives.

Under the "Safe Explosives Act," a "Responsible Person" and a "Possessor of Explosives" are defined as follows:

Responsible Person: An individual who has the power to direct the management and policies of the applicant pertaining to explosive materials. Generally the term includes partners, sole proprietors, project managers, site managers, corporate officers and directors, and majority shareholders.

Possessor of Explosives: An individual who has actual physical possession or constructive possession, which means the person has dominion or control over explosives. For example, persons who are physically handling explosive materials would be considered to be possessors of explosives. This would include employees who handle explosive materials in order to ship, transport, or sell them; and employees, such as blasters, who actually use explosive materials. Other examples of possessors include a supervisor at a construction site who keeps keys for magazines in which explosives are stored, or who directs the use of explosive materials by other employees; and an employee of a licensee or permittee transporting explosive materials from a licensed distributor to a purchaser.

Assistance in filling out required forms can be obtained from the MR Operations Manager, or in his absence the MR Safety Officer or the MR Market Segment Director. Submission of completed forms to ATF&E is the responsibility of the ATF&E License Holder. Upon submission of the required forms “responsible persons and possessors of explosives” may execute their duties pending completion of the background investigation.

ATF&E will notify employers in writing of the result of each background check and will supply the “responsible person” or “possessor of explosives” with a “Letter of Clearance” where appropriate. The custodian of the ATF&E records will request a copy of this certificate from the employee.

2.4 Training Requirements

2.4.1 MR Projects

CH2M HILL employees and subcontractors who work on projects that involve MR must complete the following training:

- A one-time, 40-hour Hazardous Waste Operations and Emergency Response course, and a minimum of three days’ actual field experience under the direct supervision of a trained supervisor as specified in 29 CFR §1910.120(e).
- An annual 8-hour hazardous waste refresher course, as specified in 29 CFR §1910.120(e) (8).
- Hazardous waste supervisory training (required for managers and supervisors only) as specified in 29 CFR §1910.120(e)(4).

All UXO technicians must be graduates of one of the following:

- U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD;
- U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD;
- U.S. Naval EOD School, Eglin Air Force Base (AFB), FL;
- EOD Assistants Course, Redstone Arsenal, AL;
- EOD Assistant Course, Eglin AFB; or
- An equivalent course as identified in Department of Defense Explosives Safety Board (DDESB) Technical Publication (TP) 18

The project UXOQCS or in his/her absence the MR Operations Manager, MR Safety/Quality Officer or the MR Market Segment Director, must review and accept subcontractor personnel qualifications.

2.4.2 Commercial Blaster Requirements

Commercial blasting is most often done in support of construction projects to remove or reduce obstacles that interfere with the construction of new roads, bridges, tunnels, harbors, or other facilities.

In order to be qualified as a "Blaster," the individual shall be able to understand and give written and oral orders; be in good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs; and be qualified by reason of training, knowledge, or experience in the field of transporting, storing, handling, and use of explosives, and have a working knowledge of state and local laws and regulations that pertain to explosives. A "Blaster" will be required to furnish satisfactory evidence of competency in handling explosives and performing in a safe manner the type of blasting that will be required. A Blaster must also be knowledgeable and competent in the use of each type of blasting method used.

Depending on the type and location of work performed, personnel that transport explosives may need to have a commercial driver's license (CDL) with a hazardous material endorsement in accordance with Department of Transportation Requirements specified in 49 CFR.

The following definitions provide an overview the types of explosives which may be used in commercial blasting:

Explosives -- any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture, or device is otherwise specifically classified by the U.S. Department of Transportation; see 49 CFR Chapter I. The term "explosives" shall include all material which is classified as Class A, Class B, and Class C explosives by the U.S. Department of Transportation, and includes, but is not limited to dynamite, black powder, pellet powders, initiating explosives, blasting caps, electric blasting caps, safety fuse, fuse lighters, fuse igniters, squibs, cordeau detonant fuse, instantaneous fuse, igniter cord, igniters, small arms ammunition, small arms ammunition primers, smokeless propellant, cartridges for propellant-actuated power devices, and cartridges for industrial guns. Commercial explosives are those explosives which are intended to be used in commercial or industrial operations.

(i) **Class A explosives.** Possessing, detonating, or otherwise having maximum hazard, such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

(ii) **Class B explosives.** Possessing flammable hazard, such as propellant explosives (including some smokeless propellants), photographic flash powders, and some special fireworks.

(iii) **Class C explosives.** Includes certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities.

2.5 Medical Surveillance Requirements

All CH2M HILL employees who perform field work on MR sites must participate in a medical monitoring program in accordance with 29 CFR 1910.120 and [HSE-113, *Medical Monitoring*](#).

Employees who terminate employment and who have performed field work at MR project sites may be required to undergo an exit examination.

Subcontractors are responsible for ensuring that their employees are enrolled in a medical surveillance or monitoring program that meets the requirements of 29 CFR 1910.120.

2.6 Drug Free Workplace Requirements

CH2M HILL employees who perform or oversee MR operations are subject to the provisions of [HSE-105, *Drug-Free Workplace*](#).

All CH2M HILL employees assigned to MR projects are subject to the provisions of HSE-105, Drug-Free Workplace. Subcontractors are responsible for ensuring that their employees who perform MR operations on CH2M HILL projects are on a drug abuse surveillance program that meets the requirements of HSE-105.

2.7 Competent Person Requirements

2.7.1 Munitions Response

A competent person may be a Senior UXO Supervisor, UXO Safety Officer, UXO Quality Control Specialist, or UXO Technician III. The competent person must meet the following minimum qualifications:

- Be a graduate of one of the schools and courses listed for all UXO technicians in Section 2.4.1 above and meet the requirements of DDESB TP-18,
- Have at least 8 years of combined active-duty military EOD experience and contractor UXO experience, and
- Have experience in MR operations and supervision of personnel.

The MR Operations Manager, the MR Market Segment Director, and the MR Safety/Quality Officer will compose the Ammunition & Explosive Personnel Qualification and Certification Board for employees of CH2M HILL. This Board will review individual qualifications and experiences for determining who will be allowed to perform those duties and assignments associated with SUXOS, UXOQC, UXOSO, and CDC Chamber Operator. Project managers are required to notify in writing, the MR Safety/Quality Officer of any CH2M HILL UXO Technician assignments requiring service related documented of qualifications.

2.7.2 Blasting

Blasting subcontractors are responsible for providing a competent person to oversee blasting operations. A competent person may be a state licensed blaster. The competent person must be qualified through a license or permit issued by a state or local jurisdiction based on testing, extensive knowledge, training, and experience with an ability to solve or resolve problems related to blasting, and must meet the following requirements:

- Able to understand and give written and oral orders.
- In good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs.
- Required to furnish satisfactory evidence of competency in handling explosives and performing in a safe manner the type of blasting that will be required.
- Knowledgeable and competent in the use of each type of blasting method used.

2.8 Safety Equipment

Subcontractors are responsible for providing all necessary personal protective equipment (PPE) for their employees. CH2M HILL will provide PPE only for its own employees. Other safety equipment will be provided as delineated in the subcontract and documents referenced by the subcontract. The MR Safety Officer, or in his absence the MR Operations Manager or the MR Market Segment Director, must review subcontractor work plans and site-specific HS&E plans to ensure that appropriate safety equipment has been included to meet the requirements of the scope of work (SOW).

Personnel who will be handling explosives will not wear outer or inner garments having static electricity-generating characteristics. These include clothing made of 100 percent polyester, nylon, silk, and wool, which are all highly static producing.

Protective shoes worn by personnel performing explosives operations should be constructed of nonferrous materials (e.g., fiberglass) to prevent interference with sensitive geophysical instruments.

UXO Technicians are required to wear hard hats when an overhead hazard exists or when specified in the site-specific HS&E plan. Hard hats should *not* be worn, however, when investigating suspect MEC. A hard hat can create an unsafe condition by falling off the technician's head at a critical moment. Also, if a MEC is accidentally detonated (the worst-case accident scenario), the hard hat will not protect the technician from fragments and may worsen the injury by reflecting fragments into the head of the technician. This is consistent with safety guidance from the Corps of Engineers, Huntsville Center, Military Munitions Center of Expertise (MM-CX).

2.9 Subcontractor Selection

Subcontractors are selected based on their past performance in working for CH2M HILL, safety record, experience, and compliance with federal, state, and local jurisdiction licensing and permitting.

Additional criteria may be developed, depending upon the specific SOW requirements for the subcontractor. When oversight is required by HSE-215, the CH2M HILL MR Safety/Quality Officer, or in his absence the MR Operations Manager or MR Market Segment Director, shall use these developed criteria to review the explosives procedures submitted by the subcontractor.

3.0 Definitions

Please see **Attachment 3** for definitions.

4.0 Project Execution

4.1 Safe Work Practices

Management is responsible to control and eliminate unsafe work conditions through training and engineering out the hazard. The requirements of this section are to be followed by all personnel where explosives are used, regardless of the company performing the operations. These requirements also pertain to subcontractor personnel.

4.2 MR Operations

On MR project sites, the MR Operations Manager will be contacted to establish requirements.

4.3 Regulations and Industry Standards

As described in HSE-215, the MR Safety Officer/Quality or UXOQCS may be required to oversee a subcontractor's field activities. Subcontractors retain control over their practices, and CH2M HILL's oversight does not relieve them of their own responsibility for effective implementation and enforcement of HS&E requirements. The following subsections provide the minimum regulatory and industry standards for operations.

The Military Munitions Response Program (MMRP) is a maturing program with different levels of regulatory oversight within each service component. Unless a service component has issued written regulations/guidance for execution of MR actions, then the default regulations/guidance followed will be those issued by the Department of Defense Explosive Safety Board (DDESB) and the U.S. Army Corps of Engineers. For commercial blasting operations, the following guidelines shall apply: ATF&E federal explosive laws and regulations (ATF P5400.7); ANSI A10.7, Safety Requirements for Transportation, Storage, Handling and Use of Explosives; and NFPA 495, Explosive Material Code.

4.3.1 General Safety Concerns and Procedures

Operations, including site visits, shall not be conducted until a complete plan for the site is prepared and approval for use is given by the CH2M HILL MR Safety/Quality Officer, MR Operations Manager, or MR Market Segment Director. These plans will be based upon the cardinal rule of explosive safety which is to limit exposure to the minimum number of personnel, for the minimum amount of time, to the least amount of explosives hazards consistent with safe and efficient operations.

Only UXO-qualified personnel shall perform MEC procedures. Non-UXO personnel may be used to perform MEC-related procedures when supervised by a UXO Technician III. All personnel engaged in field operations shall be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel shall be under the direct supervision of a UXO Technician III or a Senior UXO Supervisor (SUXOS).

4.3.2 Explosives Safety Precautions

Comply with the cardinal rule for explosives safety: expose the minimum number of people to the minimum amount of explosives for the minimum amount of time. Project-specific explosives safety precautions shall be developed prior to field activities and included in Work Plans and Health & Safety Plans that must be reviewed and approved by the MR Safety/Quality Officer and the MR Operations Manager, or in their absence the MR Market Segment Director.

4.3.3 Recognize, Retreat, and Report MEC

Any CH2M HILL project located on a present or former Department of Defense (DOD) facility, even if it is now under the control of a city, state, or private owner, should plan on the potential to encounter MEC/MPPEH. A contingency plan developed during pre-mobilization that addresses the three Rs of MEC/MPPEH (recognize the potential hazard, retreat upwind a safe distance, and report in accordance with approved plans) will lessen the impact to the project and enhance employee safety if MEC/MPPEH is encountered. Assistance in developing this contingency plan should be obtained from the MR Safety/Quality Officer, or in his absence the MR Operations Manager or the MR Market Segment Director.

4.3.4 Explosives Management

Management of explosives material under the "Safe Explosives Act of 2002" implements stringent requirements that must be followed. Management of explosives is a process that, if in compliance with federal, state, and local jurisdiction, will reduce, control, or eliminate civil and criminal penalties, disciplinary actions, and potential risk to personnel, the public, and the environment. Details of explosives management are developed on a site-specific basis and included in a site-specific Explosives Management Plan (EMP). These details are based on federal, state, and local jurisdiction requirements and on contractual specifications by the client.

4.3.5 Explosives Security

Security of explosives will conform to the requirements set forth by federal, state, and local jurisdictions. Provisions for explosives security during interstate or intrastate shipment will be performed by transportation vendors. Project site and overnight explosives security will conform to 49 CFR 171-173, transportation security requirements. Details of explosives security requirements are included in the EMP for each project.

4.3.6 Controlled Detonation Chamber Operations

A Controlled Detonation Chamber (CDC) is capable of repeated controlled detonations of a suite of energetic materials that are currently demilitarized by open burn/open detonation (OB/OD). An MR ORE is required on CDC projects. On CDC projects, the MR Operations Manager will be contacted to establish requirements.

4.3.7 Explosive Waste Disposal

When used or fired munitions are managed off range (i.e., transported off range and stored, reclaimed, treated, or disposed) or disposed of on range (i.e., buried without treatment), it is subject to regulation as a solid waste under RCRA. This means it may also be subject to

regulation as a hazardous waste. Also, munitions that land off range and are not promptly retrieved are solid wastes. Table 4-1 describes how solid wastes may be characterized as hazardous in these situations. All characterization must be based on field observations by qualified MR personnel who are trained to properly identify waste munitions items and meet the requirements for an emergency response expert under RCRA. In the event that the explosive waste is regulated as hazardous waste, refer to SOP [HSE-409, Waste Management: Hazardous Waste](#) for RCRA hazardous waste management requirements.

TABLE 4-1
Waste Characterization

Item	Characterization	Waste Code
Uncontaminated metal debris	If visual inspection determines that the item does not contain waste residue, then waste is non-hazardous scrap metal excluded from RCRA regulation under 40 CFR §261.6(a)(3). Waste may be subject to further incineration and certification requirements.	None
Contaminated metal debris	If visual inspection determines that the item contains hazardous waste residue, then manage it as potential hazardous waste.	Potential D003 and/or D008
Munitions less than 0.50 caliber	Small-arms ammunition is not considered reactive hazardous waste in accordance with EPA policy (November 30, 1984 Memorandum, John Skinner, OSWER Director).	None
Munitions greater than 0.50 caliber	Untreated MEC is presumed to be reactive hazardous waste using generator knowledge under 40 CFR §261.23.	D003

4.3.8 Forms and Permits

(1) **Type-20 Manufacturer of High Explosives License/Permit** issued by the ATF&E is required to purchase, store, and use high explosives including on-site use of binary explosives in support of MR operations, construction projects, and demolition and deactivation (D&D) projects. The following must be done prior to execution of field activities:

- Explosives will not be ordered, shipped, stored, or used by CH2M HILL without the review and approval of the ATF&E License Holder.
- The ATF&E License Holder must review and approve all Explosive Siting Plans (ESPs) and Explosives Management Plans (EMPs) to ensure compliance with ATF&E regulations.
- Following compliance with the above, the ATF&E License Holder will provide procurement/contracting with a certified copy of our Type 20 license and the authorization letter (responsible persons & possessors of explosives) to procure explosives.
- Written authorization designating the “Responsible Persons” and “Possessors of Explosives” who can order, receive, store, and use explosives must be provided by the ATF&E License Holder to explosives supplier.
- A copy of the CH2M HILL ATF&E Type 20 Manufacturer of High Explosives license must be posted on the project site.

- A copy of the ESP must be provided through the ATF&E License Holder to the ATF&E Office that inspects the CH2M HILL records and to the nearest ATF&E Office to the project site.

Additional details are provided in **Attachment 4**, Explosives Management Check List, including required records that must be forwarded to the CH2M HILL ATF&E Type 20 License Holder upon completion of work.

- (2) State and local explosives permits may be required for CH2M HILL and individuals to purchase, store, and use explosives in support of MR operations, CDC operations, construction projects, and D&D projects. In addition there may be local requirements to notify law enforcement or fire department agencies when establishing explosives storage.

5.0 Attachments

The following attachments are located within the SOP.

- Attachment 1 [Abbreviated Site Safety and Health Plan \(ASSHP\)](#)
- Attachment 2 [Opportunity Risk Evaluation \(ORE\)](#)
- Attachment 3 [Glossary, Acronyms, and Abbreviations](#)
- Attachment 4 [Explosives Management Check List](#)

6.0 Revision Log

Revision	Date	Description	Prepared By	Approved By
1	9/27/06	Updated to Standard Operating Procedure	Dan Young	<i>R. Keith Christopher</i>



Explosives Usage and Munitions Response (MR)
Standard Operating Procedure HSE-610

Attachment 1: Abbreviated Accident Protection Plan (AAPP)

For:

Site name _____

Site location _____

Purpose of visit _____

AAPP prepared by _____

Office _____

Address _____

Telephone _____

Date prepared _____

Signature and date _____

AAPP reviewed and approved by:

Safety office: _____ Date: _____

NOTE: This AAPP is to be used only for non- intrusive site visits or for intrusive activities (e.g. geophysical prove-outs) where anomaly avoidance is to be performed prior to intrusive activity. All team members must read and comply with this AAPP and attend the safety briefings. The UXO escort shall ensure that the Safety Briefing Checklist and Plan Acceptance Form are filled out prior to the start of the site visit.

I. Site Description and Previous Investigation

A. Site Description

Size: _____ acres

Present usage:

Military Recreational Other

Residential Commercial _____

Natural area Industrial _____

Agricultural Landfill _____

Secured Active Unknown

Unsecured

Inactive

B. Past Uses

All members of the site visit team have been provided with a copy of the ASR.

Yes

No -

C. Surrounding Population

Rural

Residential (outside base fence) Other (specify)

Urban

Industrial

Commercial

D. Previous Sampling and Investigation Results

1. MEC Encountered within anticipated boundaries of site

2. Samples (air, water, soil, and/or vegetation)

Chemical

Concentration

Medium

Location

II. Description of On-Site Activities

Walk-through

Drive-through

Other

On-road

Off-road

On-path

Off-path

Other

Other

III. Site Personnel and Responsibilities

Project Manager -

Office

Address

Phone _____

Responsibilities _____

Team Leader –
Office _____

Address _____

Phone _____

Responsibilities Responsible for documenting site visit.

UXO Safety Officer –
Office _____

Address _____

Phone _____

Responsibilities Responsible for all aspects of site safety during operations covered under this AAPP

IV. Hazard Analysis

A. Safety and Health Hazards Anticipated

- Chemical (be specific and include warning signs and symptoms of overexposure)
- Munitions (specify)
- Heat stress
- Cold stress
- Tripping hazard
- Noise
- Electrical
- Falling objects
- Foot hazard
- Biological
- Overhead hazard
- Radiological
- Confined space
- Water hazard
- Explosive
- Climbing hazard
- Sunburn
- Flammable
- Other

B. Overall Hazard Evaluation

- High
- Moderate
- Low
- Unknown

Justification

V. Accident Prevention

A. General Precautions

Before the on-site visit, all team members are required to read this AAPP and sign the form acknowledging that they have read and will comply with it. In addition, the UXO Safety Officer (escort) - shall hold a brief tailgate meeting in which site-specific topics regarding the day's activities are discussed. The buddy system shall be enforced at all times. If unanticipated hazardous conditions arise, team members are to stop work, leave the immediate area, and notify the UXO Safety Officer.

VI. Standard Operation Safety Procedures, Engineering Controls, and Work Practices

A. Site Rules and Prohibitions

At any sign of unanticipated hazardous conditions, stop tasks, leave the immediate area, and notify the UXO Safety Officer. Smoking, eating, and drinking are allowed in designated areas only.

B. Material-Handling Procedures

Do not handle.

C. Drum-Handling Procedures

Do not handle.

D. Confined Space Entry

Do not enter.

E. Ignition Source and Electrical Protection

Smoke in designated areas only. Team members are not to carry matches or lighters into the site.

F. Spill Containment

N/A

G. Excavation Safety

N/A

H. Illumination

Work during daylight hours only.

I. Sanitation

Use existing sanitary facilities.

J. Buddy System

Two persons shall be on site maintaining constant contact with each other; this shall be adhered to at all times.

K. Engineering Controls

N/A

L. Heat Stress

Dress appropriately, take sufficient breaks, and drink plenty of fluids. Watch for signs and symptoms of heat stress.

M. Poisonous Snakes or Insects

- (1) Do NOT handle any snakes even those that appear to be dead.
- (2) Avoid areas of limited visibility such as tall grass or heavy vegetation.
- (3) Roll sleeves down and use insect repellent.

N. Material Potentially Presenting an Explosive hazard (MPPEH).

1. General Information

- a. The cardinal principle to be observed involving explosives, ammunition, severe fire hazards, or toxic materials is to limit the exposure of a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material, consistent with a safe and efficient operation.
- b. The age or condition of an munition does not decrease its effectiveness. MPPEH that has been exposed to the elements for extended periods of time becomes more sensitive to shock, movement, and friction because the stabilizing agent in the explosive may be degraded.
- c. When chemical agents may be present, further precautions are necessary. If the munitions item has green markings, leave the area immediately, since it may contain a chemical filler.
- d. Consider MPPEH that has been exposed to fire as extremely hazardous. Chemical and physical changes may have occurred to the contents which render it more sensitive than it was in its original state.

2. On-Site Instructions

- a. DO NOT touch or move MPPEH regardless of the marking or apparent condition.

- b. DO NOT visit an MPPEH site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
- c. DO NOT use radio or cellular phones in the vicinity of suspected MPPEH.
- d. DO NOT walk across an area where the ground cannot be seen. If dead vegetation or animals are observed, leave the area immediately due to the potential of contamination by a chemical agent.
- e. DO NOT drive a vehicle into a suspected MPPEH area; use clearly marked lanes.
- f. DO NOT carry matches, cigarettes, lighters, or other flame-producing devices into an MPPEH site.
- g. DO NOT rely on color code for positive identification of munitions or their contents.
- h. Always assume that MPPEH contains a live charge until it can be determined otherwise.

3. Specific Actions upon Locating MPPEH

- a. DO NOT touch, move, or jar MPPEH regardless of its apparent condition.
- b. The UXO Safety Officer may approach the item cautiously; take photographs and a full description. Take notes of the markings or any other identifiers.
- c. DO NOT be misled by markings on the item stating "practice bomb," "dummy," or "inert." Even practice bombs have explosive charges that are used to mark or spot the point of impact; or the item could be miss-marked.
- d. DO NOT roll the item over or scrape the item to identify the markings.
- e. The location of any MPPEH found during site investigation should be clearly marked so it can be easily located and avoided.
- f. Notify PM upon location of any MPPEH. See Section VIII for phone number.

O. Other

Specify: _____

VII. Site Control and Communications

A. Site Map

Attach copy.

B. Site Work Zones

N/A

C. Buddy System

To be adhered to at all times.

D. Communications

1. On Site

Use verbal communications among team members to communicate to each other on site. If this communication is not possible, develop and use hand signals. Here are some examples:

Hand gripping throat: "Breathing problems, can't breathe."

Thumbs up: "OK, I'm all right, I understand."

Thumbs down: "No, negative."

Hand(s) on top of head: "Need assistance."

Grab buddy's wrist: "Evacuate site now, no questions."

One long horn blast: "Evacuate site to assembly point."

Two short horn blasts: "Condition under control, return to site."

2. Off Site

Off-site communications shall be established on every site. Communications may be established by using an on-site cellular phone or by locating the nearest public or private phone that may be readily accessed. Mark the appropriate box:

- Cellular phone
- Public or private phone
- Other: _____

3. Emergency Signals

In the case of small groups, a verbal signal for emergencies shall suffice. The emergency signal for large groups (i.e., air horn) should be incorporated at the discretion of the UXO Safety Officer. Mark the appropriate box:

- Verbal
- Nonverbal (specify) _____

VIII. Emergency Response

A. Alert Procedures

Team members are to be alert to the hazards associated with the site at all times. If an unanticipated hazardous condition arises, stop work, evacuate the immediate area, and notify the UXO Safety Officer. Practice MEC avoidance. If a suspected MEC is encountered during field activities, the team leader will contact local authorities and USACE Project Manager. The local authorities will contact military EOD. The suspected item will be marked with colored tape (or equivalent) by on-site UXO Safety Officer (escort).

B. First Aid

A first aid kit and emergency eyewash (as applicable) will be located in the UXO Safety Officer's field car. If qualified persons (i.e., a fire department, medical facility, or physician) are not accessible within five minutes of the site, at least one team member shall be qualified to administer first aid and cardiopulmonary resuscitation (CPR).

C. Emergency Telephone Numbers

1. Medical Facility

2. Fire Department

3. Police Department

4. Poison Control Center:
(800) 222-1222

5. Local EOD

6. Project Manager(s)

D. Hospital and Medical Facility Information

Route to hospital: (Attach a map with the route to the hospital marked; if a map is not available, then provide clear, written instructions.)

IX. Monitoring Equipment and Procedures

A. Exposure Monitoring

For non-intrusive on-site activities such as site visits, air monitoring is typically not required. However, if the site situation dictates the need for monitoring, then complete the following information on a separate page and attach the page to this AAPP.

Monitoring equipment to be utilized

Documentation of equipment calibration and results

Action levels

B. Heat and Cold Stress Monitoring

If heat stress monitoring is necessary, the monitoring criteria published in Chapter 8 of *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH/OSHA/USCG/EPA, October 1985) shall be followed. If cold stress monitoring is necessary, it shall be conducted in accordance with the most current American Conference of Governmental Industrial Hygienists (ACGIH) cold stress standard.

X. Personal Protective Equipment

A. General

Typically, for non-intrusive site visits, Level D PPE is required. Hard hats shall be worn if an overhead hazard exists, safety shoes if a foot hazard exists, and safety glasses if an eye hazard exists. If a higher level of protection is to be used initially or as a contingency, attach a brief discussion.

B. Non-intrusive Site Visit

Level of Protection

Initial: C D Modified (specify)

Contingency: C D Modified (specify)

Evacuate site if higher level of protection is needed.

XI. Decontamination Procedures

If decontamination is required, attach an additional sheet with the requirements.

Decontamination procedures are not anticipated for this site investigation. Team members are cautioned not to walk, kneel, or sit on any surface with potential leaks, spills, or contamination.

XII. Training

All site personnel shall have completed the training required by EM 385-1-1 and 29 CFR §1910.120 (e). The Project Manager shall ensure, and the UXO Safety Officer shall verify, that all on-site persons have completed appropriate training prior to submitting the plan to the safety office for review. Additionally, the UXO Safety Officer shall inform personnel, before they enter the site, of any potential site-specific hazards and procedures.

XIII. Medical Surveillance Program

The Project Manager shall ensure, and the UXO Safety Officer shall verify, that all on-site personnel are in the Medical Surveillance Program meeting the requirements of 29 CFR §1910.120.

XIV. Logs, Reports, and Recordkeeping

A Site Log will be maintained by the team leader. This record will include historical data, personnel authorized to visit the site, all records, standard operating procedures, the AAPP submitted, any air monitoring logs, SOPs, and attachments to plans. All logs are to be maintained and available for inspection.

XV. General

The number of persons visiting the site shall be held to a minimum. No more than 8 people per UXO Safety Officer shall be allowed on-site. The more persons on site, the greater the potential for an accident. The UXO Safety Officer may modify this AAPP if site conditions warrant it and if it does not risk the safety and health of the team members. This modification shall be coordinated with the team members, and the UXO Safety Officer shall notify PM of the change as the situation allows.

XVI. Natural Resources

The following is a list of threatened and endangered species:

Safety Briefing Checklist

(Check subjects discussed)

Location: _____ Date: _____

General Information

Purpose of visit: _____

Identify key site personnel: _____

Training and medical requirements: _____

Specific Information

Site description and past uses: _____

Results of previous studies: _____

Potential site hazards: _____

MEC safety procedures: _____

Site SOPs: _____

Site control and communications: _____

Emergency Hand Signals

Emergency Response: _____

Location of First Aid Kit

Emergency Phone Numbers and Location

Location of Nearest Medical Facility and Location of Map to Facility

PPE and Decontamination: _____

Note: Stress the following during the briefings: If an unanticipated hazardous condition arises, stop work, evacuate the immediate area, and notify the UXO Safety Officer.

Equipment List

(The following items may be necessary to support the site visit)

1. Boots or sturdy leather work shoes.
2. First aid kit.
3. Sun screen lotion.
4. Bug and/or insect repellent.
5. Rain / cold weather protection.
6. Potable water.



Explosives Usage and Munitions Response (MR)
Standard Operating Procedure HSE-610

Attachment 2: Opportunity Risk Evaluation (ORE)

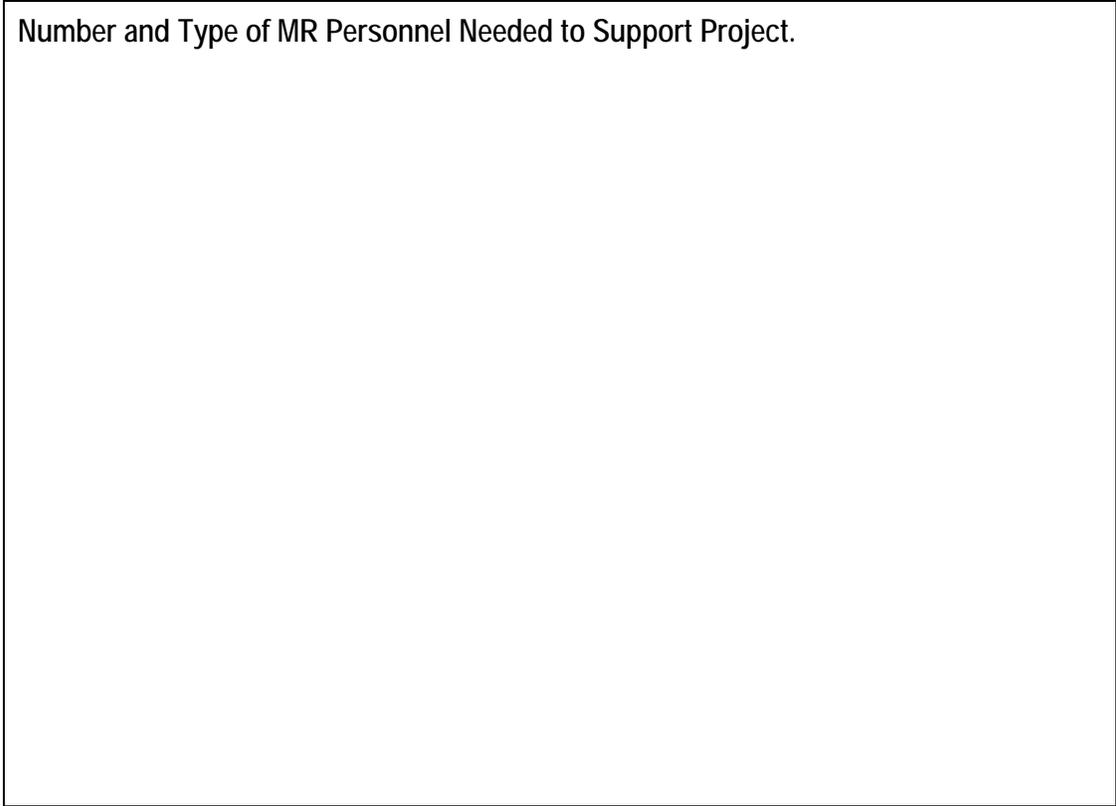
1.0 Projects Involving or Potentially Involving the Use of Explosives, Materials Potentially Presenting an Explosive Hazard (MPPEH), Munitions and Explosives of Concern (MEC) and Related Activity.

Administrative Information

Project Name:
Project Number:
Project Location: (Address, City, State, Zip Code, Country)
Address:
City:
State:
Zip Code:
Country:
Project Manager - CH2M HILL:
Contracting Organization:
Client Organization:
<input type="checkbox"/> Department of Defense
<input type="checkbox"/> Department of State
<input type="checkbox"/> Department of Energy
<input type="checkbox"/> Department of Interior
<input type="checkbox"/> Other
Client Organization Name:
Contract Type
<input type="checkbox"/> Time and Materials (T&M)
<input type="checkbox"/> Cost Plus (CP)
<input type="checkbox"/> Firm Fixed Price (FFP)
<input type="checkbox"/> Target Cost Incentive Fee (TCIF)
<input type="checkbox"/> Guaranteed Fixed Price with Insurance (GFPI)
<input type="checkbox"/> Performance Based Acquisition (PBA)
<input type="checkbox"/> Other

Brief Outline of the Scope of Work.

Number and Type of MR Personnel Needed to Support Project.



Any point value of 3, 4 or 5 in Sections A, B, C or D requires that you provide a risk management strategy as indicated. If unable to do so, you may wait until the formal MR ORE is conducted, then add the agreed to strategy at that time. Examples of strategies include, engineering controls, contractual protections, procedures, insurance and bonding, etc.

Level of effort should include MR Group Safety/Quality Control Audits for project over two weeks in field.

If you are unsure of which answer to use, leave blank and the question will be evaluated at length during the MR ORE process.

Upon completion of this form, email to those identified and schedule a telephonic conference call with them to review this document.

Part A:

Common Questions for Explosives Usage, Munitions Response (MR) and Controlled Detonation Chamber (CDC) Projects

Scoring Criteria

0 = none, 1 - 2 = Low Risk 3 Moderate Risk 4 - 5 High Risk

17.A1 Type of Reactive Materials?		
Project Risk Category?	Check (x)	Point Value
Small Arms (<.50 cal) Ammunition	<input type="checkbox"/>	0
Commercial Explosives	<input type="checkbox"/>	3
Military Explosives/Energetics (bulk)	<input type="checkbox"/>	3
CWM or CWA	<input type="checkbox"/>	5
Munitions and Explosives of Concern (MEC)	<input type="checkbox"/>	5
Pyrotechnics (including fire-works, etc.)	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		
17.A2 Client – End Land Use		
Which factor best describes the project end land use?	Check (x)	Point Value
Like Use -	<input type="checkbox"/>	0
Not Yet Determined -	<input type="checkbox"/>	1
Limited Public Access - livestock grazing/wildlife preserve/historic area	<input type="checkbox"/>	2
Public Access - Farming/Agriculture	<input type="checkbox"/>	3
Unrestricted – Commercial	<input type="checkbox"/>	4
Unrestricted – Residential	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		
17.A3 Chemical Warfare Material (CWM)		
Which factor best describes this risk factor?	Check (x)	Point Value
None	<input type="checkbox"/>	0
No-specific reference - but possible	<input type="checkbox"/>	3
CW Agents Known or Suspected	<input type="checkbox"/>	5
CW Munitions Known or Suspected	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		

17.A4 Who will write the Work & Safety Plans?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
CH2M HILL (Who in CH2M HILL ?)	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Client / Subcontractor	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		
17.A5 Does Client acknowledge that it will retain ownership of, and responsibility for MEC & recovered items ?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		
17.A6 Does the Project Delivery Team have a history of successful execution of this type of project?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know?	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		
17.A7 Is the Client responsible for obtaining necessary permits such as utility locator, state authorizations, rights of entry, etc.?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY:		

17.A8 Will there be a range debris, munition debris, etc., recovery effort?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

[Redacted]

17. A9 Will CH2M HILL subcontract MR or explosive operational actions?

Which factor best describes this risk factor?	Check (x)	Point Value
No	<input type="checkbox"/>	0
Munitions Response Master Services Agreement (MSA)	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

[Redacted]

17.A10 For "removal" activities, will "blow-in-place" (BIP) be permitted?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

[Redacted]

17.A11 Is CH2M HILL responsible for the preparation of client-owned solid waste and hazwaste? (with Client's manifest)?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

[Redacted]

17.A12 Will we need to order explosives for this project? Who will initiate the order?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Government Furnished	<input type="checkbox"/>	1
CH2M HILL	<input type="checkbox"/>	3
UXO Contractor	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		
17.A13 Is explosives storage required and/or available on site? If yes, who provides?		
Which factor best describes this risk factor?	Check (x)	Point Value
Government Provided	<input type="checkbox"/>	0
CH2M HILL	<input type="checkbox"/>	2
UXO Subcontractor	<input type="checkbox"/>	3
Unknown	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		
17.A14 Could weather conditions effect this project?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes.	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		
17.A15 Is geophysical investigation required on this project?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Geophysical Prove Out required?	<input type="checkbox"/>	3
Geophysical System Verification?	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		

17.A16 Are there public transportation routes, airport, mariners operations, rail roads, etc., within 2000 ft. to the site? If so, provide distances in feet.

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

17.A17 Are two types of communications available on this project site? Both will need to be added to the Safety Plan and exercised prior to each day activity.

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

17.A18 Are there emergency response services in close (5 minutes) proximity to project site (e.g., fire, hospital)?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

17.A19 Are there sensitive environment issues that need to be considered? Training of the UXO Technicians may be required.

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

PART B: Explosives Usage Project Questions

17.B1 Source of explosives	
Which factor best describes the source?	Check (x)
Vendor - Authorized ATF&E Dealer	<input type="checkbox"/>
Government Furnished	<input type="checkbox"/>
Client Furnished	<input type="checkbox"/>
Subcontractor Provided	<input type="checkbox"/>
Transferred from another CH2M HILL project	<input type="checkbox"/>
RISK MANAGEMENT STRATEGY: <div style="background-color: cyan; height: 15px; width: 100%;"></div>	
17.B2 Explosive operations general RISK requirements/concerns	
Which factors apply to regulatory conformance risk factor?	Check (x)
State Blasting License (Individual)	<input type="checkbox"/>
State Blasting License (Corporation)	<input type="checkbox"/>
State Explosive Storage Permit (Fire Marshal Inspection)	<input type="checkbox"/>
Vehicle Inspection (state of registration) for hazard materials transportation	<input type="checkbox"/>
Hazard Materials License (federal and or state)	<input type="checkbox"/>
Operator – Commercial Drivers License with Hazmat Endorsement	<input type="checkbox"/>
Airport/flight paths – Notice to Airmen (NOTAM) – Airspace	<input type="checkbox"/>
Navigable Waterways – Notice to Mariners (NOTM)	<input type="checkbox"/>
Power lines/ Radar/ Microwave tower/Antenna – Electro Magnetic Radiation Hazards	<input type="checkbox"/>
Military - training corridor/area/test area/research and development area	<input type="checkbox"/>
Need to establish a Temporary Open Detonation Area	<input type="checkbox"/>
Need to establish an Explosive Holding Area	<input type="checkbox"/>
Need to establish an Explosive Inspection Area for MPPEH/MDAS	<input type="checkbox"/>
Need to establish a storage area for MEC	<input type="checkbox"/>
Need to establish a storage area for MPPEH	<input type="checkbox"/>
RISK MANAGEMENT STRATEGY: <div style="background-color: cyan; height: 15px; width: 100%;"></div>	

17.B3 Explosive Storage Risk Factors		
Which factor best describes this risk factor - Magazine Condition?	Check (x)	Check (x)
Not Applicable.	<input type="checkbox"/>	0
Fire Inspector Permit/electrical grounding tests, ventilator and doors and locks and hasps IAW NFPA Code 495	<input type="checkbox"/>	1
Do Not Know	<input type="checkbox"/>	3
Unknown construction (material, etc.)	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		
17.B4 Explosive Transportation		
Which factor best describes this risk factor?	Check (x)	Check (x)
Not Applicable.	<input type="checkbox"/>	0
Within project area – private roads	<input type="checkbox"/>	1
Public Roads	<input type="checkbox"/>	3
Federal Roads (interstate - DOT) or over water (USCG)	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		
17.B5 Explosive Security		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Provided by Military	<input type="checkbox"/>	1
Provided by Others	<input type="checkbox"/>	3
Don't Know	<input type="checkbox"/>	3
Provided by CH2M HILL	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		
17.B6 Is underwater work required?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		

PART C:

Munitions Response Project Questions

17.C1 Type of Munitions Response (MR) project.		
Which factor best describes this risk factor?	Check (x)	Point Value
Desk top studies – no site visit	<input type="checkbox"/>	0
Escort and/or Avoidance Activities – (site visit, reconnaissance, sediment sampling, develop wells, perform O&M, land survey, area preparation, design work, etc.)	<input type="checkbox"/>	1
Construction Support – Direct Push, Trenching, Excavation, Soil Sifting, Insitu-treatment, Demolition, Land Clearing/grubbing etc.)	<input type="checkbox"/>	2
Demilitarization/ MPPEH/ Blasting/ Removal Action	<input type="checkbox"/>	3
Demining, Improvised Explosive Devices (IED)	<input type="checkbox"/>	4
Demining, Improvised Explosive Devices (IED)	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: <div style="background-color: #00bfff; height: 15px; width: 100%;"></div>		

17.C2 Is “over water” (on boat, bridge, etc.) work required?		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Unknown	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: <div style="background-color: #00bfff; height: 15px; width: 100%;"></div>		

17.C3 Type of Munitions Constituents (MC) contaminated soil and/or groundwater		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Low concentrations of explosives measured in ppb/ppm.	<input type="checkbox"/>	1
High Concentrations of explosives measured in ppb/ppm.	<input type="checkbox"/>	2
High Concentrations of explosives measured in ppb/ppm - No explosive hazard.	<input type="checkbox"/>	3
Soil with 5% to 10% Energetic Material by Weight - Initiation Hazard.	<input type="checkbox"/>	4
Soil with >10% Energetic Material by Weight - Explosive Hazard.	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: <div style="background-color: #00bfff; height: 15px; width: 100%;"></div>		

17.C4 Type of munitions demilitarization.

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Discarded Military Munitions (DMM).	<input type="checkbox"/>	1
MEC Unfuzed.	<input type="checkbox"/>	2
MEC Fuzed (BIP)	<input type="checkbox"/>	3
MD	<input type="checkbox"/>	4
Deteriorated material.	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

17.C5 Are we to submit an Explosives Siting Plan (ESP), Explosive Safety Submission (ESS) for the Client? (CSS for RCWM).

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
No	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
Yes	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

17.C6 Is the Munitions Response Area (MRA) secured?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

17.C7 Self Performance?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Avoidance Support	<input type="checkbox"/>	0
Vegetation Removal	<input type="checkbox"/>	1
Geophysical Survey	<input type="checkbox"/>	2
Investigaton/MPPEH Processing	<input type="checkbox"/>	3
Removal	<input type="checkbox"/>	4
Demolition	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:

PART D:

Controlled Detonation Chamber (CDC) Project Questions

17.D1 Type of MEC Hazard		
Which factor best describes this risk factor?	Check (x)	Point Value
Small Arms Ammunition < 0.50 cal.	<input type="checkbox"/>	0
Demilitarization	<input type="checkbox"/>	1
MEC/MPPEH/Bulk Explosives	<input type="checkbox"/>	3
Fireworks/pyrotechnics	<input type="checkbox"/>	4
Chemical Warfare Materiel (CWM)	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		

17.D2 Quality and Completeness of Inventory		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Inspection and Verification by CH2M HILL.	<input type="checkbox"/>	1
Inspection/Certification/Verification by Others	<input type="checkbox"/>	3
Client Statement.	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		

17.D3 MEC/MPPEH		
Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Meets CDC ESS limitations	<input type="checkbox"/>	1
CWM	<input type="checkbox"/>	3
Munitions requiring disassembly (i.e., water cutting, etc.)	<input type="checkbox"/>	5
RISK MANAGEMENT STRATEGY: [Redacted]		

17.D4 Will CH2M HILL provide CDC operator services?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:
[Redacted]

17.D5 If CDC leased to Owner, will CH2M HILL train Client operators?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:
[Redacted]

17.D6 Will Owner accept CH2M HILL rejection of MEC deemed unsuitable for CDC destruction?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:
[Redacted]

17.D7 Are all items of type, size and condition previously destroyed in CDC?

Which factor best describes this risk factor?	Check (x)	Point Value
Not Applicable.	<input type="checkbox"/>	0
Yes.	<input type="checkbox"/>	1
Don't Know	<input type="checkbox"/>	3
No.	<input type="checkbox"/>	5

RISK MANAGEMENT STRATEGY:
[Redacted]



Explosives Usage and Munitions Response (MR)
Standard Operating Procedure HSE-610

Attachment 3: Glossary, Acronyms, and Abbreviations

Active munitions inventory (or stockpile): The supply of chemical and conventional military munitions that is available for issue and use for combat, training, demonstrations, research, development, testing, or evaluation. (See **munitions stockpile** and **demilitarization inventory**.)

Active range: An operational military range that is currently in service and being regularly used for training, demonstrations, research, development, testing, or evaluation.

AEDA: ammunition, explosives, and dangerous articles.

Anomaly avoidance: Techniques employed by EOD or UXO personnel at sites with known or suspected MEC to avoid any potential surface MEC or subsurface anomalies. This usually occurs at mixed-hazard sites when HTRW investigations must occur before an MEC removal action is executed. Intrusive anomaly investigations are not authorized during MEC avoidance operations.

Anomaly: Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and nonferrous material at a site.

AP: armor piercing: Munitions that may or may not contain HE and are designed to penetrate hard targets.

APERS: antipersonnel munitions: May be loaded with high explosives or incendiary fillers and are designed to kill, wound, or obstruct personnel.

APT: armor-piercing tracer: Munitions, designed to penetrate hard targets, that contain a pyrotechnic element that produces bright light and/or smoke to aid in visual tracking of the munitions in flight.

ATV: all-terrain vehicle.

Authorized Visitors: Government or contractor personnel conducting project or mission related functions, e.g., Quality Assurance Representatives (QAR's) safety and quality inspectors (including geophysicists performing quality assurance functions) and project management. Authorized visitors must be escorted while in the EZ and be approved for entry into the EZ. No more than two visitors will be permitted in the EZ at any one time.

BD: base detonating: Impact fuze designed to function when the projectile comes in contact with the surface of the target. The fuze is located in the base or tail of the munitions.

bgs: below ground surface.

BRAC: Base Realignment and Closure.

CAD: cartridge-actuated device: An explosive device designed to produce gas pressure to expel or eject an item.

Cal: caliber: The diameter of a projectile or the bore of a weapon (i.e., .50-cal, 3-inch, 90-millimeter).

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act.

Chemical Warfare Materiel (CWM): An item configured as ammunition, containing a chemical substance intended to kill, seriously injure, or incapacitate a person through its physiological effects. Also includes V- and G-series nerve agents, H-series blister agent, and lewisite in other-than-munitions configurations. Due to their hazards, prevalence, and military-unique application, chemical agent identification sets (CAIS) are also considered CWM. CWM does not include riot control agents, chemical herbicides, smoke- and flame-producing items, or soil, water, debris, or other media contaminated with a chemical agent.

Closed range: A military range that has either been taken out of service as a range and has been put to new uses that are incompatible with range activities, or that is no longer considered to be a potential range area. A closed range is still under the control of a DOD component.

Construction support: Support provided by qualified UXO personnel during construction activities at potential MR sites to ensure the safety of construction personnel from the harmful effects of MEC. When it is determined that the probability of encountering MEC is low (current or previous land use leads to a determination that MEC may be present), a two-person UXO team will stand by in case the construction contractor encounters a suspected MEC. When it is determined that the probability of encountering a MEC is moderate to high (current or previous land use leads to a determination that MEC was employed or disposed of in the parcel of concern, e.g., open burn and open detonation areas), UXO teams are required to conduct subsurface MEC clearance for the known construction footprint, either in conjunction with the construction contractor or before construction.

Controlled Detonation Chamber (CDC): The CDC is a system for controlled detonation of MEC and MEC-related materials. It is capable of repeated controlled detonations of a suite of energetic materials that are currently demilitarized by OB/OD. This offers the DOD an alternative to OB/OD while at the same time increasing throughput, efficiency, and safety and controlling air, soil, water, and noise pollution. The CDC system meets all state and federal air discharge regulations.

CQC: Contractor Quality Control.

CTT: closed, transferring, and transferred (refers to a subset of military ranges).

DAC: Defense Ammunition Center.

DDESB: Department of Defense Explosives Safety Board.

DERP: Defense Environmental Restoration Program.

Demilitarization (“demi”): The process that removes the military characteristics from unused munitions that are either unsuitable for continued storage, excess to DOD needs, or

about to be released from DOD control. Demilitarization applies equally to munitions in unserviceable or serviceable condition. Used (i.e., fired) munitions items also sometimes undergo demilitarization. There are many demilitarization methods, such as recovery, recycling, remanufacture, disassembly, reclamation, mutilation, alteration, melting, burning, detonating, destruction, treatment, and disposal. Methods involving R3 currently constitute approximately two-thirds of the DOD demilitarization programs.

Demilitarization (demil) inventory: The demilitarization inventory consists of excess, obsolete, and unserviceable munitions. Munitions are moved from the active inventory to the demilitarization inventory after it is determined that they are not economically repairable, they are obsolete, or they are excess to DOD needs and cannot be sold under the Foreign Military Sales program. (Also see **active munitions inventory** and **munitions stockpile**.)

DENIX: Defense Environmental Network and Information Exchange.

Department of Defense Components: The Office of the Secretary of Defense, the Military Departments and Services, the Joint Staff, the Unified and Specified Combatant Commands, the Defense Agencies, the DOD Field Activities, and the National Guard.

Department of Defense Explosives Safety Board (DDESB): A Joint Service board comprising a chairperson, voting representatives from each of the Armed Services, and a permanent military and civilian secretariat to perform operational and administrative functions. The DDESB provides impartial and objective advice to the Secretary of Defense and DOD components on explosives safety matters. (See DOD 6055.9-STD for a detailed assignment of DDESB functions.)

DGPS: differential global positioning system.

Discarded Military Munitions (DMM): Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2))

DLA: Defense Logistics Agency.

DMM: discarded military munitions.

DOD: U.S. Department of Defense.

DODD: Department of Defense Directive.

DODIG: Department of Defense Inspector General.

DOI: U.S. Department of Interior.

DRMO: Defense Reutilization and Marketing Office.

DRMS: Defense Reutilization and Marketing Service.

EBS: environmental baseline survey.

Emergency Response (to munitions- or explosives-related or UXO emergencies): An immediate response by explosives and munitions emergency response personnel (i.e., DOD EOD personnel) to control, mitigate, or eliminate the actual or potential threat encountered during an explosives or munitions emergency. The response action may include in-place or on-site render-safe procedures, treatment, or destruction of the explosives or munitions or their transport to another location where these operations may be conducted. (See 40 CFR Part 260 et seq., the Military Munitions Rule.)

Energetic material: A component or item of ammunition that is designed to produce the necessary energy required for ignition, propulsion, detonation, fire, or smoke, thus enabling the item to function. Also a material (e.g., corrosive or oxidizer) that is inherently dangerous and capable of causing serious damage and that requires regulated handling to avoid accidents in connection with its existence and use.

EOD: Explosive Ordnance Disposal.

EPA: U.S. Environmental Protection Agency.

EPCRA: Emergency Planning and Community Right-to-Know Act.

ERGM: extended-range guided munitions.

ESCA: Environmental Services Cooperative Agreement.

ESOH: Environmental, Safety, and Occupational Health.

ESOHPB: Environmental, Safety, and Occupational Health Policy Board.

Essential personnel. Personnel whose duties require them to remain within an ESQD arc for one or more of the following reasons:

- a. Government and project personnel necessary for the safe and efficient completion of field operations conducted in an EZ. This is limited to: contractor work teams members including the Unexploded Ordnance (UXO) Safety Officer (UXOSO), UXO Quality Control Specialist, Senior UXO Supervisor and a USACE Ordnance and Explosives (OE) Safety specialist.
- b. Personnel not UXO qualified must be identified in the work plan by name and/or position.

ESTCP: Environmental Security Technology Certification Program.

Exclusion Zone (EZ): A safety zone established around an MR work area. Only project personnel and authorized, escorted visitors are allowed within the EZ. Examples of EZs are safety zones around MEC-intrusive activities and safety zones where MEC is intentionally detonated. (See DDESB-KO, 27 January 1990.)

Explosive Equivalent. The amount of a standard explosive which, when detonated, will produce a blast effect comparable to that which results at the same distance from the detonation or explosion of a given amount of the material for which performance is being evaluated. It is usually expressed as a percentage of the total net weight of all reactive materials contained in the item or system. For the purpose of this manual, TNT is used for comparison.

Explosive Ordnance Disposal (EOD): Includes detecting, identifying, field evaluating, rendering safe, and final disposing of MEC.

Explosive Ordnance Disposal (EOD) Personnel: Military members who have graduated from the Naval School, EOD. They have received highly specialized training to provide time-critical MEC hazard mitigation services during both peacetime and wartime. EOD personnel are trained and equipped to perform render-safe procedures (RSP) on nuclear, biological, chemical, conventional, and improvised explosive devices. (Note that EOD personnel are distinguished from UXO Technicians, who are civilian contractor or government personnel with specialized training and qualifications in the long-term remediation of MEC.)

Explosive Safety Quantity Distance (ESQD): The prescribed minimum distance between sites storing or handling hazard Class 1 explosive material and specified exposures (i.e., inhabited buildings, public highways, public railways, other storage or handling facilities, or ships, aircraft, etc.) to afford an acceptable degree of protection and safety to the specified exposure. The size of the ESQD arc is proportional to the NEW present.

Explosive Safety Submission (ESS): The document that serves as the specifications for conducting work activities at the project. The ESS details the scope of the project, the planned work activities, potential hazards, and the methods for their control.

Explosive Siting Plan (ESP): The document that serves as a DDESB Permit approving the site-specific storage locations, quantities, and safe distances for explosive operations.

Explosive soil: Mixtures of explosives in soil, sand, clay, or other solid media at concentrations such that the mixture itself is explosive. The following also defines an explosive soil: The concentration of a particular explosive in soil necessary to present an explosion hazard depends on whether an explosive is classified as “primary” or “secondary.” Primary explosives are those extremely sensitive explosives (or mixtures thereof) that are used in primers, detonators, and blasting caps. They are easily detonated by heat, sparks, impact, or friction. Examples of primary explosives include lead azide, lead styphnate, and mercury fulminate. Secondary explosives are bursting and boosting explosives (i.e., they are used as the main bursting charge or as the booster that sets off the main bursting charge). Secondary explosives are much less sensitive than primary explosives. Soil containing 10 percent or more by weight of any mixture of secondary explosives is considered “explosive soil.” Soil containing propellants (as opposed to primary or secondary high explosives) may also present explosion hazards.

°F: degrees Fahrenheit.

FAR: Federal Acquisition Regulations.

FFA: Federal Facilities Agreement.

FFCA: Federal Facilities Compliance Act.

FOST: finding of suitability to transfer.

Frag: fragment or fragmentation: Munitions material projected away from the point of detonation at a high velocity.

Free from explosive hazard: Material that has been inspected for explosives and determined not to present a danger of explosion or combustion from explosive or energetic materiel.

FUDS: formerly used defense site.

GIS: geographic information system.

GPS: global positioning system.

Hazardous waste: A solid waste that meets the following criteria: (1) is or contains a hazardous waste listed in 40 CFR Part 261, or (2) exhibits characteristics of ignitability, corrosivity, reactivity, and/or toxicity. (Refer to 40 CFR § 261.3 for further explanation.)

HE: high explosive: Explosive that normally detonates rather than burns.

HEAT: high-explosive antitank: Munitions designed to defeat armor by the use of a shaped charge.

HEI: high-explosive incendiary: High-explosive-filled munitions with additional ingredients to give a fire-producing effect.

HQMC: Headquarters, U.S. Marine Corps.

ICM: improved conventional munition.

Impact area: The identified area within a range intended to capture or contain ammunition, munitions, or explosives and resulting debris, fragments, and components from various weapon system employments. In simple terms, normally the target area where live-fire rounds or bombs impact the earth.

Improved Conventional Munition (ICM): ICMs or submunitions, cluster bombs, and cargo rounds are considered sensitive-fuzed munitions and require special authority to enter contaminated areas.

Inactive range: An operational military range that is not currently being used but is still under military control, and which the military both considers to be a potential range area and has not put to a new use that is incompatible with range activities. A potential range area is defined as meeting one of three criteria:

- (1) Mobilization and force projection: ranges that are held by a DOD component for the purpose of preparing individuals and units for worldwide deployment, redeployments, or demobilization in response to war, stability, and support operations or projected training requirements that would exceed current active range capabilities;
- (2) Force structure: ranges held as inactive during realignment, reorganization, stationing, or reequipping of units projected to use these ranges under new training requirements; or
- (3) Future: ranges that are held by DOD components for future use in support of National Security Policy or DOD component doctrine that ensures the capability to produce, establish, and maintain conditions needed for operational success.

Inhabited Building Distance (IBD): The minimum distance permitted between an inhabited building and an ammunition or explosives location for the protection of

administration, quarters, industrial, and other similar areas within a naval shore establishment. Inhabited building distances shall be provided between ammunition or explosives locations and the boundary of a shore establishment of the nearest point beyond the boundary where such inhabited structures could be erected.

Integrated Training Area Management (ITAM): A U.S. Army program designed to improve range conditions by inventorying and monitoring land conditions, determining carrying capacity of the land in terms of the training requirements, and providing for land rehabilitation and maintenance measures.

Intentional detonation: An intentional detonation is a planned, controlled detonation.

Intrusive activity: An activity that involves or results in the penetration of the ground surface at an area known or suspected to contain MEC. Intrusive activities can be of an investigative or removal action nature.

IR: Installation Restoration.

ITAM: Integrated Training Area Management (a U.S. Army program).

JOCG: Joint Ordnance Commanders Group.

JUXOCO: Joint UXO Coordination Office.

MDAS: MPPEH that has been assessed and documented as not presenting an explosive hazard and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

MDEH: MPPEH that has been assessed and documented as to the explosive hazards the material is known or suspected to present and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

Material that Potentially Presenting an Explosive Hazard (MPPEH): Military munitions, including: their components; munitions packaging material; residues from research, development, testing, and evaluation (RDT&E), production, use (to include range scrap), operational and quality testing, or demilitarization of munitions; or any other materials, equipment, or facilities potentially contaminated with explosives. MPPEH includes both end items and residues derived from processing end-items within United Nations Organization (UNO) Hazard Class (HC). It also includes munitions-related items, pieces, models, training aids, etc., that are suspected but not confirmed to be wholly inert.

Maximum Credible Event (MCE): The worst single event that could occur at any time with maximum release of a chemical agent from a munition, container, or process as a result of an unintended, unplanned, or accidental occurrence.

MEC: munitions and explosives of concern. Distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded Ordnance (UXO), (B) Discarded military munitions (DMM), (C) Munitions Constituents (MC).

MIL SPECS/STDS: military specifications and standards.

Military Munitions (MM): All ammunition products and components produced or used by or for the DOD or the U.S. Armed Services for national defense and security, including

military munitions under the control of the DOD, the U.S. Coast Guard, the U.S. DOE, and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DOD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. It does not include: wholly inert items; improvised explosive devices; and nuclear weapons, devices, and components thereof. However, it does include nonnuclear components of nuclear devices, managed under DOE's nuclear weapons program after all required sanitation operations under the Atomic Energy Act of 1954, as amended, have been completed.

Military Range: A designated land or water area set aside, managed, and used to conduct research on, develop, test, and evaluate military munitions and explosives, or weapon systems, or to train military personnel in their use and handling. Ranges include firing lines and positions, maneuver areas, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas.

MLLW: mean lower low water.

Most Probable Event (MPE): The most likely event, as a result of an accidental, unplanned, or unintended detonation of an item of munitions, that could occur during MR activities. The event must be realistic, with reasonable probability of occurrence.

MPPEH: munitions that potentially presenting an explosive hazard.

MT: Mechanical time: fuzes designed usually for airburst. MT fuzes are located in the nose of the munition.

Munitions and Explosives of Concern (MEC): Military munitions that are UXO or have been abandoned, as defined in the EPA Munitions Rule. Also includes soil, facilities, equipment, or other materials contaminated with a high enough concentration of explosives that it presents an explosive hazard.

Munitions Constituents (MC): Any materials originating from military munitions, including explosive and/or non-explosive materials, and emission, degradation, or breakdown products. [The following additional explanation is offered for purposes of this SOP: Munitions constituents are the substances or chemical residues that result from the proper functioning or use of munitions (e.g., residues created and remaining in the soil, water, or air from the burning or explosion of energetic material) or that are present in MEC. Such constituents may or may not present an immediate risk of acute physical injury from fire or explosion resulting from accidental or unintentional detonation or ignition of MEC or energetic materials. Similarly, such constituents may or may not result in environmental contamination requiring a response (i.e., response action).]

Munitions Debris (MD): Metal fragments resulting from the intended use of munitions or detonations.

Munition with the Greatest Fragmentation Distance (MGFD). The munition with the greatest fragment distance that is reasonably expected (based on research or

characterization) to be encountered in any particular munition response area (MRA) or munitions response site (MRS).

Munitions Response Area (MRA): Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites.

Munitions Response Site (MRS): A discrete location within a MRA that is known to require a munitions response.

Munitions Rule Implementation Policy: Detailed guidance and procedures issued by the Services that explains how DOD will implement and comply with the EPA Military Munitions Rule.

Munitions stockpile: Munitions in the active and demilitarization inventories as well as unused waste munitions as defined in the EPA's Military Munitions Rule (MMR). (See **active munitions inventory** and **demilitarization inventory**.)

Munitions: see **military munitions**.

Net Explosive Weight (NEW): The actual weight of explosive mixture or compound including the TNT equivalent of other energetic material which is used in the determination of explosive limits and ESQD arcs.

Non-stockpile Chemical Warfare Materiel: CWM (defined above) that is not included in the chemical stockpile. Non-stockpile CWM is divided into five categories: (1) buried CWM; (2) recovered chemical weapons (items recovered during range clearing operations, from chemical burial sites, and from research and development testing); (3) former chemical weapon production facilities; (4) binary chemical weapons; and (5) miscellaneous CWM (unfilled munitions and devices and equipment specially designed for use directly in connection with employment of chemical weapons).

OB: open burn.

OCR: Office(s) of Collateral Responsibility.

OD: open detonation.

ODEP: Office of Defense Environmental Programs.

ODUSD (I&E): Office of the Deputy Under Secretary of Defense (Installations and Environment).

OE Safety Specialist: a USACE employee involved in the execution, supervision, or oversight of munitions-related activities inside the exclusion zone who has graduated from the U.S. Naval EOD School, Indian Head, MD. An OE Safety Specialist shall be on-site each day during intrusive and MEC destruction activities. The OE Safety Specialist is on-site to ensure that the contractor establishes the appropriate daily safety routines at the beginning of UXO field operations, to perform quality assurance oversight, to verify contractor employee UXO qualifications, to advise the contractor on UXO procedures, to coordinate with the PM, and to facilitate EOD response when needed.

OEESCM: Operational and Environmental Executive Steering Committee for Munitions.

Open Burn (OB): A controlled open-air process by which excess, unserviceable, and obsolete munitions are destroyed to eliminate their inherent explosives safety hazards. DOD OB units contain the munitions with pans or pads to minimize environmental contamination. DOD OB units are permitted as “miscellaneous units” in EPA’s environmental permitting process.

Open Detonation (OD): A process used for the treatment of unserviceable, obsolete, and/or waste munitions whereby an explosive donor charge initiates the munitions to be detonated. Although surface detonations can be performed under certain circumstances, most munitions are treated in 4- to 6-foot-deep pits for safety purposes. Most OD sites are permitted as miscellaneous units as part of the EPA environmental permitting process. DOD’s units are generally permitted as combined OB/OD facilities.

Operational range: A military range that is currently under military control and management; includes both active ranges (currently in service or use) and inactive ranges (not in current use or service).

OPR: Office(s) of Primary Responsibility.

OSD: Office of the Secretary of Defense.

OU: Operable Unit.

OUSD (AT&L): Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics).

PD: point detonating: impact fuze, designed to function when the projectile comes in contact with the surface of a target; located in the nose of the munition.

Potential Explosion Site (PES): The location of a quantity of explosives that will create a blast, fragment, thermal, and/or debris hazard in event of an accidental explosion of its contents. Quantity limits for ammunition/explosives at a PES are determined by the distance to an exposed site.

POL: petroleum, oil, and lubricants.

PPE: personal protective equipment.

Primer: Small, sensitive explosive component used as the first element in the explosive train.

Proj: projo or projectile: A weapon that is projected through a tube or barrel into the air toward a target.

PSE: preliminary source evaluation.

PTT: powder train time fuse: Fuses designed usually for airburst, normally used with illumination rounds to light up the battlefield.

QA: quality assurance.

QC: quality control.

Quantity-Distance (Q-D): the quantity of explosives material and distance separations that provide defined types of protection. These relationships are based on levels of risk

considered acceptable for the stipulated exposures and are tabulated in the appropriate Q-D tables provided in DOD 6055.9-STD. Separation distances are not absolute safe distances but are relative protective safe distances. Greater distances than those shown in the Q-D tables shall be used whenever possible.

R&D: research and development.

RAB: Restoration Advisory Board.

RAC: Remedial Action Contract.

Range clearance: An operation or procedure conducted to remove and properly dispose of munitions or munitions fragments. (e.g., MEC, “duds,” etc.). Several types or degrees of clearance may be conducted (e.g., surface clearance based on visual inspection of the surface; shallow clearance where an area is systematically swept with detectors – normally to a depth of 20-24 inches; etc.) Range clearance, though technically applicable to any range category (closed, transferred, active, etc.) is often considered as occurring only at active, operational ranges. Clearance operations at these active ranges are normally conducted as part of range maintenance activities to maintain or enhance operational safety conditions at the range facility. Even though it is possible for MEC to cause environmental contamination (pollution of soil, surface water, groundwater, etc., from the chemical constituents present in munitions), range clearance is focused on removing and safely disposing of munitions items or fragments – not the removal or treatment of any chemical residues or constituents from the munitions or associated environmental contamination. Cleanup of environmental contamination or pollution is normally achieved by removal or remedial actions.

Range: see **military range**.

RCRA: Resource Conservation and Recovery Act.

RCWM: recovered chemical warfare material.

RDT&E: research, development, test, and evaluation.

Regional Environmental Coordinator (REC): A senior military officer or DOD civilian assigned to one of ten EPA regions who is responsible for the dissemination of information and coordination of environmental matters and public affairs among military installations and environmental regulatory organizations within their respective region. RECs have a liaison role and fully adhere to the Services’ chain of command.

Remedial Action/RRemoval Action process: Longer-term activities that complete the cleanup of contamination (or a contaminated site or location) if a removal action has not achieved or cannot achieve the required degree of cleanup for the contamination problem. A distinction is sometimes made between the control or cleanup measures to be implemented, which are called “remedial actions,” and the identification, evaluation, decision-making, and design and construction steps required to implement the control measures. These steps collectively are called the “remedial action process.”

Removal Action(s): Relatively quick actions designed to address imminent threats to human health and the environment posed by releases or spills of hazardous substances. Removals should satisfy one or more of the following tests:

- (1) **Imminent threat:** the site or situation poses an imminent threat to public health.
- (2) **Source control:** the removal action either removes the source of contamination off-site or effectively contains it on-site so that continuing releases to the environment are prevented or reduced.
- (3) **Access limitation:** the removal action substantially reduces the possibility of human exposure to hazardous substances. The EPA has categorized removal actions as emergency, time-critical, and non-time-critical. Each of these categories possesses its own criteria and procedural requirements.

Resource recovery and recycling (R3): Technologies and processes used by DOD to demilitarize military munitions. These include reuse, sale “as is” (e.g., Foreign Military Sales), conversion to a commercial product for sale or industrial use, or disassembly, modification, and partial or whole use for a military application.

Response(s) or Response Action(s): Responses or response actions are broadly defined in environmental law and regulations as any scientific or engineering investigation, evaluation, decision-making, design, or implementation step taken in response to (i.e., to clean up) a release or spill of hazardous substances. Removals and remedial actions (or remedial action processes) are subcategories of response actions. Procedural requirements (established in environmental regulations) for these two types of actions differ substantially, but their definitions are almost as broad as for “responses,” allowing the terms to be used almost interchangeably. The various terms are best defined by the procedural requirements imposed on them by the applicable environmental regulations.

RI/FS: remedial investigation/feasibility study.

ROD: Record of Decision.

Senior UXO Supervisor (SUXOS): Supervises all contractor on-site UXO activities. This individual must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, or the U.S. Naval EOD School, Indian Head, MD. Must have at least 10 years of combined active-duty military EOD and contractor UXO experience, to include at least 5 years in supervisory positions.

SERDP: Strategic Environmental Research and Development Program.

SHPO: State Historic Preservation Officer.

Single Manager for Conventional Ammunition (SMCA): A DOD executive agent responsibility performed by the U.S. Army Operations Support Command. The Secretary of the Army is DOD’s SMCA. The U.S. Army OSC is the day-to-day operator of the SMCA and serves as the central program manager for the execution of most of DOD’s demilitarization requirements. The objectives and responsibilities of the SMCA can be found in DOD Directive 5160.65.

Sustainable Range Management: Management of a military range in a manner that supports national security objectives and maintains the operational readiness of the Armed Forces and ensures the long-term viability of the range while protecting human health and the environment. [The following additional explanation is offered for purposes of this SOP:

A comprehensive DOD approach that develops and implements the policies, plans, practices, and procedures necessary to achieve sustainable ranges. Sustainable ranges are managed and operated in a manner that supports their long-term viability and utility to meet the national defense mission. Sustainable ranges will implement the planning, management, coordination, and public outreach necessary to ensure viable continuity of test and training operations and long-term coexistence with neighboring communities and natural ecosystems.]

Sustainable use: Actions taken to ensure that ranges maintain the ability to conduct training, research, development, testing, and evaluation of munitions in support of the national defense mission while minimizing adverse effects to human health and the environment.

SUXOS: Senior UXO Supervisor.

SWMU: solid waste management unit.

TNT equivalent: Considering the peak overpressure produced by detonation of a given weight of TNT as 100 percent, the TNT equivalency of an explosive is the amount of overpressure produced by detonation of an identical quantity of propellant under comparable conditions, expressed as a percentage.

Transferred range: A military range that is no longer under the control of a DOD component and has been leased, transferred, or returned to another entity (including other federal, non-DOD entities) for use.

Transferring range: A military range that is proposed to be leased or transferred from DOD to another entity or disposed of by conveying title to a non-federal entity. An active range will not be considered a “transferring range” until the transfer is imminent.

TRI: Toxic Release Inventory (required by the EPCRA).

Unexploded ordnance (UXO): Military munitions that have been primed, fuzed, armed, or otherwise prepared for use and that have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or materiel and that remain unexploded by malfunction, design, or any other cause. UXO presents an immediate risk of acute physical injury from fire or explosion resulting from accidental or unintentional detonation.

Unintentional detonation: A detonation not planned in advance.

USACE: U.S. Army Corps of Engineers.

Used or fired military munitions: Those military munitions that meet the following criteria: (1) have been primed, fuzed, armed, or otherwise prepared for use, and have been fired, dropped, launched, projected, placed, or otherwise used; (2) munitions fragments, (e.g., shrapnel, casings, fins, and other components, to include arming wires and pins) that result from the use of military munitions; or (3) malfunctions or misfires (e.g., fail to properly fire or detonate).

USFWS: U.S. Fish and Wildlife Service.

USGS: U.S. Geological Survey.

UST: underground storage tank.

UTM: Universal Transverse Mercator.

UXO: unexploded ordnance.

UXO personnel: Contractor personnel who have completed specialized military training in EOD methods and have satisfactorily performed the EOD function while serving in the military. Various grades and contract positions are established based on skills and experience.

UXO Quality Control Specialist (UXOQCS): Contractor personnel with the responsibility of enforcing the contractor's Quality Control Program for all MR-related evolutions; conducting quality control inspections of all UXO and explosives operations for compliance with established procedures; and directing and approving all corrective actions to ensure that all MR-related work complies with contractual requirements.

UXO Safety Officer (UXOSO): Contractor personnel with the responsibility of enforcing the contractor's SSHP. This individual must, therefore, be in the field whenever possible to observe operations. Must have the same minimum qualifications as the UXO Technician III. In addition, must have the specific training, knowledge, and experience necessary to implement the SSHP and verify compliance with applicable safety and health requirements.

UXO Technician II: must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; the U.S. Naval EOD School, Indian Head, MD; U.S. Naval EOD School, Eglin AFB, FL; or a DOD-equivalent certified course. Must have a minimum of five years of military EOD or contractor UXO experience.

UXO Technician III: supervises a UXO team. Must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; the U.S. Naval EOD School, Indian Head, MD; U.S. Naval EOD School, Eglin AFB, FL; or a DOD-equivalent certified course. This individual must have a minimum of ten years of military EOD or contractor UXO experience.

UXO: unexploded ordnance.

UXOQCS: UXO Quality Control Specialist.

UXOSO: UXO Safety Officer.

Waste Military Munitions: A military munition that is a solid waste per 40 CFR §266.202. Such a waste military munition may also be a hazardous waste if it meets the definition found in 40 CFR §261.3. Waste munitions are hazardous wastes when they exhibit the hazardous waste characteristic of ignitability, corrosivity, reactivity, or toxicity, or are listed as hazardous wastes.

WP: white phosphorus: A screening smoke that burns on contact with air and can be used as an incendiary.



Explosives Usage and Munitions Response (MR)
Standard Operating Procedure HSE-610

Attachment 4: Explosives Management Check List

Date	Check List Item	PM Date Completed	MR Ops Review Date	MR QC NTP Date
	Contract Terms and Conditions			N/A
	Scope of Work			N/A
	Completed: Opportunity Risk Evaluation (ORE), Paragraph 17 MR Projects and CDC Projects			
	Explosive Management Plan (*)			
	Explosive Siting Plan (*)			
	Obtain State/local (if required) Explosive Permit* for CH2M HILL to use high explosives within the state and or local jurisdiction.			
	Obtain State/local (if required) Permit* for CH2M HILL to site explosives magazine within the state and or local jurisdiction.			
	Identify CH2M HILL HILL HILL licensed Blaster* (if self-performing)			
	CH2M HILL ATF&E "Request to Order Explosives" form for Review and obtain authorization signature of ATF Permittee			
	Original signature of ATF&E Type 20 Explosives Manufacture License* from CH2M HILL License Holder			
	"Authorization Letter*" identifying "Responsible Persons" and "Possessor of Explosives" that are authorized to order, receive, store, and use explosives under the CH2M HILL ATF&E Type 20 Explosives Manufacturer License			
	Vender Identified by contracting (If sole source - justification is required)			N/A
	Vender required to provide a copy of their ATF&E License* to CH2M HILL ATF&E files			
STOP!!! MANDATORY MUNITIONS RESPONSE QC CHECK				
	Purchase Order* provided to vender with a copy of ATF&E Type 20 Manufacturer of High Explosives License, with endorsement			

Date	Check List Item	PM Date Completed	MR Ops Review Date	MR QC NTP Date
	Purchase Order* provided to vender with Authorization Letter for Responsible Persons and Employee Possessor of Explosives			
	Award the purchase order to the selected vender - - Hold authorization for Vendor to ship explosives			
	Notify Vendor of CH2M Possessor of Explosives authorized to receive explosives at the project site, telephone number and address of receiving location			
	Vender accepts purchase order and holds for contracting release of explosives shipment			
	Vender identifies carrier and provides a shipment schedule with copy of manifest* to CH2M HILL contracting and contracting notifies the Project Manager			
	Establish Explosives Storage Area (Security, Lightening Protection, Grounding)			
	Schedule State and or local jurisdiction site inspection for "Explosive Storage" (Magazines) if required.			
	Magazine storage area inspected and approved* for storage by local jurisdictions (if required).			
	CH2M HILL contracting notifies vender to release explosives shipment			
	Notify ATF&E servicing office for CH2M HILL ATF&E License*, local ATF&E office*, and local jurisdictions* of storage of explosives and provide an Explosives Siting Plan that includes ATF Form 5400.13/5400.16, Explosives Storage Magazine Description Worksheet* (as required).			
	Post CH2M HILL ATF&E Type 20 License on the project site			
	CH2M HILL "Responsible Person" or Possessor of Explosives" person receives shipment (presents identification to transporter, verifies manifest, and inventories shipment to ensure accuracy between purchase order and manifest. Discrepancies should be resolved IAW the project Explosive Management Plan)			
	Explosive materials are properly inventoried (date shift codes, acquisition dealer, license address, POC), and stored IAW project Explosives Management Plan			
	Material Safety Data Sheets (MSDS) for explosives materials are on-site			

Date	Check List Item	PM Date Completed	MR Ops Review Date	MR QC NTP Date
	Magazine Data Cards (Daily Summary of Magazine Transactions*) are completed and maintained IAW project Explosives Management Plan			
	Magazine has two mortise type 5 (or equivalent) pin high security locks			
	Security Checks conducted a minimum of every 72 hours and documented or IAW work plan approved methods*			
	Responsible person or possessor of explosives has control of keys to magazines (IAW local procedures).			
	Daily Usage (Shot) Log* maintained for expenditure of explosive materials including target materials			
	Weekly inventories of all explosives materials conducted and documented*			
	PM to notify local jurisdictions and ATF&E offices when explosives materials are no longer being stored*			
	*Project Manager to provide to the ATF&E License Holder completed purchase orders, manifest documents, inventories, magazine data cards, usage logs, and any other associated information for ordering, storage and use of explosives material along with an end user certification that all explosives materials have been accounted for.			
	MR Safety Officer shall conduct a quality control audit of the project explosives management plan with ATF&E requirements and report on the conformance of the Project Manager & License Holder.			
	* Indicates documents that upon completion of project will be forwarded to the License Holder and copy to Safety Office			

REQUEST to ORDER EXPLOSIVES		
Instructions: Enter information for the procurement of one (1) Explosive Class/Product Trade Name per request form.		
Block 1.	Block 2.	Block 3.
Project Name	Project Number	Date of Request mm/dd/yyyy
Block 4.	Block 5.	Block 6.
Project Manager (First, Middle, Last)	Office Location/Symbol	Project Manager Telephone Number
Block 7.	Block 8.	Block 9.
Delivery Date mm/dd/yyyy	Delivery Address	Delivery Telephone Number
Street		Block 10.
City		Receiving Person (First, Middle, Last)
County/province		
State		Block 11.
Postal Code		Receiving Person Telephone Number
Country		
Block 12.	Block 13.	Block 14.
Vendor/Supplier/Organization	Vendor ATF License	Vendor ATF License
Block 15.	Block 16.	Block 17.
Vendor/Supplier/Organization		Vendor Telephone Number
Street		
City		Block 18.
County/province		Vendor Point of Contact Person
State		
Postal Code		Primary Tel. #:
Country		2nd Tel.#:
Block 19.	Block 20.	Block 21.
Product Trade Name	Product Unit of Issue (EA, LB, FT, RL,BX)	Product Quantity Requested (Number)
Block 22.	Block 23.	Block 24.
Vendor Lot Number	Vendor Date Shift Code	Vendor MSDS Product Name
Block 25.	Block 26.	Block 27.
DOT EX Number	UN Number	DOT Hazard Class/Division
Block 28.	Block 29.	Block 30.
Estimated Product Cost	Estimated Shipping Cost	Estimated Total Cost
AUTHORIZATION FOR PURCHASING TO ORDER EXPLOSIVES		
ATF Licensee Signature		
Date		

SOP UXO Contacts

Name	Title	Office
Ben Redmond	MR Market Segment Director	KNV
George DeMetropolis	MR Western Region MR Market Segment Manager	SDO
Brint Bixler	MR Northeastern Region MR Market Segment Manager	WDC
Kyra Donell/KNV	MR Southeastern Region MR Market Segment Manager	KNV
Steve Romanow	MR Project Delivery Manager	WDC
Kevin Lombardo	MR Operations Manager	WDC
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Direct-Push Soil Sample Collection

I. Purpose

To provide a general guideline for the collection of soil samples using direct-push (e.g., Geoprobe®) sampling methods.

II. Scope

Standard direct-push (e.g., Geoprobe®) soil sampling methods.

III. Equipment and Materials

- Truck-mounted hydraulic percussion hammer
- Sampling rods
- Sampling tubes and acetate liners
- Pre-cleaned sample containers and stainless-steel sampling implements
- Personal Protective Equipment as specified by the Health and Safety Plan

IV. Procedures and Guidelines

1. Decontaminate sampling tubes and other non-dedicated downhole equipment in accordance with *SOP Decontamination of Personnel and Equipment*.
2. Drive sampling tube to the desired sampling depth using the truck-mounted hydraulic percussion hammer. If soil above the desired depth is not to be sampled, first drive the lead rod, without a sampling tube, to the top of the desired depth.
3. Remove the rods and sampling tube from the borehole and remove the sampling tube from the lead rod.
4. Cut open the acetate liner using a specific knife designed to slice the acetate liners (see below).



5. Fill all sample containers, beginning with the containers for VOC analysis, using a decontaminated or dedicated sampling implement. For the VOC samples, place the sample into a pre-preserved VOA vial or direct sample container such as an **En Core®** sampler and seal the cap tightly. Ideally, the operation should be completed in one minute. Label the vials and place on ice for shipment to the laboratory.
6. Decontaminate all non-dedicated downhole equipment (rods, sampling tubes, etc.) in accordance with *SOP Decontamination of Personnel and Equipment*.
7. Backfill borehole at each sampling location with grout or bentonite and repair the surface with like material (bentonite, asphalt patch, concrete, etc.), as required.

V. Key Checks and Items

1. Verify that the hydraulic percussion hammer is clean and in proper working order.
2. Ensure that the direct-push operator thoroughly completes the decontamination process between sampling locations.
3. Verify that the borehole made during sampling activities has been properly backfilled.

Attachment 2
Data Management Guidelines

Version 1

Navy CLEAN Data Management Plan

Prepared for
Navy CLEAN & Joint Venture Programs

June 2009

CH2MHILL

Preface

This document presents the standardized six-step workflow process for environmental data management being performed for the Navy Comprehensive Long-Term Environmental Action - Navy (CLEAN) and Joint Venture Programs. Included in Appendix A is the responsible, approve, support, consult, and inform (RASCI) diagram along with the associated roles and responsibilities, which is the basis for the Navy CLEAN and Joint Venture Programs Data Management Plan (DMP). Following are the six steps in the workflow process:

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation and loading
5. Data management
6. Data evaluation and reporting

Figure P-1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs. The various steps in the flow process are numbered 1 to 26. Figure P-2 presents, in more detail, the tools used in each step of the process.

Appendix B contains a data flow diagram that outlines the tools that used to help collect data for all program and project activities. CH2M HILL uses the Sample Tracking Program (STSP) to initiate the sample collection, documentation, and tracking processes. During the laboratory analysis and data validation phase, the CH-Analyzer and Validation Data Management System (VDMS) software will be used to help evaluate the quality of the data. At the data management step, the CH-ERPTool will be used to format the data and the CH-IMPTool will be used to transfer the data into the Navy CLEAN data warehouse. At the data evaluation stage, the XTabReports Tool will be used to query data from the data warehouse, and the Crosstab Cleanup Tool and RDE Formatting Tool will produce and format data tables and comparisons to project action levels. The Site Information Management System Visual Interface to the data warehouse is an application that is often used to access and query data. Appropriate section(s) of the DMP include additional details on each of the tools used.

Change Management

This DMP is a “living” document and content may be revised or amended to accommodate changes in the scope of environmental investigations or data management requirements that affect the entire Navy CLEAN Program. In addition, the DMP appendices will be subject to modification as new or improved methods of data management are developed and implemented.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user’s responsibility to conform to revised portions of the DMP.

Amendments will be versioned and released according to the following naming scheme: [Document Name_v#.#_yymmdd]. If a significant change is made to any of these files, the

version number will increase by one integer. The revision history is shown in the following table.

REVISION HISTORY

Navy CLEAN and Joint Venture Programs Data Management Plan

Revision Date	Initiator	Purpose

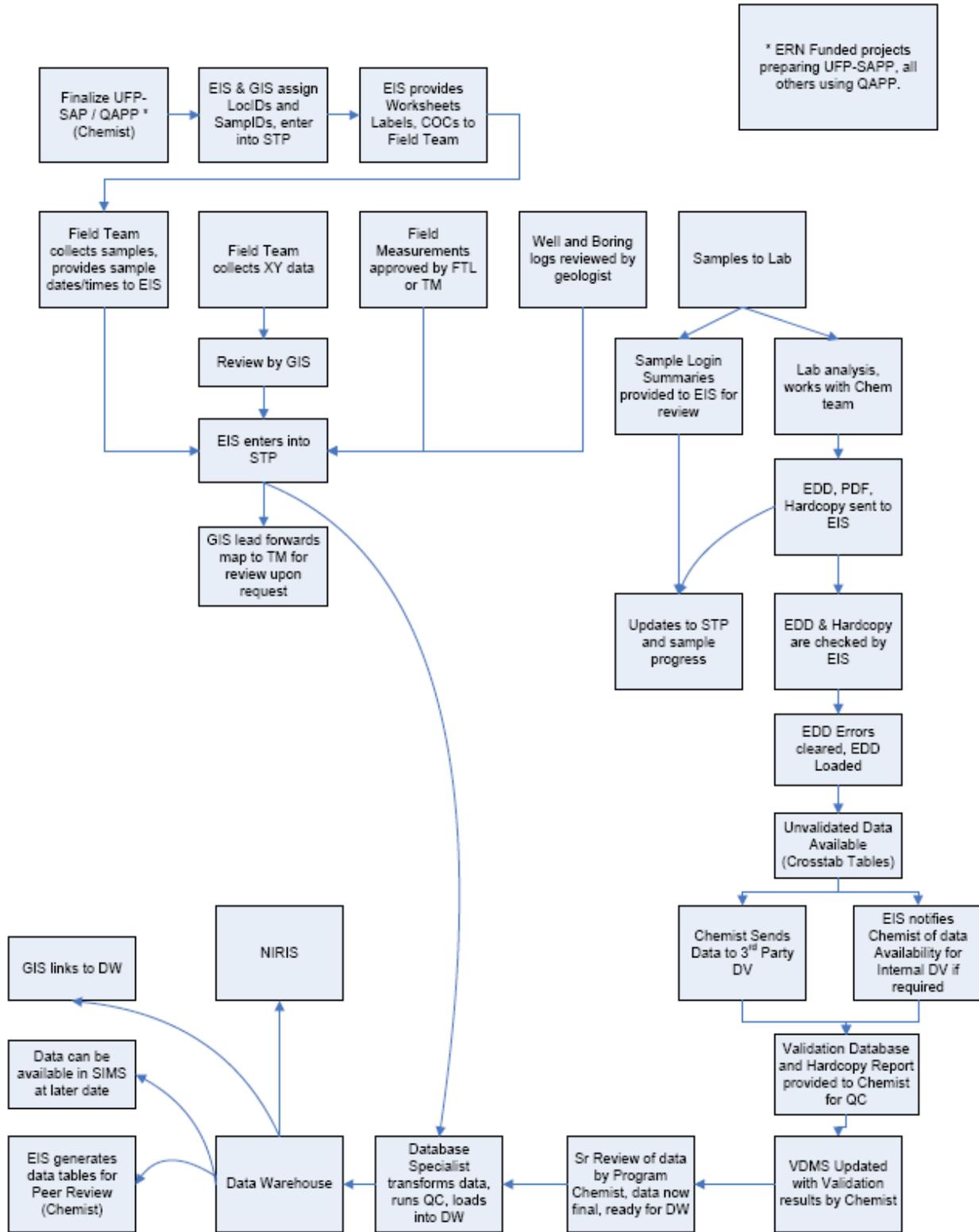


FIGURE P-1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

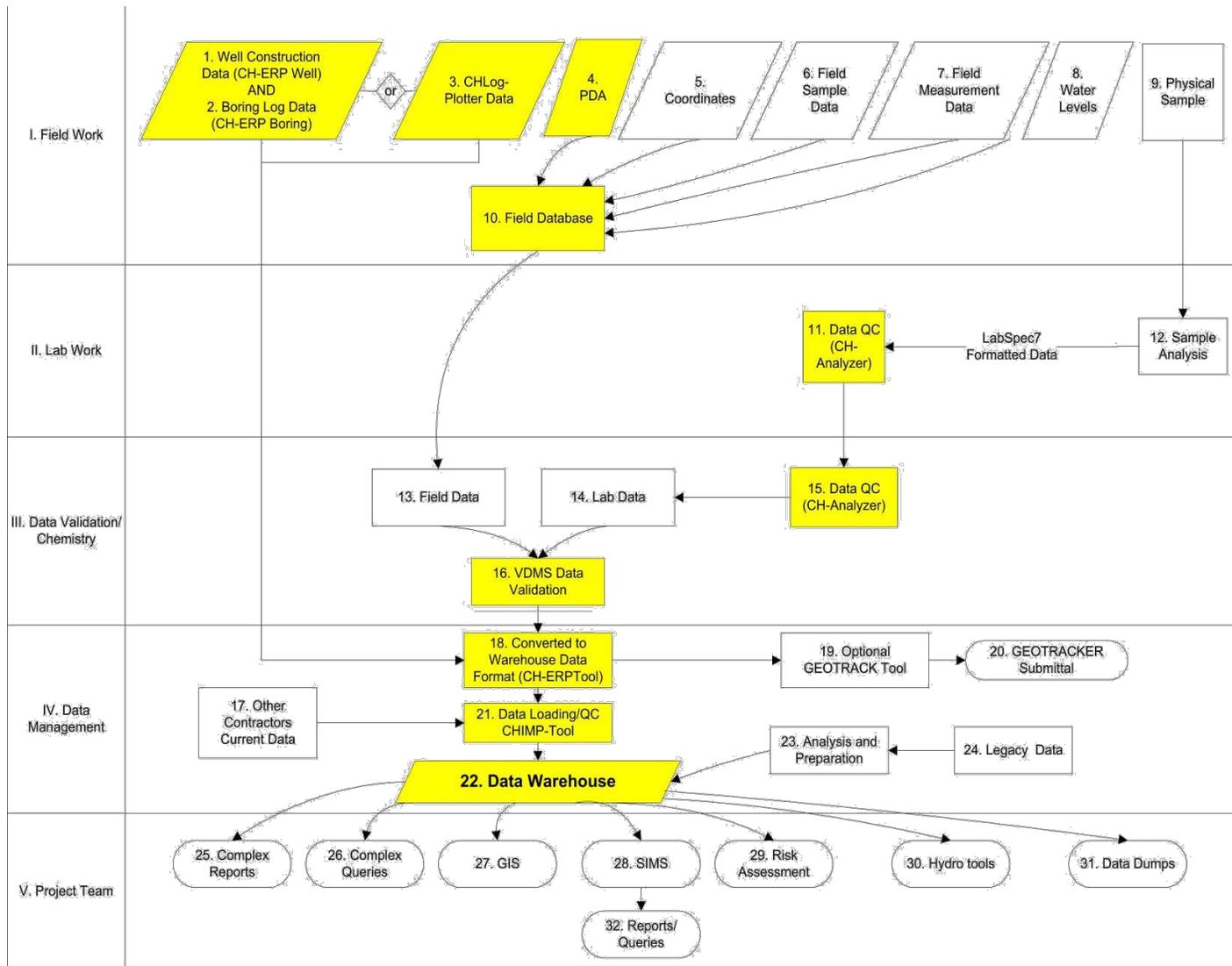


FIGURE P-2
DBMS PROCESS

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Acronyms and Abbreviations

AFCEE	Air Force Center for Engineering and the Environment
AM	Activity Manager
CAD	computer-aided design
COC	chain-of-custody
DBMS	Database Management System
DBS	Database Specialist
DMP	Data Management Plan
EDD	electronic data deliverable
EDM	Environmental Data Management
EIS	Environmental Information Specialist
EMS	Enterprise Management Solutions
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EVS	Environmental Visualization System
FD	field duplicate
FTL	Field Team Leader
GA	GIS Analyst
GIS	geographic information system
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
MS	matrix spike
MSD	matrix spike duplicate
N/FD	normal/field duplicate
NAVFAC	Naval Facilities Engineering Command
NEDD	Naval Installation Restoration Information Solution Electronic Data Deliverable

NIRIS	Naval Installation Restoration Information Solution
ODBC	open database connectivity
PC	Project Chemist
PCL	Program Chemistry Lead
PDL	Program Data Management Lead
PGDB	personal geodatabase
PGL	Program GIS Lead
PM	Project Manager
QA	quality assurance
QC	quality control
RASCI	responsible, approve, support, consult, and inform
RDM	Regional Database Manager
SDG	Sample Delivery Group
SIMS	Site Information Management System
SOP	standard operating procedure
STSP	Sample Tracking Program
VDMS	Validated Data Management System

Introduction

This Data Management Plan (DMP) describes the methods CH2M HILL will use to manage and present environmental data to support work it is conducting for the Navy CLEAN and Joint Venture Programs. These processes and procedures are part of an overall environmental data management system called the Validation Data Management System (VDMS) hosted by CH2M HILL.

Project members and any subcontractors supporting program data needs for site characterization and remediation activities can use this DMP. It is a living document that is flexible enough to meet the dynamic needs of the teams and stakeholders. Data management program details and procedures are included in the appendices.

1.1 Purpose and Objective

This document outlines how environmental data for the Navy CLEAN and Joint Venture Programs will be obtained and managed using an Enterprise Management Solutions (EMS) approach. The systematic approach will facilitate the retrieval of data from project files and the data warehouse when they are needed, help ensure that the required data are collected and are of the appropriate quality, and help ensure that data records are not lost during transfer to the central program database repository.

The EMS objectives critical to the success of the DMP are as follows:

- **Standardize and facilitate data collection.** Use standard field forms and database applications; provide guidance and standard operating procedures (SOPs) for formatting, reviewing, and transferring data collected in the field to the Database Management System (DBMS).
- **Provide the ability to capture electronic field data directly or indirectly.** Items that will be captured through standardized forms or applications include chains-of-custody (COCs), field parameter information, groundwater elevation data, and sample tracking records.
- **Minimize the uncertainties associated with the data.** Implement quality assurance (QA) and quality control (QC) measures to provide accurate representation of all data collected and stored in the DBMS. QA/QC procedures include restricting data import or entry to specific valid value lists that will not allow incorrect data to be included in the DBMS.
- **Provide a structured, yet flexible data set.** The DBMS will store all types of environmental data and provides a standard framework for all projects within the Navy CLEAN Program to use. The DBMS is organized and structured, yet flexible enough to allow additional data and data types to be added at any time over the life of the program.
- **Provide data that are well documented.** Retain enough descriptive and source information for technical defensibility and legal admissibility of the data.

- **Provide end-users with tools to gain access to the data.** Provide reporting and delivery support from a single DBMS source and allow relatively simple and rapid access to stored data for environmental characterization, report generation, modeling, geographic information system (GIS) mapping, statistical analyses, and risk assessments.
- **Provide data visualization capabilities.** Allow accurate representation of data used in models, GIS, boring log programs (Environmental Visualization System [EVS]), computer-aided design (CAD), graphics, and other software used for mapping, graphing, charting, analyzing, and displaying environmental data.
- **Provide the ability to compare data electronically.** Allow electronic comparison of project data to specific reference or screening criteria.
- **Provide the ability to transfer data to different formats.** Provide the ability to reformat, convert, and transfer the data to any format as required by specific end-user applications.

1.2 Scope of the Data Management Plan

The scope of the data management activities addressed by this plan includes the following:

- Definition of staff roles and responsibilities (Appendix A).
- Flow diagrams illustrating how environmental data are collected, reviewed, and entered into the DBMS (Appendix B)
- SOPs (Appendix C).
- Description and use of data outputs (Appendix D).
- Electronic data deliverable (EDD) format specifications that analytical laboratories are required to use to transfer analytical data electronically to CH2M HILL. (Provided to laboratories via a scope of work.)
- Management and archive procedures for hard copy and electronic project documentation.

SECTION 2

Roles and Responsibilities

The Navy CLEAN and Joint Venture Programs Environmental Data Management (EDM) team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The EDM team is composed of environmental, data, GIS, and EMS resources. The EDM team is responsible for all aspects of planning, execution, and reporting environmental data. Data are derived from sampling events related to investigative and remedial activities for Navy CLEAN and Joint Venture projects.

Responsibilities related to data management and information solutions functions are grouped into roles, as listed in Table 1. Checklist_VDMS-DM-Process_20090615 in Appendix C documents the specific responsibilities associated with each of these roles.

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Navy CLEAN Activity Manager (AM)	Various	Various	Various	Various
Navy CLEAN Project Manager (PM)	Various	Various	Various	Various
Field Team Leader (FTL)	Various	Various	Various	Various
Program EMS Team Lead	John Kochanowski 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6227	757-497-6885	jkochanowski@ch2m.com
Program Chemistry Lead (PCL)	Anita Dodson 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6218	757-497-6885	adodson@ch2m.com
Project Chemist (PC)	Mike Zamboni 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5111	703-376-5801	mzamboni@ch2m.com
Project Chemist (PC)	Megan Hilton 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	401-619-2657	703-376-5801	mhilton@ch2m.com
Project Chemist (PC) / Environmental Information Specialist (EIS)	Bianca Kleist 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6281	757-497-6885	bkleist@ch2m.com
Database Specialist (DBS)	Bhavana Reddy 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703- 462-3784	703- 376-5010	breddy@ch2m.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Program Data Management Lead (PDL)	Chelsea Leigh 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6208	773-695-1378	cleigh@ch2m.com
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Environmental Information Specialist (EIS)	Emma Brower 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5305	703-376-5805	ebrower@ch2m.com
Environmental Information Specialist (EIS)	Rebekha Shaw 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6279	757-497-6885	rshaw22@ch2m.com
Environmental Information Specialist (EIS)	Gwendolyn Buckley 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-8311	757-497-6885	Gbuckle1@ch2m.com
Environmental Information Specialist (EIS)	Kyle Block 25 New Chardon Street. Suite 300 Boston, MA 02114	617-626-7013		kblock@ch2m.com
Environmental Information Specialist (EIS)	Victoria Brynildsen 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462		757-497-6885	vbrynildsen@ch2m.com
Program GIS Lead (PGL)	Mike Dierstein 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierstein@ch2m.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
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GIS Analyst (GA)	Chris Bowman 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6276	757-497-6885	cbowman@ch2m.com
GIS Analyst (GA)	Matt Rissing 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6243	757-497-6885	mrrissing@ch2m.com
GIS Analyst (GA)	Forrest Cain 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6271	757-497-6885	fcain@ch2m.com

SECTION 3

Data Management System Description

During field investigation, monitoring, and remedial activities, CH2M HILL will collect a variety of environmental information to support data analysis, reporting, and decision-making activities. To meet current regulatory QA requirements, a complete audit trail of the information flow must be implemented. The six steps in the workflow process are:

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation
5. Data management and loading
6. Data evaluation and reporting

Each step in the data management process must be adequately planned, executed, and documented. Figure 1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs. Figure 2 presents, in more detail, the tools used in each step of the process.

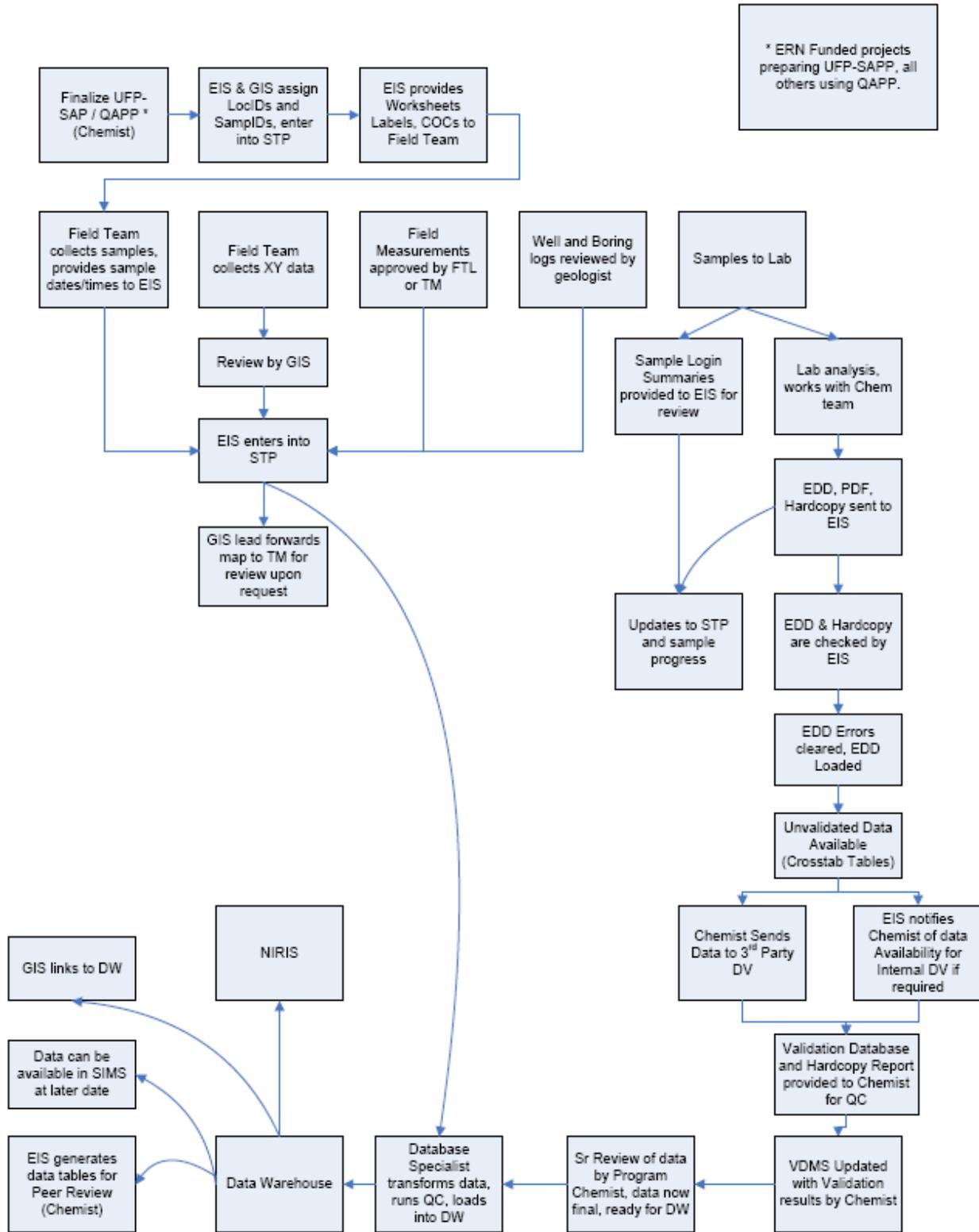


FIGURE 1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

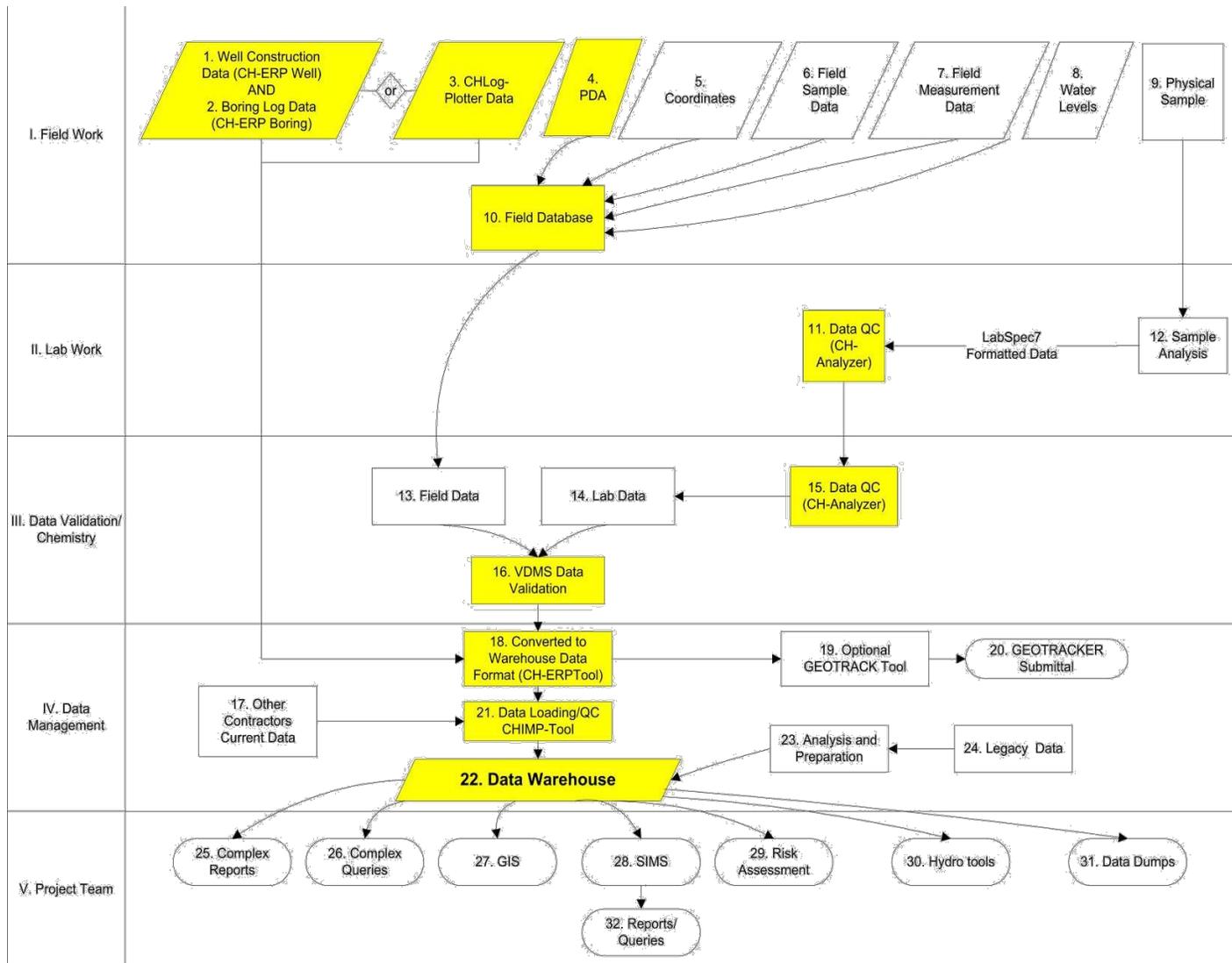


FIGURE 2
DBMS PROCESS

Phases of Data Management

4.1 Project Planning and Setup

Project planning starts when a new project or task is identified in the program. Evaluation of what is required from the data management and visualization occurs to determine the data needs. The Program EMS Team Lead (EMS Lead) works with the project and/or program manager to determine what is expected and required from the data management and visualization team. Specific items that should be considered are as follows:

- Inputs - Determine what data will be collected and stored in the database. Determine frequency and quantity. Determine what tools will be used to handle data input.
- Historical Data - This is a unique data input and requires special consideration. The Program Data Management Lead (PDL) *must* work with the other technical leads to assess what effort will be required. This step is often missed, and the resulting data quality issues created from inadequate planning in this area can plague the project for its entire duration.
- Outputs - Determine what data will need to be presented in reports, figures, and electronic deliverables. Determine frequency and quality requirements. Determine preliminary data, validated data, and what tools will most effectively handle the output requirements. Discuss how the outputs needed by the team will be requested and documented.
- Visualization - Determine necessity for GIS and CAD.

After the information above is determined, the data management scope, schedule, and budget are developed and endorsed by the Project Manager (PM), PDL, and Program Chemistry Lead (PCL). The team can then proceed upon client authorization of the overall project budget.

Figure 3 shows the process for project planning.

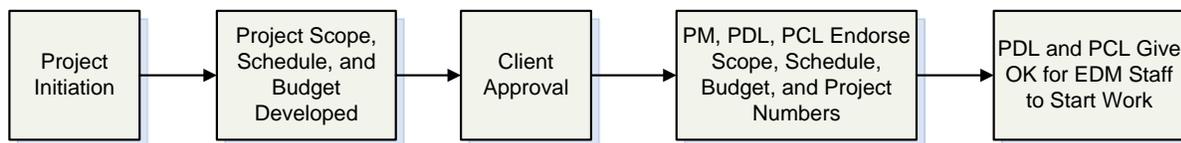


FIGURE 3
PROJECT PLANNING

4.1.1 Database Setup and Administration

CH2M HILL Database

The PDL will oversee the administration of the DBMS, including the design, development, and maintenance of the program database and data management processes. Database and data management process design and development will focus on providing rapid data entry and

data retrieval while promoting data integrity through various automated procedures. The PDL will perform the database maintenance, which consists of the following:

- Assisting with the allocation of sufficient system storage for the program database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting and compacting the database for more efficient operation
- Upgrading database software and associated applications as necessary
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions
- Performing routine virus checks on incoming and outgoing data

The DBMS is comprised of VDMS and the Data Warehouse combined, and will support the storage, analysis, display, and reporting of the Navy's environmental, analytical, and geotechnical data. The DBMS will consist of primary data tables that store the environmental data, dependent tables that store more details related to the data in the primary tables, and look-up tables that store valid values to provide input to the primary tables. The EIS will maintain the table content and the PDL will manage it.

Valid values are critical to any large relational database. Tables 2 and 3 provide examples of valid values for the Navy CLEAN and Joint Venture Programs' sites, stations, and samples. Inconsistencies in naming conventions, subtle analyte or method spelling differences, and the use of non-standard abbreviations can result in lost data and incorrect conclusions. Most tables and forms in the program database will use look-up tables for acceptable valid values and will not allow the entry of data that do not conform.

The primary purpose of managing data in a relational database environment is to ensure that each data record is unique and that the information contained within each field is consistent with conventions defined in other areas of the database. To ensure uniqueness, a key field or fields will be identified for each data record. Key fields define the record as unique. The VDMS architecture supports this approach and eliminates the possibility of data redundancy.

NIRIS Database

All Navy CLEAN and Joint Venture data must be loaded into the Navy's own internal database system, the Naval Installation Restoration Information Solution (NIRIS). NIRIS is a web-based centralized database that has been implemented across all Naval Facilities Engineering Command (NAVFAC) offices and will be used by the Navy and contractors to manage, evaluate, and visualize data, documents and records for Navy and the Marine Corps sites. NIRIS manages all Environmental Restoration Program (ERP) analytical and spatial data, which includes the Munitions Response and Installation Restoration Program (IRP) data, ensuring institutional memory is preserved, land use controls are maintained, and remedial actions are effective.

CH2M HILL will use the VDMS system to track, collect, review, and prepare Navy-related sample and project data for loading into NIRIS. Project data stored in VDMS must be consistent

and comparable with data that is loaded and stored within NIRIS. As such, all associations between VDMS and NIRIS valid values, output reports, and data tables will be tracked and maintained.

4.1.2 Data Security Procedures

Some VDMS applications and data are stored in a secure location with login and password protection. Authorized users of the STSP tool and VDMS will have logins and passwords in advance. The PDL will provide security access to these tools. Access2003 must be installed on the computer that the user will be using to run these applications, and proper licenses distributed. Files received from any subcontractors will be scanned for common viruses using industry standard, current virus protection programs. The file servers storing the data must be running current virus software, with automatic virus signature updates.

NIRIS data are stored in a secure location with login and password protection. Users who require access to NIRIS and the data contained therein will need to follow procedures outlined in the SOP Access to NIRIS to procure security certificates, training, and access rights to installation-specific data. Authorized users of NIRIS will be assigned logins and passwords maintained by the Navy.

4.1.3 Data Backup and Recovery

All project data management files will reside on CH2M HILL's terminal server, "Gaia," and will have a tape backup or equivalent created in accordance with CH2M HILL's network server management policy.

4.2 Sample Collection and Management

Sample control during the sampling phase is required to ensure the integrity of the associated data. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented 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. Figure 4 shows the process for planning and executing field sampling events.

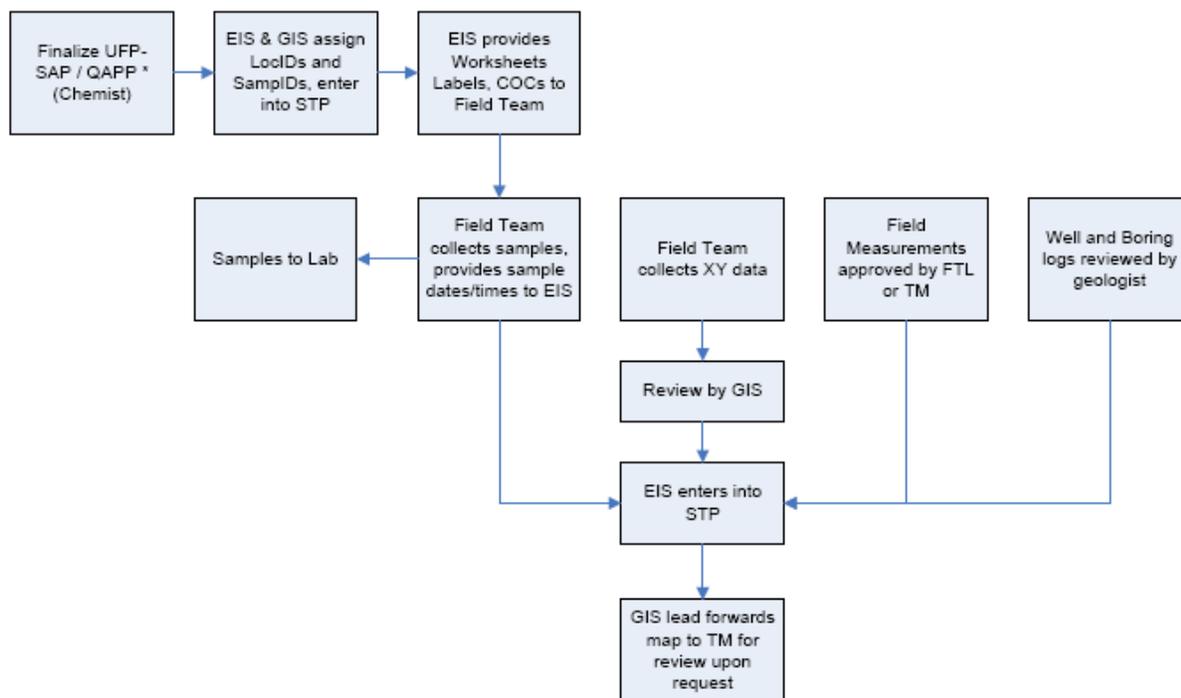


FIGURE 4
FIELD SAMPLING

4.2.1 Sample Tracking Program

During the planning stage, the PM specifies the data requirements for the sampling event. The work plan or similar document will provide project-specific data requirements for a given sampling event. The PC is responsible for reviewing the Sampling and Analysis Plan and ensuring that the FTL is aware of the number of field and laboratory QC samples required for the sampling event (trip blanks, equipment blanks, field blanks, field duplicates, matrix spikes, and matrix spike duplicates). All of this information is to be entered into the STSP.

The STSP tool will be used in advance to develop daily assignments for field crews, identify sampling container and preservation requirements, identify analytical laboratories for samples, print labels for sample bottles before the sampling event, and prepare and print COC forms after sampling is complete.

4.2.2 Sample Nomenclature Guidelines

The following guidelines are provided for sample nomenclature, COC clarification, and eData expectations.

Station ID (Location)

Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides a key in a database to which any samples collected from that location can be linked to form a relational database structure.

Before beginning fieldwork, the FTL will review the proposed level of effort and coordinate a list of unique station identification names, or station IDs, with the PDL or EIS. The FTL will be responsible for enforcing the use of the standardized ID system and agreed upon station IDs during all field activities.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, station type, sequential station number, and possibly an additional qualifier as needed. The naming scheme to be used for the identification of a sampling station is documented in Table 2.

For example, if the first sample location at next month's event within Yorktown Site 30 is at a soil location, then the location ID could possibly YS30-SO391 because that was the next available sequence number for soil locations. This should also be reflected in the Sample ID. QC and IDW station IDs must be established for each site that they are associated with.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a station is mislabelled and ensure there are unique identifiers for every sampling location. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample ID

Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the FTL will review the proposed level of effort and coordinate a list of unique sample identification names, or sample IDs, with the PDL or EIS. The FTL will be responsible for enforcing the use of the standardized ID system and agreed upon sample IDs during all field activities.

Each sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, sample/station type, sequential station number, modifier (as needed), depth (as needed), date, and date modifier (as needed). The naming scheme to be used for the identification of samples is documented in Table 3.

The standardized ID system will identify all samples collected during sampling activities. The system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. For example, a surface soil sample collected from station YS30-SO391 reference above in June of 2009 will result in a sample ID of YS30-SS391-0609.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a sample is mislabelled and ensure there are unique identifiers for every sample. Required deviations to this format in response to field conditions will be documented in the field logbook.

Navy Clean		
First Segment	Second Segment	
Facility, Site Number	Station Type	Station Number, Modifier
AA,ANN	AA	NNN _A
Notes: "A" = alphabetic "N" = numeric		
<u>Facility:</u> A = ABL AN = Anacostia BA = Bainbridge BW = Bloodsworth Island BR = Bremerton CA = Cheatham Annex CH = Cherry Point CI = Craney Island CL = Camp Lejeune CP = Camp Peary CR = Carderock DA = Dahlgren DN = Dam Neck DR = Driver IH = Indian Head LS = Little Creek NA = Naval Academy NB = Naval Station Norfolk NM = NNMC (Bethesda Naval Hospital) NN = Norfolk Naval Shipyard NR = Naval Research Laboratory NWA = Northwest Annex OC = Oceana PA = Pax River PI = Pineros Islands QU = Quantico RO = Rota RR = Roosevelt Roads SI = Sigonella SJ = St. Juliens SS = Sabana Seca VE = Vieques East VW = Vieques West WN = Washington Navy Yard WO = White Oak Y = Yorktown <u>Site/AOC/SWMU Number - Sequential Number:</u> Site = S01, S02, S03... Site Screening Area = SA01, SA02, SA03... AOC = A01, A02, A03... AOI = AI01, AI02, AI03... SWMU = W01, W02... Building = B01, B02, B03... Range = R01, R02... LIA - LI Area, East Vieques BSxx = Background locations outside of site (BS25 = Background Site 25) BKL = Background locations outside of the facility BKG = Background locations (inside base) <u>QC and IDW Stations</u> Site ID (First Segment) followed by -QC or -IDW	<u>Station Type:</u> AGT = Above Ground Tank AS = Ash BH = Borehole CO = Concrete DP = Direct Push DR = Drill Rig EW = Extraction Well FG = Frog FS = Fish GB = Geotechnical Boring GP = Geoprobe GV = Gas Vent HP = Holding Pond/Lagoon IDW = Investigative Derived Waste IW = Injection Well LW = Leach Well MA = Alluvial Monitoring Well MB = Bedrock Monitoring Well MU = UST Monitoring Well MW = Monitoring Well (GW for Y) PC = Paint Chip PW = Production Well QC = Quality Control RK = Rock RC = Recovery Well RM = Remediation Well RW = Residential Well SD = Sediment Location SG = Soil Gas SL = Storm Sewer Line Sediment SO = Soil Location SP = Seep ST = Storm Water SU = Sump SV = Soil Vapor SW = Surface Water SWS = Surface Water Body (for SW and SD) UST = Underground Storage Tank TA = Tap Water TD = Tidal Station TI = Tissue Sample (general) TO = Tadpole TP = Test Pit TR = Trench Sediment TS = Treatment System TW = Temporary Well WA = Alluvial Extraction Well WB = Bedrock Extraction Well WL = Water Supply Well WN = Pore Water WP = Wipe Sample WT = Water Table Piezometer <u>Station Number:</u> Sequential Station Number (i.e., 01, 02, 03...)	<u>Modifier (used selectively):</u> D = Deep monitoring well S = Shallow monitoring well
<u>Example Station IDs:</u> YS01-DP02 = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1 CHR05-MW02S = Shallow monitoring well location 2, at the Cheatham Annex facility, Range 5. NMBKL-SD02 = Background sediment location #2 located outside of NNMC CHBS03-SO05 = Soil location #5, located in reference area outside of Site 3 in Cherry Point VEW04-QC = QC Station at East Vieques SWMU-4 CAA08-IDW = IDW Station at Cheatham Annex AOC-8		

TABLE 2
STATION ID SCHEME

Navy Clean			
First Segment	Second Segment	3rd Segment	Fourth Segment
Site ID Facility, AOC Number	Station/Sample Type, Station Number, Modifier	Depth (As Needed)	Date (MMYY) _A
AA,ANN	AANNNA	A	NNNN _A
Notes: "A" = alphabetic "N" = numeric			
<p>A = ABL AN = Anacostia BA = Bainbridge BW = Bloodsworth Island BR = Bremerton CA = Cheatham Annex CH = Cherry Point CI = Craney Island CL = Camp Lejeune CP = Camp Peary CR = Carderock DA = Dahlgren DN = Dam Neck DR = Driver IH = Indian Head LS = Little Creek NA = Naval Academy NB = Naval Station Norfolk NM = NNMC (Bethesda Naval Hospital) NN = Norfolk Naval Shipyard NR = Naval Research Laboratory NWA = Northwest Annex OC = Oceana PA = Pax River PI = Pineros Islands QU = Quantico RO = Rota RR = Roosevelt Roads SI = Sigonella SJ = St. Juliens SS = Sabana Seca VE = Vieques East VW = Vieques West WN = Washington Navy Yard WO = White Oak Y = Yorktown</p> <p><u>Site/AOC/SWMU - Sequential Number:</u> Site = S01, S02, S03... Site Screening Area = SA01, SA02, SA03... AOC = A01, A02, A03... AOI = AI01, AI02, AI03... SWMU = W01, W02... Building = B01, B02, B03... Range = R01, R02... LIA - LI Area, East Vieques</p> <p>BSxx = Background locations outside of site (BS25 = Background Site 25) BKL = Background locations outside of the facility BKG Background locations (inside base)</p>	<p><u>Sample Type:</u> AGT = Above Ground Tank AH = Air - Headspace AS = Ash BH = Borehole CO = Concrete DR = Drill Rig DS = Direct Push - Soil DW = Direct Push - Groundwater EW = Extraction Well FG = Frog FS = Fish GB = Geotechnical Boring GP = Geoprobe GV = Gas Vent HP = Holding Pond/Lagoon IW = Injection Well LF = Free Product LW = Leach Well MA = Alluvial Monitoring Well MB = Bedrock Monitoring Well MU = UST Monitoring Well MW = Monitoring Well (GW for Y) PC = Paint Chip PW = Production Well RK = Rock SW = Surface Water RC = Recovery Well RM = Remediation Well RW = Residential Well SB = Subsurface Soil SD = Sediment Location SG = Soil Gas SL = Storm Sewer Line Sediment SO = Soil Location (Composite) SP = Seep SS = Surface Soil SSD = Subsurface Sediment ST = Storm Water SU = Sump SV = Soil Vapor SW = Surface Water UST = Underground Storage Tank TA = Tap Water TD = Tidal Station TI = Tissue Sample (general) TO = Tadpole TP = Test Pit TR = Trench Sediment TS = Treatment System TW = Temporary Well WA = Alluvial Extraction Well WB = Bedrock Extraction Well WL = Water Supply Well WN = Pore Water WP = Wipe Sample WT = Water Table Piezometer</p> <p><u>Station Number:</u> Sequential Number (e.g., 001, 002, 003)</p> <p><u>Modifier (used selectively):</u> D = Deep monitoring well S = Shallow monitoring well P = Duplicate</p>	<p><u>Depth:</u> Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C...</p> <p><u>Sample Number:</u> 1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. AB01-MW11P-0506 2. MS/MSD Samples - Append a modifier of '-MS' for matrix spike or '-SD' for matrix spike duplicate to the end of the sample ID. 3. QC & IDW Samples (Blank Samples & Waste Char.) - Format consists of Facility, AOC Number, Qualifier Code, Sequential Qualifier Number-Date (AAANN-AANN-MMDDYY). E.g. LSA05-TB02-061106</p> <p><u>Qualifier Codes:</u> TB = Trip Blank FB = Field Blank EB = Equipment Blank WQ = Source Blank WS = Waste Char. Soil WW = Waste Char. Water</p> <p>4. Drill Rig Samples - Format consists of Facility, AOC Number, Station Type, Station Number, Date. E.g. YS12-DR02-020507 5. Multiple samples - Should multiple samples be collected from the same location in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C...</p>	
<p><u>Example Sample IDs:</u> WNA01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at the Washington Navy Yard facility. PIW01-SW023P-0306 = Pineros Island duplicate surface water sample collected at location 23, at SMWU-1 in March 2006. SSW06-FB01-061106 = The first field blank collected on June 11, 2006 at SMWU-6 in Sabana Seca.</p>			

TABLE 3
STATION ID SCHEME

4.2.3 Sample Collection

A photocopy of each field logbook page completed during sampling and of each COC will be made by the FTL and forwarded to the EIS at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

Communication with field and laboratory staff will occur daily during the field event. The EIS will resolve issues that arise in the field (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.

4.2.4 Chain-of-Custody and eData

A single COC number per project / laboratory / cooler should be generated each day (there can be multiple pages to one COC number). MSs and MSDs will be requested at a set frequency for each project (usually one per 20 samples collected). MS and MSD samples should not be taken from field duplicates (FDs) or field blanks. FDs will be requested at a set frequency for each project (usually one per 10 samples). FDs should not be taken from MSs, MSDs, or field blanks. The MS and MSD samples listed on the COC should be spiked and analyzed by the laboratory.

A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter.

Once the field data and samples are collected, information on sampling date and time are to be entered into the STSP by the EIS, and as necessary field measurements, such as water levels and other data collected in the field also should be entered. Any data entered into the STSP must be exported into an excel file to facilitate a manual QC review of the data. The correction of any anomalies should be verified with the PM and PC. The information entered into the STSP will be exported into CH2M HILL's VDMS where field data and laboratory analytical data are linked by location and sample ID. This allows verification that all sample and method combinations have been received and reported by the laboratory.

4.2.5 Sample and Document Tracking

A Sample Tracking Sheet (STS) will be generated from the sample information entered and QC'd in the STSP. The STS should be updated and kept current throughout the data management process. All samples collected, resulting deliverables, and deliverable dates will be tracked throughout the data management process to ensure that the project schedule is met and subcontractor invoices are evaluated correctly.

All documentation acquired during the data management process, including Statements of Work (SOWs), Bids, COCs, Field Notes, Sample Tracking Sheets, Login Reports, Corrections-to-File Letters, FDETool QC tables, Post Load Reports, Invoices, and Communication Logs shall be compiled throughout the process to be stored in the appropriate Activity's Project Notebook.

4.3 Laboratory Analysis

Figure 5 shows the laboratory analysis process. 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 in by the laboratory using information from the COC forms and the project instructions.

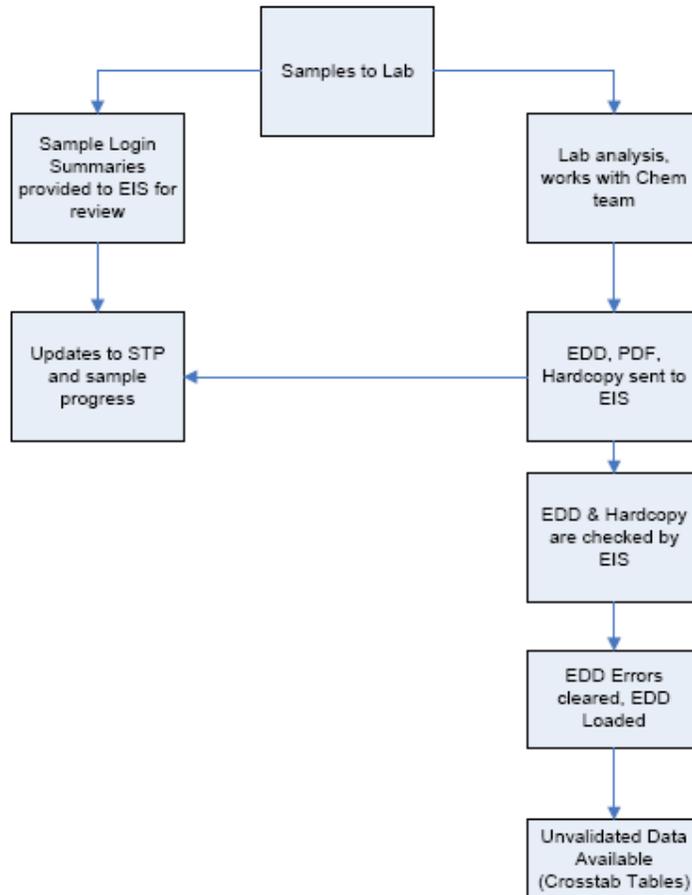


FIGURE 5
LABORATORY ANALYSIS

Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the EIS.

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.

Hard copy data and EDDs will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC For Unvalidated Data Checklist. 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 tables will be generated following data import into VDMS by querying data with the VDMS XTab Tool and formatting the output with the Crosstab Cleanup and RDE Formatting Tools. A separate table must be created for each matrix, and provided to the PM for review.

Data archiving forms will be generated and affixed to each laboratory report received per Sample Delivery Group (SDG) for cataloguing, tracking, and archiving purposes.

The tools used to QC the laboratory's EDD are as follows:

- **CH-Analyzer:** Before the laboratory analytical data is entered into VDMS, the laboratory EDD must be processed through CH2M HILL's CH-Analyzer Microsoft Access database application. The CH-Analyzer application includes several automated diagnostic checks to verify format and content compliance with EDD specifications. The analytical laboratory must correct any errors before transmitting the EDD to CH2M HILL. The laboratory will forward the CH-Analyzer report, checked EDD, and hard copy of the data to the EIS who will manage the EDD verification process and data entry to VDMS.
- The EDD will be checked again using CH-Analyzer to verify correct format and content. If errors are found, the file will be returned to the laboratory for correction and re-submittal. Even if the formatting of the EDD is completely correct, the data loader may reject the EDD if the contents of the file do not comply with the data library standardization requirements.
- The CH-Analyzer also should be used to compare COCs, hard copy, and EDD content, and resolve discrepancies and document data error issues (for example, EDD re-submissions, turnaround time problems, hard copy incompleteness). These checks ensure the consistency and the validity of the EDD's content before the data are electronically transferred to VDMS. The objective of using the CH-Analyzer is to ensure that the validation process is performed on consistently high-quality data and minimize the chance of finding data errors later in the validation process, which would require the laboratory to resend corrected data and start the validation process over again.
- **VDMS:** Once the EDD verification is complete, it is electronically transferred into CH2M HILL's VDMS tool for data quality verification and validation according to project specifications. During import, the data are checked against a list of valid values. Once all error messages are resolved, validation can begin.

4.4 Data Validation

The data validator will be notified by the PC in advance of when to expect data and of any samples or analyses that should not be validated. (i.e. grain size should not be validated). For internal data validation, the EIS will notify the PC of data availability, and provide the hardcopy data and a QC Association Table.

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

4.4.1 External Data Validation

For external data validation, a subset of the analytical data will be loaded into the 3rd Party DV Tool, a CH2M HILL Microsoft Access database designed for external data validation. The tool will allow external data validators to configure various with tables with QC information, associated validation logic, and qualifiers applied when QC criteria are not achieved. Qualifier criteria will be based on the Quality Assurance Project Plan.

The hard copy data, 3rd Party DV Tool, and a QC Association Table will be provided to the data validator. The PC will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

Data Validators will provide the following materials to the PC within the required turn around time:

- Hardcopy Data Validation Report
- Validated Version of 3rd Party DV Tool (external validation)
- Validated Version of Data in VDMS (internal validation)

Once returned to CH2M HILL, the data in VDMS will be updated with the results in the 3rd Party DV Tool. The validated data will be reviewed by the PC to ensure that they are complete and acceptable as outlined in the VDMS and Chemist PreLoad Checklist. 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.

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

Validated raw and detects tables will be generated by querying data with the VDMS XTab Tool and formatting the output with the Crosstab Cleanup and RDE Formatting Tools. A separate table must be created for each matrix, and provided to the PM for review.

4.4.2 Internal Data Validation

VDMS will be operated in a semi-automated mode, which will require the chemist to configure various with tables with QC information, associated validation logic, and qualifiers applied when QC criteria are not achieved. Qualifier criteria will be based on the Quality Assurance Project Plan. A hardcopy data validation report will be generated. Data archiving forms will be generated and affixed to each Data Validation Report per SDG validated for cataloguing, tracking, and archiving purposes

Validated raw and detects tables will be generated by querying data with the VDMS XTab Tool and formatting the output with the Crosstab Cleanup and RDE Formatting Tools. A separate table must be created for each matrix, and provided to the PM for review.

4.4.3 Unvalidated Data Preload Check

Occasionally, unvalidated data will need to be loaded into the database. Although this data will not be validated, it will undergo a basic Preload Check by the PC to ensure laboratory compliance with project guidelines and determine results to be reported as the best result where

multiple runs were conducted for a given sample/analysis. The PCL will provide input and oversight to ensure that data flags are applied correctly by the PC.

4.4.4 Senior Review

The PCL will verify that the validated hardcopy data and data contained in VDMS are complete and acceptable. Any identified discrepancies will be resolved with the assistance of the PC, EIS, laboratory, or validator as needed.

4.5 Data Preparation and Loading

Once the data are validated and approved by the PCL, they are exported from VDMS to the project warehouse. Field and laboratory data are merged into a format that is amenable to the warehouse. The backbone is a SQL-server-based data warehouse. Data in the warehouse are accessible through Site Information Management System (SIMS), a Web-based GIS application that allows users to query the data through a graphical interface and the XTabReports Tool.

4.5.1 Data Preparation

As part of the normal process of loading data into the warehouse, data standardization tasks must be completed. A Database Specialist (DBS) will load data into the warehouse using the following two programs: CH-ERPTool and CH-IMPTool. The CH-ERPTool runs an extensive series of logical QC checks and formats the data to be compatible with the data warehouse structure.

4.5.2 Data Loading

CH2M HILL Loading

The CH-IMPTool runs an additional series of QC checks and adds project-specific formatting and valid values, and loads the data into the warehouse. The following tasks need to be completed to load the data for project use:

- **Unit Standardization:** Analytical units and the associated results, reporting limits, and method detection limits will need to be converted to a consistent set of units as required by the project.
- **Resolve Reanalysis and Dilutions:** All samples that had an associated reanalysis or dilution run by the laboratory must have all of the excluded or rejected results marked as not the best result for reporting.
- **Resolve Analytical Overlap and Split Samples:** Analytical overlap occurs when a sample is analyzed by two or more methods that report the same analyte. To resolve this, the following logic is used to select the usable result:
 - If the overlapping results are all non-detections, the lowest non-detection result is selected.
 - If the overlapping results are all detected, the highest detected result is selected.

- If the overlapping results consist of a mixture of detections and non-detections, the highest detected result is selected.

When data are loaded into the warehouse, an automated script will run to identify the “best” result when more than one analytical result exists.

NIRIS Loading

All Navy CLEAN and Joint Venture data must be loaded into NIRIS. Following the successful loading of data into the data warehouse, the DBS will use the NEDD Creator Tool to generate project NIRIS Electronic Data Deliverables (NEDD) files.

The DBS will use NIRIS’s Data Checker Loader Tool to QC and submit the project NEDD files into NIRIS. The NIRIS Regional Database Manager (RDM) will load the data into NIRIS, and will work with the DBS to resolve any potential issue that may arise during loading. Following notification of successful data loading from the RDM, the DBS will query the data from NIRIS for review to ensure data integrity and accuracy.

4.5.3 Data Warehouse

The data warehouse is a Microsoft SQL Server 2005 relational database. This database, and all other “CH” tools used, has a data structure designed to achieve compliance with the Environmental Restoration Program Information Management System (ERPIMS) standard specified by Air Force Center for Engineering and the Environment (AFCEE). ERPIMS is an effective, comprehensive standard for environmental management.

The warehouse will use valid value tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, analyte names, units. These reference tables are critical for maintaining the completeness and accuracy of data sets and are essential for accurate querying of the data.

Data are loaded and stored so that relationships among categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and collection, analysis, and reporting tools used in the DBMS are designed to enforce, for any project data record, entries in fields that refer to other types of data as required by the overall data model.

The data warehouse will automatically update the SIMS application whenever data are added or changed.

4.6 Data Reporting

Data reporting includes the following tasks:

- Retrieving data from the data warehouse for project deliverables, data visualization, or consumption by third parties
- Reviewing initial data and producing data queries and draft reports to dissect and disassemble the data
- Producing any requested client and regulatory agency data deliverables

Data for project deliverables, data visualization, or consumption by third parties will be retrieved from the warehouse, and will be equivalent to the real-time state of the project repository database. PMs and GIS Analysts (GAs) will work with the EIS and PCL for quality queries and data for reports.

4.6.1 Tables, Figures, and Diagrams

Once the data have been sufficiently analyzed, the list of requested data reports (tables, figures, diagrams) can be developed and finalized by the project team and submitted to the PCL and PM for review.

All requests for figures or graphics are to be directed to the GA assigned as the Point of Contact (POC) for that particular Navy installation. All requests for analytical data (crosstab tables, data dumps, third party deliverables etc) should be directed to the EIS assigned as the POC for that particular Navy installation. The EIS will generate a data deliverable from the data warehouse or NIRIS (as needed) suitable for end use and will provide data support to the end user. All requests for data statistics and calculations should be directed to the Risk Assessor assigned to the project.

4.6.2 GIS

The Navy CLEAN program will utilize ESRI's suite of GIS software for the majority of GIS-related tasks. The GIS data model will consist of one or more geodatabases (GDBs) per installation. Each installation will maintain one common installation GDB, which will store the common infrastructure data such as buildings, roads, topography, hydrography, utilities, etc. The common installation GDB should adhere, as much as possible, to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) data model. All project specific GDBs shall be developed and named for ease of interpretation by the GA.

All station location information for each installation will be pulled directly from that installation's data warehouse and stored in the common installation GDB as a data table. The data warehouse must contain valid coordinate information for the locations to be displayed correctly. Valid coordinate information will be maintained in the data warehouse by the EIS, and updated as necessary by the DBS.

ESRI's ArcMap 9.3 (or the latest version available) will be utilized for spatially displaying the environmental data within maps and figures, as well as for spatial analysis. The GA will need to coordinate efforts with the EIS on all requests that require the display of environmental sample data on a map to ensure that the appropriate data is queried from the data warehouse and linked to the appropriate station location table within the GIS.

4.6.3 Site Information Management System

This is currently not being used on the Navy CLEAN and Joint Venture Programs.

SIMS is a tool for publishing data of sufficient quality from the project. However, the project data warehouse will remain the database of record for the project.

SIMS provides many standard report formats, all of which are used in conjunction with the Query Tool feature, to isolate and retrieve information. Users can generate and save their

queries using a graphical point-and-click tool. Reports in a wide variety of formats also can be requested and produced.

4.6.4 Legacy Data

Legacy data are those collected from any contractor other than CH2M HILL and data collected by CH2M HILL that have not been managed in accordance with Navy CLEAN and Joint Venture Program requirements. Legacy data are commonly compiled from various electronic and hard copy sources including spreadsheets, databases, technical reports, and laboratory hard copy data reports. When working with legacy data, usability assessment must be completed for the project team to be able to use the data with confidence. In order to assess the data properly, the legacy data needs to be evaluated by skilled professionals that are familiar with the type of data being evaluated so that any errors identified in the data can be corrected when possible or qualified in a manner to reflect the limitations of the data's use.

The PM has overall responsibility for the selection for inclusion of legacy data into the data management process. The PDL and PCL will work with the PM to establish the data review and import process, compile a comprehensive data inventory, and identify staff to facilitate data review.

The PDL and PCL will work with the EIS to determine the appropriate intermediary files and tools used to collect the data. The PDL and PCL will oversee the data review and flagging process and approve the data for upload into the Data Warehouse. The EIS is responsible for assembling the field and laboratory data in formats that facilitate data review, aid the PDL and PCL in overseeing the data review and flagging process, schedule, conversion of the data to the proper data warehouse format, and then loading the data into the Data Warehouse after approval by the PDL and PCL.

The GA, PDL, PCL, and PM have the primary responsibility for reviewing the data in their area of expertise and providing the PCL with data usability flags to be associated with each record.

SECTION 5

Project Closeout

The project completion/closeout phase includes the following:

- Archive hard copy and electronic documents
- Conduct project closeout meeting

5.1 Archive Procedures

A large variety of technical data will be generated during the field investigations. The EIS and PC will collect all hard copy and electronic data they are responsible for and verify that the incoming records are legible and in suitable condition for storage. Record storage will be performed in two stages:

- Storage during the project
- Permanent storage following project completion

During the project, CH2M HILL will store data hardcopy reports in CH2M HILL offices. Physical records will be secured in steel file cabinets or shelves, and labelled with the appropriate project identification. Electronic data will be maintained on CH2M HILL's corporate local area network servers.

Information generated from field activities will be documented on appropriate forms and will be maintained in the project file. These include COC records, field logbooks, well construction forms, boring logs, location sketches, and site photographs. In addition, notes from project meetings and telephone conversations will be filed.

Following project completion, both hard copy and electronic data deliverables will be archived. Team staff will provide all hard copies of laboratory and validation reports to the Data Closeout Coordinator to be prepped and shipped to Stone Mountain for archiving. Final laboratory EDDs and loading files will be provided to the PDL, to be archived on CH2M HILL's corporate local area network servers.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

5.2 Invoice Review and Approval

The EIS is responsible for tracking all data deliverables throughout the data management process to ensure that the project schedule is maintained, subcontractors comply with all required turn around times, and data provided are complete and acceptable. Following project completion, EISs are to review and provide comments on all laboratory and data validator invoices regarding data quality and schedule compliance prior to approval by the PM.

5.3 Project Closeout

At the end of each project, the PM will notify team staff of project closeout. The PM will coordinate and verify that all pertinent data has been archived. The PM may also review lessons learned, suggest process improvements, or revisions to the DMP and other project documentation as deemed necessary.

Appendix A
Workflow Process

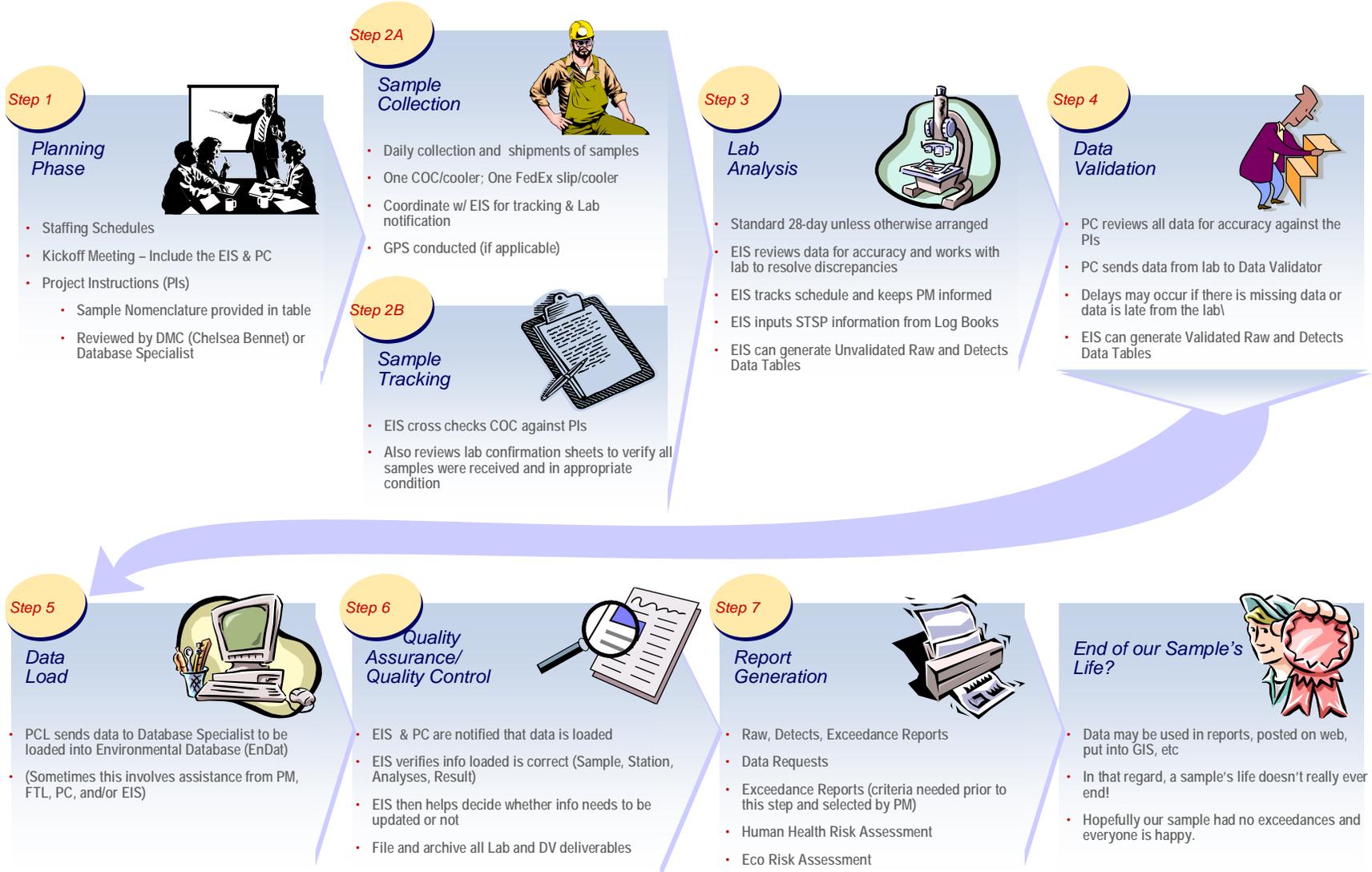
Environmental Data Management Work Process

1.0 Project Planning & Setup	2.0 Sample Collection & Management	3.0 Lab Analysis	4.0 Data Validation	5.0 Data Management	6.0 Data Evaluation & Reporting
1.1 Project Setup	2.1 Sample Management	3.1 Sample Analysis	4.1 Internal Chemical Data Validation	5.1 CH2M HILL Data	6.1 Data Prep & Processing for Reporting
1.2 QAPP, SAP, DMP, DQOs Integration	2.2 Sample Collection	3.2 EDD Management	4.2 External Chemical Data Validation	5.2 Other Contractor & Legacy Data	6.2 Tabular Data Queries & Reports
1.3 Laboratory Setup	2.3 Sample Data Management	3.3 Hard Copy Management	4.3 Senior Review of Validated Data	5.3 Database Maintenance & Administration	6.3 Field Logs and Graphs
1.4 Database Setup					6.4 GIS Queries and Maps

Appendix B
Life of a Sample

A Sample's Life

Step-by-Step Outline of Navy CLEAN and JV Data Management Process, and Roles & Responsibilities



Appendix C
List of Standard Operating Procedures

Checklist - EIS Project Start-up Questions
Checklist - EIS QC for Unvalidated Data
Checklist - Generating RDE Tables
Checklist - Historic Data Cleanup
Checklist - VDMS DM Process
SOP-103 - Sample Tracking Program
SOP-107 - CH-Analyzer
SOP-109 - VDMS Validation
SOP-113 - CHERP Tool
SOP-114 - CHIMPTool
SOP-115 - VDMS Importing
SOP-126 - XTab Reports Tool
SOP - Access To NIRIS
SOP - Cherry Point Exceedance Formatting Wizard
SOP - Corrections To File
SOP - Data Archiving Procedures
SOP - Data Shipping
SOP - NEDD Creator Tool

Attachment 3
DoD Environmental Laboratory Accreditation
Program Certification



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

ENVIRONMENTAL CONSERVATION LABORATORIES - JACKSONVILLE

Jacksonville, FL

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 29th day of March 2010.

A handwritten signature in black ink, appearing to read "Peter Meyer".

President & CEO
For the Accreditation Council
Certificate Number 3000.02
Valid to April 30, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.



SCOPE OF ACCREDITATION TO ISO/IEC 17025-2005

ENVIRONMENTAL CONSERVATION LABORATORIES – JACKSONVILLE

4810 Executive Park Court, Suite 211
 Jacksonville, FL 32216

Dr. Mark Inman Phone: 904 296 3007
 Email address: minman@encolabs.com

ENVIRONMENTAL

Valid To: April 30, 2012

Certificate Number: 3000.02

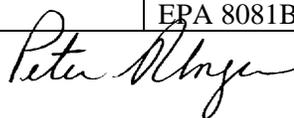
In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1)) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Isopropyl alcohol (2-Propanol)	EPA 8015C	-----	ENCO VGCMS-07
4-Ethyltoluene	-----	-----	ENCO VGCMS-07
Cyclohexane	EPA 8260B	EPA 8260B	ENCO VGCMS-07
1,1,1-Trichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,2,2-Tetrachloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B	EPA 8260B	EPA TO-14A
1,1,2-Trichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1-Dichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1-Dichloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichloro-1,1,2,2-tetrafluoroethane	-----	-----	EPA TO-14A
1,3-Butadiene	-----	-----	EPA TO-15
1,4-Dioxane	EPA 8260B	EPA 8260B	EPA TO-15
2,2,4-Trimethylpentane	NA	-----	EPA TO-15
Benzyl chloride	-----	-----	EPA TO-15
n-Hexane	-----	-----	EPA TO-15
2-Hydroxy isobutyric acid	ENCO VGC-13	-----	-----
Acetic acid	ENCO VGC-13	-----	-----
Butyric acid (Butanoic acid)	ENCO VGC-13	-----	-----
Hexanoic acid	ENCO VGC-13	-----	-----

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Isohexanoic acid (4-methyl-pentanoic acid)	ENCO VGC-13	-----	-----
Isopentanoic acid (3-methyl-butanoic acid)	ENCO VGC-13	-----	-----
Lactic acid	ENCO VGC-13	-----	-----
Pentanoic acid	ENCO VGC-13	-----	-----
Propionic acid (Propanoic acid)	ENCO VGC-13	-----	-----
Pyruvic acid	ENCO VGC-13	-----	-----
Propylene glycol	ENCO VGC-18	-----	-----
Ethyl acetate	EPA 8015C	-----	ENCO VGCMS-07
Ethylene glycol	EPA 8015C	-----	-----
Gasoline range organics (GRO)	EPA 8015C	EPA 8015C	-----
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015C, 8260B	EPA 8260B	-----
Methanol	EPA 8015C	-----	-----
n-Butyl alcohol	EPA 8015C	-----	-----
n-Propanol	EPA 8015C	-----	-----
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504, 504.1, 8011, 8260	EPA 8260B	-----
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504, 504.1, 8011, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,2-Dichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichloropropane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,3-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,4-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
2-Chloroethyl vinyl ether	EPA 624, 8260B	EPA 8260B	-----
Acrolein (Propenal)	EPA 624, 8260B	EPA 8260B	-----
Acrylonitrile	EPA 624, 8260B	EPA 8260B	-----
Benzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Bromodichloromethane	EPA 624, 8260B	EPA 8260B	ENCO VGCMS-07
Bromoform	EPA 624, 8260B	EPA 8260B	EPA TO-15
Carbon tetrachloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chlorobenzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chloroform	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
cis-1,3-Dichloropropene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Dibromochloromethane	EPA 624, 8260B	EPA 8260B	ENCO VGCMS-07
Ethylbenzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methyl bromide (Bromomethane)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methyl chloride (Chloromethane)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methylene chloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Tetrachloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Toluene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
trans-1,2-Dichloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-15
trans-1,3-Dichloropropylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Trichloroethene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Trichlorofluoromethane	EPA 624, 8260B	EPA 8260B	EPA-TO-14A

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<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Vinyl chloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Xylene (total)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,1,2-Tetrachloroethane	EPA 8260B	EPA 8260B	-----
1,1-Dichloropropene	EPA 8260B	EPA 8260B	-----
1,2,3-Trichlorobenzene	EPA 8260B	EPA 8260B	-----
1,2,3-Trichloropropane	EPA 8260B	EPA 8260B	-----
1,2,4-Trichlorobenzene	EPA 625, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,2,4-Trimethylbenzene	EPA 8260B	EPA 8260B	EPA TO-14A
1,3,5-Trimethylbenzene	EPA 8260B	EPA 8260B	EPA TO-14A
1,3-Dichloropropane	EPA 8260B	EPA 8260B	-----
2,2-Dichloropropane	EPA 8260B	EPA 8260B	-----
2-Butanone (Methyl ethyl ketone,MEK)	EPA 8015, 8260B	EPA 8260B	EPA TO-15
2-Chlorotoluene	EPA 8260B	EPA 8260B	NA
2-Hexanone	EPA 8260B	EPA 8260B	ENCO VGCMS-07
4-Chlorotoluene	EPA 8260B	EPA 8260B	-----
4-Methyl-2-pentanone (MIBK)	EPA 8015C , 8260B	EPA 8260B	EPA TO-15
Acetone	EPA 8260B	EPA 8260B	-----
Acetonitrile	EPA 8260B	EPA 8260B	-----
Allyl chloride (3-Chloropropene)	EPA 8260B	EPA 8260B	EPA TO-15
Bromobenzene	EPA 8260B	EPA 8260B	-----
Bromochloromethane	EPA 8260B	EPA 8260B	-----
Carbon disulfide	EPA 8260B	EPA 8260B	EPA TO-15
Chloroprene	EPA 8260B	EPA 8260B	-----
cis-1,2-Dichloroethylene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Dibromomethane	EPA 8260B	EPA 8260B	-----
Dichlorodifluoromethane	EPA 8260B	EPA 8260B	EPA TO-14A
Ethanol	EPA 8015, 8260B	EPA 8260B	-----
Hexachlorobutadiene	EPA 625, 8260B, 8270D	EPA 8260, 8270	EPA TO-14A, EPA TO-15
Isopropylbenzene	EPA 8260B	EPA 8260B	-----
Methacrylonitrile	EPA 8260B	EPA 8260B	-----
Methyl methacrylate	EPA 8260B	EPA 8260B	-----
Methyl tert-butyl ether (MTBE)	EPA 8260B	EPA 8260B	EPA TO-15
m-Xylene	EPA 8260B	EPA 8260B	-----
Naphthalene	EPA 625, 8260B, 8270D, 8270D PAHSIM	EPA 8260B, 8270D, 8270D PAHSIM	-----
n-Butyl benzene	EPA 8260B	EPA 8260B	-----
n-Propyl benzene	EPA 8260B	EPA 8260B	-----
o-Xylene	EPA 8260B	EPA 8260B	-----
p-Isopropyltoluene	EPA 8260B	EPA 8260B	-----
Propionitrile (Ethyl cyanide)	EPA 8260B	EPA 8260B	-----
p-Xylene	EPA 8260B	EPA 8260B	-----
sec-Butylbenzene	EPA 8260B	EPA 8260B	-----
Styrene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
tert-Butylbenzene	EPA 8260B	EPA 8260B	-----
trans-1,4-Dichloro-2-butene	EPA 8260B	EPA 8260B	-----
Vinyl acetate	EPA 8260B	EPA 8260B	EPA TO-15
4,4'-DDD	EPA 608, 8081B	EPA 8081B	-----
4,4'-DDE	EPA 608, 8081B	EPA 8081B	-----



<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
4,4'-DDT	EPA 608, 8081B	EPA 8081B	-----
Aldrin	EPA 608, 8081B	EPA 8081B	-----
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	-----
Aroclor-1016(PCB-1016)	EPA 608, 8082A	EPA 8082A	-----
Aroclor-1221(PCB-1221)	EPA 608, 8082A	EPA 8082A	-----
Aroclor-1232(PCB-1232)	EPA 608, 8082A	EPA 8082A	-----
Aroclor-1242(PCB-1242)	EPA 608, 8082A	EPA 8082A	-----
Aroclor-1248(PCB-1248)	EPA 608, 8082A	EPA 8082A	-----
Aroclor-1254(PCB-1254)	EPA 608, 8082A	EPA 8082A	-----
Aroclor-1260(PCB-1260)	EPA 608, 8082A	EPA 8082A	-----
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	-----
Chlordane(tech.)	EPA 608, 8081B	EPA 8081B	-----
delta-BHC	EPA 608, 8081B	EPA 8081B	-----
Dieldrin	EPA 608, 8081B	EPA 8081B	-----
Endosulfan I	EPA 608, 8081B	EPA 8081B	-----
Endosulfan II	EPA 608, 8081B	EPA 8081B	-----
Endosulfan sulfate	EPA 608, 8081B	EPA 8081B	-----
Endrin	EPA 608, 8081B	EPA 8081B	-----
Endrin aldehyde	EPA 608, 8081B	EPA 8081B	-----
gamma-BHC (Lindane,gamma-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	-----
Heptachlor	EPA 608, 8081B	EPA 8081B	-----
Heptachlor epoxide	EPA 608, 8081B	EPA 8081B	-----
Toxaphene (Chlorinated camphene)	EPA 608, 8081B	EPA 8081B	-----
alpha-Chlordane	EPA 8081B	EPA 8081B	-----
Endrin ketone	EPA 8081B	EPA 8081B	-----
gamma-Chlordane	EPA 8081B	EPA 8081B	-----
Isodrin	EPA 8081B, 8270D	EPA 8081B, 8270D	-----
Methoxychlor	EPA 8081B	EPA 8081B	-----
Mirex	EPA 8081B	EPA 8081B	-----
Kepone	EPA 8270D	EPA 8270D	-----
o,o,o-Triethylphosphorothioate	EPA 8270D	EPA 8270D	-----
Parathion,ethyl	EPA 8270D	EPA 8270D	-----
Phorate	EPA 8270D	EPA 8270D	-----
Sulfotepp	EPA 8270D	EPA 8270D	-----
Thionazin (Zinophos)	EPA 8270D	EPA 8270D	-----
Dalapon	EPA 615, 8151A	EPA 8151A	-----
3,5-DCBA	EPA 615, 8151A	EPA 8151A	-----
4-Nitrophenol	EPA 615, 625, 8151A, 8270D	EPA 8270D, 8151A	-----
Dicamba	EPA 615, 8151A	EPA 8151A	-----
MCPP	EPA 615, 8151A	EPA 8151A	-----
MCPA	EPA 615, 8151A	EPA 8151A	-----
Dichlorprop	EPA 615, 8151A	EPA 8151A	-----
2,4-D	EPA 615, 8151A	EPA 8151A	-----
Pentachlorophenol	EPA 615, 625, 8151A, 8270D	EPA 8151A, 8270D	-----
2,4,5-TP (Silvex)	EPA 615, 8151A	EPA 8151A	-----
Chloramben	EPA 615, 8151A	EPA 8151A	-----



<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
2,4,5-T	EPA 615, 8151A	EPA 8151A	-----
2,4-DB	EPA 615, 8151A	EPA 8151A	-----
Bentazon	EPA 615, 8151A	EPA 8151A	-----
Picloram	EPA 615, 8151A	EPA 8151A	-----
Dinoseb	EPA 615, 625, 8151A, 8270D	EPA 8151A, 8270D	-----
Dacthal	EPA 615, EPA 8151A	EPA 8151A	-----
Acifluorfen	EPA 615, EPA 8151A	EPA 8151A	-----
2,4-DCAA	EPA 615, EPA 8151A	EPA 8151A	-----
Total coliforms	SM 9222B	-----	-----
Fecal coliforms	SM 9222D	-----	-----
Aluminum	EPA 200.7, 6010C	EPA 6010C	-----
Antimony	EPA 200.7, 6010C	EPA 6010C	-----
Arsenic	EPA 200.7, 6010C	EPA 6010C	-----
Barium	EPA 200.7, 6010C	EPA 6010C	-----
Beryllium	EPA 200.7, 6010C	EPA 6010C	-----
Boron	EPA 200.7, 6010C	EPA 6010C	-----
Cadmium	EPA 200.7, 6010C	EPA 6010C	-----
Calcium	EPA 200.7, 6010C	EPA 6010C	-----
Chromium	EPA 200.7, 6010C	EPA 6010C	-----
Cobalt	EPA 200.7, 6010C	EPA 6010C	-----
Copper	EPA 200.7, 6010C	EPA 6010C	-----
Hardness (calc.)	EPA 200.7, SM2340B	-----	-----
Iron	EPA 200.7, 6010C, SM 18 3500-Fe D	EPA 6010C	-----
Lead	EPA 200.7, 6010C	EPA 6010C	-----
Lithium	EPA 200.7, 6010C	EPA 6010C	-----
Magnesium	EPA 200.7, 6010C	EPA 6010C	-----
Manganese	EPA 200.7, 6010C	EPA 6010C	-----
Molybdenum	EPA 200.7, 6010C	EPA 6010C	-----
Nickel	EPA 200.7, 6010C	EPA 6010C	-----
Potassium	EPA 200.7, 6010C	EPA 6010C	-----
Selenium	EPA 200.7, 6010C	EPA 6010C	-----
Silver	EPA 200.7, 6010C	EPA 6010C	-----
Sodium	EPA 200.7, 6010C	EPA 6010C	-----
Strontium	EPA 200.7, 6010C	EPA 6010C	-----
Thallium	EPA 200.7, 6010C	EPA 6010C	-----
Tin	EPA 200.7, 6010C	EPA 6010C	-----
Titanium	EPA 200.7, 6010C	EPA 6010C	-----
Vanadium	EPA 200.7, 6010C	EPA 6010C	-----
Zinc	EPA 200.7, 6010C	EPA 6010C	-----
Mercury	EPA 245.1, 7470	EPA 7471	-----
Sulfate	ASTM D516-90	-----	-----
Ignitability	EPA 1010	EPA 1010, EPA 1030	-----
Conductivity	EPA 120.1, SM 18 2510B	-----	-----
Oil & Grease (HEM)	EPA 1664A	EPA 9071B	-----
Total Petroleum Hydrocarbons (TPH) (HEM-SGT)	EPA 1664A	-----	-----
Turbidity	EPA 180.1, SM 18 2130B	-----	-----
Orthophosphate as P	EPA 365.3	-----	-----
Color	SM 2120B	-----	-----
Alkalinity as CaCO3	SM 2320B	-----	-----

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<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Hardness	SM 2340C	-----	-----
Residue-nonfilterable (TSS)	SM 2540D	-----	-----
Residue-total	SM 2540B	-----	-----
Residue-filterable (TDS)	SM 2540C	-----	-----
Chromium VI	SM 3500-Cr D(18th/19th Ed.)/UV-VIS	-----	-----
Chloride	SM 4500-Cl C	-----	-----
Total residual chlorine	SM 4500-Cl G	-----	-----
pH	SM 18 4500-H+-B, EPA 9040	EPA 9040, 9045	-----
Nitrite	SM 4500-NO ₂ B	-----	-----
Biochemical oxygen demand	SM 5210B	-----	-----
Carbonaceous BOD(CBOD)	SM 5210B	-----	-----
Chemical oxygen demand	SM 5220D, EPA 410.4	-----	-----
Total Organic Carbon	SM 18 5310B, EPA 9060	-----	-----
Total Petroleum Hydrocarbons (TPH)	FL-PRO	FL-PRO	-----
Carbon dioxide	RSK-175	-----	-----
Ethane	RSK-175	-----	-----
Ethylene	RSK-175	-----	-----
Methane	RSK-175	-----	-----
2,4,6-Trichlorophenol	EPA 625, 8270D	EPA 8270D	-----
2,4-Dichlorophenol	EPA 625, 8270D	EPA 8270D	-----
2,4-Dimethylphenol	EPA 625, 8270D	EPA 8270D	-----
2,4-Dinitrophenol	EPA 625, 8270D	EPA 8270D	-----
2,4-Dinitrotoluene (2,4-DNT)	EPA 625, 8270D	EPA 8270D	-----
2,6-Dinitrotoluene (2,6-DNT)	EPA 625, 8270D	EPA 8270D	-----
2-Chloronaphthalene	EPA 625, 8270D	EPA 8270D	-----
2-Chlorophenol	EPA 625, 8270D	EPA 8270D	-----
2-Methyl-4,6-dinitrophenol	EPA 625, 8270D	EPA 8270D	-----
2-Nitrophenol	EPA 625, 8270D	EPA 8270D	-----
3,3'-Dichlorobenzidine	EPA 625, 8270D	EPA 8270D	-----
4-Bromophenyl phenylether	EPA 625, 8270D	EPA 8270D	-----
4-Chloro-3-methylphenol	EPA 625, 8270D	EPA 8270D	-----
4-Chlorophenyl phenylether	EPA 625, 8270D	EPA 8270D	-----
Acenaphthene	EPA 625, 8270D	EPA 8270D	-----
Acenaphthylene	EPA 625, 8270D	EPA 8270D	-----
Aniline	EPA 625, 8270D	EPA 8270D	-----
Anthracene	EPA 625, 8270D	EPA 8270D	-----
Benzidine	EPA 625, 8270D	EPA 8270D	-----
Benzo(a)anthracene	EPA 625, 8270D	EPA 8270D	-----
Benzo(a)pyrene	EPA 625, 8270D	EPA 8270D	-----
Benzo(b)fluoranthene	EPA 625, 8270D	EPA 8270D	-----
Benzo(g,h,i)perylene	EPA 625, 8270D	EPA 8270D	-----
Benzo(k)fluoranthene	EPA 625, 8270D	EPA 8270D	-----
bis(2-Chloroethoxy)methane	EPA 625, 8270D	EPA 8270D	-----
bis(2-Chloroethyl) ether	EPA 625, 8270D	EPA 8270D	-----

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<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane)	EPA 625, 8270D	EPA 8270D	-----
bis(2-Ethylhexyl) phthalate(DEHP)	EPA 625, 8270D	EPA 8270D	-----
Butylbenzylphthalate	EPA 625, 8270D	EPA 8270D	-----
Chrysene	EPA 625, 8270D	EPA 8270D	-----
Dibenzo(a,h)anthracene	EPA 625, 8270D	EPA 8270D	-----
Diethyl phthalate	EPA 625, 8270D	EPA 8270D	-----
Dimethyl phthalate	EPA 625, 8270D	EPA 8270D	-----
Di-n-butyl phthalate	EPA 625, 8270D	EPA 8270D	-----
Di-n-octyl phthalate	EPA 625, 8270D	EPA 8270D	-----
Fluoranthene	EPA 625, 8270D	EPA 8270D	-----
Fluorene	EPA 625, 8270D	EPA 8270D	-----
Hexachlorobenzene	EPA 625, 8270D	EPA 8270D	-----
Hexachlorocyclopentadiene	EPA 625, 8270D	EPA 8270D	-----
Hexachloroethane	EPA 625, 8270D	EPA 8270D	-----
Indeno(1,2,3-cd)pyrene	EPA 625, 8270D	EPA 8270D	-----
Isophorone	EPA 625, 8270D	EPA 8270D	-----
Nitrobenzene	EPA 625, 8270D	EPA 8270D	-----
n-Nitrosodimethylamine	EPA 625, 8270D	EPA 8270D	-----
n-Nitrosodi-n-propylamine	EPA 625, 8270D	EPA 8270D	-----
n-Nitrosodiphenylamine	EPA 625, 8270D	EPA 8270D	-----
Phenanthrene	EPA 625, 8270D	EPA 8270D	-----
Phenol	EPA 625, 8270D	EPA 8270D	-----
Pyrene	EPA 625, 8270D	EPA 8270D	-----
Pyridine	EPA 625, 8270D	EPA 8270D	-----
1,1-Biphenyl	EPA 8270D	EPA 8270D	-----
1,2,4,5-Tetrachlorobenzene	EPA 8270D	EPA 8270D	-----
1,2-Diphenylhydrazine	EPA 8270D	EPA 8270D	-----
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	EPA 8270D	-----
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	EPA 8270D	-----
1,4-Naphthoquinone	EPA 8270D	EPA 8270D	-----
1,4-Phenylenediamine	EPA 8270D	EPA 8270D	-----
1-Methylnaphthalene	EPA 8270D	EPA 8270D	-----
1-Naphthylamine	EPA 8270D	EPA 8270D	-----
2,3,4,6-Tetrachlorophenol	EPA 8270D	EPA 8270D	-----
2,4,5-Trichlorophenol	EPA 8270D	EPA 8270D	-----
2,6-Dichlorophenol	EPA 8270D	EPA 8270D	-----
2-Acetylaminofluorene	EPA 8270D	EPA 8270D	-----
2-Methylnaphthalene	EPA 8270D	EPA 8270D	-----
2-Methylphenol (o-Cresol)	EPA 8270D	EPA 8270D	-----
2-Naphthylamine	EPA 8270D	EPA 8270D	-----
2-Nitroaniline	EPA 8270D	EPA 8270D	-----
2-Picoline (2-Methylpyridine)	EPA 8270D	EPA 8270D	-----
3,3'-Dimethylbenzidine	EPA 8270D	EPA 8270D	-----
3-Methylcholanthrene	EPA 8270D	EPA 8270D	-----
3-Methylphenol (m-Cresol)	EPA 8270D	EPA 8270D	-----
3-Nitroaniline	EPA 8270D	EPA 8270D	-----

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<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
4-Aminobiphenyl	EPA 8270D	EPA 8270D	-----
4-Chloroaniline	EPA 8270D	EPA 8270D	-----
4-Dimethyl aminoazobenzene	EPA 8270D	EPA 8270D	-----
4-Methylphenol (p-Cresol)	EPA 8270D	EPA 8270D	-----
4-Nitroaniline	EPA 8270D	EPA 8270D	-----
4-Nitroquinoline-n-oxide	EPA 8270D	EPA 8270D	-----
5-Nitro-o-toluidine	EPA 8270D	EPA 8270D	-----
7,12-Dimethylbenz(a)anthracene	EPA 8270D	EPA 8270D	-----
a-a-Dimethylphenethylamine	EPA 8270D	EPA 8270D	-----
Acetophenone	EPA 8270D	EPA 8270D	-----
Aramite	EPA 8270D	EPA 8270D	-----
Atrazine	EPA 8270D	EPA 8270D	-----
Benzaldehyde	EPA 8270D	EPA 8270D	-----
Benzoic acid	EPA 8270D	EPA 8270D	-----
Benzyl alcohol	EPA 8270D	EPA 8270D	-----
Caprolactam	EPA 8270D	EPA 8270D	-----
Carbazole	EPA 8270D	EPA 8270D	-----
Chlorobenzilate	EPA 8270D	EPA 8270D	-----
Cresol, Total	EPA 8270D	EPA 8270D	-----
Diallate	EPA 8270D	EPA 8270D	-----
Dibenzo(a,h)pyrene	EPA 8270D	EPA 8270D	-----
Dibenzofuran	EPA 8270D	EPA 8270D	-----
Dimethoate	EPA 8270D	EPA 8270D	-----
Diphenylamine	EPA 8270D	EPA 8270D	-----
Disulfoton	EPA 8270D	EPA 8270D	-----
DPH (as Azobenzene)	EPA 8270D	EPA 8270D	-----
Ethyl methanesulfonate	EPA 8270D	EPA 8270D	-----
Famphur	EPA 8270D	EPA 8270D	-----
Hexachlorophene	EPA 8270D	EPA 8270D	-----
Hexachloropropene	EPA 8270D	EPA 8270D	-----
Isosafrole	EPA 8270D	EPA 8270D	-----
Methapyrilene	EPA 8270D	EPA 8270D	-----
Methyl methane sulfonate	EPA 8270D	EPA 8270D	-----
Methyl parathion (Parathion,methyl)	EPA 8270D	EPA 8270D	-----
Nitroquinoline-1-oxide	EPA 8270D	EPA 8270D	-----
n-Nitrosodiethylamine	EPA 8270D	EPA 8270D	-----
n-Nitroso-di-n-butylamine	EPA 8270D	EPA 8270D	-----
n-Nitrosomethylethylamine	EPA 8270D	EPA 8270D	-----
n-Nitrosomorpholine	EPA 8270D	EPA 8270D	-----
n-Nitrosopiperidine	EPA 8270D	EPA 8270D	-----
n-Nitrosopyrrolidine	EPA 8270D	EPA 8270D	-----
o-Toluidine	EPA 8270D	EPA 8270D	-----
Pentachlorobenzene	EPA 8270D	EPA 8270D	-----
Pentachloroethane	EPA 8270D	EPA 8270D	-----
Pentachloronitrobenzene	EPA 8270D	EPA 8270D	-----
Phenacetin	EPA 8270D	EPA 8270D	-----
Pronamide (Kerb)	EPA 8270D	EPA 8270D	-----
Safrole	EPA 8270D	EPA 8270D	-----



<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
C9-C18 Aliphatic Hydrocarbons	MAEPH	MAEPH	-----
C19-C36 Aliphatic Hydrocarbons	MAEPH	MAEPH	-----
C11-C22 Aromatic Hydrocarbons	MAEPH	MAEPH	-----
Diesel Range Organics (DRO)	EPA 8015	EPA 8015	-----
2-Methylnaphthalene	EPA 8270	EPA 8270	-----
4-Methylphenol (p-Cresol)	EPA 8270	EPA 8270	-----
Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	EPA 1311	-----
Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	EPA 1312	-----
Corrosivity (pH)	NA	EPA 9040	-----
Paint Filter Liquids Test	NA	EPA 9095	-----
Diethyl ether	EPA 8260	EPA 8260	-----
Ethyl methacrylate	EPA 8260	EPA 8260	-----
Iodomethane (Methyl iodide)	EPA 8260	EPA 8260	-----
Methyl cyclohexane	EPA 8260	EPA 8260	-----
Methyl acetate	EPA 8260	EPA 8260	-----
Isopropyl ether	EPA 8260	EPA 8260	-----

<u>Analytical Method</u>	<u>Prep Method</u>			
	<u>Soil</u>	<u>Water</u>	<u>Air</u>	<u>Waste</u>
EPA 8260B	EPA 5035	EPA 5030B	-----	EPA 5035
EPA 624	-----	EPA 5030B	-----	-----
EPA 625	-----	EPA 3510C	-----	-----
EPA 8270D	EPA 3545A	EPA 3510C	-----	EPA 3580A
EPA 200.7	-----	EPA 200.7	-----	-----
EPA 6010C	EPA 3050B	EPA 3005A	-----	EPA 3050B
EPA 608	-----	EPA 3510C	-----	-----
EPA 8081B	EPA 3545A	EPA 3510C	-----	EPA 3580A
EPA 8082A	EPA 3545A	EPA 3510C	-----	EPA 3580A
EPA 615	-----	EPA 615	-----	-----
EPA 8151A	EPA 8151A	EPA 8151	-----	EPA 8151A
MA VPH, May 2004 Revision 1.1	EPA 5035	EPA 5030B	-----	-----
MA EPH, May 2004 Revision 1.1	EPA 3545A	EPA 3510C	-----	-----
FLPRO	EPA 3545A	EPA 3510C	-----	-----
8015C – GRO	EPA 5035	EPA 5030B	-----	-----
8015C – DRO	EPA 3545A	EPA 3510C	-----	-----
TO14A	-----	-----	TO14A	-----
TO15	-----	-----	TO15	-----
SPLP	EPA 1312	EPA 1312	-----	EPA 1312
TCLP	EPA 1311	EPA 1311	-----	EPA 1311

Peter Abney



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ENVIRONMENTAL CONSERVATION LABORATORIES – ORLANDO
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ENVIRONMENTAL

Valid To: March 31, 2012

Certificate Number: 3000.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1)) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
<u>Metals</u>	EPA 6020A/200.8	EPA 6020A
Aluminum	EPA 6020A/200.8	EPA 6020A
Antimony	EPA 6020A/200.8	EPA 6020A
Arsenic	EPA 6020A/200.8	EPA 6020A
Barium	EPA 6020A/200.8	EPA 6020A
Beryllium	EPA 6020A/200.8	EPA 6020A
Cadmium	EPA 6020A/200.8	EPA 6020A
Calcium	EPA 6020A/200.8	EPA 6020A
Chromium	EPA 6020A/200.8	EPA 6020A
Cobalt	EPA 6020A/200.8	EPA 6020A
Copper	EPA 6020A/200.8	EPA 6020A
Hardness	SM 2340 B	-----
Iron	EPA 6020A/200.8	EPA 6020A
Lead	EPA 6020A/200.8	EPA 6020A
Magnesium	EPA 6020A/200.8	EPA 6020A
Manganese	EPA 6020A/200.8	EPA 6020A
Mercury	EPA 245.1/7470A	EPA 7471B
Molybdenum	EPA 6020A/200.8	EPA 6020A
Nickel	EPA 6020A/200.8	EPA 6020A
Potassium	EPA 6020A/200.8	EPA 6020A
Selenium	EPA 6020A/200.8	EPA 6020A
Silver	EPA 6020A/200.8	EPA 6020A

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Sodium	EPA 6020A/200.8	EPA 6020A
Thallium	EPA 6020A/200.8	EPA 6020A
Tin	EPA 6020A/200.8	EPA 6020A
Titanium	EPA 6020A/200.8	EPA 6020A
Vanadium	EPA 6020A/200.8	EPA 6020A
Zinc	EPA 6020A/200.8	EPA 6020A
<u>Microbiology</u>		
Total Coliforms	SM 9222B	-----
Fecal Coliforms	SM 9222D	-----
<u>General Chemistry</u>		
Acidity, as CaCO ₃	EPA 305.1/SM 2310 B (4A)	-----
Alkalinity as CaCO ₃	EPA 310.1/SM 2320 B	EPA 310.1/SM 2320 B
Alkalinity as CaCO ₄	EPA 310.2	EPA 310.2
Ammonia as N	-----	EPA 350.1
Biochemical oxygen demand	EPA 405.1/SM 5210 B	-----
Bromide	EPA 300.0/9056A	EPA 9056A
Carbonaceous BOD (CBOD)	SM 5210 B	-----
Chemical oxygen demand	EPA 410.4	-----
Chloride	EPA 300.0/9056A	EPA 9056A
Chromium VI	EPA 7196/ SM 3500-Cr D	EPA 7196
Conductivity	EPA 120.1	-----
Cyanide	EPA 335.2/SM 4500-CN E	EPA 9014
Ferric iron (calculated)	SM 3500-Fe D	-----
Ferrous iron	SM 3500-Fe D	-----
Fluoride	EPA 300.0/9056A	EPA 9056A
Hardness	EPA 130.2/SM 2340 C	-----
Kjeldahl nitrogen -total	EPA 351.2	EPA351.2
Nitrate as N	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrate-nitrite	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrite as N	EPA 300.0/354.1/9056A/SM 4500-NO ₂ B	EPA 9056A/ SM 4500-NO ₂ B
Organic nitrogen	EPA 351.2/350.1	EPA 351.2/350.1
Orthophosphate as P	EPA 365.1	-----
Orthophosphate as P	EPA 365.3	-----
pH	EPA 150.1/9040C/SM 4500-H ⁺ -B	EPA 9040C
Phosphorus, total	EPA 365.4	EPA 365.4
Residue-filterable (TDS)	SM 2540 C	-----
Residue-nonfilterable (TSS)	SM 2540 D	-----
Residue-total	SM 2540 B/SM 2540 G/EPA 160.3	SM 2540G/EPA 160.3
Residue-volatile	EPA 160.4	EPA 160.4
Sulfate	EPA 300.0/9056A	EPA 9056A
Sulfide	EPA 376.1/SM 4500-S E	-----
Surfactants -MBAS	SM 5540 C	-----
Total nitrate-nitrite	EPA 9056 A/SM 4500-NO ₃ H	EPA 9056 A/SM 4500-NO ₃ H
Total cyanide	EPA 9014	EPA 9014
Total nitrogen	TKN + Total nitrate-nitrite	TKN + Total nitrate-nitrite
Total Organic Carbon	EPA 9060A/SM 5310B	TOC Walkley Black
Total phenolics	EPA 420.1	EPA 420.1
Total, fixed, and volatile residue	SM 2540 G	SM 2540 G
Turbidity	EPA 180.1	-----

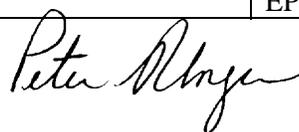
Peter Abney

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Un-ionized ammonia	DEP SOP 10/03/83	DEP SOP 10/03/83
<u>Extractable Organics</u>		
1,2,4-Trichlorobenzene	EPA 8270D/625	EPA 8270D
1,2,4,5-Tetrachlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,3-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,4-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1-Methylnaphthalene	EPA 8270D/625	EPA 8270D
2,3,4,6-Tetrachlorophenol	EPA 8270D/625	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dimethylphenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrophenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D/625/ Scan-Sim	EPA 8270D
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D/625	EPA 8270D
2-Chloronaphthalene	EPA 8270D/625	EPA 8270D
2-Chlorophenol	EPA 8270D/625	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D/625	EPA 8270D
2-Methylnaphthalene	EPA 8270D/625	EPA 8270D
2-Methylphenol (o-Cresol)	EPA 8270D/625	EPA 8270D
2-Nitroaniline	EPA 8270D/625	EPA 8270D
2-Nitrophenol	EPA 8270D/625	EPA 8270D
3,3'-Dichlorobenzidine	EPA 8270D/625	EPA 8270D
3/4-Methylphenols (m/p-Cresols)	EPA 8270D/625	EPA 8270D
3-Nitroaniline	EPA 8270D/625	EPA 8270D
4-Bromophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D/625	EPA 8270D
4-Chloroaniline	EPA 8270D/625	EPA 8270D
4-Chlorophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Nitrophenol	EPA 8270D/625	EPA 8270D
Acenaphthene	EPA 8270D/625	EPA 8270D
Acenaphthylene	EPA 8270D/625	EPA 8270D
4-Methylphenol (p-Cresol)	EPA 8270D/625	EPA 8270D
4-Nitroaniline	EPA 8270D/625	EPA 8270D
Acetophenone	EPA 8270D/625	EPA 8270D
Anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Atrazine	EPA 8270D/625	EPA 8270D
Benzaldehyde	EPA 8270D/625	EPA 8270D
Benzidine	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(a)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(a)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(g,h,i)perylene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D
1,1-Biphenyl	EPA 8270D/625	EPA 8270D
bis(2-Chloroethoxy) methane	EPA 8270D/625	EPA 8270D
bis(2-Chloroethyl) ether	EPA 8270D/625	EPA 8270D
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270D/625	EPA 8270D

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270D/625	EPA 8270D
Butyl benzyl phthalate	EPA 8270D/625	EPA 8270D
Caprolactam	EPA 8270D/625	EPA 8270D
Carbazole	EPA 8270D/625	EPA 8270D
Chrysene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Dibenz(a,h)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Dibenzofuran	EPA 8270D/625	EPA 8270D
Diethyl phthalate	EPA 8270D/625	EPA 8270D
Dimethyl phthalate	EPA 8270D/625/ Scan-Sim	EPA 8270D
Di-n-butyl phthalate	EPA 8270D/625	EPA 8270D
Di-n-octyl phthalate	EPA 8270D/625	EPA 8270D
Fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Fluorene	EPA 8270D/625	EPA 8270D
Hexachlorobenzene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorobutadiene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D/625	EPA 8270D
Hexachloroethane	EPA 8270D/625	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Isodrin	EPA 8270D/625	EPA 8270D
Isophorone	EPA 8270D/625	EPA 8270D
Naphthalene	EPA 8270D/625	EPA 8270D
Nitrobenzene	EPA 8270D/625	EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodiphenylamine	EPA 8270D/625	EPA 8270D
Pentachlorophenol	EPA 8270D/625/ Scan-Sim	EPA 8270D
Phenanthrene	EPA 8270D/625	EPA 8270D
Phenol	EPA 8270D/625	EPA 8270D
Pyrene	EPA 8270D/625	EPA 8270D
Total Petroleum Hydrocarbons (TPH)	FL-PRO	FL-PRO
<u>Volatile Organics</u>		
1,1,1,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethene	EPA 8260B/624	EPA 8260B
1,1-Dichloropropene	EPA 8260B/624	EPA 8260B
1,2,3-Trichlorobenzene	EPA 504.1/8260B/624	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B/624	EPA 8260B
1,2,4-Trichlorobenzene	EPA 8260B/624	EPA 8260B
1,2,4-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504 /504.1/8011/8260B	EPA 8260B
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504 /504.1/8011/8260B	EPA 8260B
1,2-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,2-Dichloroethane	EPA 8260B/624	EPA 8260B

Peter Abney

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
1,2-Dichloropropane	EPA 8260B/624	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,3-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,3-Dichloropropane	EPA 8260B/624	EPA 8260B
1,4-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,4-Dioxane (1,4-Diethylenoxide)	EPA 8260B/624	EPA 8260B
2,2-Dichloropropane	EPA 8260B/624	EPA 8260B
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B/624	EPA 8260B
2-Chloroethyl vinyl ether	EPA 8260B/624	EPA 8260B
2-Chlorotoluene	EPA 8260B/624	EPA 8260B
2-Hexanone	EPA 8260B/624	EPA 8260B
4-Chlorotoluene	EPA 8260B/624	EPA 8260B
4-Methyl-2-pentanone (MIBK)	EPA 8260B/624	EPA 8260B
Acetone	EPA 8260B/624	EPA 8260B
Acetonitrile	EPA 8260B/624	EPA 8260B
Acrolein (Propenal)	EPA 8260B/624	EPA 8260B
Acrylonitrile	EPA 8260B/624	EPA 8260B
Allyl chloride (3-Chloropropene)	EPA 8260B/624	EPA 8260B
Benzene	EPA 8260B/624	EPA 8260B
Bromobenzene	EPA 8260B/624	EPA 8260B
Bromochloromethane	EPA 8260B/624	EPA 8260B
Bromodichloromethane	EPA 8260B/624	EPA 8260B
Bromoform	EPA 8260B/624	EPA 8260B
Carbon tetrachloride	EPA 8260B/624	EPA 8260B
Carbon disulfide	EPA 8260B/624	EPA 8260B
Chlorobenzene	EPA 8260B/624	EPA 8260B
Chloroethane	EPA 8260B/624	EPA 8260B
Chloroform	EPA 8260B/624	EPA 8260B
Chloroprene	EPA 8260B/624	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
Cyclohexane	EPA 8260B/624	EPA 8260B
Dibromochloromethane	EPA 8260B/624	EPA 8260B
Dibromomethane	EPA 8260B/624	EPA 8260B
Dichlorodifluoromethane	EPA 8260B/624	EPA 8260B
Ethyl methacrylate	EPA 8260B/624	EPA 8260B
Hexachlorobutadiene	EPA 8260B/624	EPA 8260B
Ethylbenzene	EPA 8260B/624	EPA 8260B
Iodomethane (Methyl iodide)	EPA 8260B/624	EPA 8260B
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260B/624	EPA 8260B
Isopropylbenzene	EPA 8260B/624	EPA 8260B
m+p-Xylenes	EPA 8260B/624	EPA 8260B
Methacrylonitrile	EPA 8260B/624	EPA 8260B
Methyl acetate	EPA 8260B/624	EPA 8260B
Methyl bromide (Bromomethane)	EPA 8260B/624	EPA 8260B
Methyl chloride (Chloromethane)	EPA 8260B/624	EPA 8260B
Methyl methacrylate	EPA 8260B/624	EPA 8260B
Methyl tert-butyl ether (MTBE)	EPA 8260B/624	EPA 8260B
Methylcyclohexane	EPA 8260B/624	EPA 8260B
Methylene chloride	EPA 8260B/624	EPA 8260B



Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Naphthalene	EPA 8260B/624	EPA 8260B
n-Butylbenzene	EPA 8260B/624	EPA 8260B
n-Propylbenzene	EPA 8260B/624	EPA 8260B
o-Xylene	EPA 8260B/624	EPA 8260B
Pentachloroethane	EPA 8260B/624	EPA 8260B
p-Isopropyltoluene	EPA 8260B/624	EPA 8260B
Propionitrile (Ethyl cyanide)	EPA 8260B/624	EPA 8260B
sec-Butylbenzene	EPA 8260B/624	EPA 8260B
Styrene	EPA 8260B/624	EPA 8260B
tert-Butylbenzene	EPA 8260B/624	EPA 8260B
Tetrachloroethene (Perchloroethylene)	EPA 8260B/624	EPA 8260B
Toluene	EPA 8260B/624	EPA 8260B
trans-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
trans-1,4-Dichloro-2-butene	EPA 8260B/624	EPA 8260B
Trichloroethene (Trichloroethylene)	EPA 8260B/624	EPA 8260B
Trichlorofluoromethane	EPA 8260B/624	EPA 8260B
Vinyl acetate	EPA 8260B/624	EPA 8260B
Vinyl chloride	EPA 8260B/624	EPA 8260B
Xylene (total)	EPA 8260B/624	EPA 8260B
<u>Pesticides-Herbicides-PCBs</u>		
2,4,5-T	EPA 8151A /615	EPA 8151A
2,4-D	EPA 8151A /615	EPA 8151A
2,4-DB	EPA 8151A /615	EPA 8151A
3,5-Dichlorobenzoic acid	EPA 8151A /615	EPA 8151A
4,4'-DDD	EPA 8081B/608	EPA 8081B
4,4'-DDE	EPA 8081B/608	EPA 8081B
4,4'-DDT	EPA 8081B/608	EPA 8081B
4-Nitrophenol	EPA 8151A/615	EPA 8151A
Acifluorfen	EPA 8151A/615	EPA 8151A
Aldrin	EPA 8081B/608	EPA 8081B
alpha-BHC (alpha- Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
alpha-Chlordane	EPA 8081B/608	EPA 8081B
Aroclor-1016(PCB-1016)	EPA 8082A/608	EPA 8082A
Aroclor-1221 (PCB-1221)	EPA 8082A/608	EPA 8082A
Aroclor-1232 (PCB-1232)	EPA 8082A/608	EPA 8082A
Aroclor-1242 (PCB-1242)	EPA 8082A/608	EPA 8082A
Aroclor-1248 (PCB-1248)	EPA 8082A/608	EPA 8082A
Aroclor-1254 (PCB-1254)	EPA 8082A/608	EPA 8082A
Aroclor-1260 (PCB-1260)	EPA 8082A/608	EPA 8082A
Azinphos-methyl (Guthion)	EPA 8141B/614	EPA 8141B
Bentazon	EPA 8151A/615	EPA 8151A
beta-BHC (beta- Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
Bolstar (Sulprofos)	EPA 8141B/614	EPA 8141B
Chloramben	EPA 8151A/615	EPA 8151A
Chlordane (tech.)	EPA 8081B/608	EPA 8081B
Chlorpyrifos	EPA 8141B/614	EPA 8141B
Coumaphos	EPA 8141B/614	EPA 8141B



Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Dacthal (DCPA)	EPA 8151A/615	EPA 8151A
Dalapon	EPA 8151A/615	EPA 8151A
delta-BHC	EPA 8081B/608	EPA 8081B
Demeton-o	EPA 8141B/614	EPA 8141B
Demeton-s	EPA 8141B/614	EPA 8141B
Diazinon	EPA 8141B/614	EPA 8141B
Dicamba	EPA 8151A/615	EPA 8151A
Dichlorofenthion	EPA 8141B/614	EPA 8141B
Dichloroprop (Dichlorprop)	EPA 8151A/615	EPA 8151A
Dlchlorovos (DDVP, Dichtorvos)	EPA 8141B/614	EPA 8141B
Dieldrin	EPA 8081B/608	EPA 8081B
Dimethoate	EPA 8141B/614	EPA 8141B
Dinoseb (2-sec-buty1-4 ,6-dinilrophenol, DNB P)	EPA 8151A/615	EPA 8151A
Disulfoton	EPA 8141B/614	EPA 8141B
Endosulfan I	EPA 8081B/608	EPA 8081B
Endosulfan II	EPA 8081B/608	EPA 8081B
Endosulfan sulfate	EPA 8081B/608	EPA 8081B
Endrin	EPA 8081B/608	EPA 8081B
Endrin aldehyde	EPA 8081B/608	EPA 8081B
Endrin ketone	EPA 8081B/608	EPA 8081B
EPN	EPA 8141B/614	EPA 8141B
Ethion	EPA 8141B/614	EPA 8141B
Ethoprop	EPA 8141B/614	EPA 8141B
fensulfothion	EPA 8141B/614	EPA 8141B
fenthion	EPA 8141B/614	EPA 8141B
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
gamma-Chlordane	EPA 8081B/608	EPA 8081B
Heptachlor	EPA 8081B/608	EPA 8081B
Heptachlor epoxide	EPA 8081B/608	EPA 8081B
Isodrin	EPA 8081B/608	EPA 8081B
Malathion	EPA 8141B/614	EPA 8141B
MCPA	EPA 8151A/615	EPA 8151A
MCPP	EPA 8151A/615	EPA 8151A
Merphos	EPA 8141B/614	EPA 8141B
Methoxychlor	EPA 8081B/608	EPA 8081B
Methyl parathion (Parathion. methyl)	EPA 8141B/614	EPA 8141B
Mevinphos	EPA 8141B/614	EPA 8141B
Mirex	EPA 8081B/608	EPA 8081B
Monocrotophos	EPA 8141B/614	EPA 8141B
Naled	EPA 8141B/614	EPA 8141B
Parathion, ethyl	EPA 8141B/614	EPA 8141B
Pentachlorophenol	EPA 8151A/615	EPA 8151A
Phorate	EPA 8141B/614	EPA 8141B
Picloram	EPA 8151A/615	EPA 8151A
Ronnel	EPA 8141B/614	EPA 8141B
Silvex (2A.5-TP)	EPA 8151B/615	EPA 8151B
Stirofos	EPA 8141B/614	EPA 8141B
Sulfotepp	EPA 8141B/614	EPA 8141B
Tetraethyl pyrophosphate (TEPP)	EPA 8141B/614	EPA 8141B
Tokuthion (Prothiophos)	EPA 8141B/614	EPA 8141B

Peter Abney

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Toxaphene (Chlorinated camphene)	EPA 8081B/608	EPA 8081B
Trichloronate	EPA 8141B/614	EPA 8141B

Preparation Methods

Fraction	Analytical Method	Preparation Method
Cyanide	EPA 9014 EPA 335.2 /SM 4500-CN E	EPA 9010C
TX	EPA 9056A	EPA 5050
Metal water prep	EPA 6020A/200.8	EPA 3005A
Metals soil prep	EPA 6020A	EPA 3050B
Metals TCLP prep	EPA 6020A/200.8	EPA 3010A
Extractable organics and Pesticides water prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3510C
Extractable organics and Pesticides waste prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3580A
Extractable organics and Pesticides soil prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3550C
Organics water and mid-level soil prep	EPA 8260B/624	EPA 5030B
Organics low-level soil prep	EPA 8260B/624	EPA 5035
Soil/water leachate	Wets	ENCO WETS-88
SPLP	Wets, Organics, and Metals	EPA 1312
TCLP	Wets, Organics, and Metals	EPA 1311



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

ENVIRONMENTAL CONSERVATION LABORATORIES - ORLANDO

Orlando, FL

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 29th day of March 2010.

A handwritten signature in black ink, appearing to read "Peter Meyer".

President & CEO
For the Accreditation Council
Certificate Number 3000.01
Valid to March 31, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

GEL LABORATORIES, LLC
 2040 Savage Road
 Charleston, SC 29414
 Robert L. Pullano Phone: (843) 556-8171
 rlp@gel.com

ENVIRONMENTAL

Valid To: August 31, 2011

Certificate Number: 2567.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1)) accreditation is granted to this laboratory to perform the following radiochemical tests in various matrices, including soils, drinking water, wastewater, groundwater, fiber air filters, vegetation, animal tissues and milk.

	<u>Preparation SOP</u>	<u>Analytical SOP</u>
<u>Alpha Spectrometry:</u> Alpha: Am-241, Am-243, Cf-252, Cm-242, Cm-243/244, Cm-245/246, Np-237, Po-208, Po-209, Po-210, Pu-236, Pu-238, Pu-239/240, Pu-242, Pu-244, Th-228, Th-229, Th-230, Th-232, U-232, U-233/234, U-235/236, U-238	GL-RAD-A-011, GL-RAD-A-016, GL-RAD-A-032, GL-RAD-A-036, GL-RAD-A-038, GL-RAD-A-043, GL-RAD-A-045	GL-RAD-I-009
<u>Radon Emanation:</u> Ra-226	GL-RAD-A-008, GL-RAD-A-028	GL-RAD-I-007
<u>Gamma Spectrometry:</u> Gamma: 46 to 1836 keV, I-129, I-131, Ni-59	GL-RAD-A-006, GL-RAD-A-013, GL-RAD-A-022	GL-RAD-I-001
<u>Kinetic Phosphorescence Analyzer</u> Total Uranium	GL-RAD-A-023	GL-RAD-B-018

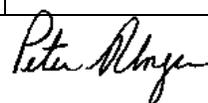
	<u>Preparation SOP</u>	<u>Analytical SOP</u>
<u>Gas Flow Proportional Counting:</u> Beta: Cl-36, I-131, Pb-210, Ra-228, Sr-89, Sr-90, Total Radium	GL-RAD-A-004, GL-RAD-A-009, GL-RAD-A-010, GL-RAD-A-017, GL-RAD-A-018, GL-RAD-A-029, GL-RAD-A-030, GL-RAD-A-033	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
Gross Alpha/Gross Beta:	GL-RAD-A-001, GL-RAD-A-001B, GL-RAD-A-001C	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
48 hour Gross Alpha	GL-RAD-A-047	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
<u>Liquid Scintillation Spectrometry:</u> Beta: C-14, Ca-45, Fe-55, H-3, Ni-63, P-32, Pm-147, Pu-241, S-35, Se-79, Tc-99 Alpha: Rn-222	GL-RAD-A-002, GL-RAD-A-003, GL-RAD-A-005, GL-RAD-A-007, GL-RAD-A-019, GL-RAD-A-020, GL-RAD-A-022, GL-RAD-A-031, GL-RAD-A-035, GL-RAD-A-040, GL-RAD-A-048, GL-RAD-A-049, GL-RAD-A-050	GL-RAD-I-004, GL-RAD-I-014, GL-RAD-I-017
ICP-MS Uranium Isotopes Tc-99	GL-MA-E-008 GL-RAD-A-005	GL-MA-E-014 GL-RAD-B-034

Additionally, in recognition of the successful completion of the A2LA evaluation process, including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1), accreditation is granted to this laboratory to perform recognized EPA, Standard Methods for the Examination of Water and Wastewater, ASTM, Department of Energy (DOE), California and Connecticut test methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP/MS, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Methylene Blue Active Substances, Misc.- Electronic Probes (pH, O₂), Oxygen Demand, Hazardous Waste Characteristics Tests, Spectrophotometry (Visible), Spectrophotometry (Automated), IR Spectrometry, Titrimetry, Total Organic Carbon, Total Organic Halide, Turbidity, Liquid Chromatography/Mass Spectrometer/Mass Spectrometer and Various Radiochemistry Techniques

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
Metals		
Aluminum	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Antimony	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Arsenic	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Barium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Beryllium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Boron	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Cadmium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Calcium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Chromium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Cobalt	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Copper	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Iron	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Lead	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Lithium	EPA 6020/6020A	EPA 6020/6020A
Magnesium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Manganese	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Mercury	EPA 1631E/7470/7470A/245.1	EPA 7470/7470A/7471A/7471B
Molybdenum	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Nickel	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Phosphorous	EPA 6020/6020A	EPA 6010B/6010C/6020/6020A
Potassium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Selenium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Silicon ¹	EPA 6010B/6010C modified	EPA 6010B/6010C modified
Silica as SiO ₂	EPA 6010B/6010C	EPA 6010B/6010C
Silver	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Sodium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Strontium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Thallium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Tin	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Titanium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Tungsten	-----	EPA 6020/6020A
Vanadium	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
Zinc	EPA 6010B/6010C/6020/6020A	EPA 6010B/6010C/6020/6020A
General Chemistry		
Acidity	SM 2310 B/EPA 305.1	-----
Adsorbable Organic Halogens (AOX)	EPA 1650	-----



<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
Alkalinity	SM 2320B/EPA 310.1	-----
Ammenable Cyanide	EPA 9012A/9012B/EPA 335.1	EPA 9012A/9012B
Ammonia Nitrogen	EPA 350.1	-----
Biochemical oxygen demand	SM 5210 B/EPA 405.1	-----
Bromide	EPA 9056A/EPA 300.0	EPA 9056A ³
Carbonaceous BOD	SM 5210 B	-----
Chemical Oxygen Demand (COD)	EPA 410.4	-----
Chloride	EPA 9056A/EPA 300.0	EPA 9056A ³
Chlorine (residual)	SM 4500Cl-G/EPA 330.5	-----
Chromium VI	EPA 7196A/SM 3500Cr-B	EPA 7196A
Color	SM 2120B/EPA 110.2	-----
Corrosivity toward Steel	-----	EPA 1110/1110A
Cyanide	EPA 9012A/9012B/335.3/335.4	EPA 9012A/9012B
Density	-----	ASTM D 5057
Extractable Organic Halides (EOX)	-----	EPA 9023
Filterable residue	SM 2540C	-----
Fluoride	EPA 9056A/EPA 300.0	EPA 9056A ³
Ignitability	EPA 1010/1020A/1020B	EPA 1010/1020A/1020B
Hardness	SM 2340B/SM2340C/ EPA 130.2	-----
Kjeldahl Nitrogen	EPA 351.2	-----
MBAS/Surfactants	SM 5540C/EPA 425.1	-----
Moisture Determination	-----	ASTM D-2216 (M)
Nitrate (as N)	EPA 9056A/EPA 300.0	EPA 9056A ³
Nitrate-nitrite (as N)	EPA 9056A/EPA 300.0	EPA 9056A ³
Nitrite (as N)	EPA 9056A/EPA 300.0	EPA 9056A ³
Nonfilterable residue	SM 2540D	-----
Oil & Grease	EPA 1664A	EPA 1664A
Organic Nitrogen	TKN – Ammonia EPA 351.2 – EPA 350.1	-----
Orthophosphate (as P)	EPA 9056A/EPA 300.0	EPA 9056A ³
Paint Filter Liquids Test	-----	EPA 9095A/9095B
Perchlorate	EPA 314.0/6850	EPA 6850
pH	SM 4500-H ⁺ B/ EPA 9040B /9040C/9041A/ EPA 150.1	EPA 9040B/9040C/9045C/9045D
Reactive Cyanide	Sec 7.3.3 SW846	Sec 7.3.3 SW846
Reactive Sulfide	Sec 7.3.4 SW846	Sec 7.3.4 SW846
Residue-Volatile	SM 2540E/EPA 160.4	-----
Residue-Settleable	SM 2540F	-----
Specific conductance	EPA 9050A/EPA 120.1	-----
Sulfate	EPA 9056A/EPA 300.0	EPA 9056A ³
Sulfite	SM 4500-SO ₃ B	-----
Sulfide	EPA 9030B/9034	EPA 9030B/9034
Temperature	EPA 170.1	EPA 170.1
Total, fixed, and volatile residue	SM 2540G	-----
Total Nitrate-Nitrite	EPA 353.2	-----

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
Total Organic Carbon (TOC)	EPA 9060/9060A/ SM 5310D/415.1	EPA 9060/9060A ²
Total Organic Halides (TOX)	EPA 9020B	EPA 9020B ²
Total Petroleum Hydrocarbons	EPA 1664A	EPA 1664A
Total Phenolics	EPA 9066/EPA 420.4	-----
Total Phosphorous	EPA 365.4	-----
Total residue	SM 2540B	-----
Turbidity	EPA 180.1/SM 2130	EPA 180.1/SM 2130
Organic Analytes		
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011/8260B	EPA 8260B
1,2 Dibromoethane (EDB)	EPA 8011/8260B	EPA 8260B
Purgeable Organics (Volatiles)		
Acetone	EPA 8260B	EPA 8260B
Acetonitrile	EPA 8260B	EPA 8260B
Acrolein (Propenal)	EPA 8260B	EPA 8260B
Acrylonitrile	EPA 8260B	EPA 8260B
Allyl Chloride	EPA 8260B	EPA 8260B
Benzene	EPA 8260B	EPA 8260B
Benzyl chloride	EPA 8260B	EPA 8260B
Bromobenzene	EPA 8260B	EPA 8260B
Bromochloromethane	EPA 8260B	EPA 8260B
Bromodichloromethane	EPA 8260B	EPA 8260B
Bromoform	EPA 8260B	EPA 8260B
Bromomethane	EPA 8260B	EPA 8260B
2-Butanone (Methyl Ethyl Ketone)	EPA 8015B/8015C/8260B	EPA 8260B
n-Butyl alcohol	EPA 8015B/8015C/8260B	EPA 8260B
n-Butylbenzene	EPA 8260B	EPA 8260B
Sec-Butylbenzene	EPA 8260B	EPA 8260B
Tert-Butylbenzene	EPA 8260B	EPA 8260B
Carbon disulfide	EPA 8260B	EPA 8260B
Carbon tetrachloride	EPA 8260B	EPA 8260B
Chlorobenzene	EPA 8260B	EPA 8260B
Chloroethane	EPA 8260B	EPA 8260B
2-Chloroethyl vinyl ether	EPA 8260B	EPA 8260B
Chloroform	EPA 8260B	EPA 8260B
Chloromethane	EPA 8260B	EPA 8260B
Chloroprene	EPA 8260B	EPA 8260B
2-Chlorotoluene	EPA 8260B	EPA 8260B
4-Chlorotoluene	EPA 8260B	EPA 8260B
Dibromochloromethane	EPA 8260B	EPA 8260B
Dibromomethane	EPA 8260B	EPA 8260B
1,2-Dichlorobenzene	EPA 8260/8270C/8270D	EPA 8260/8270C/8270D
1,3-Dichlorobenzene	EPA 8260/8270C/8270D	EPA 8260/8270C/8270D
1,4-Dichlorobenzene	EPA 8260/8270C/8270D	EPA 8260/8270C/8270D

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
Dichlorodifluoromethane	EPA 8260B	EPA 8260B
1,1-Dichloroethane	EPA 8260B	EPA 8260B
1,2-Dichloroethane	EPA 8260B	EPA 8260B
1,1-Dichloroethene	EPA 8260B	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B	EPA 8260B
trans-1,2-Dichloroethene	EPA 8260B	EPA 8260B
1,2-Dichloropropane	EPA 8260B	EPA 8260B
1,3-Dichloropropane	EPA 8260B	EPA 8260B
2,2-Dichloropropane	EPA 8260B	EPA 8260B
1,1-Dichloropropene	EPA 8260B	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B	EPA 8260B
cis-1,4-Dichloro-2-butene	EPA 8260B	EPA 8260B
trans-1,4-Dichloro-2-butene	EPA 8260B	EPA 8260B
Diethyl ether	EPA 8260B	EPA 8260B
1,4-Dioxane	EPA 8260B	EPA 8260B
Ethyl Acetate	EPA 8015B/8015C/8260B	EPA 8015B/8015C/8260B
Ethyl Benzene	EPA 8260B	EPA 8260B
Ethyl methacrylate	EPA 8260B	EPA 8260B
2-Hexanone	EPA 8260B	EPA 8260B
Hexachlorobutadiene	EPA 8260/8270C/8270D	EPA 8260/8270C/8270D
Isopropylbenzene	EPA 8260B	EPA 8260B
4-Isopropyltoluene	EPA 8260B	EPA 8260B
Iodomethane	EPA 8260B	EPA 8260B
Isobutyl Alcohol	EPA 8015B/8015C/8260B	EPA 8260B
Methacrylonitrile	EPA 8260B	EPA 8260B
Methylene chloride	EPA 8260B	EPA 8260B
Methyl methacrylate	EPA 8260B	EPA 8260B
4-Methyl-2-pentanone	EPA 8260B	EPA 8260B
Methyl tert butyl ether (MTBE)	EPA 8260B	EPA 8260B
Naphthalene	EPA 8260B/8270C/8270D/8310	EPA 8260B/8270C/8270D/8310
2-Nitropropane	EPA 8260B	EPA 8260B
n-Propylbenzene	EPA 8260B	EPA 8260B
Pentachloroethane	EPA 8260B	EPA 8260B
Propionitrile	EPA 8260B	EPA 8260B
Styrene	EPA 8260B	EPA 8260B
1,1,1,2-Tetrachloroethane	EPA 8260B	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B	EPA 8260B
Tetrachloroethene	EPA 8260B	EPA 8260B
Toluene	EPA 8260B	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B	EPA 8260B
Trichloroethene	EPA 8260B	EPA 8260B
Trichlorofluoromethane	EPA 8260B	EPA 8260B
1,2,3-Trichlorobenzene	EPA 8260B	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B	EPA 8260B
1,2,4-Trichlorobenzene	EPA 8260B/8270C/8270D	EPA 8260B/8270C/8270D
1,1,2-Trichloro-1,2,2- trifluoroethane	EPA 8260B	-----

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
1,2,4-Trimethylbenzene	EPA 8260B	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B	EPA 8260B
Trihalomethanes	EPA 8260B	EPA 8260B
Vinyl acetate	EPA 8260B	EPA 8260B
Vinyl chloride	EPA 8260B	EPA 8260B
Xylenes, total	EPA 8260B	EPA 8260B
o-Xylene	EPA 8260B	EPA 8260B
m+p-Xylene	EPA 8260B	EPA 8260B
Semivolatle Compounds		
Acenaphthene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Acenaphthylene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Acetophenone	EPA 8270C/8270D	EPA 8270C/8270D
2-Acetylaminofluorene	EPA 8270C/8270D	EPA 8270C/8270D
4-Aminobiphenyl	EPA 8270C/8270D	EPA 8270C/8270D
Aniline	EPA 8270C/8270D	EPA 8270C/8270D
Anthracene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Aramite	EPA 8270C/8270D	EPA 8270C/8270D
Atrazine	EPA 8270C/8270D	EPA 8270C/8270D
Benzidine	EPA 8270C/8270D	EPA 8270C/8270D
Benzoic acid	EPA 8270C/8270D	EPA 8270C/8270D
Benzo (a) anthracene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (b) fluoranthene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (k) fluoranthene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (ghi) perylene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Benzo (a) pyrene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
p-Benzoquinone	EPA 8270C/8270D	EPA 8270C/8270D
Benzyl alcohol	EPA 8270C/8270D	EPA 8270C/8270D
Bis (2-chloroethoxy) methane	EPA 8270C/8270D	EPA 8270C/8270D
Bis (2-chloroethyl) ether	EPA 8270C/8270D	EPA 8270C/8270D
Bis (2-chloroisopropyl) ether	EPA 8270C/8270D	EPA 8270C/8270D
Bis (2-ethylhexyl) phthalate	EPA 8270C/8270D	EPA 8270C/8270D
4-Bromophenyl phenyl ether	EPA 8270C/8270D	EPA 8270C/8270D
Butyl benzyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D
Carbazole	EPA 8270C/8270D	EPA 8270C/8270D
4-Chloroaniline	EPA 8270C/8270D	EPA 8270C/8270D
Chlorobenzilate	EPA 8270C/8270D	EPA 8270C/8270D
4-Chloro-3-methylphenol	EPA 8270C/8270D	EPA 8270C/8270D
2-Chloronaphthalene	EPA 8270C/8270D	EPA 8270C/8270D
2-Chlorophenol	EPA 8270C/8270D	EPA 8270C/8270D
4-Chlorophenyl phenyl ether	EPA 8270C/8270D	EPA 8270C/8270D
Chrysene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
n-Decane	EPA 625	-----
Diallate	EPA 8270C/8270D	EPA 8270C/8270D
Dibenzo (a,h) anthracene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Dibenzofuran	EPA 8270C/8270D	EPA 8270C/8270D
Dibenzo (a,e) pyrene	EPA 8270C/8270D	EPA 8270C/8270D
1,2-Dichlorobenzene	EPA 8260B/8270C/8270D	EPA 8260B/8270C/8270D
1,3-Dichlorobenzene	EPA 8260B/8270C/8270D	EPA 8260B/8270C/8270D
1,4-Dichlorobenzene	EPA 8260B/8270C/8270D	EPA 8260B/8270C/8270D

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
3,3'-Dichlorobenzidine	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D
2,6-Dichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D
3,3'-Dimethylbenzidine	EPA 8270C/8270D	EPA 8270C/8270D
Diethyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D
Dimethoate	EPA 8270C/8270D	EPA 8270C/8270D
1,3-Dinitrobenzene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
1,4-Dinitrobenzene	EPA 8270C/8270D	EPA 8270C/8270D
Disulfoton	EPA 8270C/8270D	EPA 8270C/8270D
p-Dimethylaminoazobenzene	EPA 8270C/8270D	EPA 8270C/8270D
7,12-Dimethylbenz(a)anthracene	EPA 8270C/8270D	EPA 8270C/8270D
Alpha, alpha-Dimethylphenethylamine	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dimethylphenol	EPA 8270C/8270D	EPA 8270C/8270D
Dimethyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D
Di-n-butyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D
Di-n-octyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dinitrophenol	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dinitrotoluene	EPA 8270/8330A/8330B	EPA 8270/8330A/8330B
2,6-Dinitrotoluene	EPA 8270/8330A/8330B	EPA 8270/8330A/8330B
Diphenylamine	EPA 8270C/8270D	EPA 8270C/8270D
1,2-Diphenylhydrazine	EPA 8270C/8270D	EPA 8270C/8270D
Ethyl methanesulfonate	EPA 8270C/8270D	EPA 8270C/8270D
Famphur	EPA 8270C/8270D	EPA 8270C/8270D
Fluoroanthene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Fluorene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Hexachlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D
Hexachlorobutadiene	EPA 8260B/8270C/8270D	EPA 8260B/8270C/8270D
Hexachlorophene	EPA 8270C/8270D	EPA 8270C/8270D
Hexachloropropene	EPA 8270C/8270D	EPA 8270C/8270D
Hexachlorocyclopentadiene	EPA 8270C/8270D	EPA 8270C/8270D
Hexachloroethane	EPA 8270C/8270D	EPA 8270C/8270D
Indeno (1,2,3-cd) pyrene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Isodrin	EPA 8270C/8270D	EPA 8270C/8270D
Isophorone	EPA 8270C/8270D	EPA 8270C/8270D
Isosafrole	EPA 8270C/8270D	EPA 8270C/8270D
Kepone	EPA 8270C/8270D	EPA 8270C/8270D
Methapyrilene	EPA 8270C/8270D	EPA 8270C/8270D
3-Methylcholanthrene	EPA 8270C/8270D	EPA 8270C/8270D
2-Methyl-4,6-Dinitrophenol	EPA 8270C/8270D	EPA 8270C/8270D
Methyl methanesulfonate	EPA 8270C/8270D	EPA 8270C/8270D
1-Methylnaphthalene	EPA 8270C/8270D	EPA 8270C/8270D
2-Methylnaphthalene	EPA 8270C/8270D	EPA 8270C/8270D
Methyl Parathion	EPA 8270C/8270D	EPA 8270C/8270D
2-Methylphenol (o-cresol)	EPA 8270C/8270D	EPA 8270C/8270D
3/4-Methylphenols(m/p cresols)	EPA 8270C/8270D	EPA 8270C/8270D
Naphthalene	EPA 8260B/8270C/8270D/8310	EPA8260B/8270C/8270D/8310
1,4-Naphthoquinone	EPA 8270C/8270D	-----

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
1-Naphthylamine	EPA 8270C/8270D	EPA 8270C/8270D
2-Naphthylamine	EPA 8270C/8270D	EPA 8270C/8270D
2-Nitroaniline	EPA 8270C/8270D	EPA 8270C/8270D
3-Nitroaniline	EPA 8270C/8270D	EPA 8270C/8270D
4-Nitroaniline	EPA 8270C/8270D	EPA 8270C/8270D
Nitrobenzene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
5-Nitro-o-toluidine	EPA 8270C/8270D	EPA 8270C/8270D
2-Nitrophenol	EPA 8270C/8270D	EPA 8270C/8270D
4-Nitrophenol	EPA 8270C/8270D	EPA 8270C/8270D
Nitroquinoline-1-oxide	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosodiethylamine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosodimethylamine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosodi-n-butylamine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosodi-n-propylamine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosodiphenylamine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosodimethylethylamine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosomorpholine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosopiperidine	EPA 8270C/8270D	EPA 8270C/8270D
N-Nitrosopyrrolidine	EPA 8270C/8270D	EPA 8270C/8270D
n-Octadecane	-----	EPA 8270C/8270D
o,o,o-Triethyl phosphorothioate	EPA 8270C/8270D	EPA 8270C/8270D
o-Toluidine	EPA 8270C/8270D	EPA 8270C/8270D
Parathion, ethyl	EPA 8270C/8270D	EPA 8270C/8270D
Pentachlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D
Pentachloronitrobenzene	EPA 8270C/8270D	EPA 8270C/8270D
Pentachlorophenol	EPA 8270C/8270D/8151A	EPA 8270C/8270D/8151A
Phenacetin	EPA 8270C/8270D	EPA 8270C/8270D
Phenanthrene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Phenol	EPA 8270C/8270D	EPA 8270C/8270D
1,4-Phenylenediamine	EPA 8270C/8270D	-----
Phorate	EPA 8270C/8270D	EPA 8270C/8270D
2-Picoline (2-Methylpyridine)	EPA 8270C/8270D	EPA 8270C/8270D
Pronamide (Kerb)	EPA 8270C/8270D	EPA 8270C/8270D
Pyrene	EPA 8270C/8270D/8310	EPA 8270C/8270D/8310
Pyridine	EPA 8270C/8270D	EPA 8270C/8270D
Safrole	EPA 8270C/8270D	EPA 8270C/8270D
Sulfotepp	EPA 8270C/8270D	EPA 8270C/8270D
1,2,4,5-Tetrachlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D
2,3,4,6-Tetrachlorophenol	EPA 8270C/8270D	EPA 8270C/8270D
Thionazin (Zinophos)	EPA 8270C/8270D	EPA 8270C/8270D
1,2,4-Trichlorobenzene	EPA 8260B/8270C/8270D	EPA 8260B/8270C/8270D
2,4,5-Trichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D
2,4,6-Trichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D
1,3,5-Trinitrobenzene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
Pesticides & PCBs		
Aldrin	EPA 8081A/8081B	EPA 8081A/8081B
alpha-BHC	EPA 8081A/8081B	EPA 8081A/8081B
alpha-Chlordane	EPA 8081A/8081B	EPA 8081A/8081B

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
beta-BHC	EPA 8081A/8081B	EPA 8081A/8081B
Chlordane (technical)	EPA 8081A/8081B	EPA 8081A/8081B
delta-BHC	EPA 8081A/8081B	EPA 8081A/8081B
gamma-BHC	EPA 8081A/8081B	EPA 8081A/8081B
gamma-Chlordane	EPA 8081A/8081B	EPA 8081A/8081B
4,4'-DDD	EPA 8081A/8081B	EPA 8081A/8081B
4,4'-DDE	EPA 8081A/8081B	EPA 8081A/8081B
4,4',-DDT	EPA 8081A/8081B	EPA 8081A/8081B
Dieldrin	EPA 8081A/8081B	EPA 8081A/8081B
Endosulfan I	EPA 8081A/8081B	EPA 8081A/8081B
Endosulfan II	EPA 8081A/8081B	EPA 8081A/8081B
Endosulfan sulfate	EPA 8081A/8081B	EPA 8081A/8081B
Endrin	EPA 8081A/8081B	EPA 8081A/8081B
Endrin aldehyde	EPA 8081A/8081B	EPA 8081A/8081B
Endrin ketone	EPA 8081A/8081B	EPA 8081A/8081B
Heptachlor	EPA 8081A/8081B	EPA 8081A/8081B
Heptachlor epoxide	EPA 8081A/8081B	EPA 8081A/8081B
Methoxychlor	EPA 8081A/8081B	EPA 8081A/8081B
Toxaphene	EPA 8081A/8081B	EPA 8081A/8081B
PCB-1016 (Aroclor)	EPA 8082/8082A	EPA 8082/8082A
PCB-1221	EPA 8082/8082A	EPA 8082/8082A
PCB-1232	EPA 8082/8082A	EPA 8082/8082A
PCB-1242	EPA 8082/8082A	EPA 8082/8082A
PCB-1248	EPA 8082/8082A	EPA 8082/8082A
PCB-1254	EPA 8082/8082A	EPA 8082/8082A
PCB-1260	EPA 8082/8082A	EPA 8082/8082A
PCB-1262	EPA 8082/8082A	EPA 8082/8082A
PCB-1268	EPA 8082/8082A	EPA 8082/8082A
Total Aroclors	EPA 8082/8082A	EPA 8082/8082A
FID Compounds		
Ethyl acetate	EPA 8015B/8015C/8260B	EPA 8015B/8015C/8260B
Ethylene Glycol	EPA 8015B/8015C	EPA 8015B/8015C
Isobutyl Alcohol	EPA 8015B/8015C/8260B	EPA 8260B
Isopropyl Alcohol (2-Propanol)	EPA 8015B/8015C	-----
Methanol	EPA 8015B/8015C	EPA 8015B/8015C
Diesel Range Organics (DRO)	EPA 8015B/8015C/CA-LUFT/ CT-ETPH	EPA 8015B/8015C/CA-LUFT/ CT-ETPH
Gas Range Organics (GRO)	EPA 8015B/8015C/CA-LUFT	EPA 8015B/8015C/CA-LUFT
Herbicides		
2,4-D	EPA 8151A	EPA 8151A
2,4-DB	EPA 8151A	EPA 8151A
Dalapon	EPA 8151A	EPA 8151A
Dicamba	EPA 8151A	EPA 8151A
Dichloroprop	EPA 8151A	EPA 8151A
Dinoseb	EPA 8151A	EPA 8151A
MCPA	EPA 8151A	EPA 8151A
MCPP	EPA 8151A	EPA 8151A

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
2,4,5-T	EPA 8151A	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A	EPA 8151A
Pentachlorophenol	EPA 8151A	EPA 8151A
Nitrosamines, Nitroaromatics		
1,3-Dinitrobenzene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
2,4-Dinitrotoluene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
2,6-Dinitrotoluene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
2,4,6-Trinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
2-Amino-4,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
2-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
3-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
3,5-Dinitroaniline		EPA 8330B (Solids Only)
4-Amino-2,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
4-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B
Nitrobenzene	EPA 8270C/8270D/8330A/8330B	EPA 8270C/8270D/8330A/8330B
Nitroglycerine	EPA 8330A/8330B	EPA 8330A/8330B
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330A/8330B	EPA 8330A/8330B
Pentaerythritoltetranitrate (PETN)	EPA 8330A/8330B	EPA 8330A/8330B
hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	EPA 8330A/8330B	EPA 8330A/8330B
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330A/8330B	EPA 8330A/8330B
Radiochemistry		
Barium 133	DOE 4.5.2.3	DOE 4.5.2.3
Cesium 134	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Cesium 137	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Cobalt-60	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Gamma Emitters	DOE 4.5.2.3/EPA 901.1	DOE 4.5.2.3
Gross Alpha	EPA 900.0/9310	EPA 9310
Gross Beta	EPA 900.0/9310	EPA 9310
Radioactive Iodine	DOE 4.5.2.3/EPA 901.1/902.0	DOE 4.5.2.3
Radium-226	EPA 903.1/DOE Ra-04	DOE Ra-04
Radium-228	EPA 904.0/9320/DOE 4.5.2.3	DOE 4.5.2.3/EPA9320
Total Radium	EPA 9315	EPA 9315
Radon	SM7500 Rn-B	-----
Strontium-89	EPA 905.0	DOE Sr-01
Strontium-90	EPA 905.0/DOE Sr-02	DOE Sr-02
Thorium	DOE 4.5.5	DOE 4.5.5
Tritium	EPA 906.0	-----
Uranium	ASTM D5174-02/D5174-97/DOE U-02/EPA 6020/6020A	DOE U-02/EPA 6020/6020A
Zinc-65	EPA 901.1/DOE 4.5.2.3	DOE 4.5.2.3
<u>Preparatory and Clean-up Methods</u>		

<u>Parameter/Analyte</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste (Liquids and Solids)</u>
Toxicity Characteristic Leaching Procedure (Inorganics, Extractable Organics, Volatile Organics)	-----	EPA 1311
Synthetic Preparation Leaching Procedure	-----	EPA 1312
Waste Extraction Test (W.E.T.)	-----	CCR Chapter 11, Article 5, Appendix II
Anion Preparation	-----	EPA 9056A ³
Cyanide Distillation	EPA 9010B/9010C	EPA 9010B/9010C ³
Sulfide Distillation	EPA 9030B	EPA 9030B
Metals Digestion	EPA 200.2, 3005A, 3010A	EPA 3050B
Alkaline Digestion for Hexavalent Chromium	-----	EPA 3060A
Bomb Preparation for Solid Waste	-----	EPA 5050
Mercury Preparation	EPA 7470/7470A	EPA 7471A/7471B
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	-----
Continuous Liquid-Liquid Extraction	EPA 3520C	-----
Solid Phase Extraction	EPA 3535A	-----
Automated Soxhlet Extraction	-----	EPA 3541
Ultrasonic Extraction	-----	EPA 3550C
Waste Dilution	-----	EPA 3580A
Waste Dilution for Volatile Organics	-----	EPA 3585
Purge and Trap for Volatile Organics	EPA 5030A/5030B/5030C	EPA 5035/5035A
Alumina Clean-up	-----	EPA 3610B/3611B
Florisil Clean-up	-----	EPA 3620B/3620C
Silica Gel Clean-up	-----	EPA 3630C
Gel Permeation Clean-up	-----	EPA 3640A
Sulfur Clean-up	-----	EPA 3660B
Sulfuric Acid/Permanganate Clean-up	-----	EPA 3665A

Additionally, in recognition of the successful completion of the A2LA evaluation process (including an assessment of the laboratory's compliance with the 2003 NELAC Chapter 5 Requirements), accreditation is granted to this laboratory to perform the following bioassay analyses on bone, tissue, urine, fecal, and nasal swabs.

	<u>Preparation SOP</u>	<u>Analytical SOP</u>
<u>Bioassay Analysis</u>		

	<u>Preparation SOP</u>	<u>Analytical SOP</u>
<u>Bioassay Analysis</u>		
<u>Alpha Spectrometry:</u> Alpha: Am-241, Cm-242, Cm-243/244, Cm-245/246, Cf-252, Np-237, Po-208, Po-209, Po-210, Pu-236, Pu-238, Pu-239/240, Pu-242, Pu-244, Th-228, Th-229, Th-230, Th-232, U-232, U-233/234, U-235/236, U-238	GL-RAD-B-001, GL-RAD-B-002, GL-RAD-B-003, GL-RAD-B-010, GL-RAD-B-012, GL-RAD-B-013, GL-RAD-B-017	GL-RAD-B-009
<u>Liquid Scintillation Spectrometry:</u> C-14, Gross Alpha, H-3, Ni-63, Pu-241, Tc-99	GL-RAD-B-001, GL-RAD-B-008, GL-RAD-B-011, GL-RAD-B-012, GL-RAD-B-013, GL-RAD-B-016, GL-RAD-B-020, GL-RAD-B-023	GL-RAD-I-004, GL-RAD-I-014, GL-RAD-I-017
<u>Gas Flow Proportional Counting:</u> Beta: Sr-90	GL-RAD-B-001	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
Gross Alpha/Gross Beta:	GL-RAD-B-022	GL-RAD-I-006
<u>Kinetic Phosphorescence Analyzer</u> Total Uranium	GL-RAD-B-019	GL-RAD-B-018
<u>Radon Emanation:</u> Ra-226	GL-RAD-B-002	GL-RAD-I-007
<u>Refractometer</u> Specific Gravity	GL-RAD-B-027	GL-RAD-B-027
<u>ICP-MS</u> Uranium Isotopes	GL-RAD-B-035	GL-RAD-B-027
<u>Gamma Spectrometry:</u> Gamma: Ni-59, 46 to 1836 keV	GL-RAD-B-020, GL-RAD-A-013	GL-RAD-I-001

Finally, accreditation is also granted to this laboratory to perform the following tests on children's toys:

<u>Chemical</u>

1 - Calculated from silica determination

2 – Applicable only to liquid ‘Solid Hazardous Waste’, where liquids may include aqueous, non-aqueous, and oily wastes. Solids may include soils, sediments, sludges, tissues, filters and any matrix deemed non-liquid.

3 – The referenced method is modified to include a simple prep for non-aqueous and/or solid matrix samples.



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

GEL LABORATORIES, LLC

Charleston, SC

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).



Presented this 23rd day of October 2009.

A handwritten signature in black ink, appearing to read "Peter Meyer".

President & CEO

For the Accreditation Council

Certificate Number 2567.01

Valid to August 31, 2011

REVISED June 22, 2011

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.