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Final

Sampling and Analysis Plan for the Site Inspection of Former Small Arms Firing Ranges

(Field Sampling Plan and Quality Assurance Project Plan)

Naval Air Station Oceana
Fleet Combat Training Center - Dam Neck Annex
Naval Auxiliary Landing Field - Fentress
Virginia Beach, Virginia

Naval Facilities Engineering Command

Prepared for

Department of the Navy

Naval Facilities Engineering Command
Mid-Atlantic

Contract No.
N62470-08-D-1000
CTO-0028

June 2010

Prepared by

CH2MHILL

SAP Worksheet #1—Title and Approval Page

Final

Sampling and Analysis Plan for the Site Inspection of Former Small Arms Firing Ranges (Field Sampling Plan and Quality Assurance Project Plan)

Naval Air Station Oceana
Fleet Combat Training Center - Dam Neck Annex
Naval Auxiliary Landing Field – Fentress

Virginia Beach, Virginia

Contract Task Order 028

June 2010

Prepared for:

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

Navy CLEAN 1000 Program
Contract No. N62470-08-D-1000

Prepared by:

CH2MHILL

Virginia Beach, Virginia

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6/10/10

John Tomik
CH2M HILL – Activity Quality Manager /Senior Technical Consultant

Approval Signatures:

Mary Margaret Kutz 6/10/10
Mary Margaret Kutz
NAVFAC Mid-Atlantic – Remedial Project Manager

6/28/10
Steve Mihalko
VDEQ – Remedial Project Manager

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Executive Summary

CH2M HILL has been contracted by the U.S. Navy, Naval Facilities Engineering Command Mid-Atlantic Division to conduct a Site Inspection (SI) of six former small-arms firing ranges associated with Naval Air Station Oceana, Dam Neck Annex, and Naval Auxiliary Landing Field Fentress. The SI activities will be conducted under the Munitions Response Program.

This Sampling and Analysis Plan (SAP) was prepared in accordance with current U.S. Environmental Protection Agency and Navy guidance documents related to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

This SAP addresses the SI of six former small-arms firing ranges listed below:

Naval Air Station Oceana
- Machine Gun Boresight Range

Fleet Combat Training Center – Dam Neck Annex
- Pistol Range North
- Pistol Range South
- Rifle Range
- Skeet and Trap Range

Naval Auxiliary Landing Field Fentress
- Machine Gun Boresight Range

The objective of the SI is to confirm or deny the potential source release of munitions constituents associated with small arms ammunition use and contaminants of concern within the defined boundaries of the six MRP sites, and if present, to determine whether this release warrants further investigation or action.

This SAP details the procedures necessary to complete the SI, and has been completed under Contract N62470-08-D-1000, Contract Task Order 028, in accordance with the Navy's Uniform Federal Policy (UFP) SAP policy guidance to ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable for intended uses. The laboratory information cited in this SAP is specific to Empirical Laboratories. If additional laboratory services are requested that require modification to the existing SAP, revised SAP worksheets will be submitted to the Navy and regulatory agencies for approval.

This SAP consists of the 37 worksheets specific to the UFP-SAP. All tables are embedded within the worksheets. All figures are presented at the end of the document. The project-specific Health and Safety Plan is provided in **Appendix A**. Field standard operating procedures (SOPs) are provided in **Appendix B**, the site-specific laboratory SOPs are provided in **Appendix C**, and data management documentation are provided in **Appendix D**.

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9 Machine Gun Boresight Range

Appendices

A Health and Safety Plan
B Field Standard Operating Procedures
C Laboratory Standard Operating Procedures
D Data Management Documentation

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Abbreviations and Acronyms

° C	degree(s) Celsius
AM	Activity Manager
ANOVA	analysis of variance
AQM	Activity Quality Manager
bgs	below ground surface
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CoC	chain of custody
COPC	contaminant of potential concern
CV	calibration verification
DoD	Department of Defense
DQI	data quality indicators
Eco-SSL	ecological soil screening level
EIS	Environmental Information Specialist
ELAP	Environmental Laboratory Accreditation Letter
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessor
FTL	Field Team Leader
FTM	field team member
GC/MS	gas chromatograph/ mass spectrometer
GPS	global positioning system
H&S	health and safety
HHRA	Human Health Risk Assessor
HSP	Health and Safety Plan
ICAL	initial calibration
ICP-AES	inductively coupled plasma - atomic emission spectrometer
ICS	interference check standards
ICV	initial calibration verification
ID	identification
IDL	instrument detection limit
LCS	lower confidence level
LCS	laboratory control sample
MC	munitions constituent
MDL	method detection limit

MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MRP	Munitions Response Program
MS/MSD	matrix spike/matrix spike duplicate
NALF	Naval Auxiliary Landing Field
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
N/A	not applicable
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PM	Project Manager
POC	point of contact
PPE	personal protective equipment
PQL	project quantitation limit
PQO	project quality objective
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
QL	quantitation limit
RF	response factor
RPD	relative percent difference
RPM	Remedial Project Manager
RSL	risk screening level
SAP	Sampling and Analysis Plan
SAFR	small arms firing range
SI	Site Inspection
SIM	selected ion monitoring
SOP	standard operating procedure
SSC	Site Safety Coordinator
STC	Senior Technical Consultant
TM	Task Manager
TBD	to be determined
UCL	upper confidence limit
UFP	Uniform Federal Policy
UTL	upper tolerance limit
VDEQ	Virginia Department of Environmental Quality
VMRC	Virginia Marine Resources Commission

SAP Worksheet #2—SAP Identifying Information

Site Name/Number: Naval Air Station (NAS) Oceana
Machine Gun Boresight Range

Fleet Combat Training Center – Dam Neck Annex
Pistol Range North
Pistol Range South
Rifle Range
Skeet and Trap Range

Naval Auxiliary Landing Field (NALF) Fentress
Machine Gun Boresight Range

Operable Unit: Not Applicable (N/A)
Contractor Name: CH2M HILL
Contract Number: N62470-08-D-1000, Contract Task Order 028
Contract Title: Navy Comprehensive Long-term Environmental Action-Navy (CLEAN) 1000 Program

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

2. **Identify regulatory program:** These sites are not included in an official regulatory program at this time. However, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) framework was used to develop the sampling and decision-making strategy included in this SAP.

3. **Type or SAP:** This is a project-specific SAP. This SAP provides specific details for conducting a Site Inspection (SI) of the six former small-arms firing ranges among NAS Oceana, Fleet Combat Training Center - Dam Neck Annex and NALF Fentress, as listed above.

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

Scoping Session	Date
CH2M Hill Project Team Meeting	April 21, 2009
Initial External Project Team Meeting	April 27, 2009
Second External Project Team Meeting	August 13, 2009
Third External Project Team Meeting	November 16, 2009

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

Title	Date
Final Preliminary Assessment – Naval Air Station Oceana, Dam Neck Annex and Naval Auxiliary Landing Field Fentress, Virginia. (Malcolm-Pirnie, 2008)	October 2008

SAP Worksheet #2—SAP Identifying Information (continued)

6. **List organizational partners (stakeholders) and connection with lead organization:**
   - Virginia Department of Environmental Quality (VDEQ) – Regulatory stakeholder
   - Virginia Marine Resources Commission (VMRC) - Coastal program stakeholder
7. **Lead organization:** Naval Facilities Engineering Command (NAVFAC)
   (see **Worksheet #7** for detailed list of data users)
8. **Applicable SAP elements:** If any required SAP elements or required information are not applicable to the project or are provided elsewhere, note the omitted SAP elements and provide an explanation for their exclusion below: N/A

   All SAP elements required for this project are described herein on the 37 UFP-SAP Worksheets. Therefore, the crosswalk table is not necessary for this project.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	Document Control Number
Mary Margaret Kutz	Remedial Project Manager (RPM)	NAVFAC Mid-Atlantic	757-445-6676	mary.kutz@navy.mil	To be determined (TBD)
Steve Mihalko	RPM	VDEQ	804-698-4202	samihalko@deq.state.va.us	
Tony Watkinson	Habitat Manager	VMRC, Habitat Management Division	757-247-2255	tony.watkinson@mrc.virginia.gov	
Laura Cook	Activity Manager (AM)	CH2M HILL	757-671-6214	laura.cook@ch2m.com	
Steve Falatko	Project Manager (PM)		703-376-5099	stephen.falatko@ch2m.com	
Dennis Ballam	Field Team Leader (FTL)		757-671-6251	dennis.ballam@ch2m.com	
Sonya Gordon	Laboratory PM	Empirical Laboratories	615-345-1115	sgordon@empirlabs.com	

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SAP Worksheet #4—Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number	Signature/ email receipt	SAP Worksheets Reviewed	Date SAP Read
Mary Margaret Kutz	NAVFAC Mid-Atlantic/ RPM	757-445-6676			
Steve Mihalko	VDEQ/ RPM	804-698-4202			
Tony Watkinson	Habitat Management Division, VMRC/ Habitat Manager	757-247-2255			
Laura Cook	CH2M HILL/ AM	757-671-6214			
Steve Falatko	CH2M HILL/ PM	703-376-5099			
Stefanie Eggermann	CH2M HILL/ TM	703-376-5328			
John Tomik	CH2M HILL/ AQM and STC	757-671-6259			
Paul Favara	CH2M HILL/ Navy CLEAN Program UFP-SAP Reviewer	352-384-7067			
Bill Kappleman	CH2M HILL/ Senior ERA	703-376-5152			
Roni Warren	CH2M HILL/ Senior HHRA	814-364-2454			
Tim Garretson	CH2M HILL/ Senior MEC Consultant	757-671-6224			
Mark Orman	CH2M HILL/ H&S Manager	414-847-0597			
Anita Dodson	CH2M HILL/ Navy CLEAN Program Chemist	757-671-6218			
Megan Morrison	CH2M HILL/ Project Chemist	703-376-5053			
Victoria Brynildsen	CH2M HILL/ EIS	757-671-6252			
Dennis Ballam	CH2M HILL/ FTL	757-671-6251			
Mark Ost	CH2M HILL/ FTM	757-671-6247			

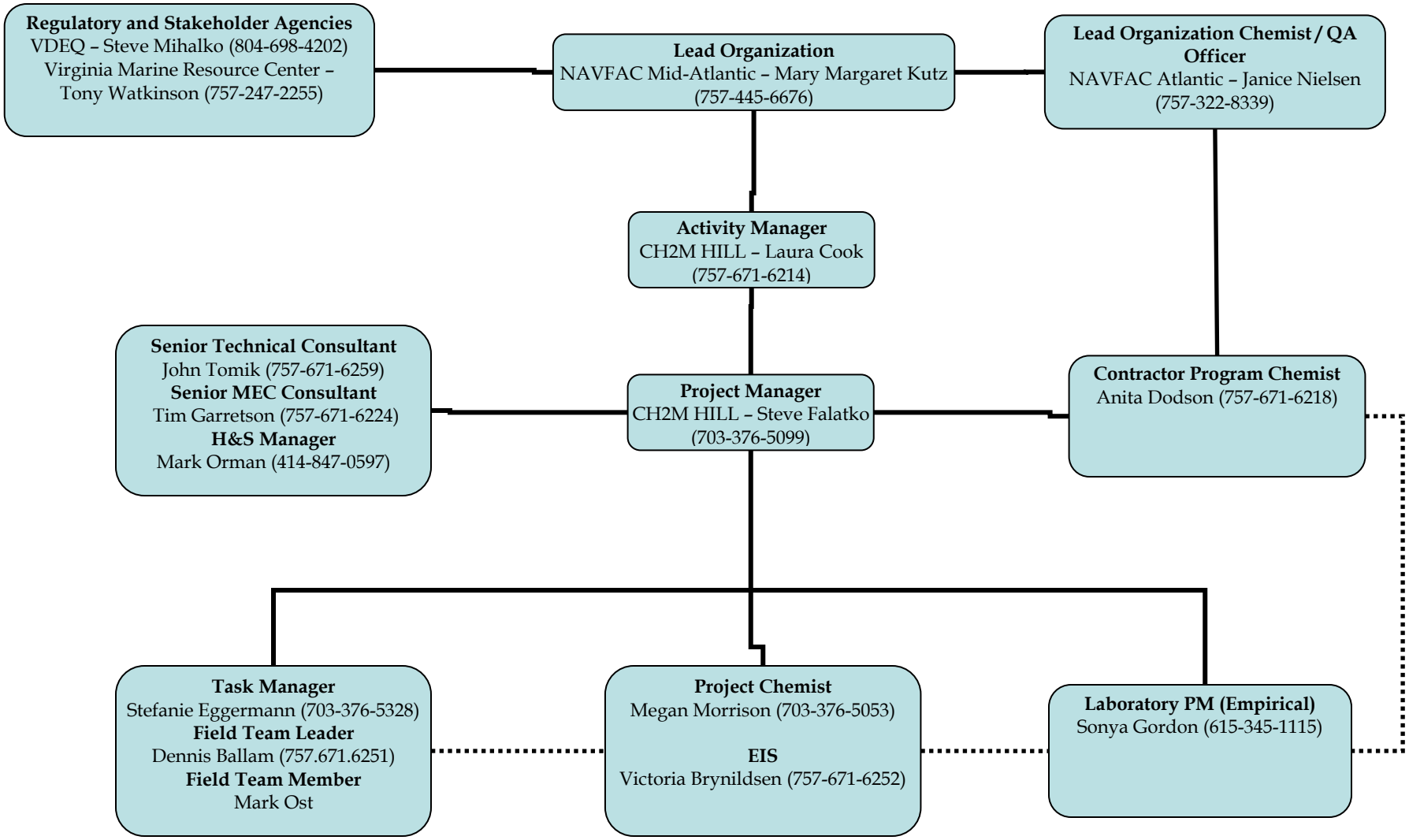
SAP Worksheet #4—Project Personnel Sign-Off Sheet (continued)

Name	Organization/Title/Role	Telephone Number	Signature/ email receipt	SAP Section Reviewed	Date SAP Read
Sonya Gordon	Empirical/ Laboratory PM	615-345-1115			
Randy Ward	Empirical/ QA Officer	615-345-1115			

Once the UFP-SAP is finalized, CH2M HILL will send copies of it to all parties on the distribution list in Worksheet #3 and request signatures. If signatures are returned, copies will be kept on internal CH2M HILL project folders, which are organized by activity and CTO number.

The personnel listed above acknowledge their receipt, acceptance, and approval for the listed sections of this UFP-SAP for the SI for the former small arms firing ranges (SAFRs) at NAS Oceana. The signed version of this document becomes a part of the administrative record for NAS Oceana, and a copy will be maintained in CH2M HILL's project file.

SAP Worksheet #5—Project Organizational Chart



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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/ or e-mail	Procedure
Communication with Navy (lead agency)	Navy RPM	Mary Margaret Kutz	757-445-6676	Point of contact (POC) for the Navy; can delegate communication to other internal or external POCs. RPM will notify VDEQ via email within 24 hours for field changes affecting the scope. Navy will have 30 days for SAP review.
Communication with VDEQ (regulatory agency)	VDEQ RPM	Steve Mihalko	804-698-4202	Primary POC for VDEQ; can delegate communication to other internal or external POCs. Upon notification of field changes, VDEQ will have 24 hours to approve or comment on the field changes. VDEQ will have 30 days for SAP review.
Communication with VMRC	VMRC Habitat Manager	Tony Watkinson	757-247-2255	Primary POC for the VMRC; can delegate communication to other internal or external POCs. Upon notification of intrusive activities to be conducted along the dunes at the site, VMRC will evaluate whether the action will adversely affect the coastal zone. If the evaluation finds no impact, VMRC will send a notification as such.
Communication regarding overall project status and implementation and primary POC with Navy RPM and VDEQ	CH2M HILL AM	Laura Cook	757-671-6214	Oversees project and will be informed of project status by the PM.
Communications regarding project management and implementation of all project phases, and primary POC with AM	CH2M HILL PM	Steve Falatko	703-376-5099	Forwards information and materials about the project to NAVFAC Mid-Atlantic, VDEQ RPM, and the VMRC. All information about the project will be forwarded to the AM within 24 hours of the activity. Sampling results will be communicated to the project team during meetings.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Technical communications for project implementation, and data interpretation	AQM/ STC	John Tomik	757-671-6259	The STC is contacted regarding questions/issues encountered in the field and input on data interpretation, as needed. The STC will have 24 hours to respond to technical field questions as necessary. The AQM will also communicate strategies for ensuring that the approach for investigation and clean-up of individual NAS Oceana sites is consistent with the overall strategy for the cleanup of the base and its corresponding annexes.
Munitions Response	Senior MEC Consultant	Tim Garretson	757-671-6224	The senior MEC consultant will be the POC if conditions in the field change regarding munitions (i.e., suspect item). The Senior MEC Consultant will direct the initial action and advise on who to contact and a path forward.
H&S	FTL Onsite H&S Officer	Dennis Ballam Mark Orman	757-671-6251 414-847-0597	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 misses to PM within 24 hours.
Reporting Laboratory Data Quality Issues	Laboratory PM	Sonya Gordon	615-345-1115	All quality assurance/quality control (QA/QC) issues with project field samples will be reported as soon as possible to the Project Chemist (Megan Morrison) by the laboratory.
Data tracking from collection through upload to database	EIS	Victoria Brynildsen	757-671-6252	The EIS will track data from sample collection through upload to the database, ensuring SAP requirements are met by laboratory and field staff. The EIS will act as main POC for laboratory QA officer. The EIS receives analytical reports and electronic data deliverables from the laboratory. Laboratory issues will be reported to the PM and Project Chemist within 4 hours.
Field and analytical corrective actions	FTL / Project Chemist	Dennis Ballam/ Megan Morrison	757-671-6251/ 703-376-5053	Any corrective actions for field and analytical issues will be identified by the FTL and/or the Project Chemist and reported to the PM within 4 hours.

SAP Worksheet #7—Personnel Responsibilities Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Mary Margaret Kutz	RPM	NAVFAC Mid-Atlantic	Coordinates Environmental Restoration and Munitions Response Program (MRP) activities at NAS Oceana.
Janice Nielsen	Chemist/ QA Officer	NAVFAC Atlantic	Performs lead agency review of UFP-SAP.
Steve Mihalko	RPM	VDEQ	Provides oversight of environmental activities at NAS Oceana.
Tony Watkinson	Habitat Manager	VMRC	Enforces sand dune regulations for the Commonwealth of Virginia.
Laura Cook	AM	CH2M HILL	Oversees project. Provides final review of UFP-SAP prior to publication.
Steve Falatko	PM		Manages and oversees project. Prepares project instructions. Ensures adherence to project schedule and goals. Reviews plan prior to senior review and provide final review prior to publication.
John Tomik	AQM / STC		Provides ongoing input on the project, meeting data quality objectives. Senior technical review of UFP-SAP document. Ensures the individual site strategies are consistent with the overall base-wide strategy for Oceana and its annexes.
Paul Favara	Navy CLEAN Program UFP-SAP Reviewer		Provides program-level review of UFP-SAP.
Bill Kappleman	Senior ERA		Provides guidance on ecological risk screening for SI.
Roni Warren	Senior HHRA		Provides guidance on human health risk screening for SI.
Tim Garretson	Senior MEC Consultant		Completes Explosives Safety Submission determination form. Provides guidance to project team on approach to working on sites with potential munitions constituents (MCs) related to small arms ammunition.
Mark Orman	H&S Manager		Prepares HSP; manages H&S for all field activities.
Anita Dodson	Navy CLEAN Program Chemist		Provides program-level review of UFP-SAP
Megan Morrison	Project Chemist		Prepares chemistry-specific UFP-SAP worksheets. Ensures proper data reporting and maintains communication with EIS and laboratory.
Victoria Brynildsen	EIS		Performs data management activities, including sample tracking and communication with the laboratory and the data validator. Responsible for coordination of laboratory deliverables.

SAP Worksheet #7—Personnel Responsibilities Table (continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Stefanie Eggermann	Lead Author/Task Manager	CH2M HILL	Writes non-chemistry sections of the SAP; prepares Attachments; coordinates with geographic information systems technicians, senior consultants, and publications; assists PM in planning and coordinating.
Dennis Ballam	FTL		Coordinates all field activities. Responsible for H&S while conducting field activities.
Mark Ost	FTM		Assists FTL in conducting field activities.
Sonya Gordon	Laboratory PM	Empirical	Manages sample tracking, analysis and reporting and maintains good communication with Project Chemist and EIS.

SAP Worksheet #8—Special Personnel Training Requirements Table

No special personnel training will be required for this project. The following are the routine training requirements for the sampling personnel.

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
Surface and subsurface soil, and sediment sampling	Hazardous Waste Operations and Emergency Response 40-hour training or 8-hour annual refresher, as appropriate	Registered training organization	Personnel files	FTL, FTMs, site safety coordinator (SSC); onsite, NAVFAC and other agency representatives and subcontractors.	FTL, SSC, FTMs from CH2M HILL; onsite subcontractors, visitors from NAVFAC and VDEQ.	CH2M HILL, NAVFAC, regulatory agency, or subcontractor Human Resources Department
Surface and subsurface soil, and sediment sampling	SSC – Hazardous Waste. CPR/First Aid trained	Registered training organization	Personnel files	SSC	Onsite SSC from CH2M HILL	CH2M HILL Human Resources Department

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SAP Worksheet #9-1—Project Scoping Session Participants Sheet

Project Name: SI, MRP, NAS Oceana **Projected Date(s) of Sampling:** June 2010 **PM:** Steve Falatko	**Site Name:** Former SAFRs **Site Location**: NAS Oceana, Dam Neck Annex, and NALF– Fentress, Virginia Beach, Virginia

Date of Session: April 21, 2009

Scoping Session Purpose: Internal Project Team develop a sampling and analysis strategy for sample collection and analysis of soil, primarily surface soil with some subsurface soil, for the SI at the former SAFRs.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Steve Falatko	PM	CH2M HILL HILL	703-376-5099	stephen.falatko@ch2m.com	PM
Laura Cook	AM	CH2M HILL HILL	757-671-6214	laura.cook@ch2m.com	AM
Stacin Martin	Former AQM	CH2M HILL	757-671-6241	stacin.martin@ch2m.com	Senior reviewer and technical resource
Cassandra Brown	Staff Consultant	CH2M HILL	703-376-5337	cassandra.brown@ch2m.com	TM
Christopher Reed	Staff Consultant	CH2M HILL	703-376-5047	christopher.reed@ch2m.com	Primary author
Tim Garretson	Senior MEC Consultant	CH2M HILL	757-671-6224	timothy.garretson@ch2m.com	MEC Technical resource
Bill Kappleman	Senior ERA	CH2M HILL	703-376-5152	william.kappleman@ch2m.com	ERA
Roni Warren	Senior HHRA	CH2M HILL	814-364-2454	roni.warren@ch2m.com	HHRA
Megan Morrison	Project Chemist	CH2M HILL	703.376-5053	megan.morrison@ch2m.com	Chemistry

Comments/Decisions:

The participants discussed the approach for the SI to be conducted at the SAFRs. A proposed sampling strategy was developed based on a review of the information in the Preliminary Assessment (PA) report, and on the approach for the SI at the Machine Gun Range at Dam Neck Annex, to which the Navy and VDEQ had already agreed. At the SI stage for the SAFRs, the objective is to confirm the presence or absence of contaminants of concern related to range activities and to assess whether the contaminants present have the potential to pose unacceptable risks to human and ecological receptors. The following activities were proposed to support the objective of the SI:

1) Use of an all-metals detector to assist in locating and screening sampling points.
2) Collection of soil samples from each of the sites at locations to be selected using a grid approach. Sample depths will be based on the likely penetration depth for the munitions types used at each site.
3) Analysis of all samples at the Machine Gun Boresight Range, the Dam Neck Pistol Range North, Dam Neck Pistol Range South, and Machine Gun Boresight Range for small arms ammunition-related metals (lead, antimony, arsenic, copper, nickel, and zinc).

SAP Worksheet #9-1—Project Scoping Session Participants Sheet (continued)

4) Analysis of samples from the Dam Neck Skeet and Trap Range for lead (associated with shot) and polycyclic aromatic hydrocarbons (PAHs) (associated with clay targets).

5) Preparation of an SI report to document the activities and present the results of the sampling. Depending on the results, a Decision Document for Closure or further investigation may be required.

6) Use of the following screening levels:

   - Residential risk screening levels (RSLs) for metals and PAHs
   - Ecological soil screening levels (Eco-SSLs) for flora and fauna for metals and PAHs

7) Implementation of measures necessary to act in accordance with the Sand Dune Protection Act

   a. VMRC must be notified if any activities, including sampling, are to take place on the sand dunes (Dam Neck Annex sites). Submitting a letter describing the activities prior to sampling will be sufficient.

   b. If remedial activities such as removal of contaminated soil are warranted, a permit application with design details must be prepared and submitted to VMRC for review and acceptance.

8) Use of the same data decision flowchart developed for the SI at the Machine Gun Range at Dam Neck Annex.

SAP Worksheet #9-2—Project Scoping Session Participants Sheet

Project Name: SI, MRP, NAS Oceana **Projected Date(s) of Sampling:** June 2010 **PM:** Steve Falatko	**Site Name:** Former SAFRs **Site Location**: NAS Oceana, Dam Neck Annex, and NALF–Fentress, Virginia Beach, Virginia

Date of Session: April 27, 2009
Scoping Session Purpose: Project Team agreement on sampling and analysis strategy for the SI at former SAFRs.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Mary Margaret Kutz	RPM	NAVFAC Mid-Atlantic	757-445-6676	mary.kutz@navy.mil	RPM
Steve Mihalko	RPM	VDEQ	804-698-4202	samihalko@deq.state.va.us	Regulator
Steve Falatko	PM	CH2M HILL	703-376-5099	stephen.falatko@ch2m.com	PM
Cassandra Brown	Staff Consultant	CH2M HILL	703-376-5337	cassandra.brown@ch2m.com	TM
Stacin Martin	Former AQM	CH2M HILL	757-671-6241	stacin.martin@ch2m.com	Senior reviewer and technical resource

Comments/Decisions:

The participants discussed the approach developed by CH2M HILL for the SI to be conducted at the sites. CH2M HILL led the presentation, which included a summary of the information garnered from the PA.

The approach presented included initial screening of the sites using an all-metals detector to assist in locating sampling points most likely to be affected by past activities. Following the metal detector survey, surface soil (0 to 12 inches below ground surface [bgs]) samples from each of the sites and additional subsurface soil (12-24 inches bgs) samples at the Machine Gun Boresight Ranges (Oceana and NALF Fentress) would be collected. Based on the nature of the munitions likely to have been used on these sites, the potential source of contamination is suspected to be within the top 12 inches of the surface, except for the Machine Gun Boresight Ranges (Oceana and NALF Fentress), where contamination is suspected to be within the top 24 inches of the surface. The proposed analytical approach included analysis of all sites with the exception of the skeet and trap ranges for small arms-related metals (lead, antimony, arsenic, copper, nickel, and zinc). Ammunition used at the former Skeet and Trap Range was expected to be 12 gauge or smaller shotgun ammunition. The primary contaminant associated with shotgun ammunition is lead, therefore lead will be the only metal analyzed for. The skeet and trap ranges will also be analyzed for PAHs because of the clay targets.

Based on the nature of the munitions likely to have been used on site, the potential source of contamination is suspected to be within the top 24 inches of the surface.

Action Items:

a) Proceed with preparation of UFP-SAP (CH2M HILL)

b) Prepare Request for a Naval Ordnance Safety and Security Activity Explosives Safety Submission Determination (CH2M HILL)

SAP Worksheet #9-3—Project Scoping Session Participants Sheet

Project Name: SI, MRP, NAS Oceana **Projected Date(s) of Sampling:** June 2010 **PM:** Steve Falatko	**Site Name:** Former SAFRs **Site Location**: NAS Oceana, Dam Neck Annex, and NALF–Fentress, Virginia Beach, Virginia

Date of Session: August 13, 2009
Scoping Session Purpose: Update and revise strategy for the SI at the former SAFRs.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
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Steve Mihalko	RPM	VDEQ	804-698-4202	samihalko@deq.state.va.us	Regulator
Steve Falatko	PM	CH2M HILL	703-376-5099	stephen.falatko@ch2m.com	PM

Comments/Decisions:

- The Navy and CH2M HILL conducted a site visit to the SAFRs on July 30, 2009. Based on site visit observations, it was discussed and agreed to by all parties that samples at the Machine Gun Boresight Ranges will be collected from the berm and biased towards areas where scarring of the backstop was evident.

Action Item:

- Continue preparation of UFP-SAP with these revisions (CH2M HILL)

SAP Worksheet #9-4—Project Scoping Session Participants Sheet

Project Name: SI, MRP, NAS Oceana **Projected Date(s) of Sampling:** June 2010 **PM:** Steve Falatko	**Site Name:** Former SAFRs **Site Location**: NAS Oceana, Dam Neck Annex, and NALF–Fentress, Virginia Beach, Virginia
Date of Session: November 16, 2009 **Scoping Session Purpose:** Update and revise strategy for the SI at the former SAFRs.	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
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Comments/Decisions:

The Navy and CH2M HILL conducted an additional scoping session with VDEQ. The following revisions were discussed and agreed to by all parties:

1. The Rifle Range at Dam Neck Annex will be addressed in the SAFR work planning documents.

2. Twenty sediment sampling locations will be added to the Skeet and Trap Range because the likely range of shot fall extends into Lake Tecumseh. Sediment samples will be collected from the water body region of the site and analyzed for lead. Two of the sediment locations closest to the firing points will also be analyzed for PAHs because of the higher likelihood of clay targets in that region.

3. Based on the nature of skeet and trap ranges, the potential source of contamination associated with lead shot is suspected to be within the top 6 inches of the surface, therefore, samples will be collected from a depth of 0-6inches bgs at the Skeet and Trap Range.

4. The sample numbers and general sampling design were agreed upon for all six MRP sites. Locations were adjusted since the first scoping session to reflect areas most likely to be impacted by potential site contaminants. The proposed sampling approach included in **Worksheets 10-1 through 10-6** is biased to reflect the site history and use.

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SAP Worksheet #10—Problem Definition

Location

NAS Oceana is located along the Atlantic Ocean, within the southeastern portion of the city of Virginia Beach, Virginia (**Figure 1**). The installation encompasses just over 5,300 acres, as well as approximately 3,600 acres in restrictive easements. In addition, NAS Oceana maintains control over several annex properties and outlying fields in the surrounding Virginia—North Carolina area. The mission of the facility is to support the Navy's Atlantic and Pacific fleet forces of strike-fighter aircraft and joint/interagency operations (Malcolm-Pirnie, 2008).

Dam Neck Annex is located approximately 5 miles southeast of NAS Oceana, in Virginia Beach, Virginia and covers approximately 1,400 acres (**Figure 1**). The mission of this installation is to provide force-level engineering solutions, mission-critical and associated testing, and training technologies for the maritime, joint, special warfare, and information operations domains (Malcolm-Pirnie, 2008).

NALF Fentress is located in Chesapeake, Virginia, approximately 7 miles southwest of NAS Oceana. Established in 1940, the installation encompasses just over 2,500 acres and approximately 8,700 acres in restrictive easements. The facility is used primarily by squadrons stationed at NAS Oceana or Naval Station Norfolk Chambers Field for field carrier landing practice operations (Malcolm-Pirnie, 2008).

Problem Definition

Based on historical information, small arms ammunition debris may be present at the six MRP sites and may be a potential source of MC contamination. The objective of the SI is to identify the presence or absence of the contaminants related to range activities and to assess whether the contaminants, if present, have the potential to pose unacceptable risks to human and ecological receptors.

No MEC are suspected to be associated with the six MRP sites (Malcolm-Pirnie, 2008). Note that small arms munitions, as used on these sites, are not considered MEC under the MRP.

The specific site location and background, existing data, and environmental questions answered for each of the six MRP sites are covered in **Worksheets 10-1 through 10-6.**

Conceptual Site Model

Some of the common components of the conceptual site model are as follows. The source areas are defined for the each of the six sites in **Worksheets 10-1 through 10-6.**

- Transport Pathways: A transport pathway describes the mechanisms whereby contaminants may be transported from a source of contamination to an exposure point for human and ecological receptors. Overland transport of contaminants via surface runoff or dust generation is a potentially complete and current contaminant transport pathway from the source areas to downgradient surface soil.

  Potentially complete pathways to subsurface soils also may be present via infiltrating precipitation and leaching. However, chemical fate and transport information is required for potentially identified sources in order to determine whether these transport pathways are

SAP Worksheet #10—Problem Definition (continued)

complete and significant. These pathways and exposure may be investigated in future efforts if MCs related to small arms ammunition are identified in the most conservative exposure medium (surface soil) in the source area at levels exceeding risk-based criteria.

- Exposure Pathways, Routes, and Receptors: An exposure pathway links a source of contamination with one or more receptors via exposure to one or more media. An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. Potential exposure routes include direct contact with soils, root uptake from soils by plants, ingestion of soils, inhalation of dust, and ingestion of contaminated plant and/or animal tissue. Potential receptors include U.S. Navy personnel, visitors, contractors, and trespassers. Animal biota and ecological flora and fauna are also potential receptors.

Hydrology

The hydrogeologic unit relevant to the six MRPs sites is the Columbia Aquifer, which mostly consists of sandy surficial deposits, extending to approximately 20 feet below mean sea level. Numerous surface water bodies are present in the vicinity of Oceana and its annexes. Consequently, groundwater is typically within a few feet of the ground surface.

SAP Worksheet #10-1—Problem Definition

Machine Gun Boresight Range (NAS Oceana)

Site Location and Background: The former Machine Gun Boresight Range at NAS Oceana covers approximately 1.7 acres and is located north of Dorr Place and west of Runway 14 (**Figure 2)**. The eastern half of the site is generally flat and grassy because it borders an active aircraft runway. The western portion however, is predominantly overgrown with brush and trees, as it is not actively used by the installation. According to an archival map from 1943, the site was initially used as a maintenance and testing range for aircraft-mounted machine guns and was later converted to an SAFR. A concrete backstop is still in place on the western portion, which suggests that the direction of fire was toward the west. The concrete backstop is overgrown with trees and brush and is deteriorating. The former firing point is approximately 900 feet east of the backstop, as shown on **Figure 2**.

Ammunition used at the former Machine Gun Boresight Range was likely limited to .50 and .30 caliber rounds for aircraft guns, as well as 9-millimeter (mm) rounds for small arms. Potential MCs related to small arms ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the .30 and .50 caliber cartridges, but in very small quantities (6 grains for the .30 caliber and approximately 19 grains for the .50 caliber). Considering the small amount used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI. Based on the nature of the munitions likely to have been used on site, the potential source of contamination is suspected to be within the top 24 inches of the surface. Although the distribution of small arms ammunition debris within the former range is not known, it is suspected that the greatest density would be present in the backstop (**Figure 2**).

Existing Data: There are no existing chemical data for the former Machine Gun Boresight Range.

Conceptual Site Model: The source area component of the conceptual site model is as follows:

Source Areas: Potential sources of contamination present at the former range are debris related to SAFR ammunition. The Navy, VDEQ, and CH2M HILL identified lead, antimony, arsenic, copper, nickel and zinc as MCs related to small arms ammunition, which are associated with potential releases at the site, based on the historical use of the site as a range. It was concluded that surface and subsurface soils are the most likely medium to be contaminated, based on the use of the range. Because groundwater in this area is not anticipated to be affected, this SI will not evaluate groundwater as a potential route of exposure. There is no surface water or sediment present onsite.

Environmental Questions answered by this Project: Site determinations will be based on the following questions:

- **What is the distribution of ammunition debris (if present) within the former Machine Gun Boresight Range?**

  Although the distribution of small arms ammunition debris within the former range is not known, the potential source of contamination is suspected to be within the top 24 inches of

SAP Worksheet #10-1—Problem Definition (continued)

the surface in the berm of the backstop, based on the estimated penetration depth of ammunition known to be used at the site. An all-metals detector survey will be conducted in the area around the berm—only to determine the extent of small arms ammunition and to help select sampling locations. Further information regarding the all-metals detector survey can be found in **Worksheet #11-1.**

- **Have there been releases of MCs from small arms ammunition at levels posing risk to human health or the environment?**

  Surface and subsurface soil samples will be collected from eight locations from the berm of the backstop. The locations will be biased toward areas having higher likelihood of MC density, related to small arms ammunition, as evidenced by the presence of bullet scarring on the back stop and based on the results of the all metals detector survey. If significant bullet scarring and metal is identified during the all metals detector survey, the need for a presumptive remedy will be discussed with the partnering team. If no evidence of bullet scarring or metal debris is found, samples will be collected at the default locations shown in **Figure 4**. Samples will be dug following the trajectory path of the bullet (horizontally) into the berm instead of vertically.

  Samples will be analyzed for lead, antimony, arsenic, copper, nickel, and zinc, as detailed in **Worksheet #18** and the decision points and actions in **Figure 3** will be utilized to determine if a release posing potential risk has occurred. Results of the samples will be compared to Project Action Limits (PALs) as detailed in **Worksheet #11-1**.

- **Is further investigation or action warranted at the former Machine Gun Boresight Range?**

  Sample results will be compared against PALs and, if applicable, background samples. Information on the comparison between PALs can be found in **Worksheet #11-1** and details to background sampling can be found in **Worksheet #11-2**. Decision points and actions are presented in **Figure 3**.

SAP Worksheet #10-2—Problem Definition

Pistol Range North (Dam Neck Annex)

Site Location and Background: The former Pistol Range is located near the southeastern portion of Dam Neck Annex, as shown in **Figure 5**. Specifically, the site lies along the east side of Regulus Avenue and just north of the active Drone Launching Area. The site was formerly a small arms shooting range, covering approximately 2 acres. The direction of fire was presumed to be toward the east, in the direction of the Atlantic Ocean. Although the 1950 map shows the general outline and orientation of the former range, no backstop or berm is identified. It is unclear whether the natural topography of nearby dunes served as a backstop during site activities. Based upon a site visit conducted by CH2M HILL in July 2009, the eastern portion of the site is currently covered by a parking lot and Regulus Avenue itself. The remaining portion is comprised of undeveloped lowland area, covered with dense brush and sand dunes. No evidence of the range or associated structures was observed. Additionally, the former range lies within a Dune Management Area and is protected pursuant to the Coastal Sand Dune Protection Act, a program administered by the VMRC.

Ammunition used at the former Pistol Range North was expected to be limited to .22, .38, and .45 caliber rounds for small arms. Potential MCs related to small arms ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the cartridges, but in very small quantities. Considering the small amount used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI. Based on the nature of the munitions likely to have been used on site, the potential source of contamination is suspected to be within the top 12 inches of the surface.

Existing Data: There are no existing chemical data for the former Pistol Range North.

Conceptual Site Model: The source areas component of the conceptual site model is as follows:

- Source Areas: Potential sources of contamination present at the former Pistol Range North are debris related to SAFR ammunition. The Navy, VDEQ, and CH2M HILL identified lead, antimony, arsenic, copper, nickel and zinc as MCs related to small arms ammunition, which are associated with potential releases at the site, based on the historical use of the site as a range. It was also concluded that surface soils are the most likely medium to be contaminated, based on the use of the range. Because groundwater in this area is not anticipated to be affected, this SI will not evaluate groundwater as a potential route of exposure. There is no surface water or sediment present onsite.

Environmental Questions answered by this Project: Site determinations will be based on the following questions:

- **What is the distribution of ammunition debris within the former Pistol Range North?**

The distribution of small arms ammunition debris within the former Pistol Range North is not known. Based on the nature of the munitions likely to have been used on site, the potential source of contamination is suspected to be within the top 12 inches of the surface. Therefore, if a release has occurred, the most likely medium to be affected is surface soil. An all-metals

SAP Worksheet #10-2—Problem Definition (continued)

detector survey will be conducted to determine the extent of small arms ammunition and to help select sample collection locations. Further information regarding the all-metals detector survey can be found in **Worksheet #11-1.**

- **Have there been releases of MCs from small arms ammunition that pose potential risk to human health or the environment?**

  Discrete surface soil samples will be collected from 0-12 inches bgs from 20 locations within the former Pistol Range North area. The locations will be biased toward areas having higher likelihood of MC density, related to small arms ammunition, as evidenced by the results of the all metals detector survey. If no evidence of metal debris is found, samples will be collected at the default locations shown in **Figure 5**. Samples will be analyzed for lead, antimony, arsenic, copper, nickel, and zinc, as detailed in **Worksheet #18**, and the decision points and actions in **Figure 3** will be used to evaluate whether a release that poses potential risk to human health or the environment has occurred. Surface soil samples will be compared to PALs, as detailed in **Worksheet #11-1**.

- **Is further investigation or action warranted at the Pistol Range North site?**

  Sample results will be compared to PALs and, if applicable, background samples. Information on the comparison between PALs can be found in **Worksheet #11-1** and details on background sampling can be found in **Worksheet #11-2**. Decision points and actions are presented in **Figure 3**.

SAP Worksheet #10-3—Problem Definition

Pistol Range South (Dam Neck Annex)

Site Location and Background: The former Pistol Range is located near the southwestern portion of Dam Neck Annex (**Figure 6**). Specifically, the site is adjacent to Bullpup Avenue and is identified in archival maps as early as 1942. The former Pistol Range South consisted of a small arms shooting range, covering approximately 1 acre. The direction of fire was southeast, toward a berm that has since been removed from the site. As observed during a site reconnaissance by Malcolm Pirnie in December 2007, and a site visit by CH2M HILL on July 30, 2009, the entire site has been graded and developed as Building 464, a grassy field, and an associated parking lot. The building portion currently occupies approximately 90 percent of the site area. No evidence of the former range or associated structures was observed.

Ammunition used at the former Pistol Range South was expected to be limited to .22, .38, and .45 caliber rounds for small arms. Potential MCs associated with these types of ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the cartridges, but in very small quantities. Considering the small amounts used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely that these constituents are present at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI. Based on the nature of the munitions likely to have been used onsite, the potential source of contamination is suspected to be within the top 12 inches of the surface.

Existing Data: There are no existing chemical data for the former Pistol Range South.

Conceptual Site Model: The source areas component of the conceptual site model is as follows:

- Source Areas: Potential sources of contamination present at the former Pistol Range South are debris related to SAFR ammunition. The Navy, VDEQ, and CH2M HILL identified lead, antimony, arsenic, copper, nickel and zinc as MCs related to small arms ammunition, which are associated with potential releases at the site, based on the historical use of the site as a range. It was concluded that surface soils are the most likely medium to be contaminated, based on the use of the range. Because groundwater in this area is not anticipated to be affected, this SI will not evaluate groundwater as a potential route of exposure. There is no surface water or sediment present onsite.

Environmental Questions answered by this Project

Site determinations will be based on the following questions:

- **What is the distribution of ammunition debris within the former Pistol Range South?**

  Although the distribution of small arms ammunition debris within the former Pistol Range South is not known, it is suspected that the greatest concentration would be present along the southeast portion of the site, in the presumed vicinity of the former backstop or berm (**Figure 6**). Based on the nature of the munitions likely to have been used onsite, the potential source of contamination is suspected to be within the top 12 inches of the surface. Therefore, if a release has occurred, the most likely medium to be affected is surface soil. An all-metals detector survey will be conducted to determine the extent of small arms

SAP Worksheet #10-3—Problem Definition (continued)

ammunition and to help select sample collection locations. Further information regarding the all-metals detector survey can be found in **Worksheet #11-1.**

- **Have there been releases of MCs from small arms ammunition that pose potential risk to human health or the environment?**

  Because approximately 90 percent of the site area is covered by Building 464 and an associated parking lot, access to sampling locations is severely limited. Therefore, discrete surface soil samples will be collected from 0-12 inches bgs from 8 locations just southeast of the former site, as shown in **Figure 6**. Sample collection locations will be spaced approximately 20 feet apart. Samples collected at three of the locations (shown in blue) will be analyzed by the lab. The samples collected at the other locations (shown in red) will be collected and held by the laboratory. If the results associated with the first three samples exceed acceptable levels, the remaining five samples will be analyzed, as detailed in **Worksheet #18**, and the decision points and actions in **Figure 3** will be used to determine if a release that poses potential risk to human health or the environment has occurred. Surface soil samples will be compared to PALs as detailed in **Worksheet #11-1**.

- **Is further investigation or action warranted at the Pistol Range South site?**

  Sample results will be compared to PALs and, if applicable, background samples. Information on the comparison between PALs can be found in **Worksheet #11-1** and details to background sampling can be found in **Worksheet #11-2**. Decision points and actions are presented in **Figure 3**.

SAP Worksheet #10-4—Problem Definition

Rifle Range (Dam Neck Annex)

Site Location and Background: The former Rifle Range is located on the southwestern portion of Dam Neck Annex, east of Regulus Avenue, as shown in **Figure 7**. The northern portion of the site is occupied by the active Drone Launching Area and is identified in an archival map from 1950. The site was formerly a practice target range, measuring 600 feet wide by 1,500 feet long. The direction of fire was presumed to be east, toward the Atlantic Ocean. Portions of the Rifle Range are overlapped by the active Drone Launching Area to the east and another MRP site (Moving Target/Mortar Range, North) to the north. The remaining portion of the Rifle Range is covered under this work plan and is approximately 6 acres. As observed during the site reconnaissance by Malcolm Pirnie in December 2007 and the CH2M HILL site visit on July 30, 2009, the southern portion of the site has been developed as a parking lot. The remaining portion is composed of undeveloped forest, sand dunes and the beach. No evidence of the former range or associated structures was observed by Malcolm Pirnie. Additionally, the former range occupies parts of all three natural resource management units represented at Dam Neck Annex: urban, natural areas, and beaches and dunes, as defined by the Coastal Sand Dune Protection Act. The protection program is administered by VMRC.

Ammunition used at the former Rifle Range is expected to be .22, .30, .45, and .30 caliber rounds, as well as 5.56 and 7.62mm rounds for small arms. Potential MCs associated with these types of ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for some cartridges, but in very small quantities. Considering the small amounts used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI. Although no such features were observed at the site, expended small arms rounds would be typically contained by a downrange berm or backstop; based on the nature of the munitions likely to have been used on site, the potential source of contamination is suspected to be within the top 12 inches of the surface.

Existing Data: There are no existing chemical data for the former Rifle Range.

Conceptual Site Model: The source area component of the conceptual site model is as follows:

- Source Areas: Potential sources of contamination present at the former Rifle Range are debris related to small arms range ammunition. The Navy, VDEQ, and CH2M HILL identified lead, antimony, arsenic, copper, nickel and zinc as MCs associated with potential releases at the site, based on the historical use of the site as a practice target range. It was concluded that surface soils are the most likely medium to be contaminated, based on the use of the range. Because groundwater in this area is not anticipated to be affected, this SI will not evaluate groundwater as a potential route of exposure. There is no surface water or sediment present onsite.

Environmental Questions answered by this Project: Site determinations will be based on the following questions:

SAP Worksheet #10-4—Problem Definition (continued)

- **What is the distribution of ammunition debris within the former Rifle Range?**

Although the distribution of small arms ammunition debris within the former Rifle Range is not known, it is suspected that the greatest concentration would be present at the far eastern end, in the presumed vicinity of the former backstop or berm (**Figure 7**). Based on the nature of the munitions likely to have been used on site, the potential source of contamination is suspected to be within the top 12 inches of the surface. Therefore, if a release has occurred, the most likely medium to be affected is surface soil. A magnetometer survey will be conducted to determine the extent of small arms ammunition and to help select sample collection locations. Further information regarding the magentometer survey can be found in **Worksheet #11-1.**

- **Have there been releases of MCs from small arms ammunition that pose potential risk to human health or the environment?**

  Discrete surface soil samples will be collected from 0-12 inches bgs from 22 locations within the former Rifle Range area. Sample collection locations throughout the site will be spaced approximately 100 feet apart, as shown in **Figure 7**. Samples will be analyzed for lead, antimony, arsenic, copper, nickel, and zinc, as detailed in **Worksheet #14**, and the decision points and actions in **Figure 3** will be used to determine if a release that poses potential risk to human health or the environment has occurred. Surface soil samples will be compared to PALs, as detailed in **Worksheet #11-1**.

- **Is further investigation or action warranted at the Rifle Range site?**

  Samples will be screened against PALs and, if applicable, background samples. Information on the comparison between PALs can be found in **Worksheet #11-1** and details about background sampling can be found in **Worksheet #11-2**. Decision points and actions are presented in **Figure 3**.

SAP Worksheet #10-5—Problem Definition

Skeet and Trap Range (Dam Neck Annex)

Site Location and Background:

The former Skeet and Trap Range is located on the southwestern portion of Dam Neck Annex, on the eastern shore of Lake Tecumseh (**Figure 8**). More specifically, the site is situated along the northern side of Bullpup Street. The former Skeet and Trap Range was composed of four skeet ranges and four trap ranges, with approximately half of the former range area extending into Lake Tecumseh. With the presumed firing line along Bullpup Street, the direction of fire was toward the northwest, over Lake Tecumseh. A 900-foot radius drawn from the presumed firing line represents the extreme range of fire for skeet and trap ranges. The resulting site area is approximately 39 acres and was identified as the Surface Danger Zone. As observed during site reconnaissance by Malcolm Pirnie in December 2007, the southeast portion of the site, along Bullpup Street, has been developed into Building 470 and an associated parking lot. The remaining portion is composed of undeveloped forest and open lake area. During the site visit, pieces of clay targets were observed along the shoreline and in the shallow waters of Lake Tecumseh. Additionally, an abandoned building foundation was observed in the forested area. Although its purpose is unclear, the building is believed to have been used as a skeet or trap launching point.

Ammunition used at the former Skeet and Trap Range was expected to be 12 gauge or smaller shotgun ammunition. The primary contaminant associated with shotgun ammunition is lead. PAHs are also potential contaminants, which may be associated with the clay targets. Lead styphnate and lead azide are compounds that may have been used in cartridge primers, but only in very small quantities. Considering the small amount used and the possibility that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI.

Skeet and trap ranges typically produce a fan-shaped shotfall distribution, increasing the area of potential MC impact dramatically. The area of expected maximum shotfall of lead shot is a 600-foot radius from the firing point. The resulting debris is classified as both constituents from target loads and the clay targets themselves. The contaminants of concern associated with the debris are presumed to have a depth of less than 6 inches bgs.

Existing Data: There are no existing chemical data for the former Skeet and Trap Range.

Conceptual Site Model: The source areas component of the conceptual site model is as follows:

- Source Areas: Potential sources of contamination present at the former Skeet and Trap Range are debris related to SAFR ammunition and clay targets. The Navy, VDEQ, and CH2M HILL identified lead as an MC related to shotgun ammunition and PAHs as constituents of concern related to the clay targets. It was concluded that surface soils and sediment are the most likely media to be affected, based on the use of the range, and therefore will be the focus of this SI for this site.

Environmental Questions answered by this Project: Site determinations will be based on the following questions:

SAP Worksheet #10-5—Problem Definition (continued)

- **What is the distribution of ammunition debris within the former Skeet and Trap Range?**

  The distribution of small arms ammunition debris within the former Skeet and Trap Range is not known. Skeet and Trap ranges produce fan-shaped shotfall distribution. The area of expected maximum shotfall of lead shot at the Skeet trap is between 200 and 600 feet from firing points. The area of expected maximum shotfall of lead shot at the Trap range is between 350 and 600 feet from the firing points (**Figure 8**). Based on the nature of skeet and trap ranges, the potential source of contamination is suspected to be within the top 6 inches of the surface.

  Soil samples will be sifted following homogenization to remove any debris, using a #10 sieve.

- **Have there been releases of MCs from small arms ammunition that pose potential risk to human health and the environment?**

  Discrete surface soil samples will be collected at 21 locations within the land portion of the former Skeet and Trap Range area using a fan grid approach. Discrete sediment samples will be collected at 20 locations within the water body portion of the site, also using a fan grid approach. Sample collection locations throughout the site will be spaced approximately every 50 feet along the radius extending from each presumed firing point. The sampling layout is shown in **Figure 8**. During sample collection, the field team will note whether shot is observed in shallow waters. This information may support later risk decisions due to the potential of water fowl to ingest the shot.

  All samples will be analyzed for lead, while samples within the target fall zone will be analyzed for PAHs, as detailed in **Worksheet #18**, the decision points and actions in **Figure 3** will be utilized to determine if a release has occurred that poses potential risk to human or ecological receptors. Surface soil and sediment samples will be compared to PALs as detailed in **Worksheet #11-1**.

- **Is further investigation or action warranted at the Dam Neck Skeet and Trap Range site?**

  Sample results will be compared to PALs and, if applicable, background samples. Information on the comparison between PALs can be found in **Worksheet #11-1** and details to background sampling can be found in **Worksheet #11-2**. Decision points and actions are presented in **Figure 3**.

SAP Worksheet #10-6—Problem Definition

Machine Gun Boresight Range (NALF Fentress)

Site Location and Background

The former Machine Gun Boresight Range at NALF Fentress encompasses about 1.0 acre and lies southwest of runway 1-19, on the northern portion of the facility (**Figure 9**). The former Machine Gun Boresight Range is oriented northeast-southwest, with the former firing point at the northernmost end, as indicated on a 1955 archival map. The southwestern half of the site is overgrown with brush and trees, while the northeastern half is generally flat and grassy because it borders an active aircraft runway. The site was initially used as a maintenance and testing range for aircraft- mounted machine guns, but was later converted to a pistol range, as shown on a 1974 archival map. A concrete backstop is still in place on the southwestern portion and is showing signs of deterioration.

Ammunition used at the former Machine Gun Boresight Range was likely limited to .50 and .30 caliber rounds for aircraft guns. Additionally, expended 7mm, 9mm, .38 and .30 caliber and shotgun rounds were observed at the site during a site reconnaissance by Malcolm Pirnie in 2007 and CH2M HILL in 2009; however, the additional rounds appeared to be from more-recent, recreational use. Potential MCs associated with these types of ammunition are composed of lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the .30 and .50 caliber cartridges, but in very small quantities (6 grains for the .30 caliber and approximately 19 grains for the .50 caliber). Considering the small amounts used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents are present at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI. Based on the nature of the munitions likely to have been used onsite, the potential source of contamination is suspected to be within the top 24 inches of the surface.

Existing Data: There are no existing chemical data for the former Machine Gun Boresight Range.

Conceptual Site Model: The source areas component of the conceptual site model is as follows:

- Source Areas: Potential sources of contamination present at the former Machine Gun Boresight Range are debris related to SAFR ammunition. The Navy, VDEQ, and CH2M HILL identified lead, antimony, arsenic, copper, nickel and zinc as MCs associated with potential releases at the site, based on the historical use of the site as a range. It was concluded that surface soils are the most likely medium to be contaminated, based on the use of the range. Because groundwater in this area is not anticipated to be affected, this SI will not evaluate groundwater as a potential route of exposure. There is no surface water or sediment present onsite.

Environmental Questions answered by this Project: Site determinations will be based on the following questions:

SAP Worksheet #10-6—Problem Definition (continued)

- **What is the distribution of ammunition debris within the former Machine Gun Boresight Range?**

  Although the distribution of small arms ammunition debris within the former Machine Gun Boresight Range is not known, it is suspected that the greatest concentration would be present in the berm (**Figure 9**). Based on the nature of the munitions likely to have been used onsite, the potential source of contamination is suspected to be within the top 24 inches of the surface in the berm of the backstop. An all-metals detector survey will be conducted in the area surrounding the berm to determine the extent of small arms ammunition and to help select sample collection locations. Further information regarding the all-metals detector survey can be found in **Worksheet #11-1.**

- **Have there been releases of MCs from small arms ammunition that poses potential risk to human health or the environment?**

  Surface and subsurface soil samples will be collected from eight locations in the berm of the backstop. The locations will be biased toward areas having higher likelihood of MC density, related to small arms ammunition, as evidenced by the presence of bullet scarring on the backstop and based on the results of the all-metals detector survey. If no evidence is found, samples will be collected at the locations shown in **Figure 4**. Samples will be dug following the trajectory path of the bullet (horizontally) into the berm instead of vertically.

  Samples will be analyzed for lead, antimony, arsenic, copper, nickel, and zinc, as detailed in **Worksheet #18**, and the decision points and actions in **Figure 3** will be used to assess whether a release that poses potential risk to human and ecological receptors has occurred. Surface soil samples will be compared to PALs, as detailed in **Worksheet #11-1**.

- **Is further investigation or action warranted at the former Machine Gun Boresight Range?**

  Sample results will be compared to PALs and, if applicable, background samples. Information on the comparison between PALs can be found in **Worksheet #11-1,** and details on background sampling can be found in **Worksheet #11-2**. Decision points and actions are presented in **Figure 3**.

SAP Worksheet #11-1—Project Quality Objectives/Systematic Planning Process Statements

Who will use the data? The data will be used by the Navy, VDEQ, CH2M HILL, and other Navy contractors.

What are the PALs? To determine whether a release of an MC has occurred, soil samples will be collected and analyzed for MCs associated with small arms ammunition (lead, antimony, arsenic, copper, nickel, and zinc), and MCs associated with clay targets (PAHs). Samples collected at the Skeet and Trap Range will be analyzed for lead and PAHs only. Site-specific soil and sediment sample results will be compared to the most current EPA reference limits for plants, soil invertebrates, and human receptors, listed in **Worksheet #15.** If, however, the site-specific results are greater than the screening levels, then further evaluations will be conducted, as discussed in detail on **Worksheet #11-2**, using the decision points and actions shown in **Figure 3.**

The laboratory's quantitation limit (QL) for several analytes might be greater than the corresponding PAL. In that case, where the specific constituent is nondetect, the analyte will be considered not present. In efforts to reach lower limits, the laboratory will J-qualify concentrations between the QL and method detection limit (MDL) as estimated. These values will be considered estimated but usable for risk screening purposes. This approach will give the lowest project quantitation limit (PQL) possible that it is still achievable by the laboratory.

How will the data be used? The data will be used for the following primary objectives**:**

- Determine if potential MCs associated with small arms ammunition have been released to the soil at the site. Based on the analytical results, decide whether further action is warranted.
- Determine if a potential exists for unacceptable human health and/or ecological risks associated with exposure to soil and sediment at the former ranges.

What types of data are needed (matrix, target analytes, analytical groups, field screening, onsite analytical or offsite laboratory techniques, sampling techniques)? This SAP provides details for the collection and analysis of surface soil, subsurface soil and sediment samples at six former SAFR sites. Because of the unknown presence/location of targets during historical range activities, a non-random, discrete sampling approach was developed to collect representative site samples for the SI. Sampling locations are shown on each respective site figure (**Figures 5 through 9**). Because the former Pistol Range North, Pistol Range South, and the Rifle Range are within a Dune Management Area, habitat disturbance will be minimized during the SI field activities at this site. Accessible areas will be considered those that can be traversed without damaging/removing vegetation. A visual inspection and an all- metals detector survey will be conducted around each proposed sampling point to identify surface locations potentially containing metallic debris suspected to be associated with the use of small arms ammunition. The all-metals detector survey will consist of sweeping the surface in the vicinity of each sampling point with a handheld metal detector that detects ferrous and nonferrous metals, such as the Fisher M-96. Based on the survey, sample locations may be modified to better reflect areas with more expended casings, rounds, and range debris.

SAP Worksheet #11-1—Project Quality Objectives/Systematic Planning Process Statements (continued)

Following the visual inspection and detector survey, a non-random, discrete sampling approach will be used at each site. Because the source of contamination is expected to be surficial, most soil samples will be collected from 0-12 inches bgs (0-6 inches bgs at the Skeet and Trap Range and 0-24 inches bgs at the Machine Gun Boresight Ranges). It is planned that discrete soil sample locations will generally be spaced evenly within each site boundary; however, some locations will be conservatively biased toward areas suspected to have a greater concentration of MCs. Sampling locations are shown on **Figures 5 through 9**. This non-random approach will ensure that an even distribution of soil samples representative of the site is collected. A stainless-steel hand auger or similar tool will be used to collect each soil sample.

At the Skeet and Trap Range, soil samples will be sifted using a #10 sieve following homogenization to remove any debris. At all other sites, soil will be visually inspected for debris and will be removed and noted for that sample. The samples will be submitted to an offsite subcontract laboratory for analysis (See **Worksheets #17 and #18).**

Following the collection of soil and sediment samples at each of the former range sites and after site analytical results are received and evaluated, background soil and sediment samples may be collected to potentially be used for comparison. More information regarding the collection of background samples is presented below and in **Worksheet #11-2**.

How "good" do the data need to be in order to support the environmental decision? The analytical data will be of the quantity and quality necessary to provide technically sound and defensible evaluation to confirm or deny a release of MCs. A third-party data validator will not be used. However, data completeness reviews will be completed, as detailed on **Worksheets #35** and **#36**. QC samples will be collected as detailed in **Worksheet #20.** The EIS and Project Chemist will evaluate the data to identify any exceedances, compared to the PALs.

How much data should be collected (number of samples for each analytical group, matrix, and concentration)? It is necessary to have an adequate sample quantity and distribution to support a conclusion as to whether contamination exists at each site. Because the presence/locations of targets are unknown in some cases, a non-random, discrete sampling pattern will be established within each of the site boundaries to provide sufficient spatial distribution of data across the site. Sample locations will be biased toward areas having a higher likelihood of MC density, as evidenced by the presence of range-related surface debris and bullet scarring observed on the backstops.

More-detailed information on data collection is provided on **Worksheet #17-1**. The quantities and types of QA/QC samples are detailed in **Worksheet #20**.

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

- Detailed information on when the data will be collected is provided on **Worksheet #16.**
- Detailed information on where and how the data will be collected is provided on **Worksheets #14 and 17**.
- Data will be collected within each of the site boundaries, as shown in **Figures** 5 through 9, for the analytes listed in **Worksheet #17**.

SAP Worksheet #11-1—Project Quality Objectives/Systematic Planning Process Statements (continued)

- Data will be collected following the standard operating procedures (SOPs) presented in **Worksheet #21**.

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

The CH2M HILL field team will collect samples and make field observations during the sampling events. The samples will be shipped via overnight courier to Empirical Laboratories, under subcontract to CH2M HILL for analysis. All analytical data generated will be submitted to CH2M HILL. The CH2M HILL data management team will upload the data into an internal database and the Naval Installation Restoration Information System, a centralized electronic database used for Navy projects.

The results of the investigation will be documented in the SI report. The report will be prepared by CH2M HILL and submitted to the Navy as a draft for review prior to distribution to VDEQ for agency review and approval. The final approved reports will be placed in the Administrative Record and will be publicly available.

How will the data be archived?

Data will be archived according to procedures dictated via the Navy CLEAN program/contract; all data will be uploaded into the Navy Installation Restoration Information System. At the end of the project, paper copies of archived analytical data will be provided to the Navy.

List the project quality objectives (PQOs) in the form of if/then qualitative and quantitative statements.

- If site-specific data do not exceed the reference limits listed in **Worksheet #15)** [Step 1], and if historical information and/or spatial distribution of the data indicate the potential source area was sufficiently sampled [Step 1a], then a No Further Action Decision Document will be prepared with regulatory approval.
- If site-specific data do not exceed the reference limits listed in **Worksheet #15)** [Step 1], and if historical information and/or spatial distribution of the data do not indicate the potential source area was sufficiently sampled [Step 1a], then additional samples will be collected.
- If site-specific data exceed the reference limits listed in **Worksheet #15)** [Step 1], and if more-realistic evaluations of the data can be performed, as listed later in this worksheet, then determine if constituent levels warrant further action [Step 2]
    - If outcomes of the additional evaluation indicate that further action is not warranted [Step 2] and if historical information and/or spatial distribution of the data indicate the potential source area was sufficiently sampled [Step 1a], then a No Further Action Decision Document will be prepared with regulatory approval.

SAP Worksheet #11-1—Project Quality Objectives/Systematic Planning Process Statements (continued)

- If outcomes of the additional evaluation indicate that further action is not warranted [Step 2] and if historical information and/or spatial distribution of the data indicate the potential source area was not sufficiently sampled [Step 1a], then additional samples will be collected.
- If the outcomes of the additional evaluation indicate that further action is warranted [Step 2], then background soil samples will be collected, as described in **Worksheet #11-2**
  - If no results with reference limit exceedances are greater than the background values [Step 3] and if historical information and/or spatial distribution of the data indicate the potential source area was sufficiently sampled [Step 1a], then a No Further Action Decision Document will be prepared with regulatory approval.
  - If no results with reference limit exceedances are greater than the background values [Step 3] and if historical information and/or spatial distribution of the data indicate the potential source area was not sufficiently sampled [Step 1a], then additional samples will be collected.
  - If there are any results with reference limit exceedances greater than the background [Step 3], then a potential release is suspected. A determination will then be made as to whether an interim action can be implemented to achieve no further action classification or whether an expanded investigation is warranted.

More-Realistic Evaluations

A more-realistic evaluation for potential human health risks will be performed by taking the RSLs for noncarcinogenic constituents and dividing those values by 10 to account for exposure to more than one constituent. This step will be performed only if any of the maximum detected concentrations exceed the screening values and will be a risk ratio evaluation. This step will involve calculating a corresponding risk level value as follows:

corresponding risk level = concentration x acceptable risk level/RSL

The concentration is the maximum detected concentration. The acceptable risk level is 1 for noncarcinogens and 10^{-6} for carcinogens. The RSL is the Residential Soil RSL value presented in the EPA RSL table. The RSL for noncarcinogenic effects is not adjusted by 10 as is done in the first step; it is used as presented in the EPA RSL table to correspond to the acceptable risk level. The corresponding risk level is calculated using the equation above. All of the corresponding risk values for each constituent within a medium are summed to calculate the cumulative corresponding hazard index (for noncarcinogens) and cumulative corresponding carcinogenic risk (for carcinogens). A cumulative corresponding hazard index is also calculated for each target organ/effect.

SAP Worksheet #11-1—Project Quality Objectives/Systematic Planning Process Statements (continued)

If the cumulative corresponding hazard index for a target organ/effect is greater than 0.5, or the cumulative corresponding carcinogenic risk is greater than 5×10^{-5}, the constituents contributing to these values are retained as contaminants of potential concern (COPCs) and carried forward to Step 3.

For constituents identified as COPCs in this substep, a corresponding risk value is calculated using the 95 percent upper confidence limit (UCL) of the mean of the data set. The 95 percent UCL of the arithmetic mean of the data set is calculated using EPA's ProUCL statistical software program. RSLs are listed in **Worksheet #15**.

A more-realistic evaluation for potential ecological risks will also be performed if there are exceedances of the most-conservative ecological screening values. More-realistic evaluations consider these types of information:

- The size of the site
- The type and quality of the habitat present on the site and in surrounding areas, and the potential receptors likely to be present
- The frequency and magnitude of screening values
- Average soil exposure concentrations
- The spatial pattern of exceedances
- Additional screening values from the literature, where applicable
- Other site-specific factors that might be relevant to assessing potential exposures (e.g., soil type, fate, transport properties)

SAP Worksheet #11-2—Project Quality Objectives/Systematic Planning Process Statements for Background Study

Who will use the data? If collected, background data will be used by the Navy (and its contractors) and the other stakeholder agencies.

What will the data be used for? If necessary to conduct the background study (see **Worksheet #10**), the data will be used to establish representative background concentrations in soil and sediment that can be compared to site-specific data to assess whether constituents detected at each site are attributable to site-specific release(s) or attributable to background. This information, in turn, will be used to identify the appropriate action(s) at the site.

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

- A spatially (horizontally) and numerically robust data set (i.e., minimum of 10 samples per medium collected in the vicinity of each former site, but unaffected by former site activities).
- Refer to **Worksheet #17-2** for more details on analytical methods and sample numbers.
- All sampling/field activities and analytical procedures will adhere to the SOPs for laboratory and sampling techniques provided in Appendix B and C and referenced in **Worksheet #21** and **Worksheet #23**.

How "good" do the data need to be in order to support the environmental decision? The background data will be of the same quality as described in **Worksheet #11-1**, and will be subject to the procedures described therein.

How much data is needed? (Number of samples for each analytical group, matrix, and concentration)? The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of the background conditions. The technical guide for ProUCL Version 4 (EPA, 2007)[1], a recent compilation of statistical approaches for site and background data, recommends a minimum of 8 to 10 sample results for any area being considered (site or background). To satisfy this requirement, the background study will target a minimum of 10 samples from each lithologic unit or potential data grouping and sediment where exceedances were observed during the sampling at each site. These potential data groupings are:

a) Acredale silt loam
b) Udorthents, loam
c) Corolla-Duckston fine sands
d) Newhan fine sand
e) Nawney silt loam
f) Nimmo loam

Additional samples might be collected to account for the possibility of rejected data, outlier elimination, or sample container breakage. If exceedances are found from site-specific soil samples in both data groupings and subsequently background samples collected in both data groupings, the individual soil data groups will be combined to generate a more robust dataset, if possible. This determination will be made based on statistical analysis, described next.

[1] United States USEPA, *ProUCL Version 4.0 Technical Guide*, Office of Research and Development, April, 2007.

SAP Worksheet #11-2—Project Quality Objectives/Systematic Planning Process Statements for Background Study (continued)

Statistical Analysis:

Information regarding the purpose of and methods for evaluating background can be found in the following reference documents:

- EPA. 2002. *Role of Background in the CERCLA Cleanup Program*. Office of Solid Waste and Emergency Response, OSWER 9285.6-07P. April
- Naval Facilities Engineering Command (NAVFACENGCOM). 2000. *Navy Interim Final Policy on the Use of Background Chemical Levels.*
- NAVFACENGCOM. 2004. *The Guidance for Environmental Background Analysis*. April.
- EPA, *ProUCL Version 4.0 Technical Guide*, Office of Research and Development, April, 2007.

To decide if the soil association groups should be combined when calculating background summary statistics, analysis of variance (ANOVA) or two-sample comparisons and graphical presentation (box and whisker plots, probability plots, or some other appropriate visual display of the concentrations, etc.) will be used to establish whether there are significant differences among soil associations. ANOVA is used when more than one effect (soil type, depth, etc.) or more than two sample groups per effect are considered simultaneously. Review of the actual data will direct which methods are of most use for this evaluation.

ANOVA is a technique designed to evaluate whether the mean values of multiple groups are statistically different from one another. Environmental data are often not consistently normally nor lognormally distributed, particularly because the data contain non-detects and outliers (EPA, 2002). A nonparametric ANOVA, using the ranks of the data, will be used for the background data. For instance, the lowest of 10 concentrations would have the rank of 1 while the highest would have the rank of 10.

The ANOVA will be performed on each constituent where at least 50 percent of the concentrations were detected measurements. Navy guidance (Navy, 2002) and EPA guidance (EPA, 2002) recommend this approach for the Wilcoxon Rank-Sum test, which is essentially a two-group version of the multi-group non-parametric ANOVA. When few detects are available, quantitative methods of evaluating differences between groups carry an increasing level of uncertainty as the number of detects decreases.

Two sample comparisons, such as the Wilcoxon Rank-Sum test, can be employed as well. When the percent of detects becomes low, a modified version of this test, known as Gehan's test, can be used.

For any of these evaluations, the probability (p-value) that the observed differences between the soil types, depths, etc., could be attributed to random variability in the data will be calculated. This p-value will be compared to a significance level of 0.05, which limits the potential false conclusion that the populations are not different (when they actually are) to 1 in 20 times. If the p-value for the comparison by soil type or depth is less than 0.05, the soil types or depths, respectively, will be considered to be significantly different. Otherwise they will be deemed to be statistically similar to one another and likely combined for summary statistics calculations.

SAP Worksheet #11-2—Project Quality Objectives/Systematic Planning Process Statements for Background Study (continued)

Summary Statistics and Background Threshold Calculations: Summary statistics for the background data, by constituent, will be calculated. These summary statistics will include the mean, median, standard deviation, frequency of detection, and minimum and maximum values. Also, the upper tolerance limit (UTL), the background threshold statistic, will be calculated and presented. The background threshold statistics will be calculated as a 95 percent/95 percent background UTL; that is, an upper bound (with 95 percent confidence) of the background 95th percentile. The calculation of the UTLs depends on the distributional assumption.

For instance, the normal UTL can be calculated using the following equation:

$$UTL = \bar{x} + (K \times s)$$

where:

$\bar{x}$ = sample mean
K = tolerance factor
s = sample standard deviation

Besides the simple normal UTL, other approaches will be used (EPA, 2007), which include calculating a lognormal UTL. For either the normal or lognormal UTLs, maximum likelihood estimates of proxy values for non-detects will be used when applicable. (No such proxies are necessary when all values are detected.) When neither the normal nor lognormal distributions are appropriate, nonparametric UTLs will be calculated using either the traditional rank-based approach (with all detects) or the Kaplan-Meier approach (when non-detects are present).

The recommendations in the technical guide for ProUCL version 4.0 (EPA, 2007) in general suggest that the gamma distribution be considered. For some applications, such as in calculating a UCL of the mean, this makes sense. Currently, however, there is no accepted protocol for calculating a UTL using an assumption of a gamma distribution. Therefore, in this evaluation, any cases recommending the gamma will either revert to another parametric approach (for example, the normal or lognormal distribution, assuming the alternate parametric distribution is approved by the distributional test) or employ a nonparametric approach.

These recent recommendations (EPA, 2007) also suggest that the distributional assumptions be tested on detected data only. That practice will be followed in this evaluation. Both detected and non-detected data will be used to calculate the summary statistics

Where, when, and how should the data be collected/generated? The data will be collected as detailed in **Worksheet #10** and in accordance with the SOPs provided in **Appendix B and C** and referenced in **Worksheet #21** and **Worksheet #23**.

A figure showing the background sampling locations will be submitted for regulatory agency review before any samples are collected.

Who will collect and generate the data? How will the data be reported? CH2M HILL field personnel will conduct the field sampling and will submit the analytical samples to Empirical Laboratories.

SAP Worksheet #11-2—Project Quality Objectives/Systematic Planning Process Statements for Background Study (continued)

A background study report will be prepared and included as an appendix to the SI report. The appendix will include summaries of activities conducted, an evaluation of data collected with respect to the investigation objectives, and conclusions and recommendations.

How will the data be archived? Data will be archived in the same manner as described in **Worksheet #11-1**.

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

Matrix: Soil, Sediment

Analytical Group: Select Metals

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)
Equipment Rinseate Blank	Metals	One per day of sampling	Bias/ Contamination	No analyte detected > ½ QL	S + A
Cooler Temperature Blank		One per cooler to the laboratory	Accuracy / Representativeness	4°C (± 2° C)	S
Field Duplicate		One per 10 samples per matrix	Precision	Relative Percent Difference (RPD) < 35%	S + A

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

Matrix: Soil, Sediment

Analytical Group: PAHs

Concentration Level: Low (Selected Ion Monitoring [SIM])

QC Sample	Analytical Group	Frequency	DQIs	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Equipment Rinseate Blank	PAHs	One per day of sampling	Bias/ Contamination	No analyte detected > ½ QL	S + A
Cooler Temperature Blank		One per cooler to the laboratory	Accuracy / Representativeness	4°C (± 2° C)	S
Field Duplicate		One per 10 samples per matrix	Precision	RPD < 35%	S + A

SAP Worksheet #13—Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
December 2007 site reconnaissance and history of usage	*Final Preliminary Assessment – Naval Air Station Oceana, Dam Neck Annex and Naval Auxiliary Landing Field Fentress, Virginia.* Malcolm-Pirnie, October 2008.	Under agreement with the Department of Defense, Navy, and VDEQ, Malcolm-Pirnie completed a PA to compile historical site information, including site features and former usage in December 2007.	The information is being used to understand former site operations and delineate the effective site boundary.	There are no limitations on the use of information in the report. No analytical sampling has been conducted at the site to date.

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SAP Worksheet #14—Summary of Project Tasks

Project Logistics:

Work will be performed in Level D personal protective equipment (PPE), which includes safety glasses and safety-toed boots. Optional PPE includes the use of Tyvek® coveralls. Upgrades to higher levels of PPE are discussed in the HSP, provided as **Appendix A**.

Project Tasks:

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

1. Coordinate with VMRC

   Before conducting any surface soil sampling on sand dunes protected by the Sand Dune Protection Act at Pistol Range North, CH2M HILL will notify VMRC of planned activities by submitting a letter describing the details of the sampling approach.

2. All-Metals Detector Survey and Soil Sampling

   A visual inspection and an all-metals detector survey will be conducted at of the former range sites to identify surface areas containing metallic debris suspected to be associated with the use of small arms ammunition and to verify sampling locations. The detector survey and visual inspection will be limited to accessible areas that can be traversed without damaging/removing vegetation. The detector survey will consist of sweeping the surface in the vicinity of each sampling point with a handheld all-metals detector that detects ferrous and nonferrous metals. Sample locations will be biased toward areas having a higher likelihood of MC density, as evidenced by the presence of range-related surface debris; however, if no range debris is detected, the sampling scheme shall follow the uniform, grid patterns shown in **Figures 4 through 8.**

   Sampling locations are shown on **Figures 4 through 8.** A stainless-steel hand auger or similar tool will be used to collect soil samples. At the Skeet and Trap Range, soil samples will be sifted following homogenization to remove any debris, using a #10 sieve. At all other sites, soil will be visually inspected for debris, and any debris will be removed and noted for that sample. Samples will be contained in laboratory-supplied glassware, packaged, and shipped to Empirical Laboratories every evening (see **Worksheet #27**) under chain of custody (CoC) procedures, as detailed in **Worksheet #17-1**.

   Sample location coordinates will be collected using a global positioning system (GPS). All relevant site-specific observations, onsite conditions, and sampling activities will be logged in the field notebook.

   Following the collection of soil and sediment samples at each of the former range sites and after site analytical results are received and evaluated, background surface soil and sediment samples may be collected to be used potentially for comparison. If background samples are necessary, 10 background surface soil or sediment samples will be collected. Samples will be contained in laboratory-supplied glassware and sent under CoC to Empirical Laboratories for analysis, as detailed in **Worksheet #17-2.**

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

3. Sediment Sampling

   Sediment sampling locations are shown on **Figures 8.** Six sediment samples will be collected from the shoreline. Samples from the remaining locations will be collected by personnel from a flat bottomed boat. A Ponar sediment sampler or similar tool will be used to collect sediment samples.

   Samples will be visually inspected for debris, which will be removed and noted for that sample. Samples will be contained in laboratory-supplied glassware, packaged. and shipped to Empirical Laboratories every evening (see **Worksheet #27**) under CoC procedures, as detailed in **Worksheet #17-1**.

   Sample location coordinates will be collected using a GPS. All relevant site-specific observations, onsite conditions, and sampling activities will be logged in the field notebook.

4. Equipment Decontamination

   All non-disposable sampling equipment will be decontaminated before use and immediately after each use in general accordance with applicable SOPs (**Appendix B**). Decontamination will take place between sample locations.

5. Quality Control

   Field and laboratory activities will be implemented following SOPs, which are provided in **Appendixes B** and **C**, respectively.

   QC samples will be collected as outlined on **Worksheet #20**.

6. Analytical Tasks

   The laboratory will calibrate, maintain, test, and inspect analytical instruments (**Worksheets #24** and **#25**).

   The laboratory will process and prepare samples for analysis.

   The laboratory will analyze project samples for various groups of parameters as shown on **Worksheet #18**: select metals (lead, antimony, arsenic, copper, nickel and zinc) and PAHs.

7. Data Management

   Appendix D provides guidance and checklists on data management steps, such as data recording, data transformation, data reduction, data transfer and transmittal, data analysis, and data review. Procedures for data tracking, storage, archiving, retrieval, and security for both electronic and hardcopy data are also provided in **Appendix D**. The Project EIS is responsible for data tracking and storage.

8. Project Assessment/Audit

   Project assessment and audits will be completed as detailed on **Worksheets #31** and **#32**.

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

9. Data Review

   A third-party data validator will not be used. However, data completeness reviews will be completed, as detailed on **Worksheets #35** and **#36**.

   A data usability assessment will be completed as detailed on **Worksheet #37**.

10. SI Report

An SI report will be prepared that discusses the field activities and evaluation of the data and presents the conclusions and recommendations, such as no further action or an expanded investigation.

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SAP Worksheet #15—Reference Limits and Evaluation Table

The following applies to all of Worksheet #15: In some instances the laboratory's QL for a particular analyte may be greater than the corresponding QL. Under these circumstances, if the specific constituent is nondetect, the analyte will be considered not present.

In efforts to reach lower limits, the laboratory will report detected concentrations between the QL and MDL as estimated with a "J" qualifier. This will give the lowest PQL goal possible that it is still achievable by the laboratory.

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

Matrix: Soil

Analytical Group: Select Metals

Analyte	CAS Number	Adjusted Residential Soil RSL (mg/kg)	Eco PAL (mg/kg)	PQL Goal (mg/kg)	Laboratory-specific		Laboratory Control Sample (LCS) and Matrix Spike/Matrix Spike Duplicate (MS/MSD) Control Limits		
					QLs (mg/kg)	MDLs (mg/kg)	LCL (%)	UCL (%)	RPD (%)
Antimony	7440-36-0	3.1	78	1	1	0.30	80	120	20
Arsenic	7440-38-2	0.39	18	0.39	0.5	0.12	80	120	20
Copper	7440-50-8	310	70	5	5	1	80	120	20
Lead	7439-92-1	400	120	5	5	1	80	120	20
Nickel	7440-02-0	160	38	8	8	2	80	120	20
Zinc	7440-66-6	2400	120	4	4	1	80	120	20

Notes:

mg/kg = milligrams per kilogram

LCL = lower confidence limit

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.

Project QL goals were established on a case-by-case basis and are at least 3 times less than the PAL and greater than the laboratory QL, with the exception of the Residential RSL PAL for arsenic, which has been shaded.

PAL and Project QL assumes dry weight basis.

Residential RSLs are the EPA's Regional Screening Levels for Residential Soil (adjusted). RSLs based on noncarcinogenic effects are adjusted by dividing by 10 to account for exposure to multiple constituents that may affect the same target organ.

Eco PALs are Eco-SSLs for plants and invertebrates.

Shading represents and/or PQL goals that are less than the Laboratory QL.

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

Matrix: Soil

Analytical Group: SIM PAHs

Analyte	CAS Number	Adjusted Residential Soil RSL (mg/kg)	Eco PAL (mg/kg)	PQL Goal (mg/kg)	Laboratory-specific		LCS and MS/MSD Control Limits		
					QLs (mg/kg)	MDLs (mg/kg)	LCL (%)	UCL (%)	RPD (%)
Naphthalene	91-20-3	3.6	3.625	0.17	0.17	0.05	40	105	30
Acenaphthylene	208-96-8	340	3.625	0.17	0.17	0.05	45	105	30
Acenaphthene	83-32-9	340	3.625	0.17	0.17	0.05	45	110	30
Fluorene	86-73-7	230	3.625	0.17	0.17	0.05	50	110	30
Phenanthrene	85-01-8	1700	3.625	0.17	0.17	0.05	50	110	30
Anthracene	120-12-7	1700	3.625	0.17	0.17	0.05	55	105	30
Fluoranthene	206-44-0	230	3.625	0.17	0.17	0.05	55	115	30
Pyrene	129-00-0	170	2	0.17	0.17	0.05	45	125	30
Benzo(a)anthracene	56-55-3	0.15	2	0.05	0.05	0.015	50	110	30
Chrysene	218-01-9	15	2	0.17	0.17	0.05	55	110	30
Benzo(b)fluoranthene	205-99-2	0.15	2	0.05	0.05	0.015	45	115	30
Benzo(k)fluoranthene	207-08-9	1.5	2	0.17	0.17	0.05	45	125	30
Benzo(a)pyrene	50-32-8	0.015	2	0.015	0.05	0.015	50	110	30
Indeno(1,2,3-cd)pyrene	193-39-5	0.15	2	0.05	0.05	0.015	40	120	30
Benzo(g,h,i)perylene	191-24-2	170	2	0.17	0.17	0.05	40	125	30
Dibenz(a,h)anthracene	53-70-3	0.015	2	0.015	0.05	0.015	40	125	30
2-Methylnaphthalene	91-57-6	31	3.625	0.17	0.17	0.05	45	105	30

Notes: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.

Project QL goals were established on a case-by-case basis and are at least three times less than the PAL and greater than the laboratory QL, with the exception of the Residential RSL PAL for Benzo(a)pyrene and Dibenz(a,h)anthracene, which have been shaded.

PAL and Project QL assumes dry weight basis.

Residential RSLs are the EPA's Regional Screening Levels for Residential Soil (adjusted). RSLs based on noncarcinogenic effects are adjusted by dividing by 10 to account for exposure to multiple constituents that may affect the same target organ.

Eco PALs are Eco-SSLs for plants and invertebrates.

Shading represents PALs and/or PQL goals that are less than the Laboratory QL.

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

Matrix: Sediment
Analytical Group: Select Metals

Analyte	CAS Number	Residential Soil RSL (mg/kg)	Eco PAL (mg/kg)	PQL Goal (mg/kg)	Laboratory-specific		LCS and MS/MSD Control Limits		
					QLs (mg/kg)	MDLs (mg/kg)	LCL (%)	UCL (%)	RPD (%)
Lead	7439-92-1	400	35.8	5	5	1	80	120	30

Notes:

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.

Project QL goals were established on a case-by-case basis and are at least three times less than the PAL and greater than the laboratory QL.

PAL and Project QL assumes dry weight basis.

RSLs are the EPA's Regional Screening Levels for Residential Soil, unadjusted. RSLs based on carcinogenic effects are used as presented in the RSL table and are not adjusted.

Eco PALs are Eco-SSLs

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

Matrix: Sediment

Analytical Group: SIM PAHs

Analyte	CAS Number	Adjusted Residential Soil RSL x 10 (mg/kg)	Eco PAL (mg/kg)	PQL Goal (mg/kg)	Laboratory-specific		LCS and MS/MSD Control Limits		
					QLs (mg/kg)	MDLs (mg/kg)	LCL (%)	UCL (%)	RPD (%)
Naphthalene	91-20-3	36	0.176	0.17	0.17	0.05	40	105	30
Acenaphthylene	208-96-8	3400	0.0059	0.17	0.17	0.05	45	105	30
Acenaphthene	83-32-9	3400	0.0067	0.17	0.17	0.05	45	110	30
Fluorene	86-73-7	2300	0.0774	0.17	0.17	0.05	50	110	30
Phenanthrene	85-01-8	17000	0.204	0.17	0.17	0.05	50	110	30
Anthracene	120-12-7	17000	0.0572	0.17	0.17	0.05	55	105	30
Fluoranthene	206-44-0	2300	0.423	0.17	0.17	0.05	55	115	30
Pyrene	129-00-0	1700	0.195	0.17	0.17	0.05	45	125	30
Benzo(a)anthracene	56-55-3	1.5	0.108	0.05	0.05	0.015	50	110	30
Chrysene	218-01-9	150	0.166	0.17	0.17	0.05	55	110	30
Benzo(b)fluoranthene	205-99-2	1.5	0.24	0.05	0.05	0.015	45	115	30
Benzo(k)fluoranthene	207-08-9	15	0.24	0.17	0.17	0.05	45	125	30
Benzo(a)pyrene	50-32-8	1.5	0.15	0.05	0.05	0.015	50	110	30
Indeno(1,2,3-cd)pyrene	193-39-5	1.5	0.2	0.05	0.05	0.015	40	120	30
Benzo(g,h,i)perylene	191-24-2	1700	0.17	0.17	0.17	0.05	40	125	30
Dibenz(a,h)anthracene	53-70-3	0.15	0.033	0.05	0.05	0.015	40	125	30
2-Methylnaphthalene	91-57-6	310	0.0202	0.17	0.17	0.05	45	105	30

Notes:
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.
Project QL goals were established on a case-by-case basis and are at least three times less than the PAL and greater than the laboratory QL, with the exception of several Eco PALs, which have been shaded.

PAL and Project QL assumes dry weight basis.
Residential RSLs are the EPA's Regional Screening Levels for Residential Soil, adjusted, and multiplied by 10 for sediment. RSLs based on noncarcinogenic effects are adjusted by dividing by 10 to account for exposure to multiple constituents that may affect the same target organ.

Eco PALs are Eco-SSLs.

Shading represents PALs and/or PQL goals that are less than the Laboratory QL.

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SAP Worksheet #16—Project Schedule / Timeline Table

	Start	End
Work Plan (UFP-SAP)	**9/29/2009**	**6/4/2010**
DRAFT Preparation	9/29/2009	2/17/2010
Submit DRAFT to Navy	2/17/2010	2/18/2010
Navy Technical Representative (NTR) Review	2/18/2010	2/25/2010
Respond to NTR Comments	2/25/2010	2/28/2010
NAVFAC Atlantic Review	2/28/2010	3/28/2010
Respond to NAVFAC Atlantic Comments	3/28/2010	4/4/2010
Submit DRAFT FINAL to Regulator	4/5/2010	4/5/2010
Regulator Review	4/6/2010	4/27/2010
Respond to Regulator Comments	4/28/2010	5/5/2010
Submit FINAL to Team	5/5/2010	5/5/2010
Perform Field Work	**5/19/2010**	**5/29/2010**
Utility Markout	5/19/2010	5/21/2010
Machine Gun Boresight Range (Oceana)	5/24/2010	5/25/2010
Machine Gun Boresight Range (Fentress)	5/24/2010	5/25/2010
Pistol Range - North (Dam Neck Annex)	5/26/2010	5/27/2010
Pistol Range - South (Dam Neck Annex)	5/26/2010	5/27/2010
Rifle Range (Dam Neck Annex)	5/28/2010	5/28/2010
Skeet/Trap Range (Dam Neck Annex)	5/28/2010	5/29/2010
Sample Analysis / Data Management	**5/30/2010**	**7/11/2010**
Laboratory Analysis	5/30/2010	6/27/2010
Database Loading	6/27/2010	7/11/2010
SI Report	**7/11/2010**	**11/14/2010**
DRAFT Preparation	7/11/2010	8/8/2010
Submit DRAFT to NTR	8/7/2010	8/8/2010
Navy NTR Review	8/8/2010	8/15/2010
Respond to NTR Comments	8/15/2010	8/22/2010
NAVFAC Atlantic Review	8/22/2010	9/19/2010
Respond to NAVFAC Atlantic Comments	9/19/2010	9/29/2010
Submit DRAFT FINAL to Regulator	9/29/2010	9/30/2010
Regulator Review	9/30/2010	10/30/2010
Respond to Regulator Comments	10/30/2010	11/13/2010
Submit FINAL to Team	11/13/2010	11/14/2010

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Worksheet #17-1—Sampling Design and Rationale

Site	Matrix	Depth of Samples	Method	Number of Field Samples	Rationale	Sampling Strategy
Machine Gun Boresight Range (Oceana)	Surface Soil (SS)/Sub-Surface Soil (SB)	0-12 inches and 12-24 inches	SW-846 6010B	16	Samples will be to collected to confirm or deny a release of MCs associated with small arms ammunition use and contaminants of concern (i.e., PAHs) within the boundary of the site, and if present, to decide whether this release warrants further investigation or action. Based on historical information, small arms ammunition debris may be present at the site and may be a potential source of MC contamination. The Navy and DEQ have agreed to the sample numbers and design.	Locations will be biased toward areas having higher likelihood of MC density as evidenced by the presence of bullet scarring on the backstop. Surface soil and subsurface soil will be collected. Subsurface samples will be dug following the trajectory of the bullet (horizontally) into the berm instead of vertically.
Pistol Range North	SS	0-12 inches	SW-846 6010B	20		Samples will be collected in a grid pattern.
Pistol Range South	SS	0-12 inches	SW-846 6010B	8		Samples will be collected in a grid pattern. Five of the samples collected will be held for analysis pending initial results.
Rifle Range	SS	0-12 inches	SW-846 6010B	22		Samples will be collected in a grid pattern.
Skeet and Trap Range	SS/Sediment (SD)	0-6 inches	SW-846 6010B, SW-846 8270C SIM	41		Samples will be collected in a fan grid pattern. The samples collected in areas with the highest likelihood of having of clay target debris will be analyzed for PAHs (shown in Figure 8).
Machine Gun Boresight Range (NALF Fentress)	SS/SB	0-12 inches and 12-24 inches	SW-846 6010B	16		Locations will be biased toward areas having higher likelihood of MC density as evidenced by the presence of bullet scarring on the backstop. Surface soil and subsurface soil will be collected. Subsurface samples will be dug following the trajectory of the bullet (horizontally) into the berm instead of vertically.

SAP Worksheet #17-2—Sampling Design and Rationale for Background Study

Matrix	Depth of Samples	Analysis	Method	Number of Field Samples	Rationale	Sampling Strategy
Soil Sample	Surface to 12 inches	Select metals (lead, antimony, arsenic, copper, nickel and zinc) PAHs	SW-846 6010B, SW-846 8270 SIM	10 (per soil type)	If site sample concentrations exceed the risk screening values, the results will be compared to background concentrations to assess whether constituents detected in the six MRP sites are attributable to site-specific release(s) or attributable to background. Depth of sampling to correspond with site-specific sampling depth. Analytical parameters to correspond with site-specific sampling parameters. Ten samples will be collected to satisfy the background data set, as recommended by the technical guide for ProUCL.	A figure detailing the locations of background surface soil samples will be presented to the Navy and VDEQ for acceptance before sample collection begins.

Note:

The appropriate QA/QC samples will be collected for this background study, as detailed in **Worksheet #20.**

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

Sampling Location / Identification (ID) Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
Machine Gun Boresight Range (Oceana)					
OMGBR-SO01/ OMGBR-SS01-MMYY	SS	0-12 inches	Metals (lead, antimony, arsenic, copper, nickel, and zinc)	16	See Appendix B
OMGBR-SO02/ OMGBR-SS02-MMYY					
OMGBR-SO03/ OMGBR-SS03-MMYY					
OMGBR-SO04/ OMGBR-SS04-MMYY					
OMGBR-SO05/ OMGBR-SS05-MMYY					
OMGBR-SO06/ OMGBR-SS06-MMYY					
OMGBR-SO07/ OMGBR-SS07-MMYY					
OMGBR-SO08/ OMGBR-SS08-MMYY					
OMGBR-SO01/ OMGBR-SB01-MMYY	SB	12-24 inches			
OMGBR-SO02/ OMGBR-SB02-MMYY					
OMGBR-SO03/ OMGBR-SB03-MMYY					
OMGBR-SO04/ OMGBR-SB04-MMYY					
OMGBR-SO05/ OMGBR-SB05-MMYY					
OMGBR-SO06/ OMGBR-SB06-MMYY					
OMGBR-SO07/ OMGBR-SB07-MMYY					
OMGBR-SO08/ OMGBR-SB08-MMYY					
Pistol Range (North)					
DNAPRN-SO01/ DNAPRN-SS01-MMYY	SS	0-12 inches	Metals (lead, antimony, arsenic, copper, nickel, and zinc)	20	See Appendix B
DNAPRN-SO02/ DNAPRN-SS02-MMYY					
DNAPRN-SO03/ DNAPRN-SS03-MMYY					
DNAPRN-SO04/ DNAPRN-SS04-MMYY					
DNAPRN-SO05/ DNAPRN-SS05-MMYY					
DNAPRN-SO06/ DNAPRN-SS06-MMYY					
DNAPRN-SO07/ DNAPRN-SS07-MMYY					
DNAPRN-SO08/ DNAPRN-SS08-MMYY					
DNAPRN-SO09/ DNAPRN-SS09-MMYY					
DNAPRN-SO10/ DNAPRN-SS10-MMYY					
DNAPRN-SO11/ DNAPRN-SS11-MMYY					

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

Sampling Location / Identification (ID) Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
Pistol Range (North)					
DNAPRN-SO12/ DNAPRN-SS12-MMYY					
DNAPRN-SO13/ DNAPRN-SS13-MMYY					
DNAPRN-SO14/ DNAPRN-SS14-MMYY					
DNAPRN-SO15/ DNAPRN-SS15-MMYY					
DNAPRN-SO16/ DNAPRN-SS16-MMYY					
DNAPRN-SO17/ DNAPRN-SS17-MMYY					
DNAPRN-SO18/ DNAPRN-SS18-MMYY					
DNAPRN-SO19/ DNAPRN-SS19-MMYY					
DNAPRN-SO20/ DNAPRN-SS20-MMYY					
Pistol Range (South)					
DNAPRS-SO01/ DNAPRS-SS01-MMYY	SS	0-12 inches	Metals (lead, antimony, arsenic, copper, nickel, and zinc)	8	See Appendix B
DNAPRS-SO02/ DNAPRS-SS02-MMYY					
DNAPRS-SO03/ DNAPRS-SS03-MMYY					
DNAPRS-SO04/ DNAPRS-SS04-MMYY					
DNAPRS-SO05/ DNAPRS-SS05-MMYY					
DNAPRS-SO06/ DNAPRS-SS06-MMYY					
DNAPRS-SO07/ DNAPRS-SS07-MMYY					
DNAPRS-SO08/ DNAPRS-SS08-MMYY					
Rifle Range					
DNARR-SO01/ DNARR-SS01-MMYY	SS	0-12 inches	Metals (lead, antimony, arsenic, copper, nickel, and zinc)	22	See Appendix B
DNARR-SO02/ DNARR-SS02-MMYY					
DNARR-SO03/ DNARR-SS03-MMYY					
DNARR-SO04/ DNARR-SS04-MMYY					
DNARR-SO05/ DNARR-SS05-MMYY					
DNARR-SO06/ DNARR-SS06-MMYY					
DNARR-SO07/ DNARR-SS07-MMYY					
DNARR-SO08/ DNARR-SS08-MMYY					

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

Sampling Location / Identification (ID) Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
Rifle Range					
DNARR-SO09/ DNARR-SS09-MMYY					
DNARR-SO10/ DNARR-SS10-MMYY					
DNARR-SO11/ DNARR-SS11-MMYY					
DNARR-SO12/ DNARR-SS12-MMYY					
DNARR-SO13/ DNARR-SS13-MMYY					
DNARR-SO14/ DNARR-SS14-MMYY					
DNARR-SO15/ DNARR-SS15-MMYY					
DNARR-SO16/ DNARR-SS16-MMYY					
DNARR-SO17/ DNARR-SS17-MMYY					
DNARR-SO18/ DNARR-SS18-MMYY					
DNARR-SO19/ DNARR-SS19-MMYY					
DNARR-SO20/ DNARR-SS20-MMYY					
DNARR-SO21/ DNARR-SS21-MMYY					
DNARR-SO22/ DNARR-SS22-MMYY					
Skeet and Trap Range					
DNASTR-SO01/ DNASTR-SS01-MMYY	SS	0-6 inches	Lead, PAHs (7 samples will be analyzed for PAHs)	21	See Appendix B
DNASTR-SO02/ DNASTR-SS02-MMYY					
DNASTR-SO03/ DNASTR-SS03-MMYY					
DNASTR-SO04/ DNASTR-SS04-MMYY					
DNASTR-SO05/ DNASTR-SS05-MMYY					
DNASTR-SO06/ DNASTR-SS06-MMYY					
DNASTR-SO07/ DNASTR-SS07-MMYY					
DNASTR-SO08/ DNASTR-SS08-MMYY					
DNASTR-SO09/ DNASTR-SS09-MMYY					
DNASTR-SO10/ DNASTR-SS10-MMYY					
DNASTR-SO11/ DNASTR-SS11-MMYY					

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

Sampling Location / Identification (ID) Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
Skeet and Trap Range					
DNASTR-SO12/ DNASTR-SS12-MMYY					
DNASTR-SO13/ DNASTR-SS13-MMYY					
DNASTR-SO14/ DNASTR-SS14-MMYY					
DNASTR-SO15/ DNASTR-SS15-MMYY					
DNASTR-SO16/ DNASTR-SS16-MMYY					
DNASTR-SO17/ DNASTR-SS17-MMYY					
DNASTR-SO18/ DNASTR-SS18-MMYY					
DNASTR-SO19/ DNASTR-SS19-MMYY					
DNASTR-SO20/ DNASTR-SS20-MMYY					
DNASTR-SO21/ DNASTR-SS21-MMYY					
DNASTR-SD01/ DNASTR-SD01-MMYY	SD	0-6 inches	Lead, PAHs (2 samples will be analyzed for PAHs)	20	See Appendix B
DNASTR-SD02/ DNASTR-SD02-MMYY					
DNASTR-SD03/ DNASTR-SD03-MMYY					
DNASTR-SD04/ DNASTR-SD04-MMYY					
DNASTR-SD05/ DNASTR-SD05-MMYY					
DNASTR-SD06/ DNASTR-SD06-MMYY					
DNASTR-SD07/ DNASTR-SD07-MMYY					
DNASTR-SD08/ DNASTR-SD08-MMYY					
DNASTR-SD09/ DNASTR-SD09-MMYY					
DNASTR-SD10/ DNASTR-SD10-MMYY					
DNASTR-SD11/ DNASTR-SD11-MMYY					
DNASTR-SD12/ DNASTR-SD12-MMYY					
DNASTR-SD13/ DNASTR-SD13-MMYY					
DNASTR-SD14/ DNASTR-SD14-MMYY					
DNASTR-SD15/ DNASTR-SD15-MMYY					
DNASTR-SD16/ DNASTR-SD16-MMYY					

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

Sampling Location / Identification (ID) Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
Skeet and Trap Range					
DNASTR-SD17/ DNASTR-SD17-MMYY					
DNASTR-SD18/ DNASTR-SD18-MMYY					
DNASTR-SD19/ DNASTR-SD19-MMYY					
DNASTR-SD20/ DNASTR-SD20-MMYY					
Machine Gun Boresight Range (NALF Fentress)					
FMGBR-SO01/ FMGBR-SS01-MMYY	SS	0-12 inches	Metals (lead, antimony, arsenic, copper, nickel, and zinc)	16	See Appendix B
FMGBR-SO02/ FMGBR-SS02-MMYY					
FMGBR-SO03/ FMGBR-SS03-MMYY					
FMGBR-SO04/ FMGBR-SS04-MMYY					
FMGBR-SO05/ FMGBR-SS05-MMYY					
FMGBR-SO06/ FMGBR-SS06-MMYY					
FMGBR-SO07/ FMGBR-SS07-MMYY					
FMGBR-SO08/ FMGBR-SS08-MMYY					
FMGBR-SO01/ FMGBR-SB01-MMYY	SB	12-24 inches			
FMGBR-SO02/ FMGBR-SB02-MMYY					
FMGBR-SO03/ FMGBR-SB03-MMYY					
FMGBR-SO04/ FMGBR-SB04-MMYY					
FMGBR-SO05/ FMGBR-SB05-MMYY					
FMGBR-SO06/ FMGBR-SB06-MMYY					
FMGBR-SO07/ FMGBR-SB07-MMYY					
FMGBR-SO08/ FMGBR-SB08-MMYY					

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

Sampling Location / Identification (ID) Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
QC Samples					
MS/MSD – Same as Parent Sample ID	Same media as parent sample	Same depth as parent sample	Same as parent sample	See Worksheet #20	See Appendix B
Duplicate - Same as Parent Sample ID with a "P" add after the location number (e.g. DNASTR-SS21P-MMYY)					
Equipment Blanks: EB01-MMDDYY (sequentially number EBs)	EB	Not Applicable	Same as the samples collected that day		

SAP Worksheet #19– Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference[1]	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time (Preparation/Analysis)[2]
Soil, Sediment	Select Metals	SW-846 6010B/ SOP-100,105	4 ounce glass jar	1-2 grams	Cool to 4 ± 2º C	180 days to extraction, 180 days to analysis
	PAHs	SW-846 8270C SIM/ SOP-231	4 ounce glass jar	15 grams	Cool to 4 ± 2º C	14 days to extraction, 40 days to analysis

[1] See **Worksheet 23**.
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted. (Not the validated time of sample receipt)

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SAP Worksheet #20—Field QC Sample Summary Table

Matrix	Analytical Group	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs	Number of Field Blanks	Number of Equipment Blanks	Number of VOC Trip Blanks	Total Number of Samples to Lab
NAS Oceana - Machine Gun Boresight Range								
Surface Soil	Select Metals	8	1	1/1	0	One per day of field sampling (approx. 1)	0	12
Subsurface Soil	Select Metals	8	1	1/1	0	One per day of field sampling (approx.1)	0	12
Dam Neck Annex - Pistol Range (North)								
Surface Soil	Select Metals	20	2	2/2	0	One per day of field sampling (approx. 1)	0	27
Dam Neck Annex - Pistol Range (South)								
Surface Soil	Select Metals	8	1	1/1	0	One per day of field sampling (approx. 1)	0	12
Dam Neck Annex - Rifle Range								
Surface Soil	Select Metals	22	3	2/2	0	One per day of field sampling (approx. 2)	0	31

SAP Worksheet #20—Field QC Sample Summary Table (continued)

Matrix	Analytical Group	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs	Number of Field Blanks	Number of Equipment Blanks	Number of VOC Trip Blanks	Total Number of Samples to Lab
Dam Neck Annex - Skeet and Trap Range								
Surface Soil	Select Metals	21	3	2/2	0	One per day of field sampling (approx. 2)	0	30
	PAHs	7	1	1/1	0	One per day of field sampling (approx. 1)	0	11
Sediment	Lead	20	2	2/2	0	One per day of field sampling (approx. 2)	0	28
	PAHs	2	1	1/1	0	One per day of field sampling (approx. 1)	0	6
NALF Fentress - Machine Gun Boresight Range								
Surface Soil	Select Metals	8	1	1/1	0	One per day of field sampling (approx. 1)	0	12
Subsurface Soil	Select Metals	8	1	1/1	0	One per day of field sampling (approx. 1)	0	11

QA/QC samples will be collected for analysis only based on the following guidelines:

1 field duplicate sample will be collected for every 10 field samples.

1 MS/MSD pair will be collected for every 20 samples, including QA/QC and field samples.

1 equipment blank sample will be collected per day for reusable equipment that is decontaminated daily.

No field blank samples will be collected during this SI.

SAP Worksheet #21—Project Sampling SOP References Table

Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
Preparing Field Log Books	CH2M HILL	Log book and indelible pen	N	N/A
Decontamination of Personnel and Equipment	CH2M HILL	Deionized, distilled, and potable water, Liquinox® or Alconox®, pesticide-grade methanol, plastic tubs, brushes, spray bottles, and plastic bags	N	N/A
Shallow Soil Sampling	CH2M HILL	Stainless steel hand auger and disposable trowel, GPS unit, pin flags, plastic bags, and laboratory-supplied glassware	N	N/A
CoC	CH2M HILL	CoC, sample labels, custody seals and indelible pen	N	N/A
Instrument Manual, Model GA-52Cs Magnetic Locator	Fisher	GA-52Cs Magnetic Locator	N	N/A
Sediment Sampling	CH2M HILL	Ponar sediment sampler, stainless steel spoon or spatula, GPS unit, and laboratory-supplied glassware	N	N/A
Flat Bottom Boat Sampling Operations	CH2M HILL	Flat bottom boat	N	N/A

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

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
Metal Detector	Instrument functional check will be conducted to ensure the instrument is functioning properly: 1) scan a surface known to not contain metals, such as an asphalt pad. 2) the FTL will hide a piece of metal within a 10' x 10' area and an FTM must then find the hidden object.	Daily, before use	Maintained in good working order per manufacturer's recommendations	Send back to manufacturer for replacement / repair	FTL	**Appendix B**	Check mechanical and electronic parts, verify system continuity, check

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SAP Worksheet #23 - Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (y/n)
SOP-100	Metals Digestion/Preparation Methods 3005A,3010A,3020A,3030,3040A,3050B, USEPA CLP ILMO 4.1 Aqueous & Soil/Sediment, USEPA Method 200.7(Standard Methods) 3030C, Rev. 19, 4/09	Definitive	Soil, Sediment/ Metals	Inductively Coupled Plasma- Atomic Emission Spectrometer (ICP-AES)	Empirical Laboratories	N
SOP-105	Metals Analysis by ICP Technique Methods 200.7, SW846 6010B, SM 19th Edition 2340B, USEPA ILMO 4.1, Rev. 12, 5/09		Soil, Sediment/ Metals	ICP-AES		
SOP-231	GC/MS Low Level PAHs By SW-846 Method 8270C SIM, Rev. 3, 1/09		Soil, Sediment/ PAHs	Gas Chromatograph/ Mass Spectrometer (GC/MS)		
SOP-343	BNA & Pesticide/PCB & TPH Non-Aqueous Matrix (Microwave Extraction) Using SW-846 Method 3546, Rev. 0, 8/09		Soil, Sediment/ PAHs	N/A		
SOP-404	Laboratory Sample Receiving Log-in and Storage SOPs Rev. 13, 6/09		Login	N/A		
SOP-410	SOPs for Laboratory Sample Storage, Secure Areas, and Sample Custody, Rev. 7, 6/09		Login	N/A		

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SAP Worksheet #24– Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CORRECTIVE ACTION	SOP Reference
ICP-AES	One point initial calibration (ICAL)	At the beginning of each day or if QC is outside criteria	R ≥ 0.995	Correct problem; repeat ICAL	Analyst/ Supervisor	Empirical SOP-105
	Low-level calibration check standard	Daily; after ICAL	80-120% of true value	Correct problem; reanalyze		
	Initial calibration verification (ICV)	After ICAL; prior to sample analysis	Second source is 90-110% of true value for ICV	Correct problem and verify second source calibration standard. Rerun ICV. If it fails again, correct problem and rerun ICAL.		
	Interference Check Standards (ICS)	At the beginning of the analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes < QL ICS-AB: Within 80-120% of true value	Terminate analysis. Locate and correct problem; reanalyze ICS and all associated samples.		
	Calibration Blank	Before sample analysis; every 10 samples; at the end of analytical sequence	No analytes detected > QL	Correct problem. Re-prepare and reanalyze calibration blank. All samples after last acceptable calibration blank should be reanalyzed.		
	Continuing calibration verification (CCV)	At the beginning and end of each 10 samples	Recovery within 90-110%	Correct problem and verify second source calibration standard. Rerun ICV. If it fails again, correct problem and rerun ICAL. Reanalyze all samples since last successful CCV.		

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

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CORRECTIVE ACTION	SOP Reference
GC/MS	Tuning (Decafluoro-triphenylphosphine)	Prior to ICAL and at beginning of 12 hour period	Mass; Ion Abundance Criteria: 51; 30-60% of mass 198 68; <2% of mass 69 70; <2% of mass 69 127; 40-60% of mass 198 197; <1% of mass 198 198; Base peak, 100% relative abundance 199; 5-9% of mass 198 275; 10-30% of mass 198 365; >1% of mass 198 441; Present, but less than mass 443 442; >40% of mass 198 443; 17-23% of mass 442	Retune and verify; rerun affected samples.		Empirical SOP-231
	Minimum five point ICAL for all analytes	Prior to sample analysis or instrument change, when instrument does not meet method criteria	Calibration check compounds: average response factor (RF) ≥ 0.05 System performance check compounds : ≤15% for average RF, 0.995 correlation for linear, 0.99 correlation for quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples		Empirical SOP-231
	ICV	After ICAL	80-120% recovery	Remake standard and recalibrate; if it still fails, replace standard and rerun ICAL		
	CCV	Every 12 hours	Calibration check compounds: average RF ≥ 0.05 System performance check compounds: 20% difference	Correct problem, rerun; If it fails, recalibrate, reanalyze affected samples		

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
ICP	Clean the torch assembly and the spray chamber when they become discolored or when degradation in data quality is observed. Clean the nebulizer, and check the argon supply. Replace the peristaltic pump tubing as needed	Metals	Inspect the torch, nebulizer chamber, pump, and tubing	Maintenance is performed prior to ICAL or as necessary.	The acceptance criteria for the continuing calibration standard is 90-110% of true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-105
GC/ MS	Check gas supply daily, Bake as necessary, manual tune if decafluoro-triphenylphosphine is not within criteria, cut column, change septum as needed	PAHs	Ion source, seal septum, liner	Prior to sample analysis or, when instrument does not meet method criteria	15% Avg RSD, 0.995 linear, 0.99 corr. Quadratic init cal; 20% diff CCV	Recalibrate and or perform necessary instrument maintenance. Check calibration standards, Reanalyze affected samples		Empirical SOP-231

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SAP Worksheet #26-1—Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FTL/ 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 (ALL PERSONNEL FROM EMPIRICAL)
Sample Receipt (Personnel/Organization): EJ Overby
Sample Custody and Storage (Personnel/Organization): EJ Overby
Sample Preparation (Personnel/Organization): Roger Burr (Metals), Antonio Monteiro (PAHs)
Sample Determinative Analysis (Personnel/Organization): Roger Burr (Metals), Antonio Monteiro (PAHs)

SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 days from receipt
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 1 year

SAMPLE DISPOSAL
Personnel/Organization: EJ Overby/ Empirical
Number of Days from Analysis: 90 days from receipt

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SAP Worksheet #27—Sample Custody Requirements Table

Sample Labeling Procedures

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

Field Sample Custody Procedures

Field samples will be collected by the FTMs under the supervision of the FTL. As samples are collected, they will immediately be placed in the appropriate, laboratory-supplied containers and labeled as outlined above. The labels will be filled out in the field by the field crew at the time of sample collection and checked before being placed into the cooler, at which time the sample will be logged on the CoC form and field logbook. The integrity of the sample labels will be maintained through the practice of placing sample containers in sealable bags (e.g., Ziploc®).

Sample containers will be cushioned with packaging material and placed in coolers containing enough ice to keep the samples below 4 degrees Celsius (°C) until they are received by the laboratory. The CoC form will also be placed into the cooler inside a Ziploc® bag. Coolers will be taped up and shipped to the laboratory via FedEx overnight service, with the airbill number indicated on the CoC form (to relinquish custody). The FTL is responsible for the care and custody of samples until they are shipped or otherwise delivered to the laboratory custodian. Upon delivery, the laboratory will log in each cooler and report the status of the samples to CH2M HILL, as discussed below.

CoC Procedures

CoC forms will include at a minimum the laboratory contact information, client contact information, sample information, and relinquished by/received by information (**Appendix B**). Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The CoC form will also have the sampler's name and signature and will link the 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 database for each sample.

Laboratory Sample Custody Procedures

The laboratory receiving samples will comply with all sample custody requirements outlined in the SOP-404. The SOP for documenting sample custody is provided in **Appendix C**.

Sample Integrity

A sample tracking system will be followed to ensure sample authenticity and data defensibility. An FTM or an EIS will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. The EIS will ensure samples arrive to the lab in the appropriate timeframe and the condition of samples upon receipt is satisfactory. If

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

samples are not delivered to the lab in the acceptable timeframe or condition, the PM will be notified and the decision will be made as to whether to recollect samples.

The EIS is responsible for checking the CoC forms against the field logbook and field project instructions to verify that the sample ID, times, analyses, and methods are correct on the CoC form. Any discrepancies will be resolved with the field team and relayed to the laboratory. These actions will be documented by both the lab and the EIS. The lab is responsible for providing the EIS with sample log-in sheets on the day of sample receipt in order for the EIS to verify the lab has accounted for all samples shipped and has correctly logged the samples into its information management system.

SAP Worksheet #28-1—Laboratory QC Samples Table

Matrix: Soil, Sediment
Analytical Group: Select Metals
Analytical Method/SOP Reference: SW-846 6010B/ SOP-100, 105

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQIs	Measurement Performance Criteria
Method Preparation Blank (PBS)	One per digestion batch of 20 or fewer samples	No target compounds should be ≥ ½ the QL	Investigate source of contamination. Re-digest and reanalyze all associated samples if sample concentration > QL and < 10x blank concentration.		Bias/ Contamination	No target compounds should be ≥ ½ the QL
MS/ MSD	One per digestion batch of 20 or fewer samples	See Worksheet #15-1	Investigate source of problem. Contact client for guidance.		Accuracy/ Bias, Precision	See Worksheet #15-1
LCS		See Worksheet #15-1	1) Investigate source of problem. 2) Re-digest and reanalyze all associated samples.		Accuracy/Bias	See Worksheet #15-1
Serial Dilution		If original sample result is at least 50x Instrument Detection Limit (IDL), 5-fold dilution must agree within 10% of original result	Perform post-digestion MS.		Accuracy/Bias	If original sample result is at least 50x IDL, 5-fold dilution must agree within 10% of original result
Post-Digestion MS	When serial dilution is outside of criteria or concentration in all samples is < 50x QL	75-125% recovery, minimum level of 10 times and a maximum of 100 times the IDL	If the spike result is not recovered within acceptable limits, then a matrix effect is suspected. The situation must be noted in the case narrative.		Accuracy/Bias	75-125% recovery, minimum level of 10 times and a maximum of 100 times the IDL

SAP Worksheet #28-2—Laboratory QC Samples Table

Matrix: Soil, Sediment
Analytical Group: SIM PAHs
Analytical Method/SOP Reference: SW846 8270C SIM/ SOP-231

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQIs	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	No target compounds should be ≥ ½ the QL	Re-clean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor	Bias / Contamination	No target compounds should be ≥ ½ the QL
LCS		See Worksheet #15-2	Evaluate and reanalyze if possible. If an MS/MSD was performed in the same 12-hour clock and acceptable, narrate. If the LCS recoveries are high but the sample results are < the QL, narrate; otherwise, re-prepare and reanalyze the batch.		Accuracy / Bias	See Worksheet #15-2
MS/ MSD		See Worksheet #15-2	Investigate source of problem. Contact client for guidance.		Precision / Accuracy / Bias	See Worksheet #15-2
Surrogates	All samples	2-Fluorobiphenyl: 45-105% Terphenyl-d14: 30-125% 2,4,6-Tribromophenol: 35-125% 2-Fluorophenol: 35-105% Phenol-d5/d6: 40-100% Nitrobenzene-d5: 35-100%	Re-prepare and reanalyze for confirmation of matrix interference when appropriate.		Accuracy / Bias	2-Fluorobiphenyl: 45-105% Terphenyl-d14: 30-125% 2,4,6-Tribromophenol: 35-125% 2-Fluorophenol: 35-105% Phenol-d5/d6: 40-100% Nitrobenzene-d5: 35-100%
Internal Standards	All samples	Retention times for internal standards must be ± 30 seconds and the responses within -50% to 100% of the last calibration verification (12 hrs) for each internal standard.	Inspect the gas chromatograph or mass spectrometer for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.		Precision / Accuracy / Bias	Retention times for internal standards must be ± 30 seconds and the responses within -50% to 100% of the last calibration verification (12 hrs) for each internal standard.

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
Field Notebooks	Electronic .pdf copies in the project file. Hardcopy (bound notebook) in the project file. Archived at project closeout.
CoC Records	Electronic .pdf copies in the project file. Hardcopy in the data validation report. Archived at project closeout.
Airbills	Hardcopy in the project file. Archived at project closeout.
Telephone Logs	Hardcopy in the project file. Archived at project closeout.
Corrective Action Forms	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Dust monitor readings	Recorded in Field Notebook. Stored in database.
Various field measurements	Recorded in Field Notebook.
All field equipment calibration information	Recorded in Field Notebook.
Pertinent telephone conversations	Recorded in Field Notebook.
Field equipment maintenance records	Inspected by FTL. Not maintained.
Sample Receipt, Custody, and Tracking Records	Electronic .pdf copies in the project file. Hardcopy in the full data package.
Standard Traceability Logs	Hardcopy in the full data package. Archived at project closeout.
Equipment Calibration Logs	Hardcopy in the full data package. Archived at project closeout.
Sample Prep Logs	Hardcopy in the full data package. Archived at project closeout.
Run Logs	Hardcopy in the full data package. Archived at project closeout.

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

Document	Where Maintained
Equipment Maintenance, Testing, and Inspection Logs	Hardcopy in the full data package. Archived at project closeout.
Reported Field Sample Results	Electronic .pdf copies in the project file. Hardcopy in the data package. Archived at project closeout.
Reported Results for Standards, QC Checks, and QC Samples	Hardcopy in the full data package. Archived at project closeout.
Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	Hardcopy in the full data package. Archived at project closeout.
Sample Disposal Records	Maintained by the laboratory.
Extraction/Clean-up Records	Maintained by the laboratory.
Laboratory Analytical Reports	Hardcopy in the full data package. Archived at project closeout.
Field Sampling Audit Checklists	Hardcopy in the project file. Archived at project closeout.
Fixed Laboratory Audit Checklists	If completed, hardcopy in the project file. Archived at project closeout.
Site Inspection Report	Electronic .pdf copies in the project file. Hardcopy in the data package. Archived at project closeout.

SAP Worksheet #30—Analytical Services Table

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory/ Organization[1]
Soil, Sediment	Select Metals	See **Worksheet #18**	SW846 6010B	28 calendar days	Empirical Laboratories 621 Mainstream Drive, Suite 270 Nashville, TN 37228 Ms. Sonya Gordon (615) 345-1115	TBD
	PAHs		SW846 8270C SIM			

[1] A backup laboratory has not been identified at this time. If circumstances arise that render Empirical unable to perform analytical services, a backup laboratory will be selected 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	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Action	Person(s) Responsible for Monitoring Effectiveness of Corrective Action
Offsite Laboratory Technical Systems Audit	Laboratories must have a current Department of Defense (DoD) Environmental Laboratory Accreditation Letter (ELAP), which will identify the period of performance. The laboratories must be re-evaluated prior to expiration of period of performance.	External	DoD ELAP/ Third party accrediting bodies	DoD ELAP/ Third party accrediting bodies	Randy Ward, Empirical QA Officer	Randy Ward, Empirical QA Officer	Anita Dodson, Navy CLEAN Program Chemist
Field Performance Audit	At least one field audit will be performed in support of the work included in this SAP. However, if multiple mobilizations are needed and the field team or site conditions change, more than one field audit may be performed.	Internal	CH2M HILL	TBD	FTL and Site H&S Officer	FTL and Site H&S Officer	Steve Falatko CH2M HILL PM

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SAP Worksheet #32-1—Planned Project Assessment Findings and Corrective Action Responses

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
Laboratory Performance and Systems Audits	Written audit report from third- party accrediting body	Randy Ward, Empirical QA Officer	Within 2 months of audit	Memorandum	Third-party Auditor, TBD	Within 2 months of receipt of initial notification
Field Performance Audit	Corrective Action Form	PM	Within 1 day	SI Report	FTL CH2M HILL John Tomik AQM CH2M HILL	Within 1 day

Note: If corrective action is warranted for a finding not included in a planned assessment, the following Corrective Action Form **(Worksheet #32-2)** will be completed and documented in the project file.

SAP Worksheet #32-2—Corrective Action Form

Person initiating Corrective Action _____ **Date** _____

Description of problem and when identified: _____

_____

_____

Cause of problem, if known or suspected:

_____

_____

_____

_____

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

_____

_____

_____

_____

_____

Corrective Action implemented by: _____Date: _____

Corrective Action initially approved by: _____Date: _____

Follow-up date: _____

Final Corrective Action approved by: _____Date: _____

Information copies to:

Anita Dodson, Navy CLEAN Program Chemist

SAP Worksheet #33—QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
SI Report	Once results are received from laboratory	November 2010	Oceana project team	Will be posted in project file.

The following will be addressed in the QA/QC section of the QA Management Report/Technical Memorandum:

- Summary of project QA/QC programs and trainings
- Conformance of project activities to SAP requirements and procedures
- Status of project and schedule delays
- Deviations from approved SAP and approved amendments to SAP
- Results of data review activities in terms of amount of usable data generated (results of the Project Chemist's QC check on data prior to loading into CH2M HILL's database)
- Required corrective actions and effectiveness of their implementation
- Data usability assessments in terms of accuracy, precision, representativeness, completeness, comparability and sensitivity
- Limitations on use of measurement data generated

The report will also include data quality concerns:

- Narrative and timelines of project activities
- Summary of PQO development
- Reconciliation of project data with PQOs
- Summary of major problems encountered and their resolution
- Data summary, including tables with appropriate sample identification or station location numbers, concentration units, and data quality flags
- Conclusions and recommendations

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

Verification Input	Description	Internal / External	Responsible for Verification
Planning Documents	Evidence of approval and completeness of UFP-SAP.	Internal	Steve Falatko - CH2M HILL
CoC and shipping forms	CoC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the CoC will be initialed by the reviewer, a copy of the CoC retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See CoC SOP found in Appendix B for further details.	Internal	Dennis Ballam – CH2M HILL Victoria Brynildsen – 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 UFP-SAP.	Internal	Steve Falatko – CH2M HILL
Laboratory Receipt	Upon their arrival at the laboratory, the samples will be cross-referenced against the CoC records. All sample labels will be checked against the CoC forms, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station as required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.	External	Empirical employees
Laboratory Data Package	Once received from the laboratory, the data package will be reviewed for completeness and consistency.	External	Victoria Brynildsen – CH2M HILL

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

Step IIa / IIb[1]	Validation Input	Description	Responsible for Validation
IIb	Onsite Screening	Ensure that all field data meet SAP requirements for completeness and accuracy based on the field prove-out records.	Dennis Ballam – CH2M HILL
IIa	SOPs	Ensure that all sampling and analytical SOPs were followed.	Mark Ost – CH2M HILL (Sampling SOPs) Randy Ward - Empirical QA Officer (Analytical SOPs)
IIa	Field QC Sample Results	Ensure that all required field QC samples were run.	Victoria Brynildsen – CH2M HILL
IIb	QLs	Ensure all sample results met the PQL specified in the SAP.	Megan Morrison, Steve Falatko – CH2M HILL

[1] IIa=compliance with methods, procedures, and contracts.

IIb=comparison with measurement performance criteria in the SAP.

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

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa	Soil	Select Metals, SIM PAHs	Data will be reviewed against the analytical methods for outstanding QA/QC issues, and anomalies by the laboratory. Issues will be summarized in the case narrative. The CH2M HILL Chemist and PM will review the analytical results and case narrative before the data are loaded to ensure no major problems exist.	Randy Ward, Empirical QA Officer Megan Morrison, Steve Falatko CH2M HILL
IIb			Results will be compared to PALs as specified in **Worksheet #15**; method calibration and QC criteria will be compared to **Worksheets #24 and 28** requirements.	

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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 PQLs listed in **Worksheet #15** were achieved. If PQLs were achieved and the verification and validation steps yielded acceptable data, the data are considered usable.
- During verification steps, data will be reviewed for completeness but will not be validated. The Project Chemist will review the data before it is loaded into CH2M HILL's internal database. Duplicate results because of reanalysis or dilutions will be resolved using an "Exclude" qualifier.
- For statistical comparisons, nondetect values will be represented by a concentration equal to one-half the sample reporting limit. For duplicate sample results, the more-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 comparing the hardcopy data and qualifiers to the electronic data deliverable. Once the data have been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be determined as the RPD between the two results.
- Deviations from the SAP will be reviewed to assess whether corrective action is warranted and to assess impacts to achievement of project objectives.

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

- To assess whether a sufficient quantity of acceptable data are available for decision making, the data will be reconciled with measurement performance criteria listed in **Worksheet #28** following validation and review of the DQI.
- If significant biases are detected with laboratory QA/QC samples, the biases will be evaluated to assess impact on decision making. Low biases will be described in greater detail because they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between laboratory and field precision, the cause will be further evaluated to assess impact on decision making.

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

SAP Worksheet #37—Usability Assessment (continued)

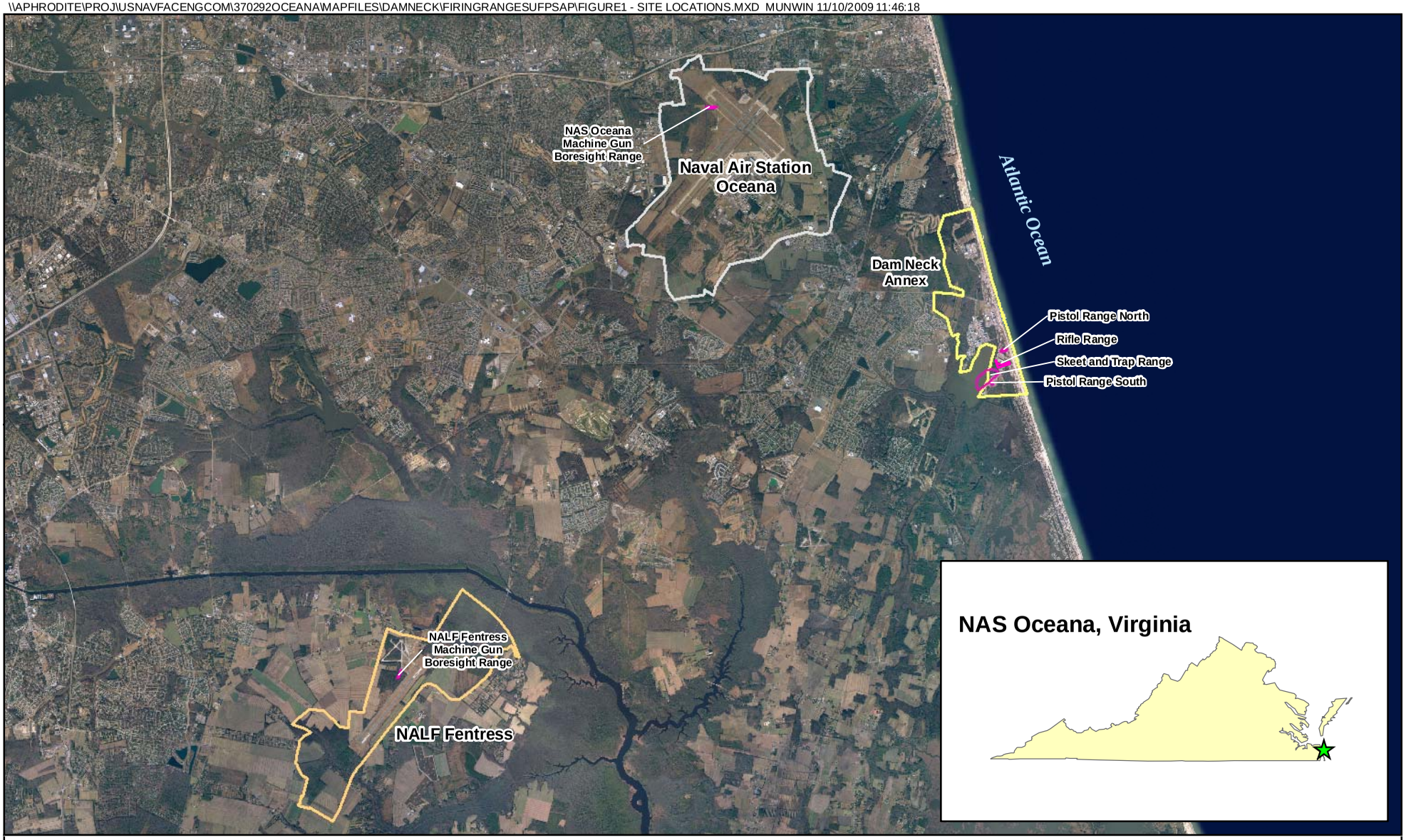
- The following materials will be prepared by CH2M HILL and submitted to NAVFAC and VDEQ for review and decisions on the path forward for the site:
  - Data tables to reflect detected and nondetected site COPCs. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.
  - Graphical representations to reflect increasing and/or decreasing concentrations of COPCs.
  - A technical memorandum to identify any data usability limitations and make recommendations for corrective action if necessary.

Identify the personnel responsible for performing the usability assessment.

- The CH2M HILL team, including the PM and Project Chemist, will review the data and compile a presentation for NAVFAC and VDEQ. The project team as a whole will assess the usability of the data.

Figures

\\APHRODITE\PROJ\USNAVFACENGCOM\370292OCEANA\MAPFILES\DAMNECK\FIRINGRANGESUFPSAP\FIGURE1 - SITE LOCATIONS.MXD MUNWIN 11/10/2009 11:46:18



Legend

- NAS Oceana Boundary
- Dam Neck Annex Boundary
- NALF Fentress Boundary
- MRP Sites

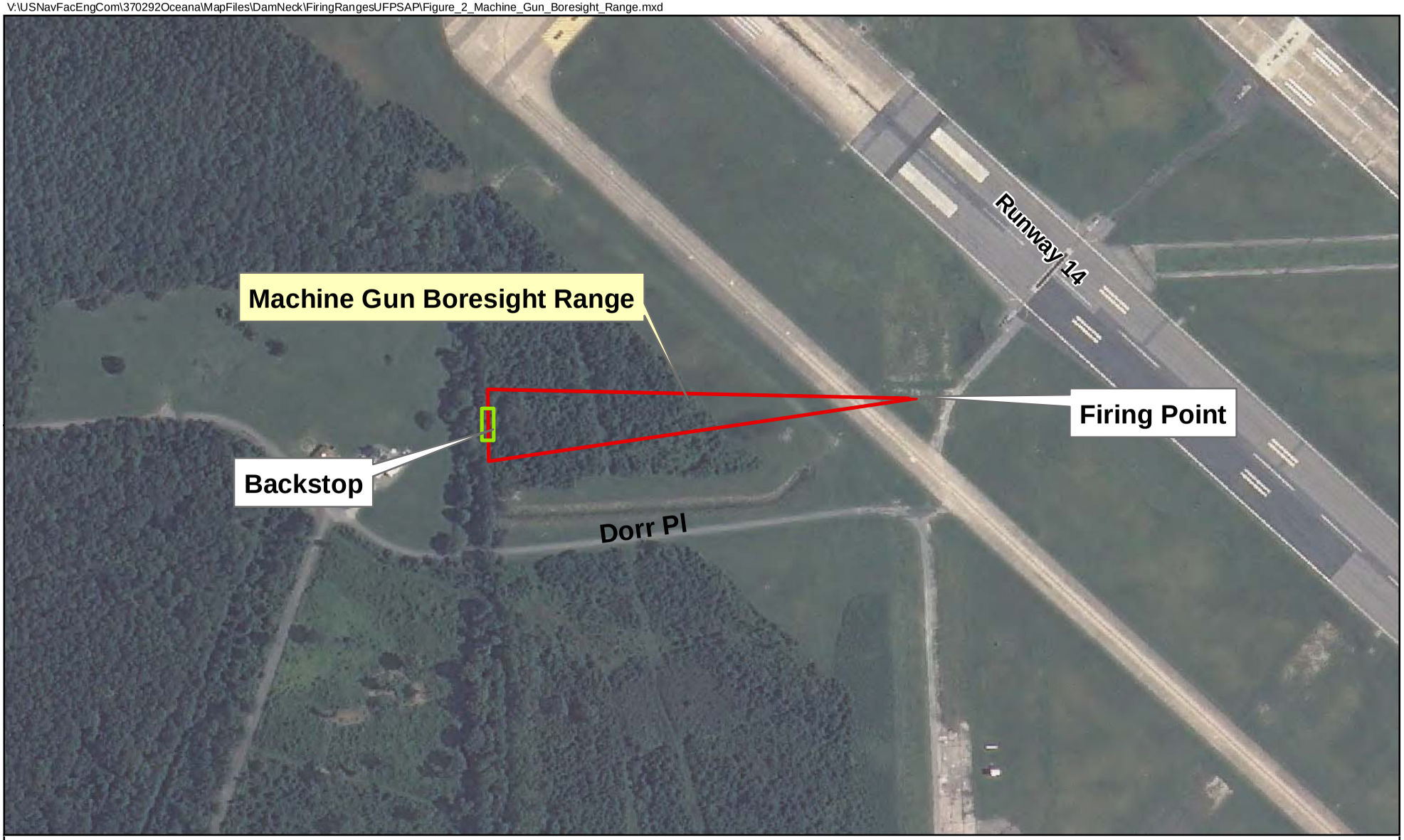
N
W E
S

0 1.1 2.2 Miles

Figure 1
Area and Site Location Map
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Naval Air Station Oceana
Virginia Beach, Virginia

CH2MHILL

V:\USNavFacEngCom\370292Oceana\MapFiles\DamNeck\FiringRangesUFPSAP\Figure_2_Machine_Gun_Boresight_Range.mxd



Legend
- MRP Site
- Backstop

N
W E
S

0 150 300
Feet

Figure 2
Machine Gun Boresight Range
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Naval Air Station Oceana
Virginia Beach, Virginia

CH2MHILL

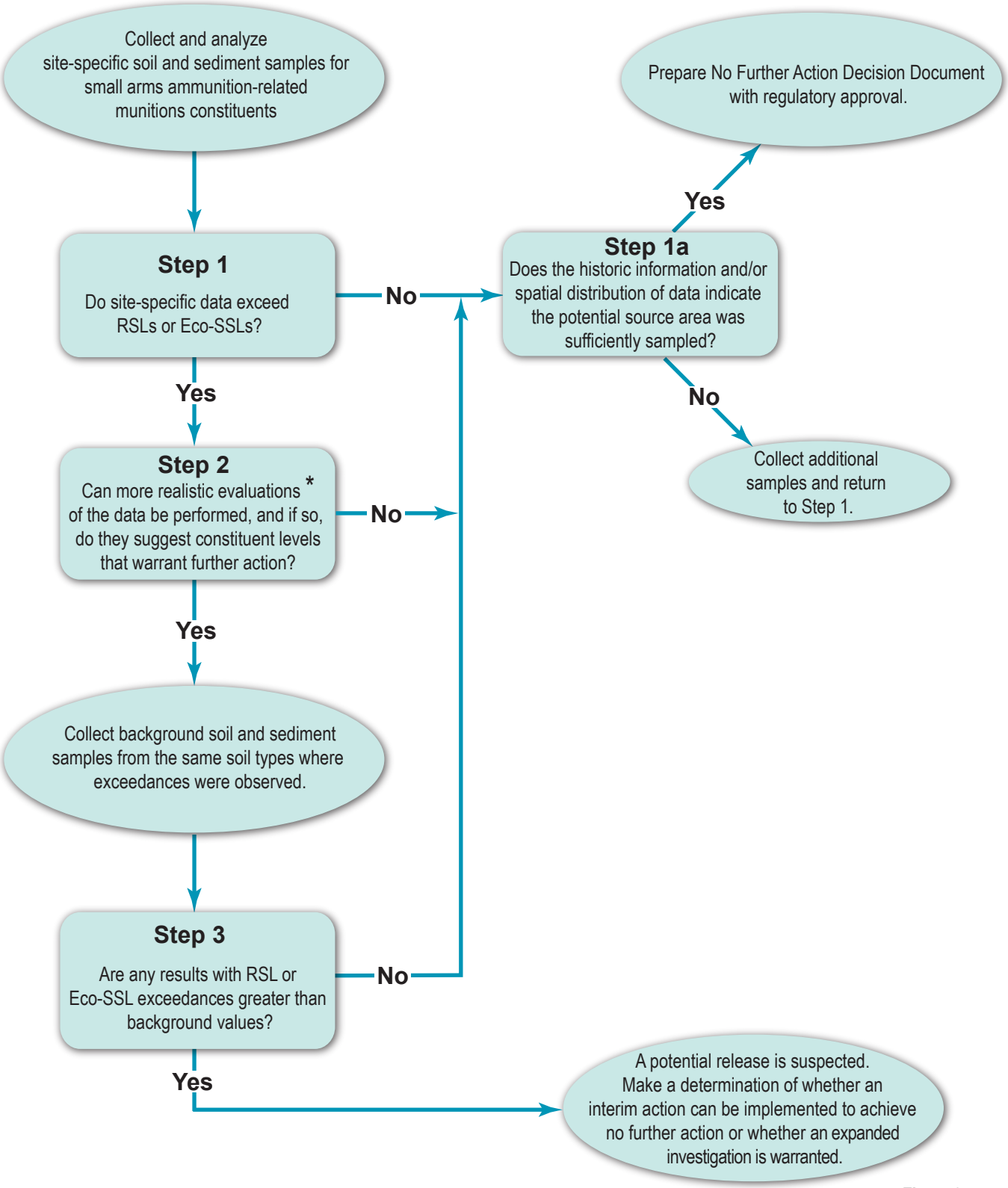
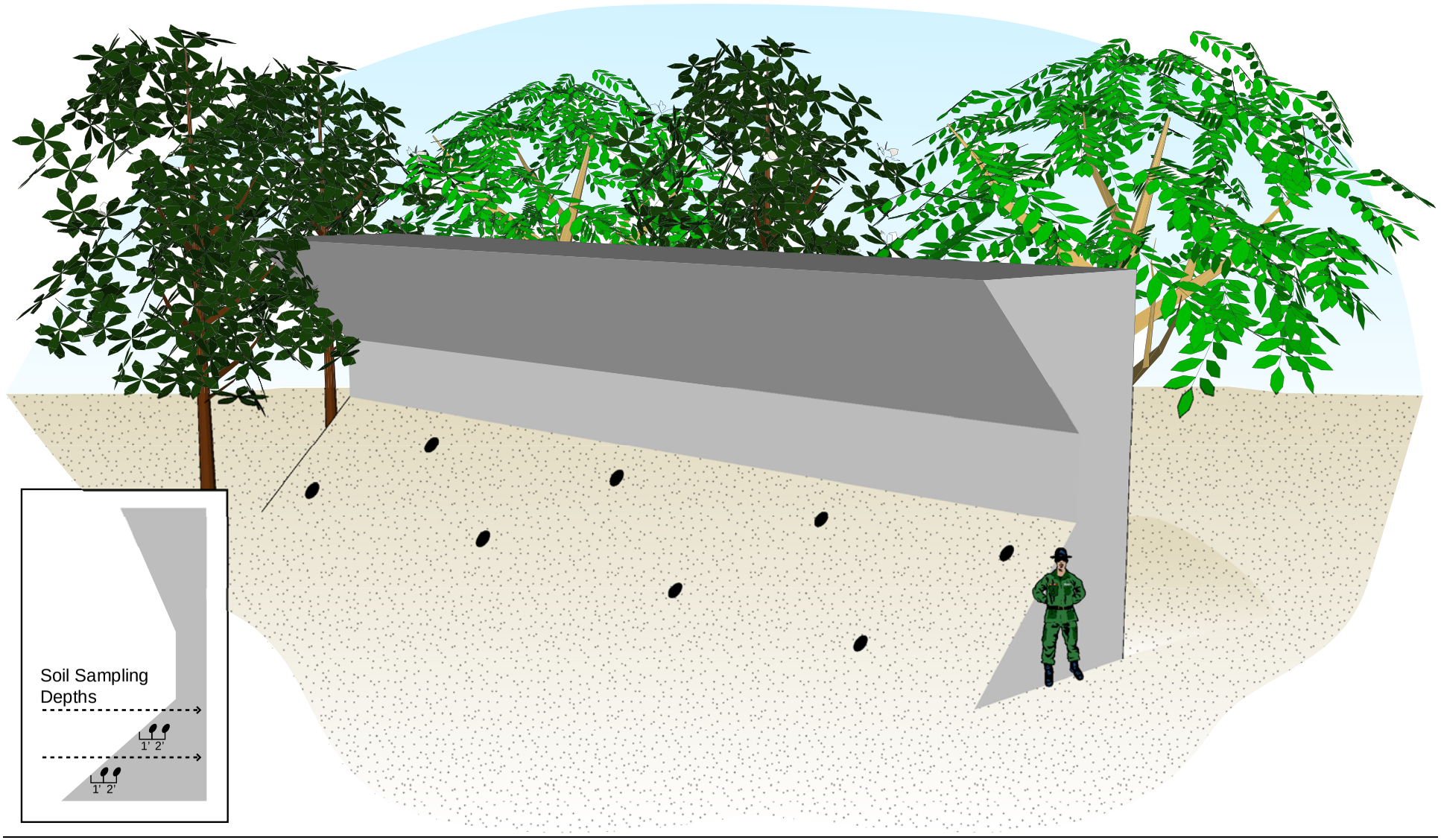


Figure 3
SI Evaluation Decision Tree
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Naval Air Station Oceana
Virginia Beach, Virginia

* See Worksheet #11 for examples of more realistic evaluations



LEGEND

Soil Sample Location

0 5 10

Approximate scale in feet

Notes: Soil sample locations will be biased toward areas having higher likelihood of munition constituent density, as evidenced by bullet scarring and/or presence of small arms ammunition related surface debris.

Figure 4

Soil Sample Locations at the Machine Gun Boresight Ranges

Former Small Arms Firing Ranges

Site Inspection UFP-SAP

Naval Air Station Oceana

Virginia Beach, Virginia

CH2MHILL

ES092009021WDC

V:\USNavFacEngCom\370292Oceana\MapFiles\DamNeck\FiringRangesUFPSAP\FIgure_5_Pistol_Range_North_Sample_Locations.mxd

Legend

- MRP Site
- Soil Sample (0-12")
- Operational Range Area

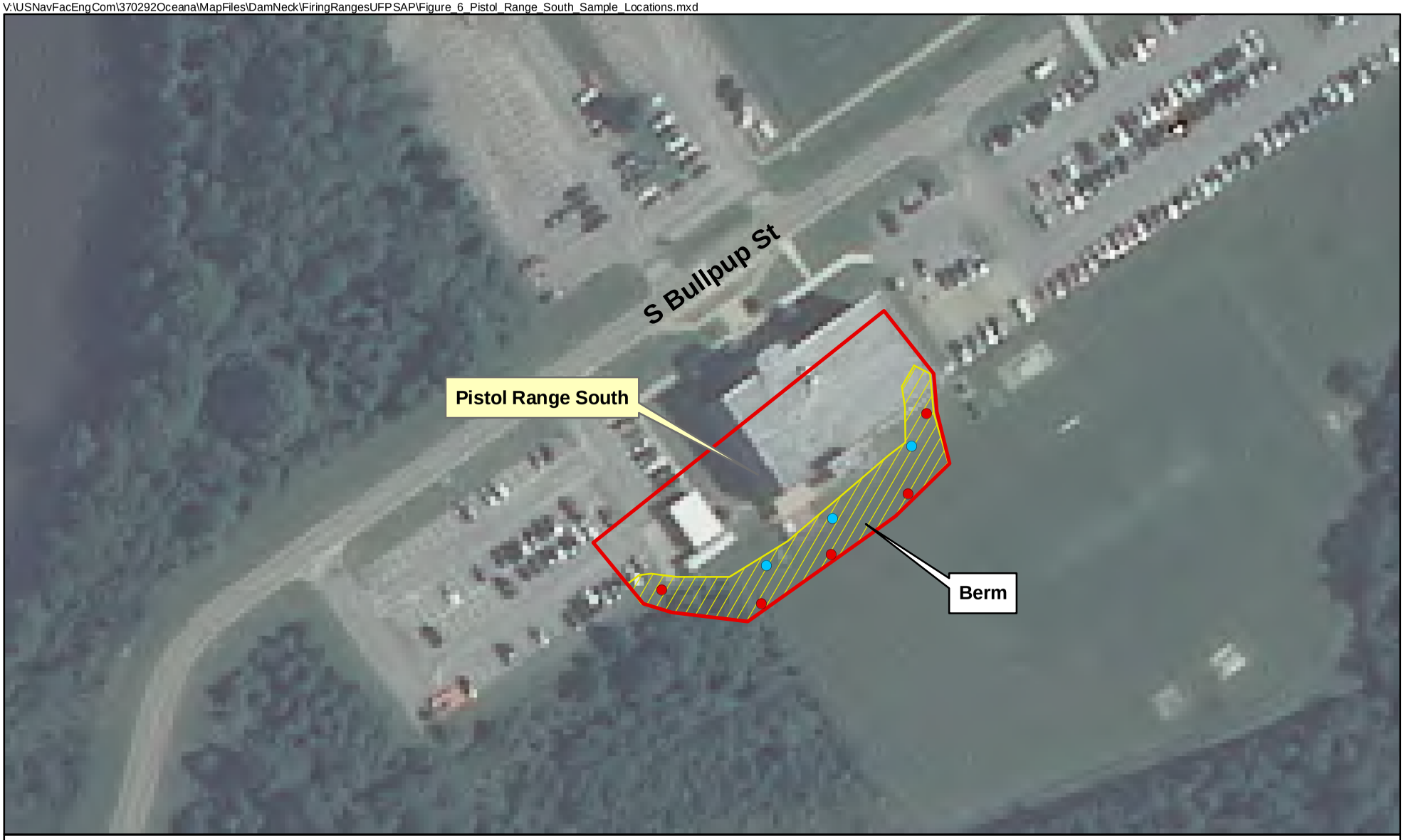
N
W E
S

0 75 150
Feet

Figure 5
Pistol Range North Sample Locations
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Dam Neck Annex, NAS Oceana
Virginia Beach, Virginia

CH2MHILL

V:\USNavFacEngCom\370292Oceana\MapFiles\DamNeck\FiringRangesUFPSAP\Figure_6_Pistol_Range_South_Sample_Locations.mxd



Legend

- MRP Site
- Soil Sample (0-12") sent to lab
- Soil Sample collected and held pending initial results

N
W E
S

0 50 100
Feet

Figure 6
Pistol Range South Sample Locations
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Dam Neck Annex, NAS Oceana
Virginia Beach, Virginia

CH2MHILL

V:\USNavFacEngCom\370292Oceana\MapFiles\DamNeck\FiringRangesUFPSAP\Figure_7_Rifle_Range_Sample_Locations.mxd

Legend

- MRP Sites
- Historical Ranges
- Operational Range Area
- Overlapping MRP Sites
- Rifle Range
- Soil Sample (0-12")

N
W E
S

0 200 400
Feet

Figure 7
Rifle Range Sample Locations
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Dam Neck Annex, NAS Oceana
Virginia Beach, Virginia

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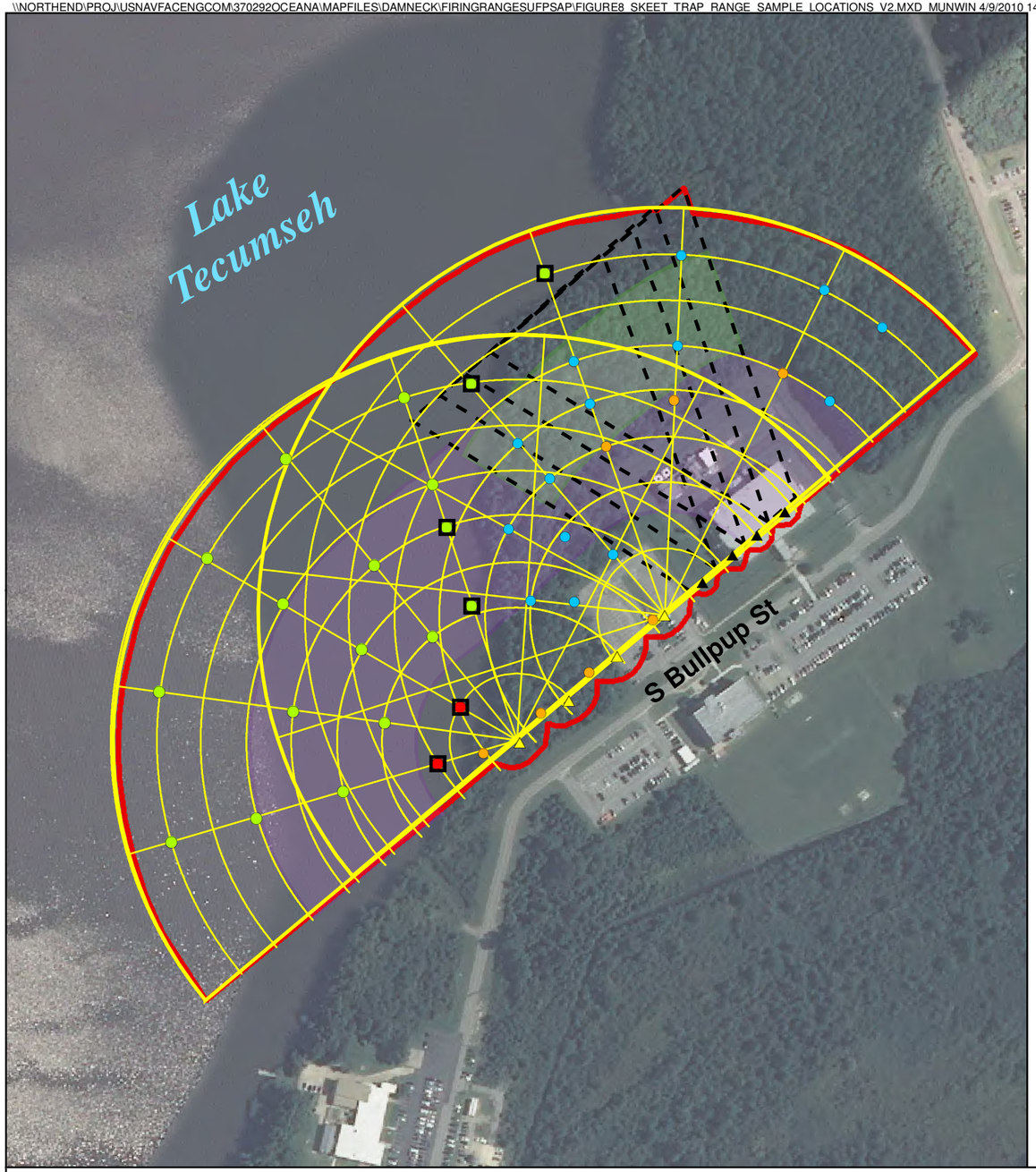
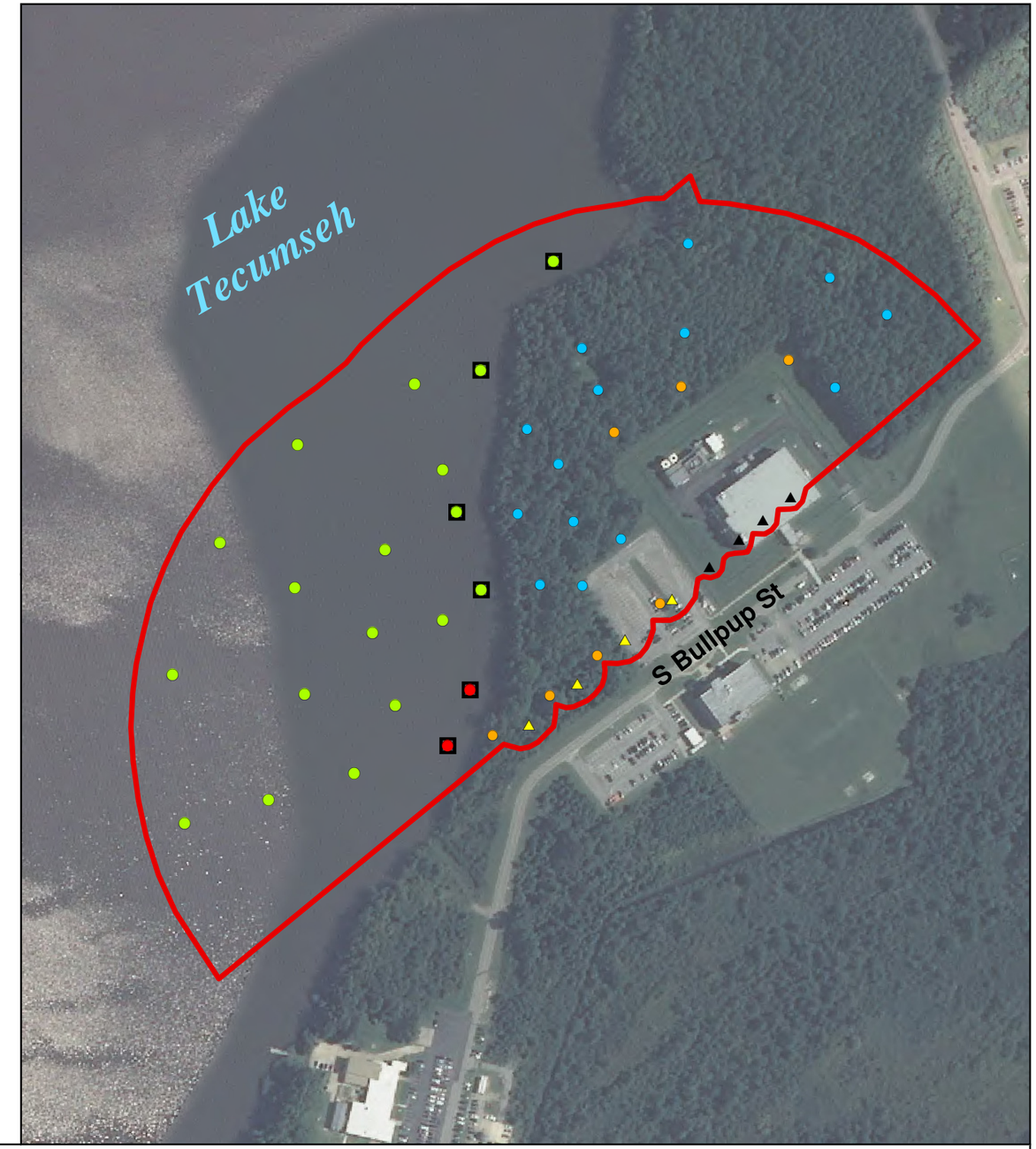
\\NORTHEND\PROJ\USNAVFACENGCOM\370292OCEANA\MAPFILES\DAMNECK\FIRINGRANGESUFPSAP\FIGURE8_SKEET_TRAP_RANGE_SAMPLE_LOCATIONS_V2.MXD MUNWIN 4/9/2010 14:57:13





Legend

- Soil Sampling Location (0-6") - Lead analysis
- Soil Sampling Location (0-6") - Lead and PAH analysis
- Sediment Sampling Location - Lead and PAHs analysis
- Sediment Sampling Location - Lead Analysis
- Samples will be collected from the shoreline.
- Firing Point (Skeet)
- Firing Point (Trap)
- Trap: area of likeliest munitions constituents (shotfall)
- Skeet: area of likeliest munitions constituents (shotfall)
- Skeet Boundary
- Trap Boundary
- MRP Site

N
W E
S

0 300 600 Feet

Figure 8
Skeet and Trap Range Sample Locations
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Dam Neck Annex, NAS Oceana
Virginia Beach, Virginia

CH2MHILL

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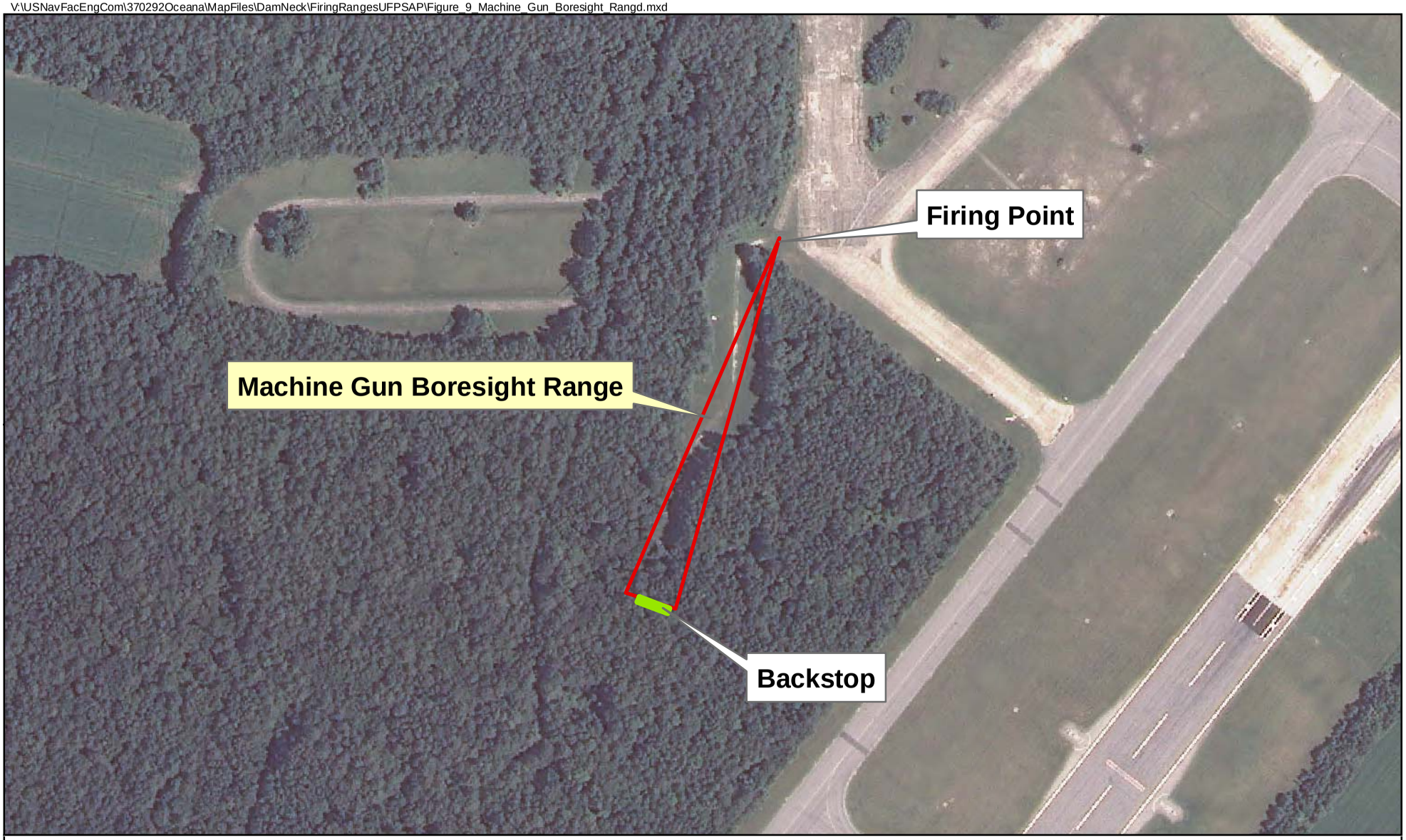


Legend
- MRP Site
- Backstop

N
W E
S

0 150 300
Feet

Figure 9
Machine Gun Boresight Range
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
NALF Fentress, NAS Oceana
Virginia Beach, Virginia

CH2MHILL

Appendix A
Health and Safety Plan

Health and Safety Plan for the Former Small Arms Firing Ranges Site Inspection

Naval Air Station, NALF Fentress, and Dam Neck Annex, Oceana

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid Atlantic

Contract No. N62470-08-D-1000
CTO-WE03

May 2010

Prepared by:

CH2MHILL

Prepared By:

Carl Woods 5/26/10

Responsible Health and Safety Manager Date

Approved By:

Project Manager Date

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HSP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Enterprise-wide Core Standards (CS) and Standard Operating Procedures (SOPs), as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Safety Coordinator (SC) is to be familiar with the CSs and SOPs and the contents of these instructions. CH2M HILL's personnel and subcontractors must be trained on this plan and sign Attachment 1.

Project Information and Background

PROJECT NO: 393979

CLIENT: US NAVAL FACILITIES ENGINEERING COMMAND

PROJECT/SITE NAME: Site Inspection at the Former Small Arms Firing Ranges, NAS Oceana, Dam Neck Annex, NALF Fentress

SITE ADDRESS: Virginia Beach, Virginia

CH2M HILL PROJECT MANAGER: Steve Falatko

CH2M HILL OFFICE: WDC

DATE HEALTH AND SAFETY PLAN PREPARED: 14 May 2010

DATE(S) OF SITE WORK: June through July 2010

SITE BACKGROUND AND SETTING:

Location:

NAS Oceana is located in the Southeastern corner of Virginia, within the city of Virginia Beach and is bordered by south Oceana Boulevard and Camp Pendleton State Military Reservation to the east, London Bridge Road to the west, U.S. Highway 264 to the north, and Dam Neck Road and Harpers Road to the south (Malcolm Pirnie, 2008[1]). The installation is approximately 5,331 acres in size.

In addition, NAS Oceana maintains control over several annex properties and outlying fields in the surrounding Virginia—North Carolina area. The mission of the facility is to support the Navy's Atlantic and Pacific fleet forces of strike-fighter aircraft and joint/interagency operations (Malcolm-Pirnie, 2008).

Dam Neck Annex is located approximately 5 miles southeast of NAS Oceana, in Virginia Beach, Virginia and covers approximately 1,400 acres. The mission of this installation is to provide force-level engineering solutions, mission-critical and associated testing, and training technologies for the maritime, joint, special warfare, and information operations domains (Malcolm-Pirnie, 2008).

NALF Fentress is located in Chesapeake, Virginia, approximately 7 miles southwest of NAS Oceana. Established in 1940, the installation encompasses just over 2,500 acres and approximately 8,700 acres in restrictive easements. The facility is used primarily by squadrons stationed at NAS Oceana or Naval Station Norfolk Chambers Field for field carrier landing practice operations (Malcolm-Pirnie, 2008).

[1] Malcolm Pirnie. 2008. *Final Preliminary Assessment, Naval Air Station Oceana, Dam Neck Annex and Naval Auxiliary Landing Field Fentress, Virginia.* October 2008.

SITE DESCRIPTIONS

***1) Machine Gun Boresight Range (Oceana)*:**

The former Machine Gun Boresight Range at NAS Oceana covers approximately 1.7 acres and is located north of Dorr Place and west of Runway 14. The eastern half of the site is generally flat and grassy because it borders an active aircraft runway. The western portion however, is predominantly overgrown with brush and trees, as it is not actively used by the installation. According to an archival map from 1943, the site was initially used as a maintenance and testing range for aircraft-mounted machine guns and was later converted to an SAFR. A concrete backstop is still in place on the western portion, which suggests that the direction of fire was toward the west. The concrete backstop is overgrown with trees and brush and is deteriorating. The former firing point is approximately 900 feet east of the backstop.

***Munitions used*:**

Ammunition used at the former Machine Gun Boresight Range was likely limited to .50 and .30 caliber rounds for aircraft guns, as well as 9-millimeter (mm) rounds for small arms.

***Potential MEC*:**

Potential MCs related to small arms ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the .30 and .50 caliber cartridges, but in very small quantities (6 grains for the .30 caliber and approximately 19 grains for the .50 caliber). Considering the small amount used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI.

***2) Pistol Range North (Dam Neck Annex)*:**

The former Pistol Range is located near the southeastern portion of Dam Neck Annex. Specifically, the site lies along the east side of Regulus Avenue and just north of the active Drone Launching Area. The site was formerly a small arms shooting range, covering approximately 2 acres. The direction of fire was presumed to be toward the east, in the direction of the Atlantic Ocean. Although the 1950 map shows the general outline and orientation of the former range, no backstop or berm is identified. It is unclear whether the natural topography of nearby dunes served as a backstop during site activities. Based upon a site visit conducted by CH2M HILL in July 2009, the eastern portion of the site is currently covered by a parking lot and Regulus Avenue itself. The remaining portion is comprised of undeveloped lowland area, covered with dense brush and sand dunes. No evidence of the range or associated structures was observed. Additionally, the former range lies within a Dune Management Area and is protected pursuant to the Coastal Sand Dune Protection Act, a program administered by the VMRC.

***Munitions used*:**

Ammunition used at the former Pistol Range North was expected to be limited to .22, .38, and .45 caliber rounds for small arms.

***Potential MEC*:**

Potential MCs related to small arms ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the cartridges, but in very small quantities. Considering the small amount used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site.

***3) Pistol Range South (Dam Neck Annex)*:**

The former Pistol Range is located near the southwestern portion of Dam Neck Annex. Specifically, the site is adjacent to Bullpup Avenue and is identified in archival maps as early as 1942. The former Pistol

Range South consisted of a small arms shooting range, covering approximately 1 acre. The direction of fire was southeast, toward a berm that has since been removed from the site. As observed during a site reconnaissance by Malcolm Pirnie in December 2007, and a site visit by CH2M HILL on July 30, 2009, the entire site has been graded and developed as Building 464, a grassy field, and an associated parking lot. The building portion currently occupies approximately 90 percent of the site area. No evidence of the former range or associated structures was observed.

***Munitions used*:**

Ammunition used at the former Pistol Range South was expected to be limited to .22, .38, and .45 caliber rounds for small arms.

***Potential MEC*:**

Potential MCs associated with these types of ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the cartridges, but in very small quantities. Considering the small amounts used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely that these constituents are present at the site.

***4) Rifle Range (Dam Neck Annex)*:**

The former Rifle Range is located on the southwestern portion of Dam Neck Annex, east of Regulus Avenue. The northern portion of the site is occupied by the active Drone Launching Area and is identified in an archival map from 1950. The site was formerly a practice target range, measuring 600 feet wide by 1,500 feet long. The direction of fire was presumed to be east, toward the Atlantic Ocean. Portions of the Rifle Range are overlapped by the active Drone Launching Area to the east and another MRP site (Moving Target/Mortar Range, North) to the north. The remaining portion of the Rifle Range is covered under this work plan and is approximately 6 acres. As observed during the site reconnaissance by Malcolm Pirnie in December 2007 and the CH2M HILL site visit on July 30, 2009, the southern portion of the site has been developed as a parking lot. The remaining portion is composed of undeveloped forest, sand dunes and the beach. No evidence of the former range or associated structures was observed by Malcolm Pirnie. Additionally, the former range occupies parts of all three natural resource management units represented at Dam Neck Annex: urban, natural areas, and beaches and dunes, as defined by the Coastal Sand Dune Protection Act. The protection program is administered by VMRC.

***Munitions used*:**

Ammunition used at the former Rifle Range is expected to be .22, .30, .45, and .30 caliber rounds, as well as 5.56 and 7.62mm rounds for small arms.

***Potential MEC*:**

Potential MCs associated with these types of ammunition are lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for some cartridges, but in very small quantities. Considering the small amounts used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site.

***5) Skeet and Trap Range* (Dam Neck Annex):**

The former Skeet and Trap Range is located on the southwestern portion of Dam Neck Annex, on the eastern shore of Lake Tecumseh. More specifically, the site is situated along the northern side of Bullpup Street. The former Skeet and Trap Range was composed of four skeet ranges and four trap ranges, with approximately half of the former range area extending into Lake Tecumseh. With the presumed firing line along Bullpup Street, the direction of fire was toward the northwest, over Lake Tecumseh. A 900-foot radius drawn from the presumed firing line represents the extreme range of fire for skeet and trap ranges. The resulting site area is approximately 39 acres and was identified as the

Surface Danger Zone. As observed during site reconnaissance by Malcolm Pirnie in December 2007, the southeast portion of the site, along Bullpup Street, has been developed into Building 470 and an associated parking lot. The remaining portion is composed of undeveloped forest and open lake area. During the site visit, pieces of clay targets were observed along the shoreline and in the shallow waters of Lake Tecumseh. Additionally, an abandoned building foundation was observed in the forested area. Although its purpose is unclear, the building is believed to have been used as a skeet or trap launching point.

***Munitions used*:**

Ammunition used at the former Skeet and Trap Range was expected to be 12 gauge or smaller shotgun ammunition. No MEC areas are suspected to be associated with the site.

***Potential MEC*:**

The primary contaminant associated with shotgun ammunition is lead. PAHs are also potential contaminants, which may be associated with the clay targets. Lead styphnate and lead azide are compounds that may have been used in cartridge primers, but only in very small quantities. Considering the small amount used and the possibility that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents exist at the site. Therefore, lead styphnate and lead azide will not be analyzed during this SI.

Potential sources of contamination present at the former Skeet and Trap Range are debris related to SAFR ammunition and clay targets. The Navy, VDEQ, and CH2M HILL identified lead as an MC related to shotgun ammunition and PAHs as constituents of concern related to the clay targets. It was concluded that surface soils and sediment are the most likely media to be affected, based on the use of the range, and therefore will be the focus of this SI for this site.

***6) Machine Gun Boresight Range (NALF Fentress)*:**

The former Machine Gun Boresight Range at NALF Fentress encompasses about 1.0 acre and lies southwest of runway 1-19, on the northern portion of the facility. The former Machine Gun Boresight Range is oriented northeast-southwest, with the former firing point at the northernmost end, as indicated on a 1955 archival map. The southwestern half of the site is overgrown with brush and trees, while the northeastern half is generally flat and grassy because it borders an active aircraft runway. The site was initially used as a maintenance and testing range for aircraft- mounted machine guns, but was later converted to a pistol range, as shown on a 1974 archival map. A concrete backstop is still in place on the southwestern portion and is showing signs of deterioration.

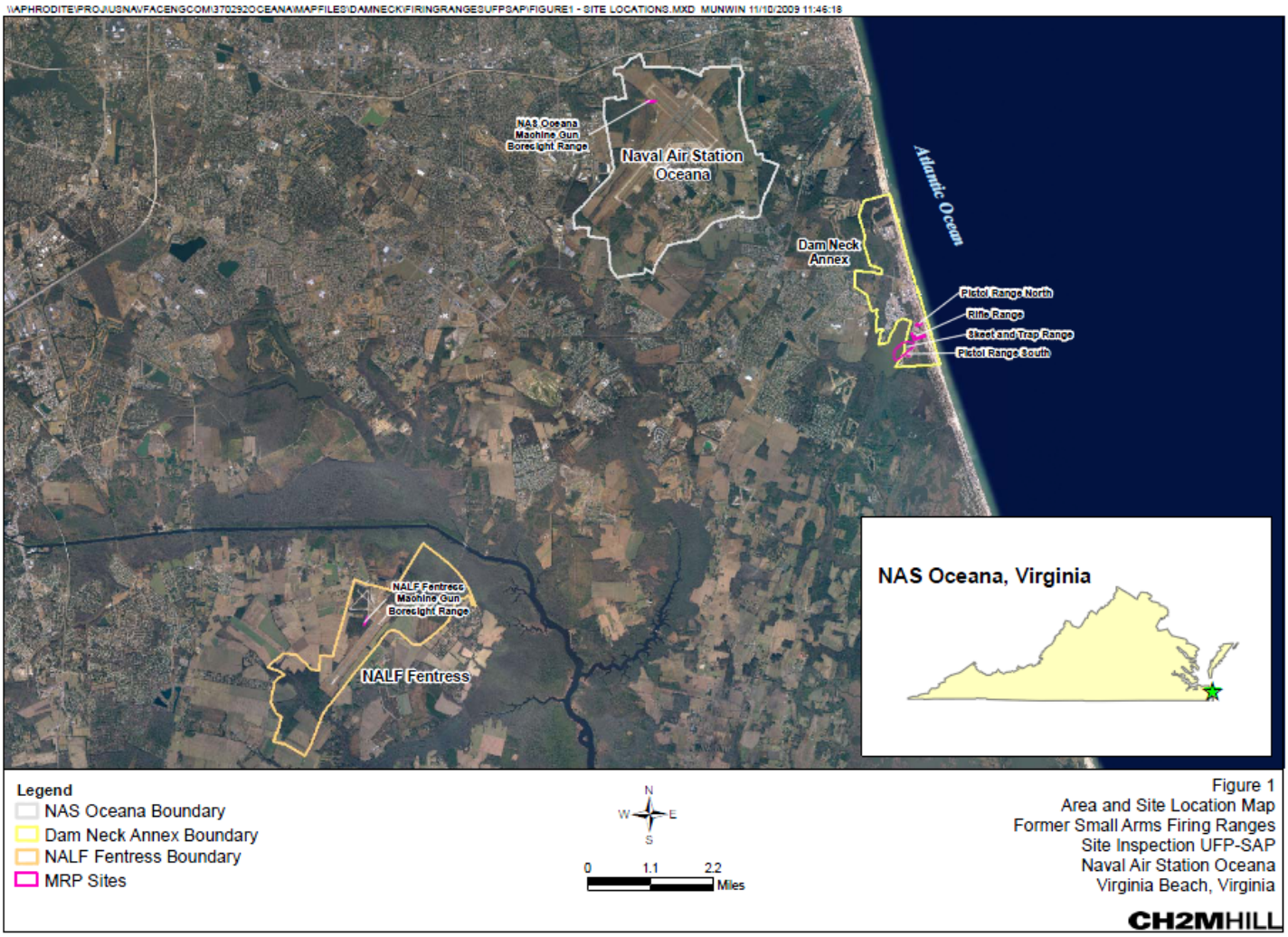
***Munitions used*:**

Ammunition used at the former Machine Gun Boresight Range was likely limited to .50 and .30 caliber rounds for aircraft guns. Additionally, expended 7mm, 9mm, .38 and .30 caliber and shotgun rounds were observed at the site during a site reconnaissance by Malcolm Pirnie in 2007 and CH2M HILL in 2009; however, the additional rounds appeared to be from more- recent, recreational use.

***Potential MEC*:**

Potential MCs associated with these types of ammunition are composed of lead, antimony, arsenic, copper, nickel, and zinc. Lead styphnate and lead azide are compounds that would have been used as the primer for the .30 and .50 caliber cartridges, but in very small quantities (6 grains for the .30 caliber and approximately 19 grains for the .50 caliber). Considering the small amounts used and that the organic component of these compounds would have been consumed in the chamber of the gun, it is unlikely these constituents are present at the site.

Site Map


\\APHRODITE\PROJ\USNAVFACENGCOM\370292OCEANA\MAPFILES\DAMNECK\FIRINGRANGES\UFPSAP\FIGURE1 - SITE LOCATIONS.MXD MUNWIN 11/10/2009 11:46:18
NAS Oceana Machine Gun Boresight Range
Naval Air Station Oceana
Atlantic Ocean
Dam Neck Annex
Pistol Range North
Rifle Range
Skeet and Trap Range
Pistol Range South
NALF Fentress Machine Gun Boresight Range
NALF Fentress
NAS Oceana, Virginia
Legend
NAS Oceana Boundary
Dam Neck Annex Boundary
NALF Fentress Boundary
MRP Sites
N
W
E
S
0
1.1
2.2
Miles
Figure 1
Area and Site Location Map
Former Small Arms Firing Ranges
Site Inspection UFP-SAP
Naval Air Station Oceana
Virginia Beach, Virginia
CH2MHILL

Emergency Contacts

24-hour CH2M HILL Serious Incident Reporting Contact/Pager – 720-286-4911

If injured on the job, notify your supervisor and then call 1-866-893-2514 to contact CH2M HILL'S Occupational Nurse

Medical Emergency – 911

CH2M HILL- Medical Consultant
WorkCare
Dr. Peter Greaney M.D.
300 S. Harbor Blvd, Suite 600
Anaheim , CA 92805
800-455-6155
714-978-7488

Urgent Care Facility
Sentara Virginia Beach General Hospital
1060 First Colonial Road
Virginia Beach, VA 23454
757-395-8000

CH2M HILL Director Security Operations
Thomas Horton/DEN
720/273-3100 (cell) or 720/286-0022 (office)

Fire/Spill Emergency -- 911
Facility Fire Response #: (757)433-9111
Local Fire Dept #: 911

Responsible Health and Safety Manager (RHSM)
Name: Carl Woods
Phone: 513-889-5771
Cell: 513-319-5771

Security & Police – 911
Facility Security #: (757)433-9111
Local Police #: 911

Human Resources Department
Name: Tina Pfaltzgraf
Phone: 703-376-5000

Utilities Emergency Phone Numbers
Water: (757)433-3105
Gas: (757)433-3105
Electric: (757)433-3105

Worker's Compensation:
Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: (720)891-5382

Safety Coordinator (SC)
Name: Mark Ost
Phone: 757-671-6247

Media Inquiries Corporate Strategic Communications
Name: John Corsi
Phone: (720) 286-2087

Project Manager
Name: Stephen Falatko
Phone: 703-376-5099
Mobile: 571-286-0786

Automobile Accidents:
Rental: Linda Anderson/COR 720/286-2401
CH2M HILL owned: Linda George 720-286-2057

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Dangerous Goods Shipping
Phone: 800/255-3924

Facility Alarms: Sound Horn of Field Vehicle (3x)

Evacuation Assembly Area(s): Field Vehicle

Facility/Site Evacuation Route(s): TBD

Directions to Local Hospital- NAS Oceana

Local Hospital

Sentara Virginia Beach General Hospital

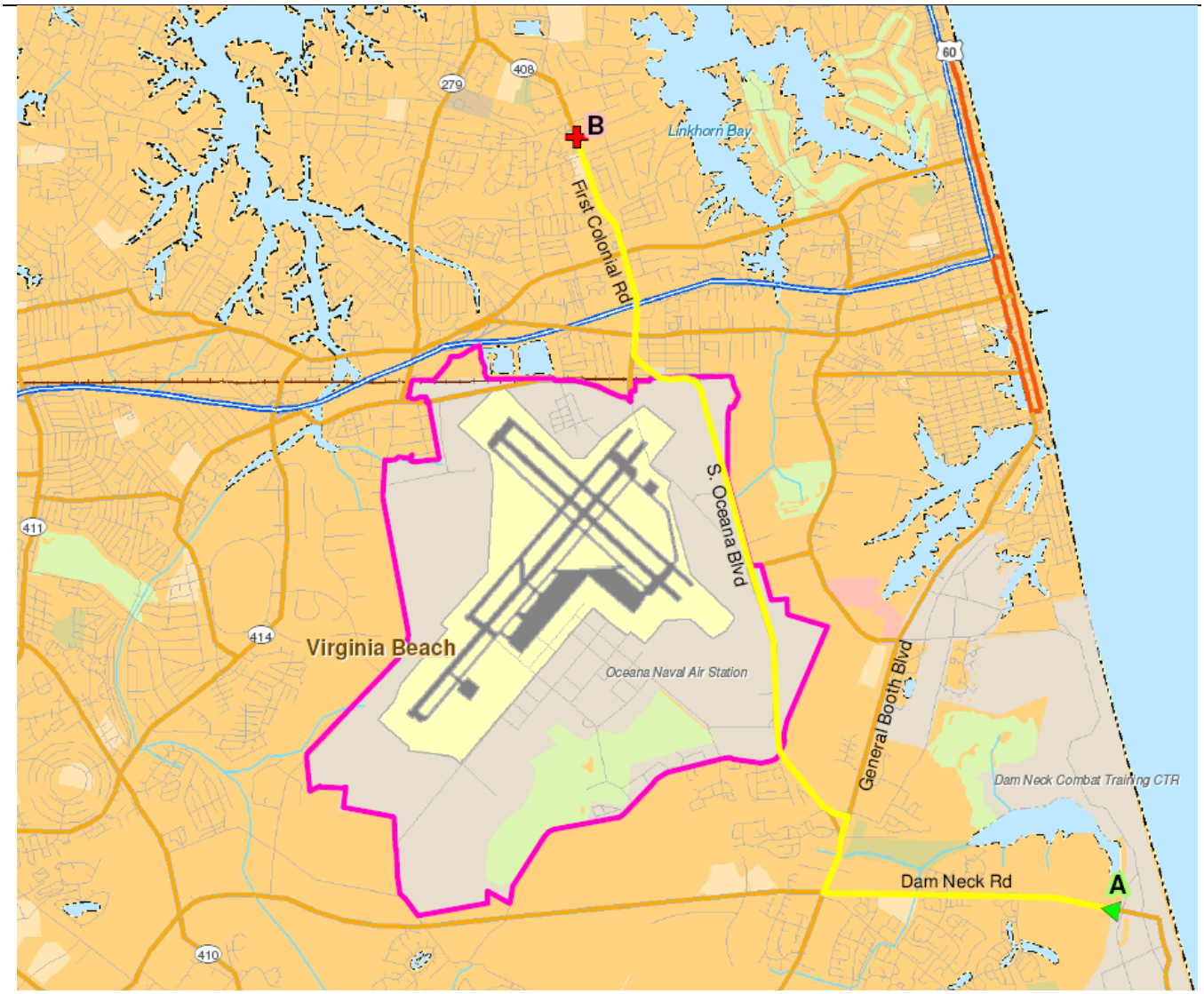
1060 First Colonial Road

Virginia Beach, VA 23454

757-395-8000

Route to Hospital:

1) From Site- Leave base from main entrance and continue west on Dam Neck Road.
2) Travel 1.9 miles, turn right at General Booth Boulevard (VA-149)
3) Turn Left at South Oceana Blvd/Prosperity Road, travel 3.8 miles
4) Slight right at First Colonial Road
5) Travel 1.5 Miles, Virginia Beach General Hospital is on the right



Directions to Local Hospital – From Dam Neck Annex

Local Hospital

Sentara Virginia Beach General Hospital

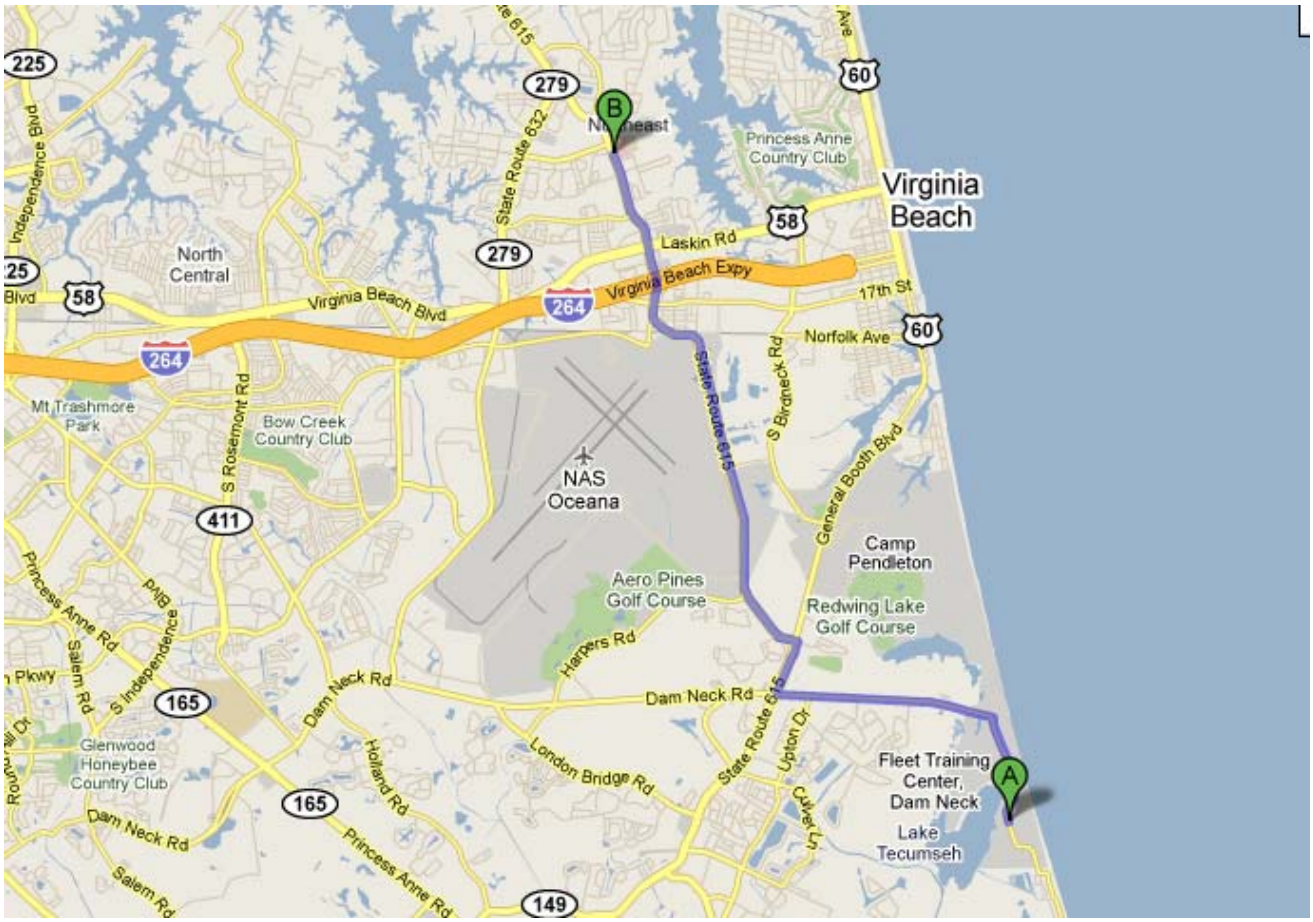
1060 First Colonial Road

Virginia Beach, VA 23454

757-395-8000

Route to Hospital:

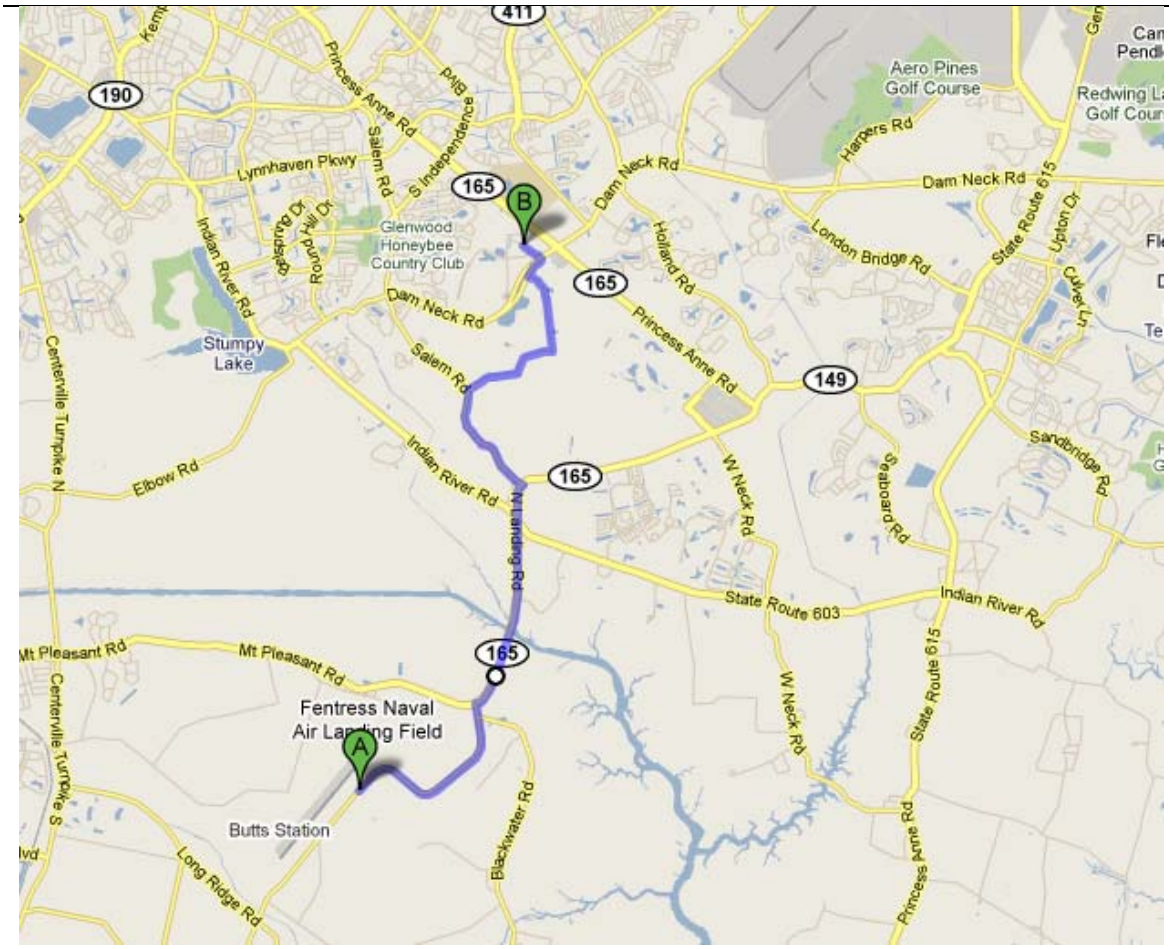
1) Head north on Regulus Ave toward Loon Ct (1.1 mi)
2) Turn left at Vanguard St (.2 mi)
3) Continue onto Dam Neck Rd (1.9 mi)
4) Turn right at General Booth Blvd/State Route 615 (.6 mi)
5) Turn left at Oceana Blvd/State Route 615 (5.6 mi)
   Continue to follow State Route 615
6) Turn right at 1st General Pkwy



Directions to Local Hospital – From NALF Fentress

Local Hospital
Sentara Princess Anne Hospital
1975 Glenn Mitchell Dr # 300
Virginia Beach, VA 23456-0167
(757) 507-0000

1) Route to Hospital:
2) Head northeast on Fentress Airfield Rd (2.1 mi)
3) Turn right at VA-165 N/Mt Pleasant Rd (2.4 mi)
   Continue to follow VA-165 N
4) Turn left at Salem Rd (1.2 mi)
5) Turn right at N Landstown Rd (1.9 mi)
6) Turn right at Dam Neck Rd (.2 mi)
7) Take the 1st left to stay on Dam Neck Rd
8) Dam Neck Rd turns slightly left and becomes Recreation Dr (.2 mi)
9) Destination will be on the right



1.0 Tasks to be Performed under this Plan

1.1 Description of Tasks

Refer to project documents (i.e., UFP-SAP) for detailed task information. A health and safety risk analysis (Table 1) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to “clean” tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.1.1 Hazwoper-Regulated Tasks

- Surface soil sampling
- Magnetometer survey
- GPS Surveying

1.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Responsible Health and Safety Manager (RHSM) is required before these tasks are conducted on regulated hazardous waste sites.**

TASKS

- NA

CONTROLS

- Brief on hazards, limits of access, and emergency procedures
- Post contaminant areas as appropriate (refer to Section 8.2 for details)
- Sample and monitor as appropriate (refer to Section 5.0)

1.2 Change Management

PROJECT HS&E Change Management Form			
*This evaluation form should be reviewed on a **continuous** basis to determine if the current site health and safety plan adequately addresses ongoing project work, and should be completed whenever new tasks are contemplated or changed conditions are encountered.*			
Project Task:	**Sediment sampling from a boat**	Project/Task Manager: **Steve Falatko and Stefanie Eggermann**	
Project Number:	393979	Project Name: Former Small Arms Firing Ranges Site Investigation, NAS Oceana	
	Evaluation Checklist	Yes	No
1.	Have the CH2M HILL staff listed in the original HASP changed?		
2.	Has a new subcontractor been added to the project?		
3.	Is any chemical or product to be used that is not listed in Attachment 2 of the plan?		
4.	Have additional tasks been added which were not originally addressed in Section 1.1 of the plan?		
5.	Have new contaminants or higher than anticipated levels of original contaminants been encountered?		
6.	Has other safety, equipment, activity or environmental hazards been encountered that are not addressed in Section 2.1 of the plan?		

If the answer is "YES" to Questions 1-3, an HSP revision is NOT needed. Please take the following actions:

- Confirm that staff's medical and training status is current – check training records at: http://www.int.ch2m.com/hands (or contact your regional SPA), and confirm subcontractor qualifications.
- Confirm with the project KA that subcontractor safety performance has been reviewed and is acceptable.
- Confirm with H&S that subcontractor safety procedures have been reviewed and are acceptable.

If the answer is "YES" to Questions 4-6, an HSP revision MAY BE NEEDED.

1.3 Hazard Analysis

(Refer to Section 2.0 for Hazard Controls)

POTENTIALHAZARDS	Project Activities									
	Soil sampling	Work from Boat								
Biological Hazards	X									
Chemical Hazard-Dermal/Inhalation	X	X								
Field Vehicles	X	X								
Fire Prevention	X	X								
Hand & Power Tools	X	X								
Lead	X	X								
Manual Lifting	X	X								
Visible Lighting	X	X								
Wild Animals	X	X								

2.0 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

The health and safety hazards posed by field activities have been identified for each project activity and are provided in the Hazard Analysis Table (Table 1). Hazard control measures for project-specific and general H&S hazards are provided in 2.1 and 2.2 of this section.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 4. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the RHSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records.

Applicable project activity self-assessment checklists (see Attachment 4) shall be completed weekly by a CH2M HILL representative during the course of the project depending on the work performed at the time.

2.1 Project-Specific Hazards

Arsenic

(Reference CH2M HILL, SOP HSE-501, *Arsenic*)

Arsenic is considered a “Confirmed Human Carcinogen.” CH2M HILL is required to control employee exposure to arsenic when exposures are at or above 5.0 micrograms per cubic meter ($\mu g/m^3$), or if there is the possibility of skin or eye irritation from arsenic. The elements of the CH2M HILL arsenic program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;
- Medical surveillance;
- Training on hazards of arsenic and control measures (includes project-specific training and the computer-based training on CH2M HILL’s Virtual Office, *Arsenic Exposure);* and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Full implantation of SOP HSE-501, Arsenic, will be required. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and

- Review the fact sheet included as an attachment to this HSP.

Electrical

(Reference CH2M HILL SOP HSE-206, *Electrical Safety*)

General Electrical Safety

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- CH2M HILL has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock.
  - GFCIs shall be used on all 120-volt, single phase 15 and 20-amphere receptacle outlets which are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
  - GFCIs can not be utilized
  - Client requires such a program to be implemented
  - Business group decides to implement program in addition to GFCI protection
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

Portable Generator Hazards

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can’t smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.

- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles or project vehicles.
- Emergency kits are available in all NWR offices for personal and rental vehicles. Fleet vehicles are equipped with emergency supplies. It is a project responsibility to equip all project vehicles with emergency equipment.
- Maintain both a First Aid kit and Fire Extinguisher in the field vehicle at all times.
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Car rental must meet the following requirements:
    - Dual air bags
    - Antilock brakes
    - Be midsize or larger
- Familiarize yourself with rental vehicle features:
    - Mirror adjustments
    - Seat adjustments
    - Cruise control features, if offered
    - Pre-program radio stations
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van.
- Pull off the road, put the car in park and turn on flashers before talking on a mobile phone.
- Close car doors slowly and carefully. Fingers can get pinched in doors.

- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.

Fire Prevention

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

Hand and Power Tools

(Reference CH2M HILL, SOP HSE-210, *Hand and Power Tools*)

- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service.
- Hand tools will be used for their intended use and operated in accordance with manufacturer’s instructions and design limitations;
- Maintain all hand and power tools in a safe condition.
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool.
- Do not carry or lower a power tool by its cord or hose.
- Portable power tools will be plugged into GFCI protected outlets; and
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated.
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters).
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed.
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials.
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer’s specifications.
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).

- When using a knife or blade tool, stroke or cut away from the body with a smooth motion. Be careful not to use excessive force that could damage the tool, the material being cut or unprotected hands.
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

Lead

(Reference CH2M HILL SOP HSE-508, *Lead*)

Based on limited intrusive activity in combination w/engineering controls there is not a reasonable anticipation of reaching or exceeding the AL.

CH2M HILL is required to control employee exposure to lead when exposures are at or above 30 $\mu g/m^3$ by implementing a program that meets the requirements of the OSHA Lead standard, 29 CFR 1910.1025 and 29 CFR 1926.62.

The Lead Competent Person is required to identify existing and potential lead hazards in the work environment and take prompt corrective action to eliminate or control such hazards. The designated “competent person” must be, at a minimum, able to:

- Establish regulated areas and ensure that access to and from those areas is limited to authorized employees.
- Ensure the adequacy of any employee exposure monitoring.
- Ensure that all employees exposed to airborne lead levels above the PEL wear the appropriate personal protective equipment and are trained to use appropriate methods to control lead exposure.
- Ensure that proper hygiene facilities are provided and that workers are trained to use these facilities.
- Ensure that required engineering controls are implemented, maintained in proper operating condition, and functioning properly.

Exposure Monitoring (not expected)

When airborne concentrations of lead are anticipated during work activities such as remediation, construction or demolition, an initial exposure assessment shall be conducted to determine employees’ exposure to lead. Where objective data is available (within the last 12 months using the same methods/materials) that demonstrates that employee exposures to lead will not exceed airborne concentrations at or above the AL under expected site conditions, initial monitoring is not required.

- Initial exposure monitoring is conducted to document employees’ breathing-zone exposures over the course of a full shift. A representative 8-hour TWA sample shall be collected for each job classification in each work area.
- When initial monitoring results are below the AL, monitoring may be suspended.

- Additional monitoring is required when there has been a change in production process, control equipment, personnel, or work practices that may result in new or additional exposures.
- Employees shall be informed in writing of exposure monitoring results within 5 working days after receipt of the results.
- Air sampling will also be performed outside the regulated area to verify that lead is not being generated outside the regulated area. One sample shall originate upwind from the work and one downwind from the work.

Respiratory Protection

- Respiratory protection must be used during the following: periods when employee exposure to lead exceeds the PEL; work operations for which engineering and work-practice controls are not sufficient to reduce employee exposure to or below the PEL; periods when an employee requests a respirator; and periods when respirators are required to provide interim protection during initial exposure assessments.
- Respiratory protection selection shall be based on the most relevant exposure monitoring results.
- A respiratory protection program, including respirator selection, shall be implemented in accordance to OSHA 29 CFR 1910.134 and with CH2M HILL SOP HSE-121, Respiratory Protection. Subcontractor respiratory protection programs shall meet or exceed these requirements.
- When air-purifying respirators are utilized, the HEPA filters shall be replaced at the beginning of each shift.
- Powered air-purifying respirators (PAPR) shall be provided to employees who request such a respirator and where it will provide adequate protection.
- If an exposure assessment for this type of removal is not available, the assumption is that this is an abrasive blasting operation. It will be assumed that concentrations of airborne lead will be in excess of 2,500 ug/m^3 and supplied air respiratory protection will be required within the regulated area.

TABLE 1. - RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use	Required respirator(1)
Not in excess of 500 ug/m(3)	- 1/2 mask air purifying respirator with high efficiency filters(2)(3). - 1/2 mask supplied air respirator operated in demand (negative pressure) mode.
Not in excess of 1,250 ug/m(3)	- Loose fitting hood or helmet powered air purifying respirator with high efficiency filters(3). - Hood or helmet supplied air respirator operated in a continuous-flow mode - e.g., type CE abrasive blasting respirators operated in a continuous-flow mode.
Not in excess of 2,500 ug/m(3)	- Full facepiece air purifying respirator with high efficiency filters(3). - Tight fitting powered air purifying respirator with high efficiency filters(3) - Full facepiece supplied air respirator operated in demand mode.

Airborne concentration of lead or condition of use	Required respirator(1)
	- 1/2 mask or full facepiece supplied air respirator operated in a continuous-flow mode. - Full facepiece self-contained breathing apparatus (SCBA) operated in demand mode.
Not in excess of 50,000 ug/m(3)	- 1/2 mask supplied air respirator operated in pressure demand or other positive-pressure mode.
Not in excess of 100,000 ug/m(3)	- Full facepiece supplied air respirator operated in pressure demand or other positive-pressure mode - e.g., type CE abrasive blasting respirators operated in a positive-pressure mode.
Greater than 100,000 ug/m(3) unknown concentration, or fire fighting	- Full facepiece SCBA operated in pressure demand or other positive-pressure mode.

Footnote (1) Respirators specified for higher concentrations can be used at lower concentrations of lead.

Footnote (2) Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

Footnote (3) A high efficiency particulate filter (HEPA) means a filter that is a 99.97 percent efficient against particles of 0.3 micron size or larger.

PPE

- Personnel shall wear disposable coveralls, booties and inner and outer gloves when inside the regulated area and exercise enhanced personal hygiene (for example, frequent hand washing prior to eating, drinking, and smoking; separation of work and street clothing and footwear; etc.).
- Contact lenses should not be worn when working with lead.
- Employee shall not be allowed to leave the regulated area wearing any protective clothing or equipment that is required during the work shift.
- All clothing requiring laundering will be packaged in a sealed container. Containers shall be labeled as follows: “Caution: Clothing contaminated with lead; do not remove dust by blowing or shaking. Dispose of lead-contaminated wash water in accordance with applicable local, state, or federal regulations.”

Written Lead Compliance Program

When employee exposures are greater than the PEL, a written lead compliance program shall be established and implemented prior to commencement of operations. The written program shall outline

the plans for maintaining employee exposure below the PEL. The compliance program shall be based on the most recent exposure monitoring data. The program shall be revised when exposure monitoring data is updated or at least annually to reflect the status of the program.

Regulated Areas

- Regulated areas shall be documented as part of the written lead compliance program.
- Regulated areas are those where airborne concentrations of lead are above the PEL without regard to the use of respirators. Personnel shall not enter regulated areas unless training, medical monitoring, and PPE, including respirator protection, requirements have been met.
- Regulated areas shall be demarcated and entry to these areas shall be limited. Only authorized personnel are allowed in these areas.
- The entrance to regulated areas shall be posted with signs that read “WARNING-LEAD WORK AREA-POISON-NO SMOKING OR EATING” so that necessary protective steps can be taken before entering regulated areas.
- Where feasible, shower facilities shall be installed and employees who work in regulated areas shall be required to shower at the end of the work shift. These facilities must be provided with an adequate supply of cleaning agents and towels.
- Hand washing facilities shall be provided for employees working in regulated areas. Furthermore, employees shall be required to wash their hands and face at the end of each work shift and prior to eating or entering eating facilities, drinking, smoking, or applying cosmetics.
- Employees shall not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in any areas where exposure to lead is above the PEL (that is, regulated areas).
- In addition to the posting requirements, written or verbal notification to owners, contractors, and other personnel working in the area shall be made.

Housekeeping

- Where airborne lead concentrations exceed the PEL, housekeeping procedures shall be documented in the written lead compliance program.
- All surfaces shall be maintained as free as possible of accumulations of lead. Methods selected for cleaning of surfaces and floors shall be those that minimize the likelihood of lead becoming airborne (for example, vacuuming).
- Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner that minimizes the reentry of lead into the workplace.
- Compressed air shall not be used to remove lead from any surface unless used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air.
- Waste containing significant amounts of lead may be subject to hazardous waste regulations and the corresponding generation, treatment and disposal requirements.

Medical Monitoring

CH2M HILL shall make available initial medical surveillance (baseline) to employees occupationally exposed on any day to lead at or above the AL. Initial medical surveillance consists of biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin (ZPP) levels.

Training

CH2M HILL employees must complete the on-line Lead Exposure Module located on the HSSE web page of the virtual office and project-specific lead-exposure-control training.

Project-specific lead-exposure-control training shall include the following:

- Discussion of site-specific lead hazards and associated control measures,
- Information contained in the Lead Fact Sheet (Attachment 8),
- Quantity, location, manner of use, storage, sources of exposure, and the specific nature of operations that could result in exposure to lead, as well as any necessary protective steps,
- Purpose, proper use, and limitation of respirators,
- Purpose and a description of the medical surveillance program,
- Engineering controls and work practices associated with the employee's job assignment, and
- A review of the OSHA Lead Standard and appendices if requested by an employee (see Attachment 9).
- See SOP-508, Lead, for further requirements.

Lockout/Tagout Activities

(Reference CH2M HILL SOP HSE-310, *Lockout and Tagout*)

- Only qualified personnel may work on energized equipment that has not been deenergized by lockout/tagout procedures.
- When CH2M HILL controls the work, CH2M HILL must verify that subcontractors affected by the unexpected operation of equipment develop a written lockout/tagout program, provide training on lockout/tagout procedures and coordinate its program with other affected subcontractors. This may include compliance with the owner or facility lockout/tagout program.
- When CH2M HILL personnel are affected by the unexpected operation of equipment they must complete the lockout/tagout training course in the Basic Program. Project training may also be required on site specific lockout procedures.
- Standard lockout/tagout procedures include the following six steps: 1) notify all personnel in the affected area of the lockout/tagout, 2) shut down the equipment using normal operating controls, 3) isolate all energy sources, 4) apply individual lock and tag to each energy isolating device, 5) relieve or restrain all potentially hazardous stored or residual energy, and 6) verify that isolation and deenergization of the equipment has been accomplished. Once verified that the equipment is at the zero energy state, work may begin.
- All safe guards must be put back in place, all affected personnel notified that lockout has been removed and controls positioned in the safe mode prior to lockout removal. Only the individual who applied the lock and tag may remove them.

Manual Lifting

(Reference CH2M HILL SOP HSE-112, *Manual Lifting*)

- Back injuries are the leading cause of disabling work and most back injuries are the result of improper lifting techniques or overexertion. Office or field tasks and activities involving manual lifting are to be identified and a program implemented to assist employees to mitigate the risks associated with manual lifting.
- When possible, the task should be modified to minimize manual lifting hazards.
- Lifting of loads weighing more than 40 pounds (18 kilograms) should be evaluated by the SC using the Lifting Evaluation Form contained in SOP HSE-112.
- Using mechanical lifting devices is the preferred means of lifting heavy objects such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys.

- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities.
- In general, the following steps must be practiced when planning and performing manual lifts: Assess the situation before you lift; ensure good lifting and body positioning practices; ensure good carrying and setting down practices.
- All employees must receive training for the correct procedures to lift safely using the computer-based health and safety training or project-specific training.

Radar Hazards

- Airports and all branches of the military use radar of significant power for buildings, towers, aircraft, ships, armor vehicles, and installations in general. Radar devices may emit harmful microwave radiation emissions.
- Microwave radiation is absorbed by the body and dissipated in the tissue as heat.
- The penetration ability of the radiation depends on the wavelength. Microwave wavelengths of 25-200 centimeters have the ability to reach the internal organs with potentially damaging effects. Wavelengths less than 25 centimeters are absorbed and dissipated by the skin and the human body is thought to be transparent to microwave wavelengths greater than 200 centimeters.
- The health effects of microwave radiation include deep burns and thermal damage to any organ or organ system with low blood flow, most notably the lenses of the eyes. If adequate time has elapsed between exposures, the repair mechanisms of the lens seem to limit damage.
- Studies have demonstrated that chronic microwave exposure can cause both psychological changes, disrupting task and function control, as well as chronic depression. Further studies suggest a possible relationship between mongolism (Down's Syndrome) in offspring and previous exposure of the male parent to radar; however, the study was not conclusive.
- Microwave radiation cannot be seen and its effects cannot be felt until serious damage has already occurred.
- Because of the inconclusive effects of microwave radiation, the Office of Safety and Health Administration (OSHA) has set a conservative exposure limit of 10 milliwatts per square centimeter (10 mW/cm^2) averaged over any 6-minute period.
- Warning signs must be posted in areas where potentially damaging microwave radiation exists.
- The prevention method for microwave radiation exposure is to not be in the path of radar or other microwave emitting devices by either ensuring that the device is not operating or ensuring that there is sufficient shielding between you and the microwave source.

Sampling/Water Level Measurements

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are performing sampling and/or water level measurements.

- Full coolers are heavy. Plan in advance to have two people available at the end of the sampling effort to load full coolers into vehicles. If two people won't be available use several smaller coolers instead of fewer large ones.
- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (see PPE section of this HSP).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to the "Site Monitoring" section of this HSP).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.

- Use the appropriate lifting procedures (see CH2M HILL SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact occurs with groundwater or the acid used in sample preservation, immediately wash all affected skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.
- Use two people to transport full coolers/containers whenever possible. If two people are not available use a dolly to move coolers. If the coolers weigh more than 40 pounds Attachment 1 of the HSE-112, *Manual Lifting,* shall be completed by the SC. If the coolers weigh more than 50 pounds they should never be lifted by one person.

Stairways and Ladders

(Reference CH2M HILL SOP HSE-214*, Stairways and Ladders*)

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails.
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Portable ladders must extend at least 3 feet above landing surface.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
- Fixed ladders $\geq$ 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

Traffic Control

(Reference CH2M HILL SOP HSE-216, *Traffic Control*)

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a contractor.

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route (e.g., behind an established barrier, parked vehicle, guardrail, etc).
- Always pay attention to moving traffic – never assume drivers are looking out for you.
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers.
- Vehicles should be parked at least 40 feet away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.

Visible Lighting

- While work is in progress outside construction areas shall have at least 33 lux (lx).
- Construction work conducted inside buildings should be provided with at least 55 lux light.

- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

Munitions of Explosive Concern (MEC)

(Reference CH2M HILL SOP HSE-610, *Explosive Usage and Munitions Response*)
MEC avoidance operations will be required during sampling / survey ops. Avoidance operations will consist of all site personnel receiving training on and implementing the 3R's. The 3R's that employees are required to follow consist of the following:

1. Recognize - If you think you have seen something that looks like UXO... DON'T TOUCH IT!
2. Retreat - Leave the area...go back the same way you came! Assemble at designated rally point at the entrance gate.
3. Report – Report discovery to FTL and base EOD. immediately as to where it is!

- All MEC contacts and suspected MEC anomalies will be reported to the site manager who in turn will make necessary notifications in accordance with normal incident reporting requirements and MEC Discovery notifications as required by NAS Oceana.
- The suspect MEC item will not be handled beyond what is necessary to safely stop work and evacuate the area. If the item begins to emit smoke or flame, personnel will not attempt to extinguish and will call 911 for emergency response in addition to base EOD contact, the designated rally point will be adjusted to maintain an upwind location.
- Access to the area will be restricted to local/State response personnel. Personnel will direct all media inquiries to the respective client rep. or as directed by the PM.
- Work will resume upon receiving concurrence from Dan Young, PM and HSM.
- Project will complete a HITS report within required timeframe.

2.1.15 Working Alone

(Reference CH2M HILL Core Standard, *Working Alone*)

Personnel can only be tasked to work alone by the Project Manager who has assessed potential hazards and appropriate control measures, with assistance from the Responsible Health and Safety Manager (RHSM).

"Lone workers" with an automated person down system or an accountability system are permitted, depending on the hazards present.

Accountability Systems

- The employee shall at all times be equipped with a working voice communication device such as a cellular phone or two-way radio to check-in to their project contact (s) at pre-determined times.
- An Activity Hazard Analysis (AHA) shall be developed for the tasks allowing work alone and shall address check in frequency and contact names and phone numbers.
- Check-in or contact times must be based on the risk associated with the task, or the timeframe expected to complete the task, but at a minimum of at least two times during an 8 hour work shift.

Work tasks will cease if communication is lost during work day. Work may resume when communication is re-established. See Attachment 7 for Working Alone Standard to be used.

2.1.16 Boating Safety

Personnel who will operate a boat during the course of a project shall first demonstrate to the site manager that they are experienced in operating boats similar to those used for the project and that they are knowledgeable of the U.S. Coast Guard Boating Safety requirements (33 CFR Subchapter S). Project boats shall be operated by experienced boat operators only. Boat operators shall also possess basic mechanical knowledge necessary to troubleshoot common mechanical problems that can and do occur. The boat operator shall be responsible for the safety of all personnel on board the boat he or she is operating and for the integrity of all boat and safety equipment.

Each designated boat operator shall give a safety briefing to all occupants of the boat prior to leaving the shore. Boats are to be occupied during use by not less than one qualified operator plus one additional person.

The boat skipper has the final authority with regard to boat safety and navigational safety.

Use the attached boat safety checklist to evaluate and verify necessary equipment prior to leaving shore

Boat Requirements

All project boats will meet or exceed U.S. Coast Guard requirements for safety equipment, as applicable to the operation and type of boat. These requirements are summarized below for small craft (less than forty feet [12 meters] in length).

Flame Arresters

All gasoline engines, except outboard motors, installed in a boat must have an approved flame arrestor (backfire preventer) fitted to the carburetor.

Sound Signaling Devices

Boats shall carry at least one air horn or similar sound-signaling device. Radio or cell-phone communication must be in place as well.

Personal Flotation Devices

All personnel and passengers shall wear an approved personal flotation device (PFD) at all times when operating or being transported in a boat. A positively buoyant wet suit or dry suit may be substituted for a PFD. PFDs shall be Type II or higher (capable of turning its wearer in a vertical or slightly backward position in the water). In addition, each boat shall be equipped with at least one Type IV PFD, designed to be thrown to a person in the water and grasped and held by the user until rescued. A buoyant boat cushion equipped with straps and a float ring are two common examples of a Type IV PFD.

Fire Extinguishers

Each boat shall carry at least one Type B-I or B-II fire extinguisher (for use in gasoline, oil and grease fires) approved by Underwriters Laboratories (UL). Each fire extinguisher shall be inspected to ensure

that it is sufficiently charged and that the nozzles are free and clear. Discharged fire extinguishers shall be replaced or recharged immediately.

Emergency Planning

As part of the project HSP and AHAs, emergencies and response actions must be addressed for potential emergencies such at fire, sinking, flooding, severe weather, man over-board, hazardous material incidents, etc.

Load Capacity

Boats shall not be loaded (passengers and gear) beyond the weight capacity printed on the U.S. Coast Guard information plate attached to the stern. In addition, several factors must be considered when loading a boat: distribute the load evenly, keep the load low, do not stand up in a small boat or canoe, and do not overload the boat.

Tool Kit

All motorized boats shall carry a tool kit sufficient for the boat operator to troubleshoot common mechanical problems such as fouled spark plugs, flooded carburetor, electrical shorts, etc. Boats operated in remote areas shall also carry appropriate spare parts (propellers, shear pins, patch kits, air pumps, etc). The tool kit shall be maintained by the boat operator and supplies used up shall be replaced immediately.

Communications

All boats operated shall carry a two-way radio or cellular telephone that enables communication back to the field camp or other pre-established location.

Good Housekeeping

Personnel using a boat shall properly stow and secure all gear and equipment against unexpected shifts when underway. Decks and open spaces must be kept clear and free from clutter and trash to minimize slip, trip, and fall hazards.

Fuel Management

Personnel shall utilize the "one-third rule" in boating fuel management. Use one-third of the fuel to get to the destination, one-third to return, and keep one-third in reserve.

No smoking is permitted on board vessels or during refueling operations.

Pollution Control

The Refuse Act of 1989 prohibits the throwing, discharging, or depositing of any refuse matter of any kind (including trash, garbage, oil, and other liquid pollutants) into the waters of the United States. The Federal Water Pollution Control Act prohibits the discharge of oil or hazardous substances in quantities that may be harmful into U.S. navigable waters. No person may intentionally drain oil or oily wastes from any source into the bilge of any vessel. Larger vessels equipped with toilet facilities must be equipped with a U.S. Coast Guard-approved marine sanitation device.

Employees shall report any significant oil spills to water to the _____ who must report the spill to the U.S. Coast Guard or other applicable regulatory agency. The procedure for incident reporting and investigation shall be followed when reporting the spill.

Training

All operators and passengers shall be trained on the requirements outlined above, as well as trained on the HSP/AHA(s), including emergency response actions.

2.2 General Hazards

2.2.1 General Practices and Housekeeping

- Site work should be performed during daylight hours whenever possible.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others.
- Familiarize yourself with, understand, and follow jobsite emergency procedures.
- Do not fight or horseplay while conducting the firm's business.
- Do not use or possess firearms or other weapons while conducting the firm's business.
- Report unsafe conditions or unsafe acts to your supervisor immediately.
- Report occupational illnesses, injuries, and vehicle accidents.
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment.
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor.
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion.
- Do not run in the workplace.
- When ascending or descending stairways, use the handrail and take one step at a time.
- Do not apply compressed air to any person or clothing.
- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location.
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery.
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations.
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible.
- Check the work area to determine what problems or hazards may exist.

2.2.2 Personal Hygiene

- Keep hands away from nose, mouth, and eyes.
- Keep areas of broken skin (chapped, burned, etc.) covered.
- Wash hands with hot water and soap frequently prior to eating and smoking.

2.2.3 Drugs and Alcohol

The following situations pertaining to drugs and alcohol are prohibited:

- Use or possession of intoxicating beverages while performing CH2M HILL work.
- Abuse of prescription or nonprescription drugs.
- Use or possession of illegal drugs or drugs obtained illegally.
- Sale, purchase, or transfer of legal, illegal or illegally obtained drugs.
- Arrival at work under the influence of legal or illegal drugs or alcohol.

2.2.4 Driving

- Always be aware of surroundings while operating a vehicle. Avoid intellectual stress & worries, talking on a cellular phone, eating, drinking, smoking, reading a map, adjusting controls or looking at a passenger while driving.
- Use prudent speed limits, assure that backup warning devices are working, be aware of blind spots or other hazards associated with low visibility, etc. Use a spotter if necessary.
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep.

2.2.5 Hazard Communication

(Reference CH2M HILL SOP HSE-107, *Hazard Communication)*

The Hazard Communication Coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.6 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's Procedures for Shipping and Transporting Dangerous Goods)

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal

Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the RHSM or the Warehouse Coordinator for additional information.

2.2.7 Ultraviolet (UV) Radiation (sun exposure)

Health effects regarding UV radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer.

Acute overexposure of UV radiation to the eyes may lead to photokeratitis (inflammation of the cornea), also known as snow blindness. Symptoms include redness of the eyes and a gritty feeling, which progresses to pain and an inability to tolerate any kind of light. This condition can also occur when working in or around water and other UV radiation reflectors. In addition, long-term exposure to sunlight is thought to cause cataracts or clouding of the lens of the eye.

Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or “Foreign Legion” style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.

- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- Remember—no sunscreen provides 100% protection against UV radiation. Other precautions must be taken to avoid overexposure.

2.2.8 Heat Stress

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope (lightheadedness), heat rash, or heat cramps should report it to their supervisor immediately to avoid progression of heat-related illness.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

These procedures should be implemented when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

2.3 Biological Hazards and Controls

2.3.1 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; contact the occupational nurse at 1-866-893-2514 immediately if a reaction develops or 911 if the reaction is severe.

2.3.2 Bloodborne Pathogens

(Reference CH2M HILL SOP HSE-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

- Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M HILL's 1-hour bloodborne computer-based training module annually.
- Hepatitis B vaccine (HBV) is offered to employees who may be exposed to PIM when they complete training and within 10 working days of assignment. (Note: Employees whose exposure stems only from rendering first aid as a collateral duty receives the vaccine after exposure.)
- Employees who decline the HBV vaccine must sign the declination form (contact regional Safety Program Assistant [SPA]) indicating they declined the vaccination. Anyone who declines the vaccination and chooses to receive the vaccination at a later time may still receive the vaccination by contacting the SPA.
- Hepatitis B and tetanus vaccinations can be requested by completing the medical portion of the enrollment form, located under Tools & Forms at the HS&E web page, or by contacting the regional SPA.

Work Controls

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Consider all sharps encountered at industrial, medical, dental, or biological waste facilities or sampling locations to be contaminated and PIMs.
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes. These must be provided for employees who have been exposed to PIMs. When antiseptic cleansers or towelettes are used, always rewash your hands and face with soap and running water as soon as available. Do not consume food or beverages until after thoroughly washing your hands and face.
- Decontaminate all potentially contaminated equipment and environmental surfaces with chlorine bleach as soon as possible. Clean and decontaminate on a regular basis (and immediately upon

visible contamination) all bins, pails, cans, and other receptacles intended for reuse that have the potential for becoming contaminated.

- Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.
- Place regulated waste in containers that are closable; are constructed to contain all contents and prevent leakage of fluids during handling, storage, transport or shipping; are labeled with a Biological warning label or color-coded; and are tightly closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

Employees who participate in waste characterization studies, sort or sample refuse, or contact medical, dental, or biological wastestreams should follow these procedures:

- If exposure is anticipated, this group of employees should wear safety goggles or glasses, puncture-resistant utility gloves with inner latex glove liners, Tyvek coveralls or cotton coveralls with a rubber apron, and puncture-resistant shoes or boots.
- If splash potential is present, employees should wear a full-face shield.
- If a respiratory hazard is present, a full-face respirator with HEPA filters should be worn.

Post Exposure

CH2M HILL will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure
- Testing the exposed employee's and the source individual's blood (with consent)
- Administering post-exposure prophylaxis

2.3.3 Bird Droppings

Large populations of roosting birds may present a disease risk. The most serious health risks arise from disease organisms that grow in the nutrient-rich accumulations of bird droppings, feathers and debris under a roost — particularly if roosts have been active for years. In addition, insects that live on birds or their droppings may become a problem when the infested birds leave roosts or nests.

Histoplasmosis and cryptococcosis are caused by fungi. The diseases are transmitted to humans by airborne fungus spores from soil contaminated by pigeon and other bird/bat droppings. Most infections are mild and produce either no symptoms or a minor influenza-like illness. On occasion, the diseases can cause high fever, blood abnormalities, pneumonia and even death.

The best way to prevent exposure to fungus spores is to avoid situations where material that might be contaminated can become aerosolized and subsequently inhaled. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease. Therefore, work practices and dust control measures that eliminate or reduce dust generation during the removal of bat or bird manure from a building will also reduce risks of infection and subsequent development of disease.

If disturbing the droppings or removal is necessary, follow these controls:

- Use dust control measures (wetting with water or HEPA vacuuming) for all activities that may generate dust form the accumulated droppings.
- Wear tyvek with hoods, disposable gloves and booties, and air-purifying respirators with a minimum N95 rating.

- Put droppings into plastic/poly bags and preferably into a 55-gallon drum to prevent bag from ripping

2.3.4 Feral Dogs

Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies. If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare. If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you have reached safety (e.g. vehicle). If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck and protect your face. If bitten, immediately scrub the bite site vigorously with soap and water. Report the incident to the local authorities. Seek medical attention as soon as possible.

2.3.5 Hanta Virus

Hantavirus pulmonary syndrome (HPS) is a rare disease caused by a virus which can be transmitted from certain rodents to humans. Symptoms may develop between 14 and 31 days after exposure to infected rodents and their droppings and body fluids. Early symptoms include fatigue, fever, and muscle aches, especially the large muscle groups--thighs, hips, back and sometimes shoulders. These symptoms are universal. About half of all HPS patients also experience headaches, dizziness, chills and/or abdominal pain. Four to 10 days after the initial phase of the illness, late symptoms of HPS may appear. These include coughing and shortness of breath, with the sensation of, as one survivor put it, a "... tight band around my chest and a pillow over my face" as the lungs fill with fluid, which can cause pulmonary shock, failure and death. If you develop symptoms suggestive of HPS, call the occupational nurse at 1-866-893-2514.

The presence of hantavirus is recognized throughout the Southwest United States. Human infection may occur when infected saliva or excreta are inhaled as aerosols produced directly from the animal. Transmission may also occur when dried materials contaminated by rodent excreta are disturbed, directly introduced into broken skin, introduced onto the eye, or ingested in contaminated food or water. Personnel have also become infected after being bitten by rodents. In New Mexico, the Deer Mouse is the main carrier of the virus, with the Cotton Rat and the White-Footed and Brush Mice also identified as carriers. Therefore, all wild mice and rats should be considered potential Hantavirus carriers. Researchers do not believe that Hantavirus is transmitted to humans by any other types of animals besides rodents. There is currently no evidence that squirrels or rabbits carry Hantavirus. Dogs and cats do not carry the virus, but they may bring home infected rodents.

Inspect each crawlspace for evidence of rodents. If there is evidence, take precautions before and during clean up of rodent-infested areas. Before cleaning, attempt to trap the rodents and prevent entry. Spring-loaded traps that kill rodents are the preferred method. If you must reuse the traps, spray them thoroughly with bleach (1:10 with water) or other commercial disinfectant mixture. Dispose of trapped or deceased rodents carefully according to the guidelines detailed below. Do not trap rodents live, nor use glueboards or rodenticides. Mice that are poisoned may die in an inaccessible place, and Hantavirus can be released as the rodent decomposes.

Continue trapping operations as long as possible. If no rodents are captured, the active infestation has most likely been eliminated.

PPE shall include:

- Tyvek coveralls;
- Rubber boots or disposable shoe covers;
- Rubber, latex, or vinyl gloves;

- Protective goggles;
- Respiratory protection such as a full face or half-mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter.

Before starting clean up of the space, ventilate the space for at least 30 minutes to allow fresh air to enter the area. Use cross-ventilation and leave the space during the airing-out period.

Spray any urine, droppings, and nesting materials with either a bleach and water solution (1 parts bleach to 9 parts water) or a household disinfectant prepared according to the label instructions for dilution and disinfection time. Soak well and let stand for 15 minutes. This will inactivate any virus. Use a paper towel or rag to pick up the materials and dispose of them.

Mop floors (if basement floor) after spraying them using bleach/water solution or a disinfectant. Dirt floors can be sprayed with either bleach and water solution or a disinfectant.

Personal protective gear should be decontaminated upon removal at the end of the day. All potentially infective waste material (including respirator filters) from clean-up operations shall be double-bagged in appropriate plastic bags.

2.3.6 Mosquito Bites

Due to the recent detection of the West Nile Virus in the Southwestern United States it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.
- Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3-15 days.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor/PM and contact the occupational nurse at 1-866-893-2514.

2.3.7 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, call the occupational nurse at 1-866-893-2514.

2.3.8 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Call the occupational nurse at 1-866-893-2514 immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.9 Spiders and Scorpions

2.1.1.1 2.3.9.1 Spiders - Brown Recluse

It is regarded by many as the most dangerous spider in the United States. Because of interstate shipping/transportation, the Brown Recluse spider can be found most anywhere in the United States. Brown Recluse Spiders are usually 1 inch

or larger in size, including the legs and can grow as large as 3 inches. Young Brown Recluse spiders are smaller. Brown recluse spider bites don't always hurt right away. away. In fact, you may not know that you have been bitten until other symptoms appear. Symptoms of a brown recluse spider bite may include the following:

- Reddened skin followed by a blister that forms at the bite site.
- Mild to intense pain and itching for 2 to 8 hours following the bite.
- An open sore with a breakdown of tissue (necrosis) that develops within a few hours to 3 to 4 days following the bite and the area may become painful, itchy, hot, swollen, red and tender. An irregular ulcerous sore, caused by necrosis, will often appear that is from 1/4 inch to 10 inches in diameter. Prompt attention is the best defense against preventing the necrosis. The wound is often described as being reddish and surrounded by a bluish area with a narrow whitish separation in between the red and the blue. This gives it the famous "bull's eye" pattern. In just hours, a bite from the highly venomous Brown Recluse spider can create blisters and cause tissue damage.

Some people have a severe, systemic (whole-body) reaction to brown recluse spider bites, including the rapid destruction of red blood cells and anemia. Signs and symptoms include:

Fever and chills.

- Skin rash all over the body with many tiny, flat purple and red spots.
- Nausea or vomiting.
- Joint pain.

If you think you have been bitten by a brown recluse spider:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood.
- Try to collect the spider, without being bitten, (even a mangled specimen has diagnostic value), if possible, for positive identification by a spider expert. A plastic bag, small jar, or pill vial is useful and no preservative is necessary, but rubbing alcohol helps to preserve the spider.
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite.
- Do not apply a tourniquet. It may cause more harm than benefit.
- Try to positively identify the spider to confirm its type.
- Seek prompt medical attention.

A brown recluse bite can be serious and will likely require immediate medical care. Seek medical attention if you believe you have been bitten by a recluse spider, especially if severe symptoms develop throughout your body or an open sore and necrosis develop. A brown recluse spider bite is diagnosed through a physical examination and questions about the bite. You should be prepared to describe the spider, where and when the bite took place, and what you were doing at the time. Your health professional will ask what your main symptoms are, when they began, and how they have developed, progressed, or changed since the bite.

2.1.1.2 2.3.9.2 Widow Spiders

The Northern Black Widow spider may be encountered in Northern Regions of the United States. Other similar widow spiders are the Red Widow and the Brown Widow. Female widow spiders range from 8-15 mm in body length; males are smaller, sometimes very small (2 mm). Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale and/or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day. In nature, most species are found under rocks and logs, but they readily adapt to human-altered environments, where they are most commonly found in outbuildings (sheds, barns, privies), water meter holes, nursery cans, and under any item or structure (*e.g.*, barbeque grill, slide, sand box) that has been undisturbed for a lengthy period. Formerly, most bites by black widows (almost all by female spiders) occurred in outhouses, but presently, widow bites occur most frequently when the spider is trapped against human skin, either by reaching under objects where the spider is hiding or when putting on clothing, gloves or shoes containing the spider. Widow spiders are generally very timid and only bite in self-defense when they accidentally contact humans.

Black Widow

Red Widow

Brown Widow

Bite symptoms are systemic, spreading through the lymphatic system, and usually start about 1-3 hours after the bite. The most common symptoms are intense pain, rigid abdominal muscles, muscle cramping, malaise, local sweating, nausea, vomiting, and hypertension. Other symptoms may include tremors, labored breathing, restlessness, increased blood pressure, and fever. If left untreated, widow bite symptoms usually last 3-5 days.

If bitten, remain calm, and immediately seek medical attention (contact your physician, hospital and/or poison control center). Apply an ice pack directly to the bite area to relieve swelling and pain. Try to collect the spider, without being bitten, (even a mangled specimen has diagnostic value), if possible, for

positive identification by a spider expert. A plastic bag, small jar, or pill vial is useful and no preservative is necessary, but rubbing alcohol helps to preserve the spider. A hospital stay may be recommended, particularly for those with a heart condition or with health problems. A physician may administer a specific antivenin to counteract the venom or calcium gluconate to relieve pain. Calcium gluconate and/or antivenin may be administered to relieve or counteract symptoms.

2.3.10 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

See Tick Fact Sheet attached to this HSP for further precautions and controls to implement when ticks are present. Information includes the procedure for submitting a removed tick for testing. If bitten by a tick, follow the removal procedures and call the occupational nurse at 1-866-893-2514, notify your supervisor immediately and submit the tick to Clongen laboratory.

Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact the occupational nurse at 1-866-893-2514.

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's Core Standard, Radiological Control and Radiological Controls Manual for additional requirements.

Hazards	Controls
None Known	None Required

2.5 Contaminants of Concern

Contaminants of Concern: Sampling data is not available for this area. Anticipate potential low level presence of Lead, Antimony, Arsenic, Copper, Nickel and Zinc.

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Arsenic	UK	0.01 mg/m^3	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Antimony	UK	0.5 mg/m^3	50	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache	NA
Lead	UK	0.05 mg/m^3	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Copper	UK	1 mg/m^3	100	Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing	NA
Nickel	UK	10 mg/m^3	NL Ca	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	NA
Zinc	UK	2 mg/m^3	500	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough	NA

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3.0 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL- SOPs HSE-113, Medical Surveillance, and HSE-110, Training)

The employees listed meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. MEC Awareness training and Lead Awareness training are required by all field staff.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL- SOP HSE-120, *Reproductive Health*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SC/FA-CPR
Mark Ost	VBO	FTL / SSC	SC-HW / FA-CPR
Stefanie Eggermann	WDC	FTM	
Genevieve Moore	VBO	FTM	
Eddy Dadzis	WDC	FTM	

3.2 Field Team Chain of Command and Communication Procedures

Client

Contact Name: Mary Margaret Kutz
Phone: 757-445-6676

Contact Name: Chris Murray
Phone: 757-445-6680

CH2M HILL

Project Manager (PM): Steve Falatko
Responsible Health and Safety Manager (RHSM): Carl Woods
Field Team Leader: Mark Ost
Safety Coordinator (SC): Mark Ost

The PM is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HS&E management process. The PM has overall management responsibility for the tasks listed below. The PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this SOP:

- Include standard terms and conditions, and contract-specific HS&E roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Select safe and competent subcontractors by:
  - Obtaining, reviewing and accepting or rejecting subcontractor pre-qualification questionnaires.
  - Ensuring that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award.
  - Including HS&E submittals checklist in subcontract agreements, and ensuring that appropriate site-specific safety procedures, training and medical monitoring records are reviewed and accepted prior to the start of subcontractor's field operations.
- Maintain copies of subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractors license, training and medical monitoring records, and site-specific safety procedures in the project file accessible to site personnel.
- Provide oversight of subcontractor HS&E practices per the site-specific safety plan.
- Manage the site and interfacing with 3rd parties in a manner consistent with our contract and subcontract agreements and the applicable standard of reasonable care.
- Ensure that the overall, job-specific, HS&E goals are fully and continuously implemented.

The CH2M HILL RHSM is responsible for:

- Review and accept or reject subcontractor pre-qualification questionnaires that fall outside the performance range delegated to the Contracts Administrator (KA).
- Review and accept or reject subcontractor training records and site-specific safety procedures prior to start of subcontractor's field operations.
- Support the oversight of subcontractor (and lower-tier subcontractors) HS&E practices and interfaces with on-site 3rd parties per the site-specific safety plan.

The SC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Verify this HSP is current and amended when project activities or conditions change.
- Verify CH2M HILL site personnel and subcontractor personnel read the HSP and sign Attachment 1, Employee Sign-Off Form, prior to commencing field activities.
- Verify CH2M HILL site personnel and subcontractor personnel have completed any required specialty training (e.g., fall protection, confined space entry) and medical surveillance as identified in Section 2.
- Verify compliance with the requirements of this HSP and applicable subcontractor health and safety plan(s).
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in Section 2.2.2.

- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in Section 9.
- Post OSHA job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established.
- Verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (e.g., as tasks or hazards change).
- Verify that project H&S forms and permits, found in Attachment 4 and 5, are being used as outlined in Section 2.
- Perform oversight and/or assessments of subcontractor HS&E practices per the site-specific safety plan and verify that project activity self-assessment checklists, found in Attachment 4, are being used as outlined in Section 2.
- Verify that project files available to site personnel include copies of executed subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractors license, training and medical monitoring records, and site-specific safety procedures prior to start of subcontractor's field operations.
- Manage the site and interfacing with 3rd parties in a manner consistent with our contract/subcontract agreements and the applicable standard of reasonable care.
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3rd party interfaces.
- Ensure that the overall, job-specific, HS&E goals are fully and continuously implemented.

The training required for the SC is as follows:

- SC-Initial and SC-Construction
- OSHA 10-hour course for Construction
- First Aid and CPR
- Relevant Competent Person Courses (excavation, confined space, scaffold, fall protection, etc.).

The SC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The RHSM should be contacted as appropriate.

CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-215, *Contracts and Subcontracts)*

- Subcontractor: None

4.0 Personal Protective Equipment (PPE)

(Reference CH2M HILL- SOP HSE-117, *Personal Protective Equipment*)

- PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.
- A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM or designee.
- Employees must be trained to properly wear and maintain the PPE.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area.
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner.
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage.
- PPE must be maintained in a clean and reliable condition.
- Damaged PPE shall not be used and must either be repaired or discarded.
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the RHSM so this table can be updated.

Project-Specific PPE Requirements[a]

Task	Level	Body	Head	Respirator [b]
General site entry	D	Work clothes; safety toed leather work boots and gloves	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
Surface soil sampling Magnetometer Survey	Modified D	Work clothes or cotton coveralls **Boots:** Safety-toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
Any function identified in this HSP where potential dermal contact with site COCs is NOT limited to the Boots / hands only.	Modified D_1	**Tyvek** **Boots:** Safety-toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
Work near vehicular traffic ways or earth moving equipment.	All	Appropriate level of ANSI/ISEA 107-2004 high-visibility safety vests.	Work near vehicular traffic ways or earth moving equipment.	
Tasks requiring upgrade	C	**Coveralls:** Polycoated Tyvek® **Boots:** Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent[e].

Reasons for Upgrading or Downgrading Level of Protection	
Upgrade[f]	**Downgrade**
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decrease the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SC.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] See cartridge change-out schedule in Section 4.1.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and an SC qualified at that level is present.

PPE Certification

I certify that the PPE requirements listed in the table above for the associated tasks are based upon the project-specific hazard assessment I performed.

Carl Woods	5/27/10	5/27/10
Name	Date of Certification	Date(s) of Project Hazard Assessment

Respiratory Protection

(Reference CH2M HILL SOP HSE-121, *Respiratory Protection*)

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR).
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used.
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months.
- Respirator use shall be limited to those activities identified in this plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan.
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use.
- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade.
- Respirators in regular use shall be inspected before each use and during cleaning
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition.
- Respirators shall be properly stored to protect against contamination and deformation.
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service.

- When breathing air is supplied by cylinder or compressor, the SC or RHSM shall verify the air meets Grade D air specifications.
- The SC or designee shall complete the H&S Self-Assessment Checklist – Respiratory Protection included in Attachment 4 of this plan to verify compliance with CH2M HILL's respiratory protection program.

5.0 Air Monitoring/Sampling

(Reference CH2M HILL SOP HSE-207, Exposure Monitoring for Airborne Chemical Hazards)

Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]	Action to be Taken when Action Level reached	Frequency[b]	Calibration
PID: MiniRAE PID with 10.6 eV lamp or equivalent	All	<1 ppm 1-5 ppm 5> ppm	Level D Level C Level B	Initially and periodically during tasks	Daily
Visual Dust Monitoring:	All	Visible dust	Level D – implement dust control measures Level C - ineffective control measures, continuous visible dust	During task	NA
Dust Monitor: Miniram model PDM-3 or equivalent	All	0 - 0.1 mg/m^3 >0.1 mg/m^3	Level D Level C	Initially and periodically during tasks	Zero Daily

[a] Action levels apply to sustained breathing-zone measurements above background.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SC;

Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

NA

Personnel and Areas

Results must be sent immediately to the RHSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM: Mark Orman

6.0 Decontamination

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

The SC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SC must ensure that procedures are established for disposing of materials generated on the site.

Decontamination Specifications

Personnel

- Boot wash/rinse
- Glove wash/rinse
- Outer-glove removal
- Body-suit removal
- Inner-glove removal
- Respirator removal
- Hand wash/rinse
- Face wash/rinse
- Shower ASAP
- Dispose of PPE in municipal trash, or contain for disposal
- Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal

Sample Equipment

- Wash/rinse equipment
- Solvent-rinse equipment
- Contain solvent waste for offsite disposal

Heavy Equipment

- Power wash
- Steam clean
- Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC to accommodate task-specific requirements.

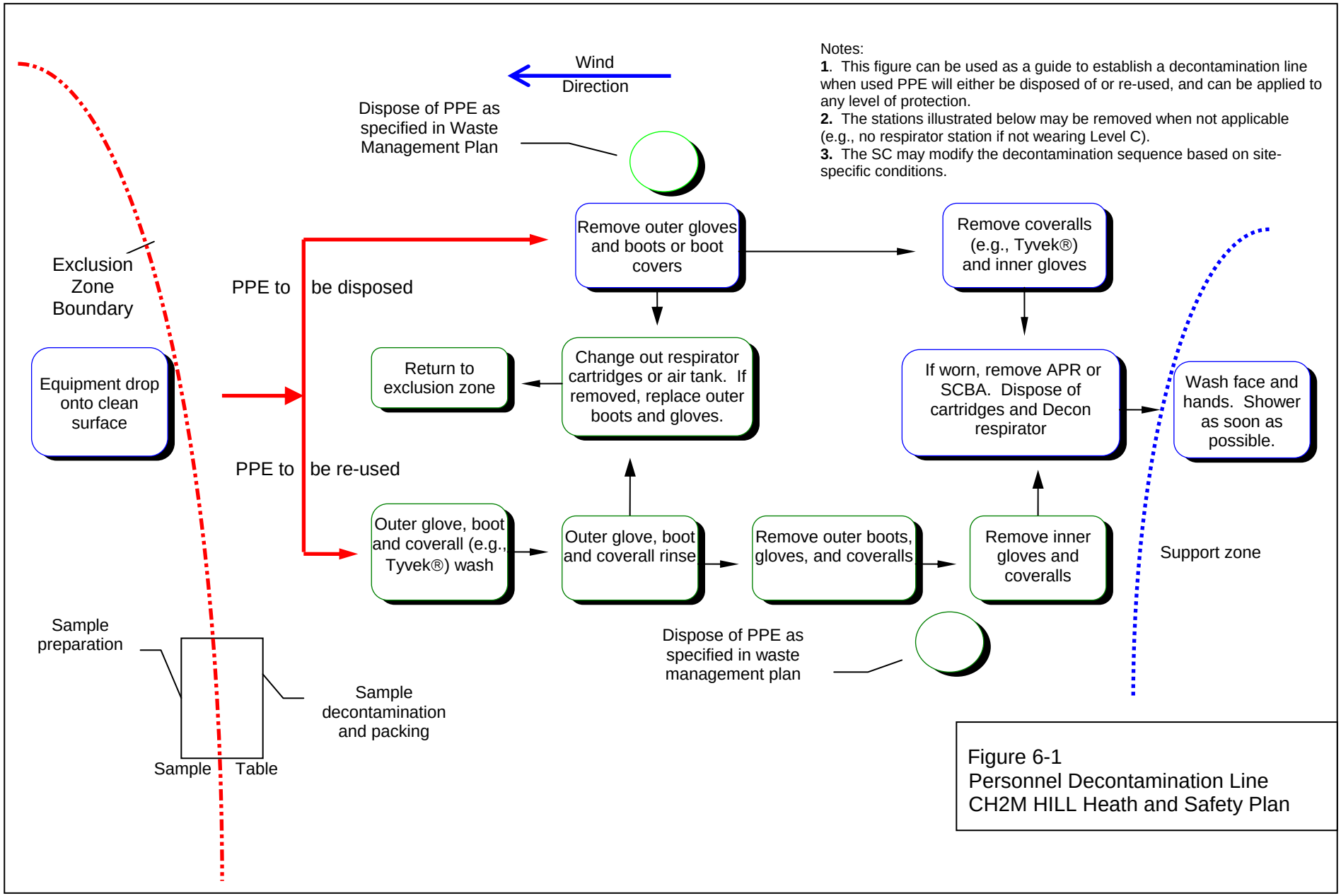


Figure 6-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

7.0 Spill Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.

8.0 Site-Control Plan

Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations)*

- The SC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL-Core Standard, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the SC in appropriate level of protection.
- The SC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

Hazwoper Compliance Plan

(Reference CH2M HILL SOP HSE-220, Written Plans and HSE-218 Hazardous Waste Operations)

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff is working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The RHSM must approve the interpretation of these data. Refer to Sections 2.0 and 5.0 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site

- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9.0 Emergency Response Plan

(Reference CH2M HILL SOP HSE-106, *Emergency Planning*)

Pre-Emergency Planning

- The Emergency Response Coordinator (ERC) performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.
- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post “Exit” signs above exit doors, and post “Fire Extinguisher” signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital. Drills should take place periodically but no less than once a year.
- Brief new workers on the emergency response plan.
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

Emergency Equipment and Supplies

The ERC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	Field Vehicle
First aid kit	Field Vehicle
Eye Wash	Field Vehicle
Potable water	Field Vehicle
Bloodborne-pathogen kit	Field Vehicle
Additional equipment (specify): Cell Phone	FTL / SSC

Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel.

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.
- Implement HSE-111, Incident Notification, Reporting and Investigation.
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in Section 9.7.

Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing/heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in Emergency Contacts at the front of this HSP.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee, the supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report forms in Attachment 5.
- Notify and submit reports to client as required in contract.

Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in Section 9.7.

Evacuation Signals

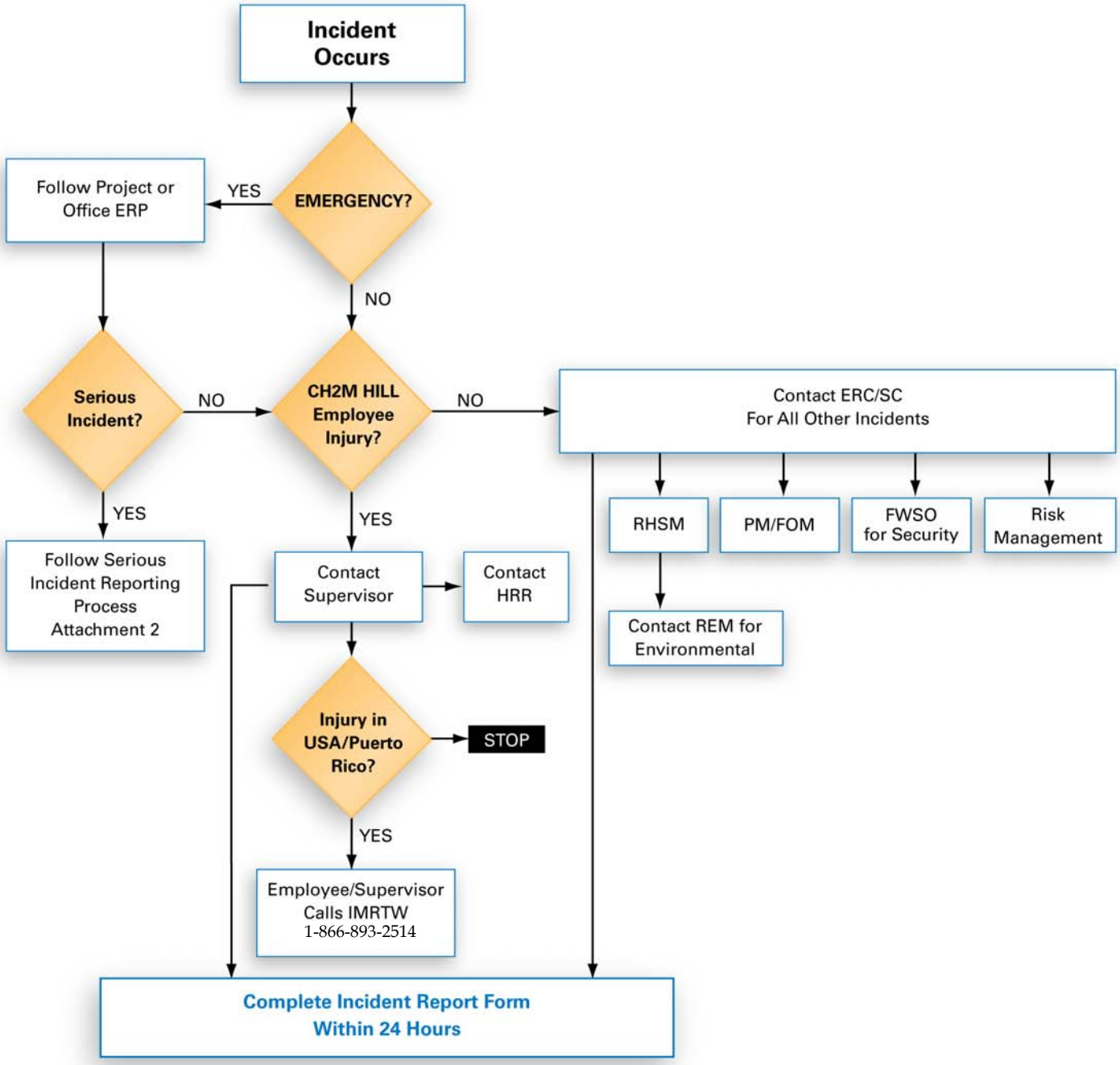
Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

Incident Notification and Reporting

(Reference CH2M HILL SOP HSE-111, *Incident Notification, Reporting and Investigation*)

- If you are injured at work, notify your supervisor immediately and contact the Injury Management/Return-to-Work toll free number (for US and Puerto Rico) 1-866-893-2514. All supervisors must contact their Human Resources Representative and complete the employee injury/illness in the Incident Report Form (IRF) in the HITS database within 24 hours of the incident.
- Immediately notify the Project Manager (PM), Emergency Response Coordinator (ERC), and/or Responsible Health and Safety Manager (RHSM) for any project incident (fire, spill/release, injury/illness, near miss, property damage, or security-related).
- Report any **serious incidents** (life-threatening injury/illness, death, kidnap/missing person, terrorism, property damage greater than $500K, significant environmental release) **immediately** to your ERC, PM, or RHSM. The Serious Incident Reporting number is 720-286-4911.
- For serious incidents, the Corporate Legal Department will determine who completes the IRF.
- For CH2M HILL subcontractor incidents, immediately notify the ERC and HSM to complete and submit an IRF.
- The RHSM will inform the Responsible Environmental Manager (REM) of any environmental incidents.
- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, REM, or FWSO. The Business Group (BG) HSE Lead will review all BG incidents and modify as required.
- Incident Investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.
- See the following flowcharts for Immediate Incident Reporting and Serious Incident Reporting.

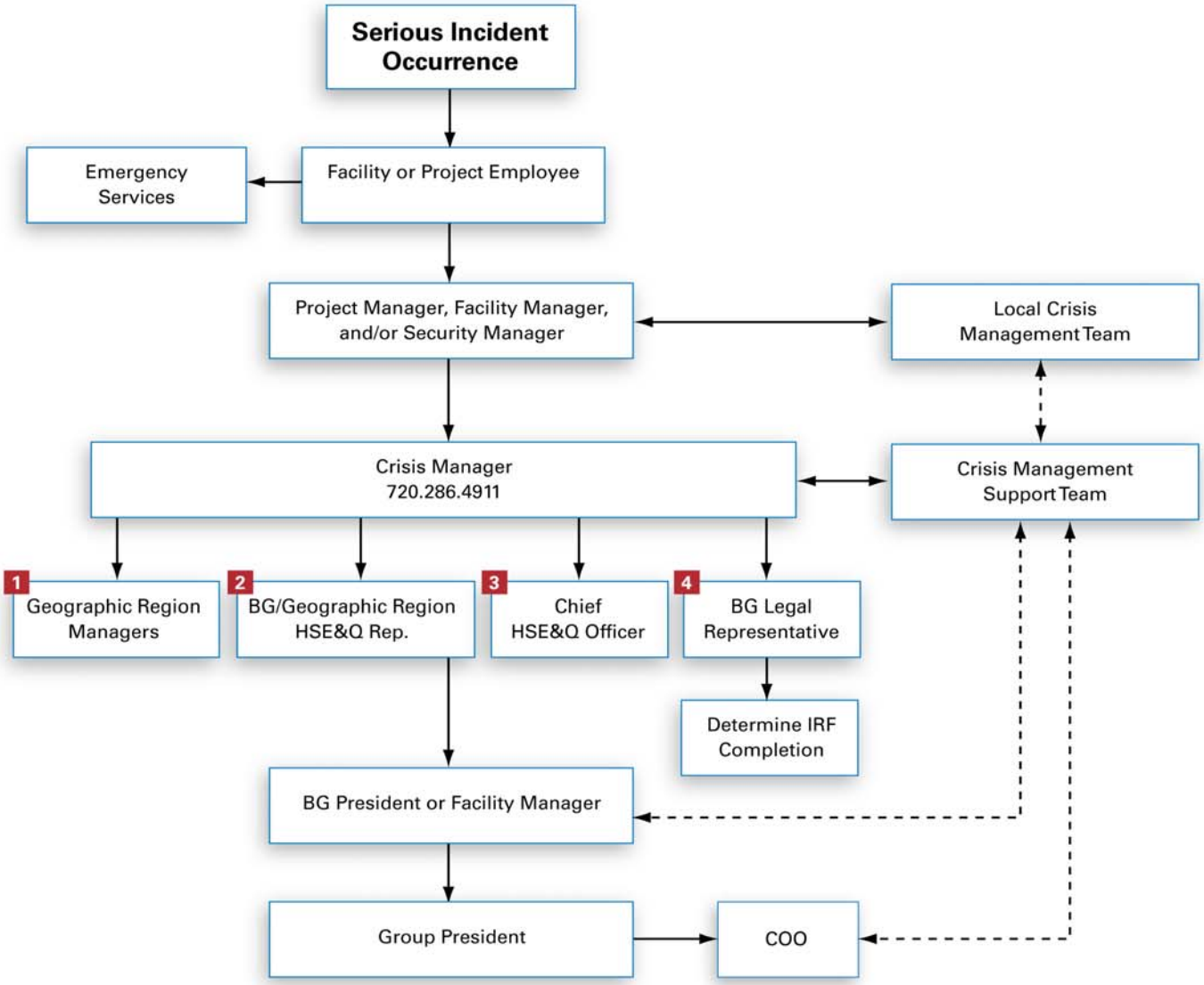
Attachment 1
CH2M HILL Immediate Incident Notification



ERC = Emergency Response Coordinator (designated in Emergency Response Plan)
ERP = Emergency Response Plan
FOM = Facility Office Manager
FWSO = Firm Wide Security Operations
HRR = Human Resources Representative
IMRTW = Injury Management/Return-to-Work
PM = Project Manager
REM = Responsible Environmental Manager
RHSM = Responsible Health & Safety Manager
SC = Safety Coordinator

HS052007002MKT

Attachment 2
CH2M HILL Serious Incident Notification



LEGEND:

Direct line of communication

Indirect line of communication

DEFINITIONS:

Local Crisis Management Team: Team comprised of key facility, project and/or business group personnel. Team is assembled as necessary and as appropriate to effectively manage and respond to a crisis situation (serious incident) at/on scene.

Crisis Management Support Team: Team comprised of key corporate personnel. Team is assembled as necessary and as appropriate to effectively support, direct, and /or supplement a Local Crisis Management Team.

Crisis Manager: Corporate based Crisis Manager, contactable by pager 24/7.

HS052007002MKT

10.0 Behavior Based Loss Prevention System

(Reference CH2M HILL SOP HSE-103, *Behavior Based Loss Prevention System*)

A Behavior Based Loss Prevention System (BBLPS) is a system to prevent or reduce losses using behavior-based tools and proven management techniques to focus on behaviors or acts that could lead to losses.

The four basic Loss Prevention tools that will be used by CH2M HILL projects to implement the BBLPS include:

- Activity Hazard Analysis (AHA)
- Pre-Task Safety Plans (PTSP)
- Safe Behavior Observations (SBO)
- Loss and Near Loss Investigations (NLI)

The SC or designated CH2M HILL representative onsite is responsible for implementing the BBLPS on the project site. The Project Manager remains accountable for its implementation. The SC or designee shall only oversee the subcontractor's implementation of their AHAs and PTSPs processes on the project.

Activity Hazard Analysis

An Activity Hazard Analysis (AHA) defines the activity being performed, the hazards posed and control measures required to perform the work safely. Workers are briefed on the AHA before doing the work and their input is solicited prior, during and after the performance of work to further identify the hazards posed and control measures required.

Activity Hazard Analysis will be prepared before beginning each project activity posing H&S hazards to project personnel using the AHA form provided in Attachment 5. The AHA shall identify the work tasks required to perform each activity, along with potential H&S hazards and recommended control measures for each work task. In addition, a listing of the equipment to be used to perform the activity, inspection requirements and training requirements for the safe operation of the equipment listed must be identified.

An AHA shall be prepared for all field activities performed by CH2M HILL and subcontractor activities during the course of the project. Hazard Controls (found in Sections 2.0 and its subsections of the HSP), the Hazard Analysis Table (Table 1), and applicable CH2M HILL CSs and SOPs should be used as a basis for preparing AHAs.

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL. Each subcontractor shall submit AHAs for their field activities, as defined in their work plan/scope of work, along with their project-specific safety plan/accident prevention plan. Additions or changes in CH2M HILL or subcontractor field activities, equipment, tools or material to perform work or additional/different hazard encountered that require additional/different hazard control measures requires either a new AHA to be prepared or an existing AHA to be revised.

Pre-Task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/AHAs, that apply for each day's project activities. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP, provided in Attachment 5, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools and equipment

that will be used to perform these tasks are listed, along with the hazards posed and required H&S procedures, as identified in the AHA. The use of PTSPs, better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry.

Safe Behavior Observations

Safe Behavior Observations (SBOs) shall be conducted by SC or designee for specific work tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific HSP and AHAs. SBOs are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss. The SC or designee shall perform at least one SBO each week for tasks/operations addressed in the project-specific HSP or AHA and forward to Margaret Dombrowski weekly. The SC or designee shall complete the SBO form in **Attachment 5** for the task/operation being observed.

Loss/Near Loss Investigations

Loss/Near Loss Investigations shall be performed for CH2M HILL and subcontractor incidents involving:

- Person injuries/illnesses and near miss injuries,
- Equipment/property damage,
- Spills, leaks, regulatory violations,
- Motor vehicle accidents.

The cause of loss and near loss incidents are similar, so by identifying and correcting the causes of near loss causes, future loss incidents may be prevented. The following is the Loss/Near Loss Investigation Process:

- Gather all relevant facts, focusing on fact-finding, not fault-finding, while answering the who, what, when, where and how questions.
- Draw conclusions, pitting facts together into a probable scenario.
- Determine incident root cause(s), which are basic causes on why an unsafe act/condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.
- Communicate incident as a Lesson Learned to all project personnel.
- Filed follow-up on implemented corrective active action to confirm solution is appropriate.

The SC or designee shall perform an incident investigation, as soon as practical after incident occurrence during the day of the incident, for all Loss and Near Loss Incidents that occur on the project. Loss and Near Loss incident investigations shall be performed using the following incident investigation forms provided in **Attachment 5.**

- Incident Report Form (IRF)
- Root Cause Analysis Form

All Loss and Near Loss incident involving personal injury, property damage in excess of $1,000 or near loss incidents that could have resulted in serious consequences shall be investigated by completing the incident investigation forms and submitting them to the PM and RHSM within 24 hours of incident occurrence. A preliminary Incident Investigation and Root Cause Analysis shall be submitted to the

Project Manager and RHSM within 24 hours of incident occurs. The final Incident Investigation and Root Cause Analysis shall be submitted after completing a comprehensive investigation of the incident.

11.0 Approval

This site-specific HSP has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

Original Plan

Written By: Mark Orman **Date: 01/06/2009**

Approved By: Mark Orman **Date: 01/16/2009**

Revisions

Revisions Made By: Lindsey Carr **Date: 05/14/2010**

Revisions to Plan: Occupational physician and nurse contact information updated.

Revisions Approved By: Carl Woods **Date: 5/27/10**

12.0 Attachments

Attachment 1: **Employee Signoff Form – Health and Safety Plan**
Attachment 2: **Chemical Inventory/Register Form**
Attachment 3: **Chemical-Specific Training Form**
Attachment 4: **Project Activity Self-Assessment Checklists/Permits**
Attachment 5: **Behavior Based Loss Prevention Forms**
Attachment 6: **Material Safety Data Sheets**
Attachment 7: **Working Alone Standard**
Attachment 8: **Tick Fact Sheet**

CH2M HILL Health and Safety Plan
Attachment 1

Health and Safety Plan Employee Sign-off Form

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: **Project Number:**

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

CH2M HILL Health and Safety Plan
Attachment 2

Chemical Inventory/Register Form

CH2MHILL

CHEMICAL INVENTORY/REGISTER FORM

Refer to Standard of Practice HSE-107 Attachment 1 for instructions on completing this form.

Location: _____

HCC: _____

☐ Office ☐ Warehouse ☐ Laboratory ☐ Project: _____

Project No.: _____

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)

MSDS for the listed products will be maintained at: _____

CH2M HILL Health and Safety Plan
Attachment 3

Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Refer to Standard Operating Procedure HSE-107 Attachment 1 for instructions on completing this form.

Location:	Project #:
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

CH2M HILL Health and Safety Plan
Attachment 4

Project Activity Self-Assessment Checklists/Permits/Forms
Lead
Manual Lifting

CH2MHILL

H&S Self-Assessment Checklist—Lead

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are exposed to lead operations and/or 2) CH2M HILL provides oversight of subcontractor personnel who are exposed to lead operations.

SSC or DSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of lead operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to lead hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with the lead standard and its requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-57.

SECTION 1

	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Work activities identified where there is a potential for lead exposure.				
2. Surfaces tested where lead may be present.				
3. Regulated areas have been identified and marked.				
4. Personnel entering into regulated areas have been trained and medically qualified.				
5. No eating, drinking, smoking, chewing, or applying cosmetics in regulated areas.				
6. Respiratory protection and other controls selected as per direction of competent person.				
7. Work progresses from areas of less contamination to more				
8. Water is added to soil prior to and during ground intrusive work to minimize dust generation				
9. Personnel in vicinity of ground intrusive activities are wearing disposable coveralls or equal				
10. Personnel exercising enhanced personal hygiene near contaminated soil operations				

SECTION 2

EXPOSURE ASSESSMENTS (3.2.2)

11. The exposure assessment has been completed.
12. Air monitoring data supporting the exposure data is available.
13. PPE is appropriate for the type of activity and concentration.
14. Personnel have been provided PPE, hygiene facilities, biological monitoring, and training during initial exposure determination.
15. An assessment has been conducted for each process, personnel, or control.
16. New assessment conducted when a change occurs in process, personnel, or controls.
17. Air monitoring results above the AL but below the PEL have been sampled in the last 6 months.
18. Air monitoring results above the PEL have been sampled in the last 3 months.
19. The exposure assessment based on theoretical calculations, historical data, or other information has been verified.

COMMUNICATION OF HAZARDS (3.2.3)

20. Training on the Hazard Communication Standard has been met.
21. The Written Compliance Program is available.
22. Warning Signs have been posted in areas above the PEL
23. Notification of owners, tenants, and contractors has been made.

CONTROL METHODS (3.2.4)

24. Engineering and work practices are implemented in areas at or above the PEL.
25. The mechanical ventilation has been assessed to control lead exposures.
26. Where administrative controls are used, a job rotation schedule has been implemented.
27. A written compliance program is established and implemented.
28. All surfaces are clean of lead dust accumulation.
29. Vacuums are equipped with HEPA filters.
30 Compressed air is not used to remove lead or control lead dust.
31. Employees not allowed to eat, drink, or smoke in regulated areas.
32. Change areas are available when regulated areas are in use.
33. PPE used in lead operations not worn by employees off the worksite.
34. Personal hygiene facilities (showers and wash facilities) are available in areas above the PEL.
35. Employees required to wash hands and face at end of shift and prior to eating, smoking, etc.
36. Eating facilities, free of lead contamination, provided and readily accessible.

PERSONAL PROTECTIVE EQUIPMENT (3.2.5)

37. Respirators are used in areas at or above the PEL.
38. The selection of the appropriate respirator is based on the airborne lead concentration.
39. All other required PPE (coveralls, gloves, goggles, etc) and equipment provided to employees.
40. PAPRs have been made available to employees who request them.
41. Clean & dry protective clothing provided weekly; daily to employees exposed over 200 $\mu g/m^3$
42. Clothing to be laundered is labeled with “Caution” signs.
43. Businesses and personnel laundering contaminated clothing have been informed of lead hazard.

SECTION 3

Complete this section for all items checked “No” in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _________________________ Project Manager: ____________________________

HSE Self-Assessment Checklist—Lifting

This checklist shall be used **only** by CH2M HILL personnel and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees perform manual lifting activities (office or projects), and/or (2) CH2M HILL provides oversight of a subcontractor performing manual lifting activities.
SC or Office Safety Coordinators/Committee members may consult with subcontractors (if applicable) when completing this checklist but shall not direct the means and methods of activities nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected.
Complete the appropriate project or office information:

Project Information
Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

Office Information
Office Location: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:
☐ Evaluate CH2M HILL employee manual lifting activities.
☐ Evaluate a CH2M HILL subcontractor's manual lifting activities.
Subcontractor Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor.
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-112.

Planning Activities	**Yes**	**No**	**N/A**	**N/O**
1. Efforts have been made to inquire about receiving equipment or supplies in containers weighting less than 50 pounds (23 kilograms).	o	o	o	o
2. Equipment or supplies are being delivered as close as possible to their use point.	o	o	o	o
3. Heavy equipment or supplies are being stored off the ground and no lower than knee height.	o	o	o	o
4. Adequate space has been provided to access and lift equipment or	o	o	o	o

	supplies without reaching or twisting.				
Safe Work Practices (5.1)		**Yes**	**No**	**N/A**	**N/O**
5.	Tasks or activities have been modified to reduce or minimize manual lifting.	o	o	o	o
6.	All employees performing manual lifting have received training on how to lift safely.	o	o	o	o
7.	Manual lifting control measures are evaluated during assessments.	o	o	o	o
8.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	o	o	o	o
9.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	o	o	o	o
Office Environments (5.1.1)		**Yes**	**No**	**N/A**	**N/O**
10.	Employees have received lifting training.	o	o	o	o
11.	Mechanical devices are readily available to employees handling equipment or supplies weighing more than 40 pounds (18 kilograms).	o	o	o	o
Field Projects (5.1.2)		**Yes**	**No**	**N/A**	**N/O**
12.	All manual lifting tasks or activities have been addressed in the written site safety plan.	o	o	o	o
13.	Employees have received safe lifting training as required by the written site safety plan.	o	o	o	o
Mechanical Lifting (5.2)		**Yes**	**No**	**N/A**	**N/O**
14.	Hand trucks and trolleys are visually inspected before use.	o	o	o	o
15.	Hand trucks and trolleys do not have any broken or damaged parts.	o	o	o	o
16.	Hand truck and trolley paths are free of uneven surfaces, water, oil, or cracks and holes.	o	o	o	o
17.	Loads carried by hand trucks are balanced and sturdy.	o	o	o	o
18.	Hand trucks or dollies are being pushed when on level ground.	o	o	o	o
19.	When going up or down a slope using a hand truck or trolley, the load is downslope of the person.	o	o	o	o
20.	Employees using hand trucks or dollies are moving slowly and cautiously.	o	o	o	o
21.	Employees using hand trucks or trolleys are able to see over the load.	o	o	o	o

Assisted Lifting (5.3)		Yes	No	N/A	N/O
22.	Personnel are not performing manual lifting beyond their physical capabilities.	o	o	o	o
23.	Loads are evenly distributed when being handled by multiple people.	o	o	o	o
Manual Lifting (5.4)		**Yes**	**No**	**N/A**	**N/O**
24.	Before the lift, the load and path was assessed.	o	o	o	o
25.	Loads being lifted are free of sharp edges, slivers, or wet or greasy spots.	o	o	o	o
26.	Gloves are used for manual lifts of loads with sharp or splintered edges.	o	o	o	o
27.	Employees performing manual lifts use the proper lifting techniques.	o	o	o	o
28.	Special tools fabricated for lifting grates or manhole covers are used.	o	o	o	o

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2M HILL Health and Safety Plan
Attachment 5

Behavior Based Loss Prevention System Forms
Activity Hazard Analysis
Pre-Task Safety Plans
Safe Behavior Observation
Incident Report and Investigation
(use electronic form when possible)
HITS

NAS Oceana ACTIVITY HAZARD ANALYSIS – Surface Soil Sampling / Magnetometer survey			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Soil sampling / mag. survey	Chemical Exposure	• All personnel performing this task shall be trained in accordance with 29CFR1910.120 and been rolled in a medical monitoring program. • Do not allow dermal contact or incidental ingestion of impacted soil. Skin contact with contaminated water, soils, debris, or equipment shall be avoided at all times. Do not kneel or step in potentially contaminated media (soil or ground water) without first donning proper PPE. • Utilize engineering controls to prevent generation / dispersal of dust. No visible dust should be present during ops. • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Adhere to PPE and action monitoring level requirements identified in the sections 5.0 and 6.0 of the site specific HSP.	Level D or Modified Level D_1 PPE or as required by HSP * D: Work clothes, reflective vests, hard hat, safety glasses and sturdy hard toed work boots, hearing and hand protection as necessary for task. D_1 : D + Tyvek
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe, mark and avoid these identified site areas. Use sturdy, steel toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices.	Level D or D_1 Modified PPE or as required by HSP *
	Stuck by/Pinched Caught in Between	• Sufficient separation between ground support personnel and the operating heavy equipment must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel shall avoid positioning themselves between fixed objects, operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. • Step away from heavy equipment when adjustments (positioning) are made. • Ensure heavy equipment operator has spotter for obstructed views and backing up.	Level D or D_1 Modified PPE or as required by HSP *

NAS Oceana ACTIVITY HAZARD ANALYSIS – Surface Soil Sampling / Magnetometer survey			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Waste Determination	• Complete waste determination requirements in accordance with applicable SOPs CH2MHILL SOP # HSE&Q-413, Waste Management Planning, CH2MHILL SOP # HSE&Q-408, Waste Characterization, Sampling, and Analysis or 2MHILL SOP # HSE&Q-411, Non-Hazardous Waste Management, CH2MHILL SOP # HSE&Q-409, Hazardous Waste Management	Level D or D_1 Modified PPE or as required by HSP *
	Visible Lighting	• Perform tasks in daylight hours whenever possible. If dawn, dusk or dark work is to be performed portable lighting must be provided to sufficient illuminate work area(s).	Level D or D_1 Modified PPE or as required by HSP *
	Cuts & Abrasions	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Avoid use of razor knives. • Cut away from the body and never towards another worker.	Level D or D_1 Modified PPE or as required by HSP *
	Manual Lifting	• Personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Do not attempt to manually lift objects that should otherwise be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Level D or D_1 Modified PPE or as required by HSP *
	Buried Objects	• Where unknown or unanticipated buried objects (including suspect MEC) are encountered personnel shall 1) secure equipment to the extent possible, without causing bodily injury, 2) evacuate the work area and 3) immediately notify the site manager, SSC and PM of the encountered condition. Work may only resume with appropriate documentation/notification that exposure hazards (physical or chemical) do not exist. Consult with PM and HSM prior to resuming activities.	Level D or D_1 Modified PPE or as required by HSP *
	Hand Tools	• Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements. • Ensure that pipe wrenches have a secure grip on drill rods and sample devices that are being disassembled. • While using pipe wrenches, ensure that other workers are not in close proximity to a wrench being used in the event the wrench grip is lost	Level D or D_1 Modified PPE or as required by HSP *

NAS Oceana ACTIVITY HAZARD ANALYSIS – Surface Soil Sampling / Magnetometer survey			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. • Institute a proper work-break regiment in a cool area to avoid heat stress symptoms and overexertion. • Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete*. 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Level D or D_1 Modified PPE or as required by HSP *
	Low Ambient Temperature	• Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather. • Frequent intake of non-caffeinated fluids to maintain body core temperature. • Frequent intake of non- caffeinated to prevent dehydration. • Obtain and review weather forecast— be aware of predicted weather systems. • Observe one (buddy system) another for initial signs of cold-related disorders. • Frequent observance of Wind Chill Chart (HSP) to assist with work warming regiment determination and frostbite avoidance	Level D or D_1 Modified PPE or as required by HSP *

NAS Oceana ACTIVITY HAZARD ANALYSIS – Surface Soil Sampling / Magnetometer survey			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Fire Prevention	• Only metal safety cans for fuel storage/transfer. Use funnels/nozzles during fueling • Appropriately sized, easily accessible ABC fire extinguisher in work area.	Level D or D_1 Modified PPE or as required by HSP *
	Biological	• Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous - Copperhead). • Avoid contact with rodents. • Observe ground surfaces or surrounding vegetation or structures for presence spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. Prior to starting field activities, n**otify supervisors of known allergies to stinging insects and location of antidotes.** • Use insect repellant. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens	Level D or D_1 Modified PPE or as required by HSP *
Sediment Sampling (Offshore activities using a boat)	Personnel falling overboard	• Approved OSHA personal flotation devices will be worn by all onboard personnel when working outside the exclusion zone.	Level D or D_1 Modified PPE or as required by HSP *
	Ignitable fuel source onboard	• Approved fire extinguishers will be onboard and readily accessible. Personnel will be trained in the proper use of said fire extinguishers.	Level D or D_1 Modified PPE or as required by HSP *
	Severe weather	• Weather conditions will be monitored during the course of the day and work will cease if lightning is spotted near the work site.	Level D or D_1 Modified PPE or as required by HSP *

NAS Oceana ACTIVITY HAZARD ANALYSIS – Surface Soil Sampling / Magnetometer survey			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Electric Safety/Overhead Utilities	• Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Keep all plugs and receptacles out of water/liquids. • Inspect all electrical power circuits prior to commencing work. • If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment. • Maintain proper separation between Power Transmission Lines and over overhead utilities. See Electric Safety section in HSP for references to proper separation between operating equipment and power transmission lines/overhead utilities. • Do not connect car batteries direct to sampling devices for power. Use a generator, GCFI or other protected circuit..	Level D or D_1 Modified PPE or as required by HSP *
	Sample & IDW Handling	• Caution should be exercised when filling bottles containing acid or base preservatives. Both liquid and vapor phases of acid can cause severe burns. • Following sample collection, sample container lids should be tightened securely to prevent any leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents. Sample activities, sample collection, and equipment decontamination procedures. • Minimize transportation of drums or other containers with IDW. • Sample only labeled drums or drums known to contain IDW. Unknown drums or drums that show evidence of excessive buckling/bulging, corrosion, vapors, crystallization, unusual discoloration or other abnormalities may not be sampled without the evaluation of engineering controls, proper PPE air monitoring equipment and the use properly trained personnel familiar with the sampling of unknown drum contents.	Level D_1 or D_2 Modified PPE or as required by HSP *

NAS Oceana ACTIVITY HAZARD ANALYSIS – Surface Soil Sampling / Magnetometer survey			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Other	• Project managers and team leaders to 1) evaluate and ensure worker safety in designated work areas, 2) confirm if potentially dangerous activities could be occurring in or adjacent to any work areas that may jeopardize worker health and safety and 3) reschedule field activities when potentially dangerous activities are not occurring adjacent to work locations. • Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio while driving on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain, wind and/or lightning. Institute 30-30 rule. • Buddy System maintained for all phases of work. • Base or local Emergency Dispatch numbers programmed into cellular phones. • Have hospital route maps readily available. • Report all conditions which may create accidents, injury, illness or property damage to supervisors immediately.	NA
EQUIPMENT REQUIRED		**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
• Hand tools/Hand Auger • Sample containers/cooler • First Aid/Bloodborne Pathogen Kit • Portable eye wash station		• Weekly Inspection of all emergency equipment (i.e.: first aid kits, fire extinguishers) • Visual Inspections of designated work areas to identify and address hazardous conditions.	• Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new personnel. • Behavior Based Loss Prevention Training (supervisors). • 1st Aid/CPR • Current training and medical surveillance requirements in accordance with 29CFR1910.120/29CFR1916.65

CH2M HILL Health and Safety Plan
Attachment 6

Material Safety Data Sheets

CH2MHILL

Arsenic
Standard of Practice HSE-501

Arsenic Fact Sheet

Uses and Occurrences

The manufacture and transportation of arsenic compounds; used in the manufacture of herbicide, pesticide, fungicides, and defoliants; used in the manufacture and handling of calcium arsenate; used in the manufacture of electrical semiconductors, diodes, and solar batteries; used as an additive for food and drinking water for animals; used as a preharvest desiccant, sugarcane ripener, soil sterilant, or for timber thinning; used as a bronzing or decolorizing addition in glass manufacturing; used in the production of opal glass and enamels; used as an addition to alloys to increase hardening and heat resistance; used during smelting of ores; used during the cleanup of soil contaminated with arsenic; used military applications; and used in the general handling, storage, and use of arsenic.

Physical Characteristics

Appearance:	Gray metal or white powder
Odor:	Odorless solid, garlic-like when heated
Flammable:	None
Flash Point:	None
Flammable Range:	None
Specific Gravity:	5.73 for arsenic metal, 3.74 for arsenic trioxide
Stability:	Stable
Incompatibilities:	Heat, hydrogen gas, and oxidizing agents
Melting Point:	Sublimes at 613°C (1135°F); 315°C (599 ^{o}F) for arsenic trioxide
Boiling Point:	Sublimes at 613°C (1135°F); 465°C (869 ^{o}F) for arsenic trioxide

Signs and Symptoms of Exposure

Short-term (Acute):	Nausea, vomiting, diarrhea, weakness, loss of appetite, cough, chest pain, giddiness, headache, and breathing difficulty.
Long-term (Chronic):	Numbness and weakness in the legs and feet, skin and eye irritation, hyperpigmentation, thickening of palms and soles (hyperkeratosis), contact dermatitis, skin sensitization, warts, ulceration, perforation of the nasal septum, and lung and lymphatic cancer.

Modes of Exposure

Inhalation:	Dusts and Vapors
Absorption:	Liquid
Ingestion:	Dusts and Liquid

Exposure Limits

Action level (AL)	5 $\mu g/m^3$
PEL	10 $\mu g/m^3$
STEL	None
TLV	10 $\mu g/m^3$

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonably achievable.
AL > EL, EL < PEL	Implement portions of the OSHA Arsenic Standard and training.
EL > PEL	Implement all portions of the OSHA Arsenic Standard, including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Safety glasses; contact lenses should **not** be worn.
Skin:	Chemical protective gloves and body protection.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air; seek medical attention promptly.
Skin:	Quick drenching with water; wash skin with soap and water; seek medical attention promptly.
Eyes:	Flush with water for 15 minutes, lifting the lower and upper lids occasionally; seek medical attention promptly.
Ingestion:	Seek medical attention promptly.

Lead
Standard of Practice HSE-508

Lead Fact Sheet

Uses and Occurrences

Lead can be found in the following: construction materials for tank linings and piping; component of lead-acid storage batteries; lead solder; plastics; steel; and pigments for paints. Lead can also be found in waste rock associated with mining activities, wood debris or stock used for electrical co-generation activities, and soil and waste associated with manufacturing activities. Elevated levels of naturally occurring lead may also be found in the soil in certain parts of this country.

Physical Characteristics

Appearance:	Bluish-white, slivery, gray metal. Very soft and easily malleable
Odor:	None
Flammable:	Noncombustible
Flash Point:	Not Applicable
Flammable Range:	Not Applicable
Specific gravity:	11.35
Stability:	very stable
Incompatibilities:	hot nitric acid, boiling concentrated hydrochloric and sulfuric acids
Melting Point:	327°C

Signs and Symptoms of Exposure

Skin and Eye: Irritation

Ingestion and Inhalation (Acute Overexposure): Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise that develops quickly to seizures, coma, and death from cardio-respiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects that take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease that arise after periods of exposure as short as days or as long as several years.

Ingestion and Inhalation (Chronic Overexposure):Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the

mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain.

Modes of Exposure

Inhalation:	Dusts and fumes
Skin Absorption:	None
Ingestion:	Dusts and solids

Exposure Limits

Action level	0.03 mg/m^3
PEL	0.05 mg/m^3
STEL	None
PEL-C	None
TLV	0.05 mg/m^3

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL less than Action Level (AL)	Maintain exposure as low as reasonably achievable
EL greater than AL and less than PEL	Implement portions of the OSHA Lead Standard (i.e., initial medical monitoring) and Training
EL greater than PEL	Implement all portions of the OSHA Lead Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Safety Glasses
Skin:	Coveralls or disposable coveralls to keep lead off clothing and to prevent the spread of lead contamination.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air, contact a physician
Skin:	Wash with water
Eyes	Flush with water
Ingestion:	Contact a physician

CH2M HILL Health and Safety Plan
Attachment 7

Working Alone Standard

CALL – IN CONTACT FORM

Date of site work:_____ Expected start time:_____

Name of CH2M HILL employee in the field:_____

Name of CH2M HILL employee responsible to receive contact:

Client Emergency Contact (if any):

CH2M HILL employee's contact numbers:

Radio #_____

Cell Phone #_____

Address and Location of work:_____

Directions/Map:

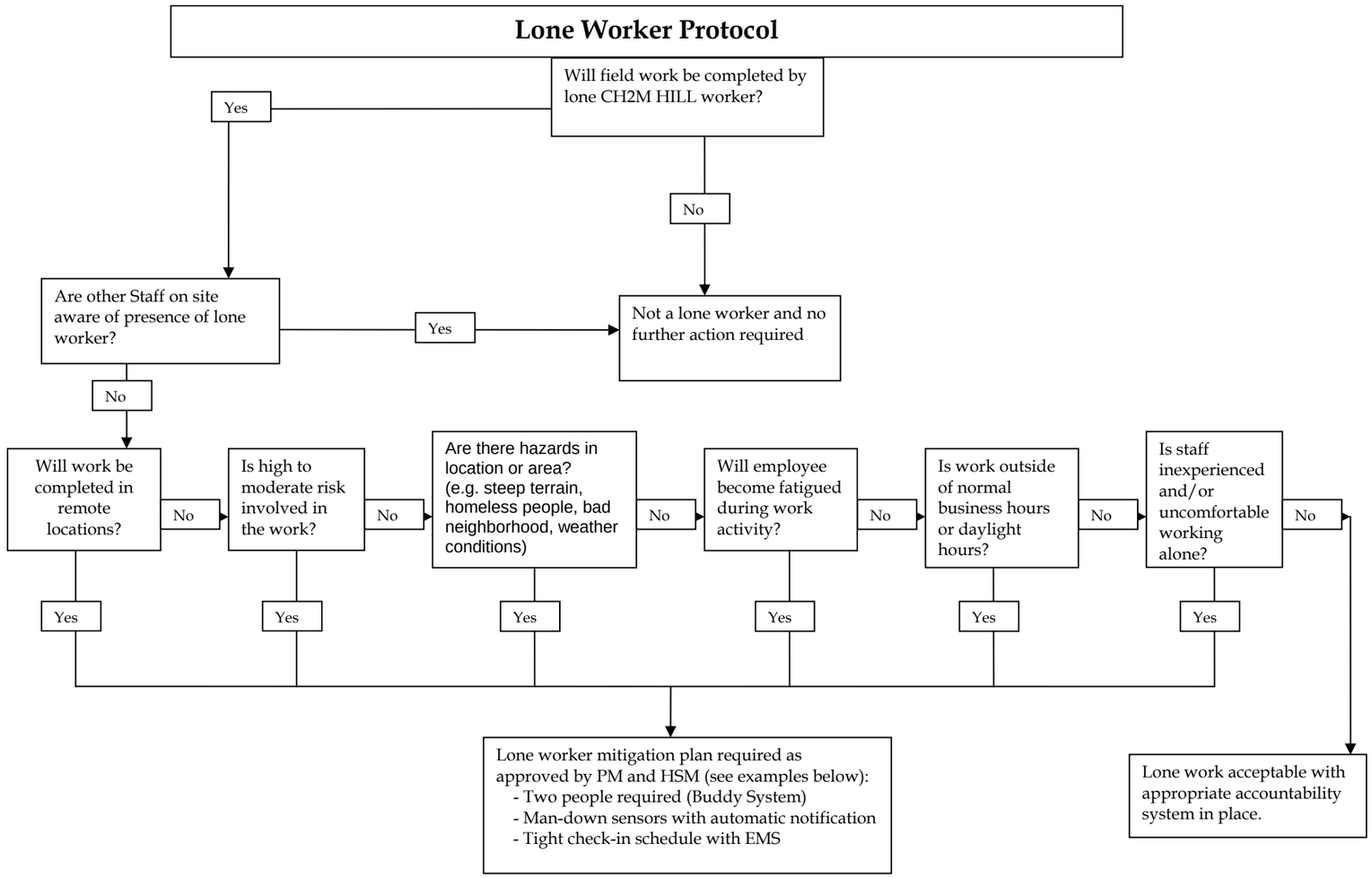
Planned Activity:_____

Specified Frequency and time for call in:_____

Time	Verified	Location

If lone worker fails to call in at specified frequency/time:

1) Call worker's radio and cell to determine if an emergency exists.
2) If no reply, immediately call Client security/emergency service if there is one at the site.
3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency on site. Provide the lone worker's name, their last known location, and your contact information.
4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Health and Safety Manager.


Lone Worker Protocol
Will field work be completed by lone CH2M HILL worker?
Yes
No
Are other Staff on site aware of presence of lone worker?
Yes
Not a lone worker and no further action required
No
Will work be completed in remote locations?
No
Is high to moderate risk involved in the work?
No
Are there hazards in location or area? (e.g. steep terrain, homeless people, bad neighborhood, weather conditions)
No
Will employee become fatigued during work activity?
No
Is work outside of normal business hours or daylight hours?
No
Is staff inexperienced and/or uncomfortable working alone?
No
Yes
Yes
Yes
Yes
Yes
Yes
Lone worker mitigation plan required as approved by PM and HSM (see examples below):
- Two people required (Buddy System)
- Man-down sensors with automatic notification
- Tight check-in schedule with EMS
Lone work acceptable with appropriate accountability system in place.

CH2M HILL HEALTH AND SAFETY PLAN
Attachment 8

Tick Fact Sheet

Tick-Borne Pathogens

There are six tick-borne pathogens that present a significant field hazard, and in some areas account for more than half of our serious field incidents. These procedures should be applied during any field activity where vegetation is present.

Hazard Control

The methods for controlling exposure to ticks include, in order of most-preferred to least:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acracide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants – tickborne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced between 72 and 100% when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant, or licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary in controlling exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be seen on your clothing wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used.
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots.
- Wear long-sleeved shirts, a hat, and high boots.
- Apply DEET repellent to exposed skin or clothing per product label.

- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label.
- Frequently check for ticks and remove from clothing.
- At the end of the day search your entire body for ticks (particularly groin, armpits, neck and head) and shower.
- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves anytime ticks are handled.

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid hand-to-face contact, eating, drinking, smoking, etc. when applying or using repellents. Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix™ lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician. Preventative antibiotic treatment in non-ill individuals who have had a recent tick bite is recommended in specific cases only.

Tick Check

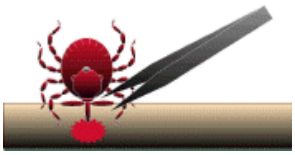
A tick check should be performed after field survey before entering the field vehicle (you do not want to infest your field vehicle with ticks). Have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thorough as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self check.

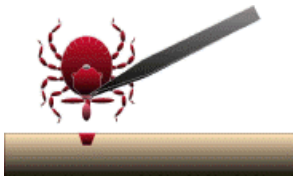
If a tick has embedded itself into the skin, remove the tick as described below. After removal, preserve the specimen in a small air tight bag and send it to Clongen Laboratories, LLC located in Germantown, Maryland for analysis. The laboratory will have results within 1-3 days. A tick testing submission form (attached) should be properly completed and submitted with the tick

Tick Removal

1. Use fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.)





3. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. You may wish to save the tick for identification in case you become ill. Your doctor can use the information to assist in making an accurate diagnosis. Place the tick in a plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Consult a healthcare professional if infection or symptoms and effects of tick-borne illnesses are develop.

Medical treatment for tick-borne infections include antibiotics and other medical interventions. Diagnosis of specific illness involves both clinical and laboratory confirmations. Preventative antibiotic treatment in non-ill individuals who have had a recent tick bite is recommended in specific cases only.

Previously infected individuals are not conferred immunity – re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs & symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These tick varieties include:

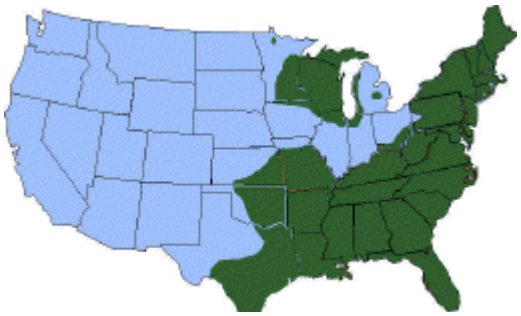
- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

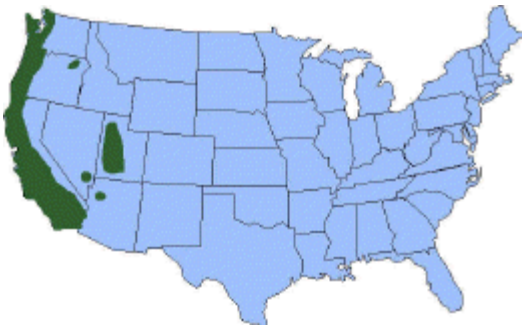
In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture. On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. Here, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Deer Tick



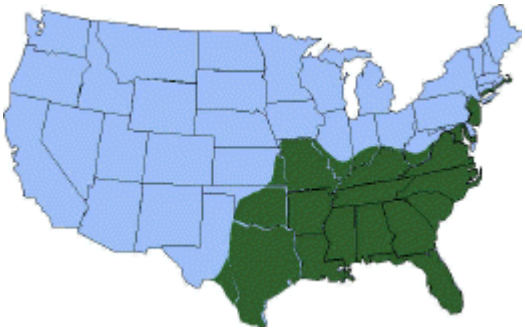
Distribution of Deer Tick (dark green)

From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)



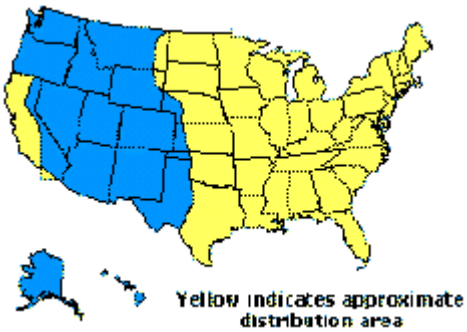
Distribution of Pacific Deer Tick (dark green)

Lone Star Tick

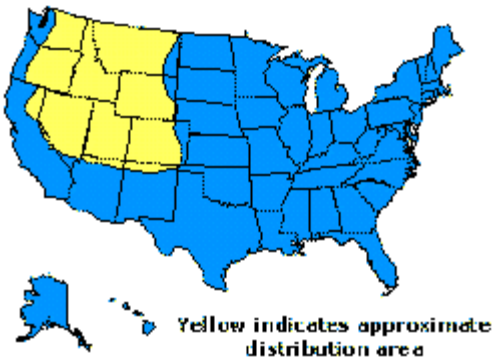


Distribution of Lone Star Tick (Green)

Dog Tick



Rocky Mountain Wood Tick



Illnesses and Signs & Symptoms

There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite – normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. A variety of long-term symptoms may result when untreated, including debilitating effects and death.

Appendix B
Field Standard Operating Procedures

STANDARD OPERATING PROCEDURE

Preparing Field Log Books

I. Purpose

To provide general guidelines for entering field data into log books during site investigation and remediation field 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 of 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, orange-covered logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.

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

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

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

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

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

5. Daily entries will be made chronologically.

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

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

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

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

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

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

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

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

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

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

5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.

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

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

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

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

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

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

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

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

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

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

16. Any conditions that might adversely affect the work or any data

obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

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

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

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

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

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

3. Sketch sampling locations and other pertinent information.

4. Sketch well construction diagrams.

V. Attachments

Example field notes.

STANDARD OPERATING PROCEDURE

Decontamination of Personnel and Equipment

I. Purpose

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

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Distilled 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
- Phthalate-free gloves such as Nitrile
- 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 DOT-approved 55-gallon drums.

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.

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.

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.

F. HEAVY EQUIPMENT AND TOOLS

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

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

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

V. Attachments

None.

VI. Key Checks and Items

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

STANDARD OPERATING PROCEDURE

Shallow Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, Teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Fiberglass measuring tape (at least 200 feet in length)
- GPS Unit (if available)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

   a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

b. Proceed to sample the points on the grid line.

c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal measurements: one to the previous grid line, and one to the previous sample on the same grid line.

d. Proceed to sample the points on the grid line as described in Section C below.

e. Repeat 1c and 1d above until all samples are collected from the area.

f. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

2. For non-grid samples:

a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).

b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.

c. Proceed to sample as described in Section C below.

d. Repeat 2a through 2c above until all samples are collected from the area.

e. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of roofs, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Leader (FTL). If the FTL concurs, the sampling point will be deleted from the program. The FTL will contact the CH2M HILL project manager (PM) immediately. The PM and Navy Technical Representative (NTR) will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the NTR in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel to scrape away surficial organic material (grass, leaves, etc.) adjacent to the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

   a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging down to a depth of about 6 inches, or the depth specified in the workplan.

   b. Subsurface soil: Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take a photoionizaton detector (PID) reading of the sampled soil if organics are anticipated to be present and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/ scoop and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP *Decontamination of Drilling Rigs and Equipment*.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with soil removed from the borehole. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Use phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

STANDARD OPERATING PROCEDURE

Chain-of-Custody

I Purpose

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

II Scope

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

III Definitions

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

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

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

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

IV Responsibilities

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

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

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

V Procedures

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

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

V.1 Sample Identification

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

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

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,
- Sample location or sampling station number,

- Date and time of sample collection and/or measurement,
- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

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

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

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

V.2 Chain-of-Custody Procedures

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

V.2.1 Field Custody Procedures

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

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

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

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

V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. A Chain-of-Custody Record Form 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

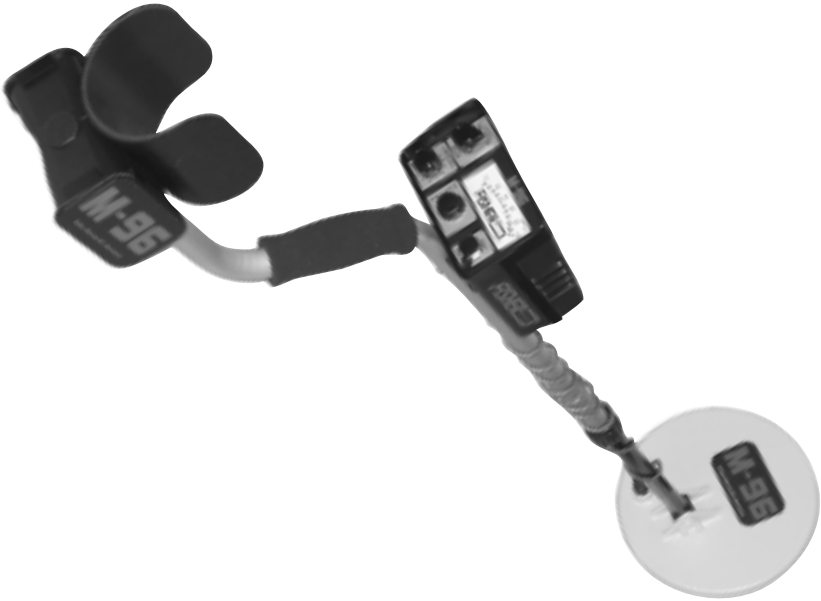
VIII References

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.

FISHER m-SCOPE®

M-96

Value, Pedestal and Box Locator



Operating Manual

FISHER RESEARCH LABORATORY

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ABOUT YOUR DETECTOR

The Fisher M-Scope Model-96 offers the utility industry an uncomplicated detector for finding paved-over or buried metallic objects. The waterproof search coil and the rugged electronics housing make the M-96 an ideal detector for field utility use.

The entire VLF (Very Low Frequency) operation of the M-96 has been reduced to just two control knobs and a pushbutton. Adjusting these knobs gives the operator maximum depth while eliminating annoying ground effects, usually caused by mineralization in the soil.

The M-96 features state-of-the-art, surface-mount electronics in a sealed control housing.

The Fisher M-96 offers a easy, uncomplicated method of finding buried metallic objects.

CONDENSED OPERATING INSTRUCTIONS

FACTORY PRESET 'TURN-ON-AND-GO' MARKS

Your Fisher M-96 is fairly simple to operate, especially when compared to other metal detectors. Even so, we strongly recommend that you read this entire manual. You'll be able to tune your M-96 to your specific needs and conditions.

But if you just can't wait any longer, and you're an experienced detector user, here's some quick instructions to get you going:

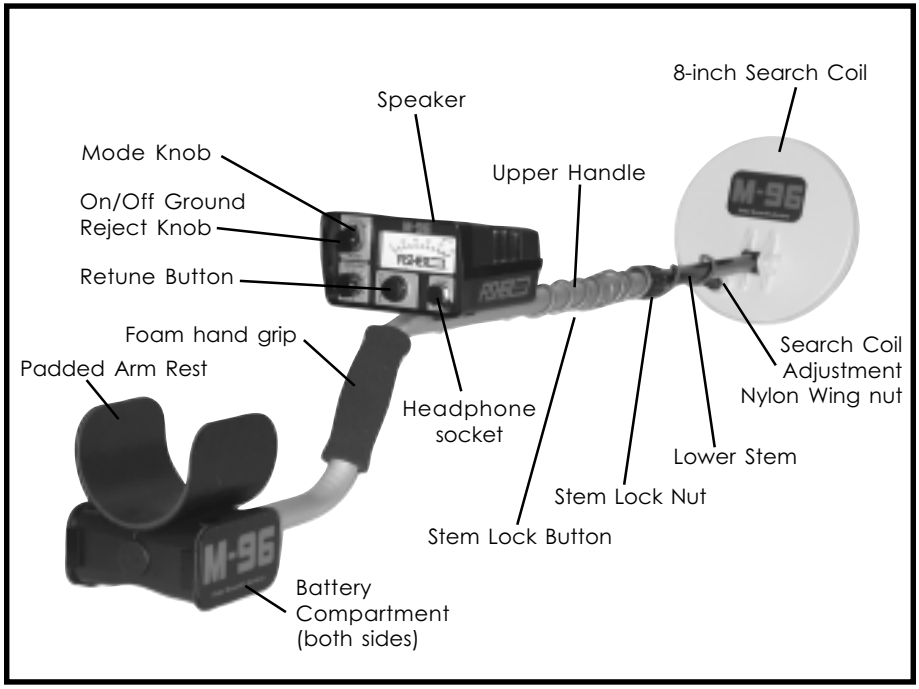
1. Unpack your M-96 carefully, and save the box. It may come in handy if you need to ship the instrument.
2. Take a look inside the lock nut on the upper handle to see if the yellow locking pad is on the left-hand side for a lower handle with a flat on one side. Loosen the locking nut by rotating it fully counterclockwise. This is the configuration for all M-96's up to Serial #62230. Units with Serial #62231 and after have a locking pad at the top and a round lower stem with a stem lock button fitting in one of the holes at two (2) inch intervals on the back side of the upper handle.
3. Slip the lower stem into the upper handle, making sure the flat side of the stem is aligned with the locking pad inside the lock nut, (Serial No. 62230 and before).
4. Adjust the stem length and coil angle so that the search coil rests flat on the ground about 6-12 inches in front of and slightly to the right of your right foot (to the left of your left foot for left handers). Your arm should be straight and relaxed, the grip held loosely. The stem length is adjusted by loosening the nylon wing nut on the search coil.

NOTE: *Remember, the longer the shaft, the more you'll have to bend your elbow to keep the coil off the ground and the sooner your arm will get tired. The M-96 is balanced for comfortable searching in a tight semicircle around the front of the operator.*

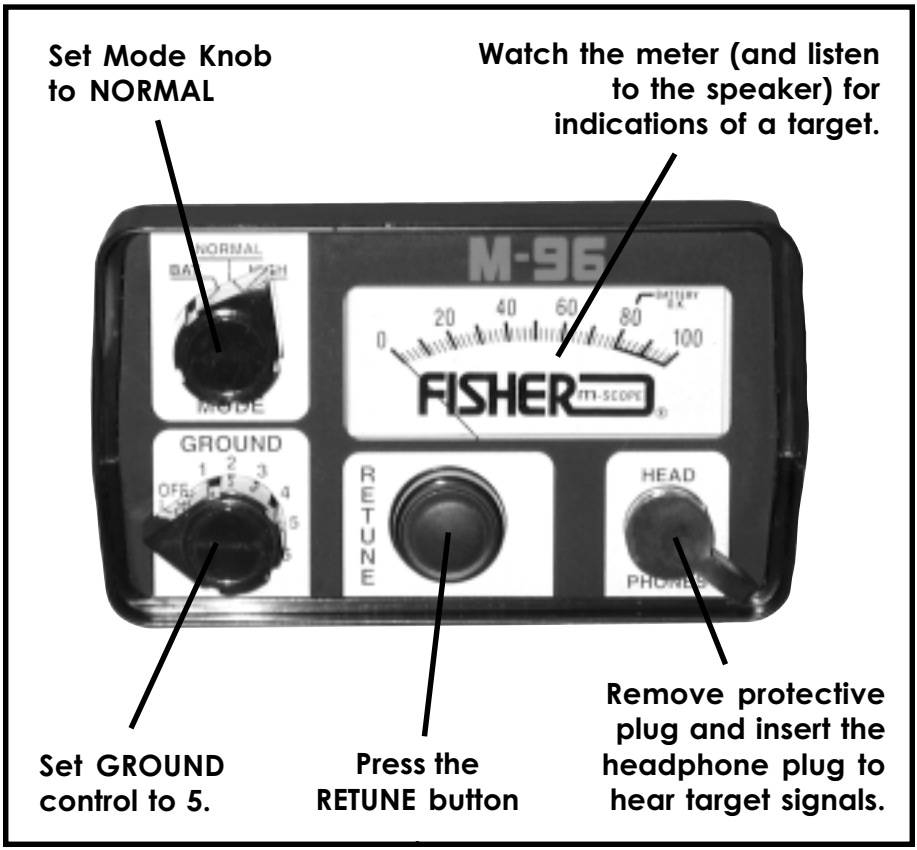
5. With the stem length properly adjusted, wrap the search coil cable snugly around the lower stem and the upper handle. Leave just enough slack near the coil to allow it to be tilted completely backward and forward.

NOTE: *A loose cable near the search coil may cause false signals, but don't wrap it so tightly that it pulls against the housing or the coil.*

6. Reconnect the coil cable to the control housing. Be careful not to cross thread it and make sure it's snug - but hand tighten only!



START-UP PROCEDURE



Turn-on-and-go factory preset control markers are colored red. The Mode Knob is set to Normal and the Ground Knob is set to 5.

7. With the shaft length and coil angle properly adjusted, you should be able to move into your search position by leaning forward very slightly and raising your arm.

8. If the arm rest is too wide or narrow, you may bend it slightly inward or outward to your exact requirements.

9. Plug your headphones (an accessory) into the headphone jack (if you don't use headphones, you can use the built-in speaker.)

10. The two knobs can be adjusted with your thumb without removing your hand from the grip, particularly if you're right handed. Set the controls of the MODE and GROUND switches to the red preset marks: NORMAL for the MODE control and 5 for the Ground control. You should hear a tone.

11. Press the RETUNE button.

12. Begin searching. Walk slowly, sweeping the M-96 search coil in front of you in a tight semicircle. Remember, the M-96 is a no-motion detector, meaning the search coil doesn't have to be moving to detect a target.

13. Keep the search coil parallel to the ground.

14. When you get a good, repeatable signal in your headphones and on the M-96 meter, pinpoint the target by passing the search coil over it both side-to-side and top-to-bottom (at 90 degree angles).

15. Watch the meter and listen to the target signal. The target will lie directly beneath the center of the coil when the meter and audio signal peak.

16. Although the M-96 is one of the easiest-to-operate metal detectors available today, skill with a metal detector takes practice. If you're having problems with your search, refer to the detailed operating instructions contained in this manual, beginning on the next page.

Your search position should be comfortable and relaxed, with the detector grasped loosely in your hand.

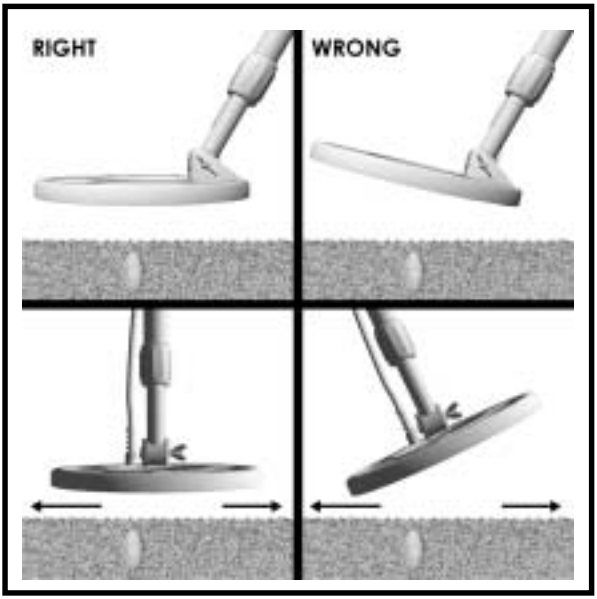
FITTING THE DETECTOR TO THE OPERATOR

1. Start by gripping the foam hand grip and letting your arm hang comfortably by your side.
2. The length of the handle shaft and the angle of the search coil are both adjustable. Adjust the search coil angle so that it is parallel to the ground.
3. Loosen the lock nut found midway down the shaft, and extend the lower shaft slightly. If the serial number is 62231 or later, there is a stem lock button on the lower shaft that fits at 2 inch intervals in the backside of the upper handle to make it a double locking stem. Be sure that the button engages in the hole closest for your best operating length. After adjusting the length of the shaft, tighten the lock nut with your hand. (Refer to the photo on page 4.) Never use pliers or other mechanical force to tighten this nut.
4. Again, completely grasp the foam handle and let your arm hang at your side with the search coil parallel to the ground. Bring your arm forward and try a few side-to-side motions with the detector. The search coil should be about 1 inch above and parallel to the ground without strain to the operator. If the position feels strained to you, your hand holding the detector is too far in front of you or the shaft length adjustment is too short. Readjust the shaft length as necessary.

NORMAL MODE

The NORMAL MODE of operation is generally used when searching for larger objects, such as manhole covers, telephone pedestals in the snow and valve boxes. The NORMAL MODE, which is marked in red, is also used for locating smaller, shallower objects. No adjustments are required in most search areas, and most small pieces of metallic trash – such as bottle caps, pull tabs and nails – will be ignored.

1. Hold the search coil 3 feet off the ground and away from any metal objects.
2. To test the batteries, turn the MODE knob to BAT and turn the GROUND knob to 5. The meter should read at least 80. If not, replace the batteries.
3. Turn the MODE knob to NORMAL.
4. Push and release the RETUNE button. You should now hear a faint hum from the speaker, and the meter reading about 10. The faint hum you hear is called the "threshold sound." You are now ready to begin your search.



Make sure the search coil is always parallel to the ground while searching.

HIGH MODE

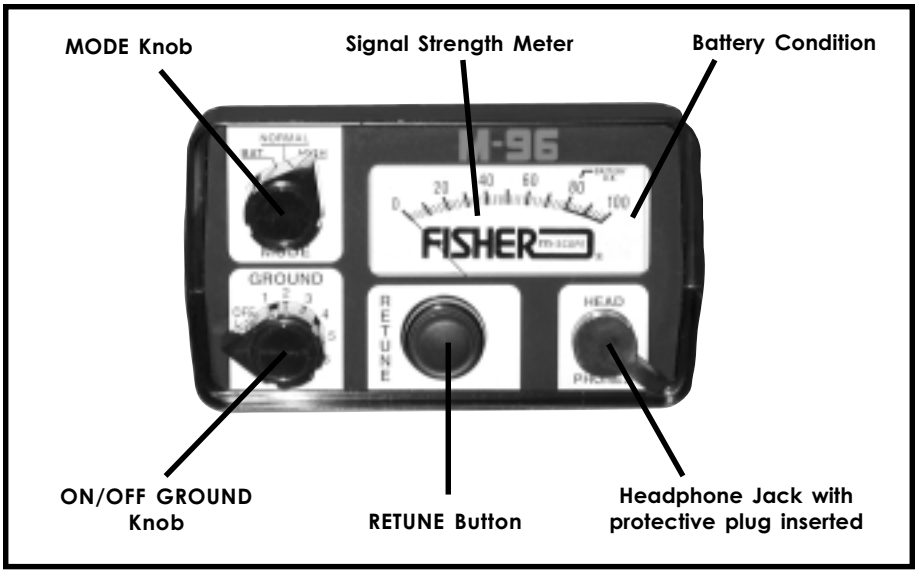
1. Rest the search coil on the ground in an area you are reasonably sure is free of metal objects.
2. After going through BAT test in the NORMAL MODE, turn the MODE knob to HIGH.
3. Turn the GROUND knob to 5.
4. Push and releases the RETUNE button. The meter reading should be about 10 and the speaker should have a slight hum, or "threshold sound."
5. Raise the coil straight up about 12 inches and note any changes in the meter indication and speaker volume.
6. If there is little or no change in the meter reading and volume, the M-96 is properly ground adjusted and you are ready to search. If there is a change, proceed to step A or B.

A. If the needle and sound level drop when you raise the coil, set the search coil flat on the ground, turn the GROUND knob to 4 and push and release the RETUNE button. Now raise the coil 12 inches from the ground and repeat steps 4 and 5, making minor adjustments to the GROUND knob until the meter reading and sound remain the same whether the search coil is flat on the ground or 12 inches in the air.

B. If the needle and sound level increase when you raise the coil, set the coil flat on the ground and turn the GROUND knob to 6, push and release the RETUNE button. Raise the coil 12 inches from the ground and repeat steps 4 and 5, making minor adjustments with the GROUND knob until the meter reading and sound remain the same whether the search coil is flat on the ground or 12 inches in the air.

The rule of thumb is this: if the volume increases when the coil is raised, turn the GROUND knob up. If the volume decreases, turn the GROUND knob down.

CONTROL PANEL



On/Off GROUND Knob

The ON/OFF GROUND Rejection Knob, when turned fully counterclockwise, clicks into the off position, turning the detector off. By turning the knob clockwise, the detector is turned on. The numbers, ranging from 0 to 10, indicate the degree of ground rejection, or electronic compensation, to counteract ground minerals. Ground mineralization can cause false signals or a false indication that the search coil is close to metal.

Mode Knob

The Mode Knob has three positions: HIGH, NORMAL and BAT (for battery testing). Use HIGH sensitivity when searching for smaller and/or deeper objects. Use NORMAL sensitivity when searching for larger, shallower objects, such as paved-over manhole covers.

RETUNE Button

The Retune Button is located at the bottom center of the control panel. Use it to retune the M-96 to prevailing ground mineralization just before pinpointing.

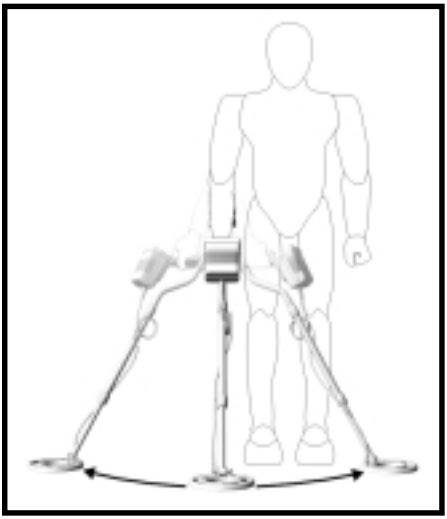
HEADPHONES Jack

The HEADPHONES Jack is located to the right of the RETUNE Button. A plastic plug can be inserted into this jack to keep dirt and water out when not in use.

SEARCH METHODS

It's a good idea to establish a systematic search pattern for your selected area. A systematic approach to searching will avoid aimless wandering, which could cause you to miss the search object and lengthen the amount of time required to do the job.

As you walk along, your sweep pattern should be in a slow, half-circle motion from side-to-side and with the coil as close to the ground as possible. When the M-96 search coil passes over a conductive (metallic) object, it will be indicated by an increase in both sound and meter reading. Because of the sensitivity of the M-96 search coil, a large and/or close-to-the surface object may be detected before the search coil is directly above it. Passing the search coil over the object from several different directions and marking the edges of the object will indicate its central position.



Your search should be slow and methodical, sweeping in a semicircle and overlapping for maximum ground penetration

HELPFUL HINTS

Raising the coil vertically in the air is another method of reducing the target size (as seen by the detector) and pinpointing the target. Because the area of greatest sensitivity is in the center of the search coil, it isvery easy to pinpoint the location of any metallic object, large or small. Also, see the section on Pinpointing, beginning on page 12.

1. Hold the search coil about 1 inch or less above the ground and begin your search by sweeping back and forth as shown on page 10.
2. Keep the search coil parallel to and as close to the ground as possible.
3. Overlap your sweeps for uniform depth penetration.
4. Search slowly and systematically. Pay attention to where you are going and where you have been.
5. During your search, the meter reading should remain at about 10 for maximum sensitivity. However, as you pass over changing ground mineralization or metallic trash, the needle may drift up or down slightly. A quick push of the RETUNE button will instantly retune the M-96 to its "threshold" sound.

SEARCHING IN WATER

The search coil is waterproof and the lower handle may be used in water; however, the water must not contract the cable connection at the box, nor should the box itself be immersed.

If you are searching in salt water, be sure to flush the lower handle with fresh water after every use. If not, continual exposure to salt water may cause the nut to freeze up.

PINPOINTING

Accurate pinpointing with the M-96 takes some practice but not much. With a little experience, you should be able to pinpoint buried targets in just a few seconds.

1. Once the presence of a buried target is indicated by a sharp increase in the audio signal and needle movement, continue moving the search coil from side-to-side across the target area in a narrower and narrower search pattern.
2. Stop the search coil over the spot where you receive the loudest response and highest meter reading.
3. Now move the coil slowly forward and straight back a couple of times, again stopping over the strongest response.
4. Move the search coil side-to-side one more time and stop over the strongest signal once again. Your target should be directly below the center of the search coil.
5. For quick and accurate pinpointing of strong signals, push the RETUNE button momentarily, close to, but not over, the target area. This will "detune" the M-96 so that it responds over a smaller area, making pinpointing of the object easier. "Detuning" also reduces depth penetration.

CAUTION:

The ultra-slow auto-tune circuitry is constantly retuning the M-96 just fast enough to counteract any drift caused by humidity, temperature changes, etc. If the search coil is held for a prolonged period of time over a target, the M-96 will eventually "tune out" the target and the signal will fade. A brief negative-meter response may also result when the coil is moved away from the target. In either case, the M-96 may be instantly retuned to the "threshold" level by pushing the RETUNE button while holding the coil away from the target area.

CHANGING BATTERIES

To change the batteries, slide the side covers on the battery housing located underneath the arm rest in the direction of the arrows. Remove the battery holders one at a time. Replace all 6 AA cells, making sure that each one is inserted with polarity (+ or -) in the same direction as the ones you remove.

The M-96 power supply is located under the arm rest at the top end of the stem.

Grasp either side of the M-96 battery compartment by the top and bottom edges.

Slide the cover about half way off toward the opposite end of the detector.

Grasp the nylon pull tape and dislodge the battery pack by pulling up. Replace all six AA batteries.

Return the battery pack to the compartment, making sure it snaps into place. Also, be careful to keep the nylon pull tape within reach.

Hold the end of the battery pack down, along with the nylon tape, and slide the cover back i into position. Repeat steps 1-6 on the other side of the battery compartment.

SPECIFICATIONS

Operating Environment
+33° F to +120° F (0 to 50° C) ..... with carbon zinc batteries
-4° F to +120° F (-20 to 50° C) ..... with alkaline batteries
Search coil submersible in water

Operating Frequency of Search Coil ..... 4.5 KHz

Sensitivity ..... 0.2 mv RMS for full scale
Sensitivity Adjustment Range 12:1

Output Indication .....Meter ..... 1 milliamp, 0-100 linear scale
Speaker ..... 16 ohm impedance
Headset (optional) ..... 8 ohm impedance
Audio Frequency ..... 450 Hz

Power Supply ..... ±9V, each consists of 12 x 1.5V AA batteries in (2) 6-battery packs
Power Consumption ..... (-9V) 13.8 mA,
(+9V) 8 mA min
7.5 - 18.5 mA @ audio threshold
50 mA max

Threshold ..... 50 mA max sound

Battery Life ..... Carbon/Zinc ..... 35-45 hours
Alkaline ..... 100+ hours

Search Coil Configuration 2-D

Weight.....(with 8-inch coil).....3.74 lbs. (1.7 kg)
(with 11-inch coil) .....4.26 lbs. (1.9 kg)

Dimensions.....Length.....40 to 54 inches adjustable (101 to 137 cm)

Shipping Weight.....(with 8-inch search coil) ..... 7.0 lbs. (3.2 kg)
(with 11-inch search coil) ..... 7.0 lbs. (3.2 kg)
Shipping Dimensions.....5 1/2 x 12 1/4 x 34 3/4 inches (14 x 31 x 88 cm)

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Should you have any questions or problems, contact:

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STANDARD OPERATING PROCEDURE

Sediment Sampling

I. Purpose

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

II. Scope

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

III. Equipment and Materials

- Sample collection device (hand corer, scoop, dredge, grab sampler, or other suitable device)
- Stainless steel spoon or spatula 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. Be especially careful to avoid the loss of the very fine clay/silt particles when collecting the sample. The fine particles have a higher adsorption capacity than larger particles. Minimize the amount of water that is collected within the sample matrix. Decant the water off of the sample slowly and carefully to maximize retention of the very fine particles. The sampler's fingers should never touch the sediment since gloves may introduce organic interference into the sample. Classify the soil type of the sample using the Unified Soil Classification System, noting particularly the percentage of silt and clay.

5. Samples for volatile organics should immediately be placed in jars. Rocks and other debris should be removed before placement in jars.

6. For channel sampling, be on the alert for submerged hazards (rocks, tree roots, drop-offs, loss silt and muck) which can make wading difficult.

7. Sample sediment for TOC and pH also, to give context to organic and inorganic data during the risk assessment.

8. Follow the site safety plan designed for the specific nature of the site's sampling activities and locations.

9. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

V. Attachments

None.

VI. Key Checks and Items

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

STANDARD OPERATING PROCEDURE

Flat Bottom Boat Sampling Operations

I. Purpose

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

II. Scope

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

III. Responsibilities

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

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

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

IV. Procedures

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

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

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

Appendix C
Laboratory Standard Operating Procedures

Laboratory SOPs are proprietary and confidential.
They are provided upon request at the discretion of the Project Manager.

Appendix D
Data Management Documentation

Version 1

Navy CLEAN
Data Management Plan

Prepared for

Navy CLEAN & Joint Venture Programs

December 2009

CH2MHILL

Preface

This document presents the standardized six-step workflow process for environmental data management being performed for the Navy Comprehensive Long-Term Environmental Action - Navy (CLEAN) and Joint Venture Programs. Included in Appendix A is the responsible, approve, support, consult, and inform (RASCI) diagram along with the associated roles and responsibilities, which is the basis for the Navy CLEAN and Joint Venture Programs Data Management Plan (DMP). Following are the six steps in the workflow process:

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation and loading
5. Data management
6. Data evaluation and reporting

Figure P-1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs.

Figure P-2 presents, in more detail, the tools used in each step of the process. CH2M HILL uses the Sample Tracking Sheet (STS) to initiate the sample collection, documentation, and tracking processes. All field-related data is captured in the Field Data Entry Tool (FDETool). During the laboratory analysis and data validation phase, the SNEDD-QC-Tool software will be used to help evaluate the quality of the data. At the data management step, the SVMTool will be used to format the data and the CH-IMPTool will be used to transfer the data into the Navy CLEAN data warehouse. At the data evaluation stage, the XTabReports Tool will be used to query data from the data warehouse, and the Crosstab Cleanup Tool (CCTool) and the Raw, Detects, and Exceedance (RDE) Formatting Tool will produce and format data tables and comparisons to project action levels. Appropriate section(s) of the DMP include additional details on each of the tools used.

Change Management

This DMP is a "living" document and content may be revised or amended to accommodate changes in the scope of environmental investigations or data management requirements that affect the entire Navy CLEAN and Joint Venture Programs. In addition, the DMP appendices will be subject to modification as new or improved methods of data management are developed and implemented.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

Amendments will be versioned and released according to the following naming scheme: [Document Name_v#.#_yymmdd]. If a significant change is made to any of these files, the version number will increase by one integer. The revision history is shown in the following table.

REVISION HISTORY

Navy CLEAN and Joint Venture Programs Data Management Plan

Revision Date	Initiator	Purpose

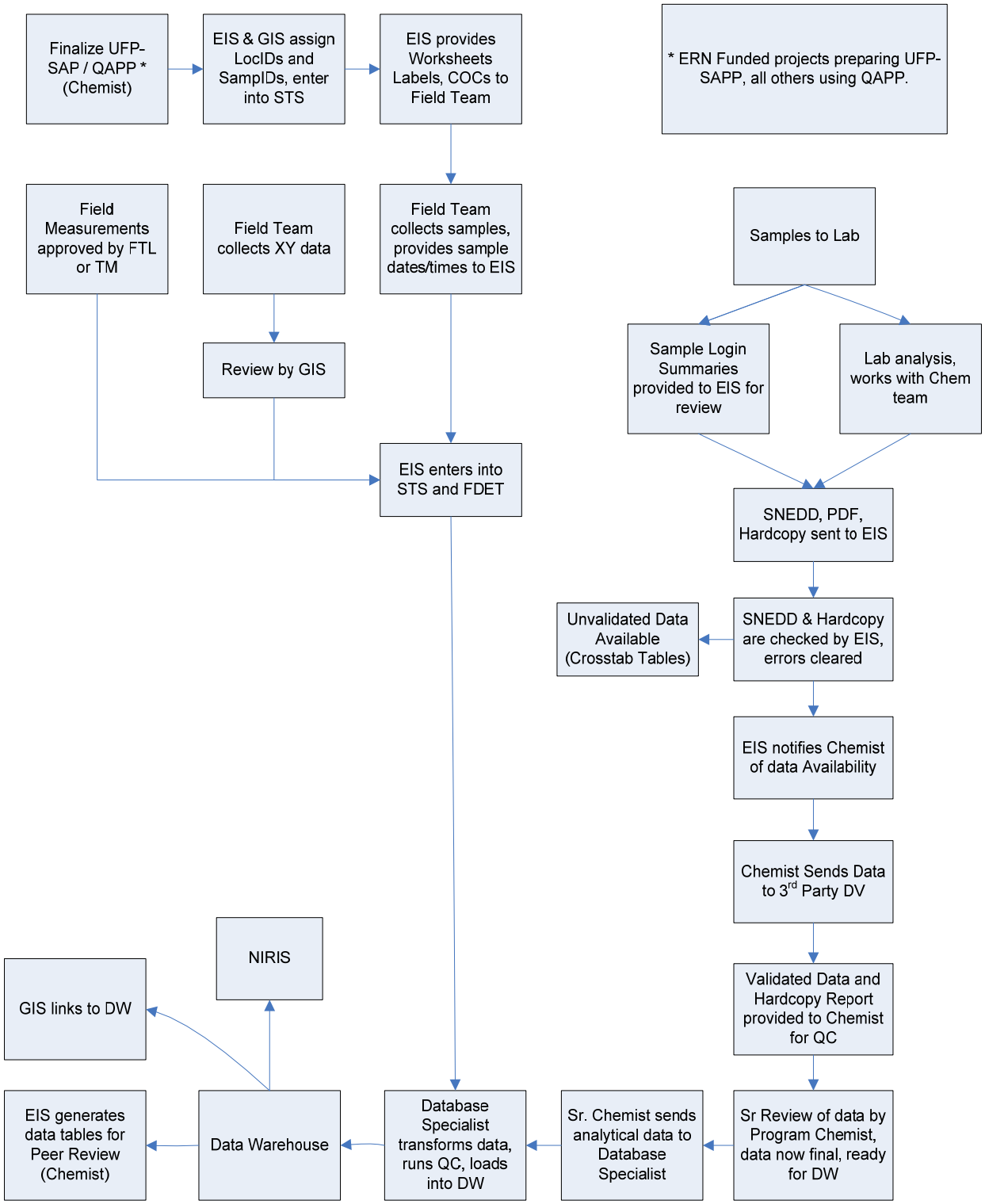

FIGURE P-1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

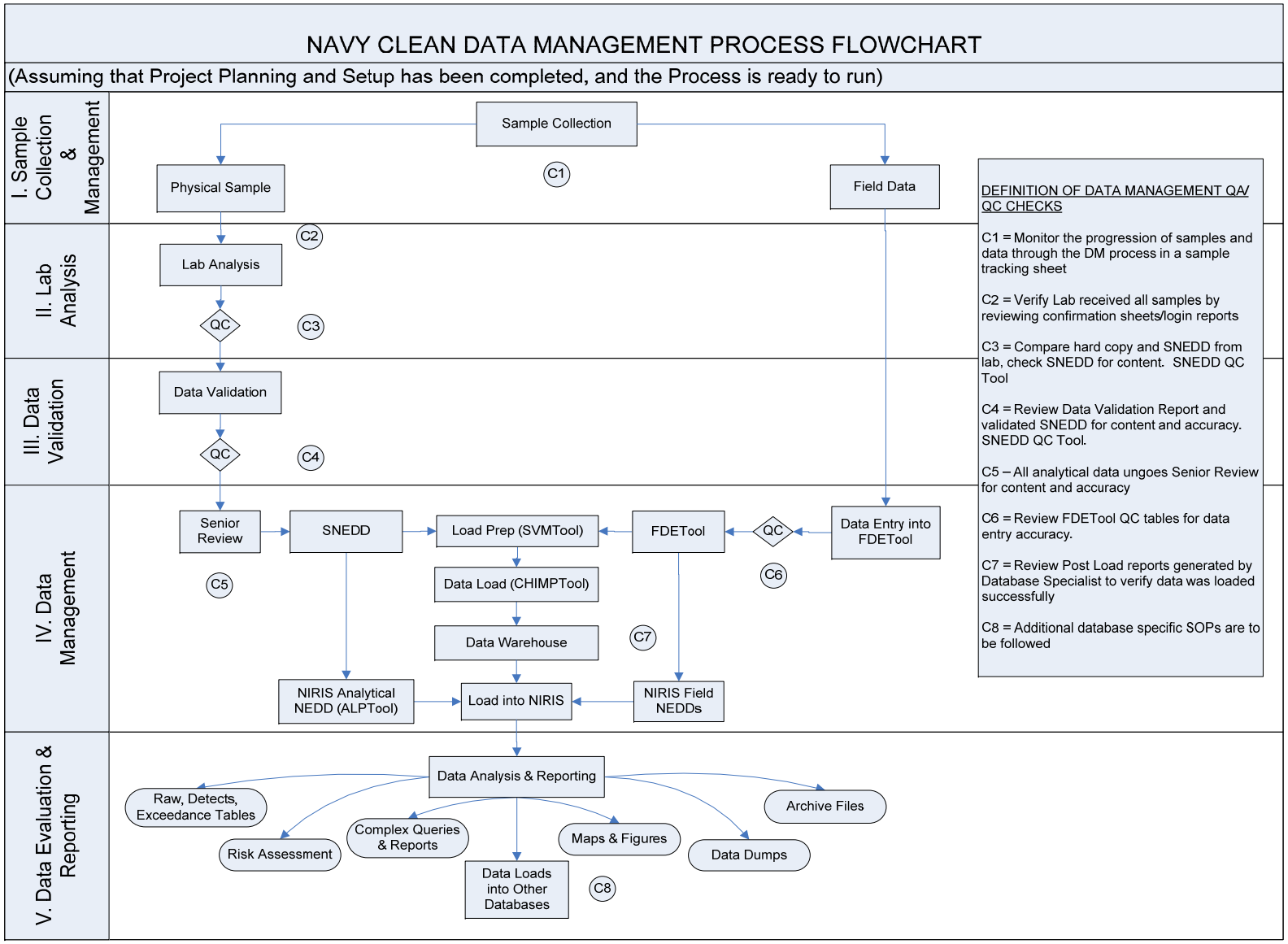

FIGURE P-2
DBMS PROCESS

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Acronyms and Abbreviations

AFCEE	Air Force Center for Engineering and the Environment
ALPTool	Archive Load and Prep Tool
AM	Activity Manager
CAD	computer-aided design
COC	chain-of-custody
DBMS	Database Management System
DBS	Database Specialist
EIS	Environmental Information Specialist
DMP	Data Management Plan
EDD	electronic data deliverable
EDM	Environmental Data Management
EMS	Enterprise Management Solutions
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EVS	Environmental Visualization System
FD	Field Duplicate
FDETool	Field Data Entry Tool
FTL	Field Team Leader
GA	GIS Analyst
GIS	geographic information system
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
MS	matrix spike
MSD	matrix spike duplicate
N/FD	normal/field duplicate
NAVFAC	Naval Facilities Engineering Command

NEDD	NIRIS Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
ODBC	open database connectivity
PC	Project Chemist
PCL	Program Chemistry Lead
PDL	Program Data Management Lead
PGL	Program GIS Lead
PM	Project Manager
QA	quality assurance
QC	quality control
RASCI	responsible, approve, support, consult, and inform
RDM	Regional Database Manager
SDG	Sample Delivery Group
SIMS	Site Information Management System
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
STS	Sample Tracking Sheet
SVMTool	SNEDD to VDMS Mapping Tool
VDMS	Validated Data Management System

SECTION 1

Introduction

This Data Management Plan (DMP) describes the methods CH2M HILL will use to manage and present environmental data to support work it is conducting for the Navy CLEAN and Joint Venture Programs. These processes and procedures are part of an overall environmental data management system called the SNEDD Approach to the Validation Data Management System (VDMS), hosted by CH2M HILL.

Project members and any subcontractors supporting program data needs for site characterization and remediation activities can use this DMP. It is a living document that is flexible enough to meet the dynamic needs of the teams and stakeholders. Data management program details and procedures are included in the appendices.

1.1 Purpose

This document outlines how environmental data for the Navy CLEAN and Joint Venture Programs will be obtained and managed using an Enterprise Management Solutions (EMS) approach. The systematic approach will facilitate the retrieval of data from project files and the data warehouse when they are needed, help ensure that the required data are collected and are of the appropriate quality, and help ensure that data records are not lost during transfer to the central program database repository.

1.2 Scope of the Data Management Plan

The scope of the data management activities addressed by this plan includes the following:

- **Roles.** Definition of staff roles and responsibilities.
- **Project Planning and Setup.** Use standard templates and database applications; provide guidance and standard operating procedures (SOPs) for formatting, reviewing, and transferring data collected in the field to the Database Management System (DBMS).
    - **Provide a structured, yet flexible data set.** The DBMS will store all types of environmental data and provides a standard framework for all projects within the Navy CLEAN Program to use. The DBMS is organized and structured, yet flexible enough to allow additional data and data types to be added at any time over the life of the program.
    - **Provide data that are well documented.** The DBMS will retain enough descriptive and source information for technical defensibility and legal admissibility of the data.
- **Sample Collection and Management.** Items that will be captured through standardized forms or applications include chains-of-custody (COCs), field parameter information, groundwater elevation data, and sample tracking records.
- **Laboratory Analysis.** Laboratory data will be reported in the Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD)

format specifications that analytical laboratories are required to use to transfer analytical data electronically to CH2M HILL. (Provided to laboratories via a scope of work.) Management and archive procedures will be implemented for hard copy and electronic project documentation.

- **Data Validation.** Internal and external data validation will be conducted in accordance with the appropriate Program and EPA requirements. All deliverables will be subjected to Senior Review quality assurance (QA) and quality control (QC) measures. Management and archive procedures will be implemented for hard copy and electronic project documentation.
- **Data Management.** QA and QC measures will be implemented to provide accurate representation of all data collected and to be stored in the DBMS. QA/QC procedures include restricting data import or entry to specific valid value lists that will not allow incorrect data to be included in the DBMS.
- **Data Evaluation and Reporting.** Reporting and delivery support will be provided from a single DBMS source and allow relatively simple and rapid access to stored data for environmental characterization, report generation, modeling, geographic information system (GIS) mapping, statistical analyses, and risk assessments.
    - **Provide data visualization capabilities.** Data will be accurately represented for use in models, GIS, boring log programs (Environmental Visualization System [EVS), computer-aided design (CAD), graphics, and other software used for mapping, graphing, charting, analyzing, and displaying environmental data.
    - **Provide the ability to compare data electronically.** Tools will allow the electronic comparison of project data to specific reference or screening criteria.
    - **Provide the ability to transfer data to different formats.** The DBMS will provide the ability to reformat, convert, and transfer the data to any format as required by specific end-user applications.

SECTION 2

Roles and Responsibilities

The Navy CLEAN and Joint Venture Programs Environmental Data Management (EDM) team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The EDM team is composed of data management, chemistry, and GIS resources. The EDM team is responsible for all aspects of planning, execution, management and reporting environmental of data. Data are derived from sampling events related to investigative and remedial activities for Navy CLEAN and Joint Venture projects.

Responsibilities related to data management and information solutions functions are grouped into roles, as listed in Table 1. The SNEDD DM Process Checklist referenced in Appendix C documents the specific responsibilities associated with each of these roles.

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Navy CLEAN Activity Manager (AM)	Various	Various	Various	Various
Navy CLEAN Project Manager (PM)	Various	Various	Various	Various
Field Team Leader (FTL)	Various	Various	Various	Various
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Database Specialist (DBS)	Bhavana Reddy 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703- 462-3784	703- 376-5010	breddy@critigen.com
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TABLE 1
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The Navy CLEAN Program Data Management Plan

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TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

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SECTION 3

Data Management System Description

During field investigation, monitoring, and remedial activities, CH2M HILL will collect a variety of environmental information to support data analysis, reporting, and decision-making activities. To meet current regulatory QA requirements, a complete audit trail of the information flow must be implemented. The six steps in the workflow process are (Appendix B):

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation
5. Data management and loading
6. Data evaluation and reporting

Each step in the data management process must be adequately planned, executed, and documented. Figure 1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs. Figure 2 presents, in more detail, the tools used in each step of the process.

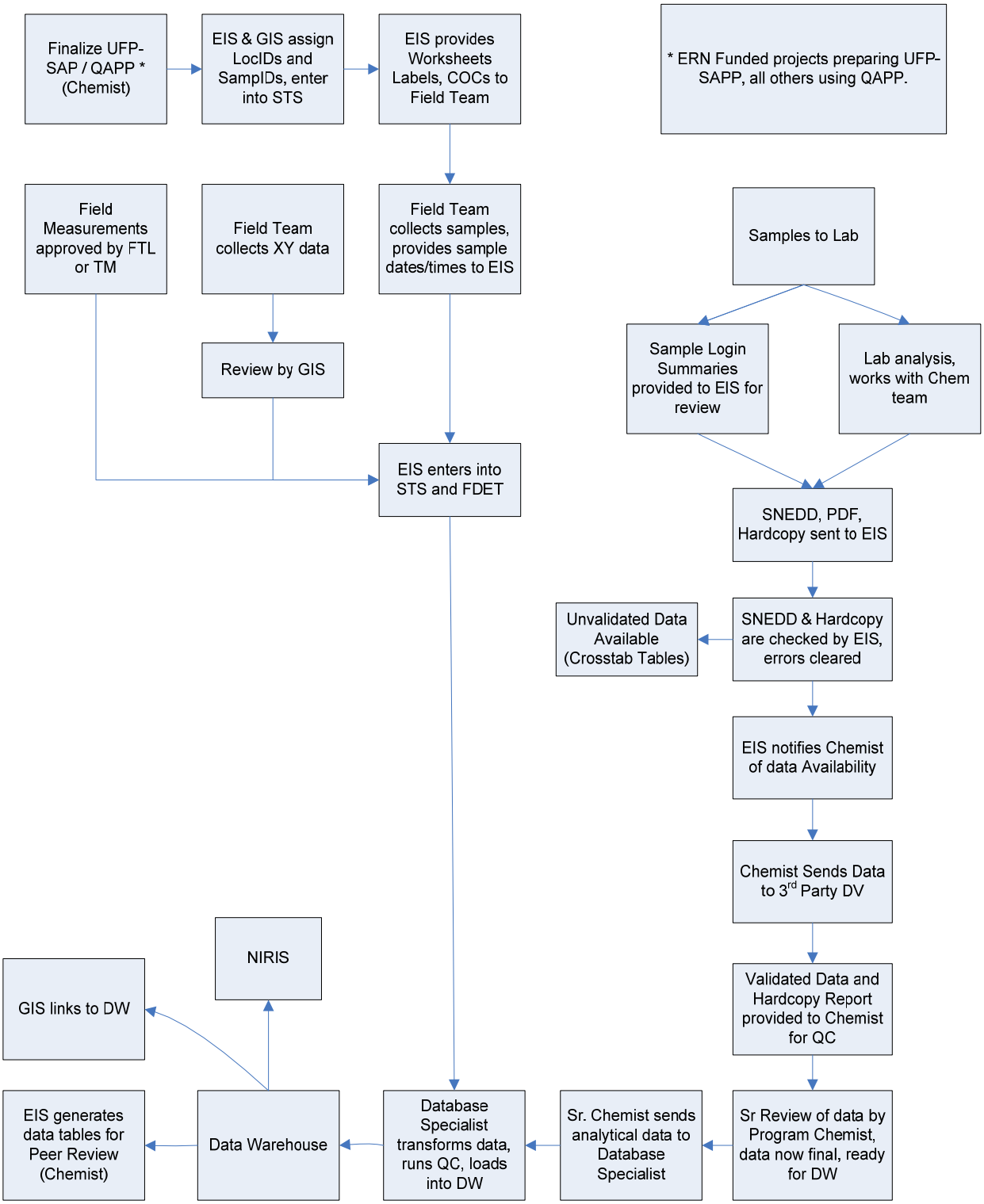


FIGURE 1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

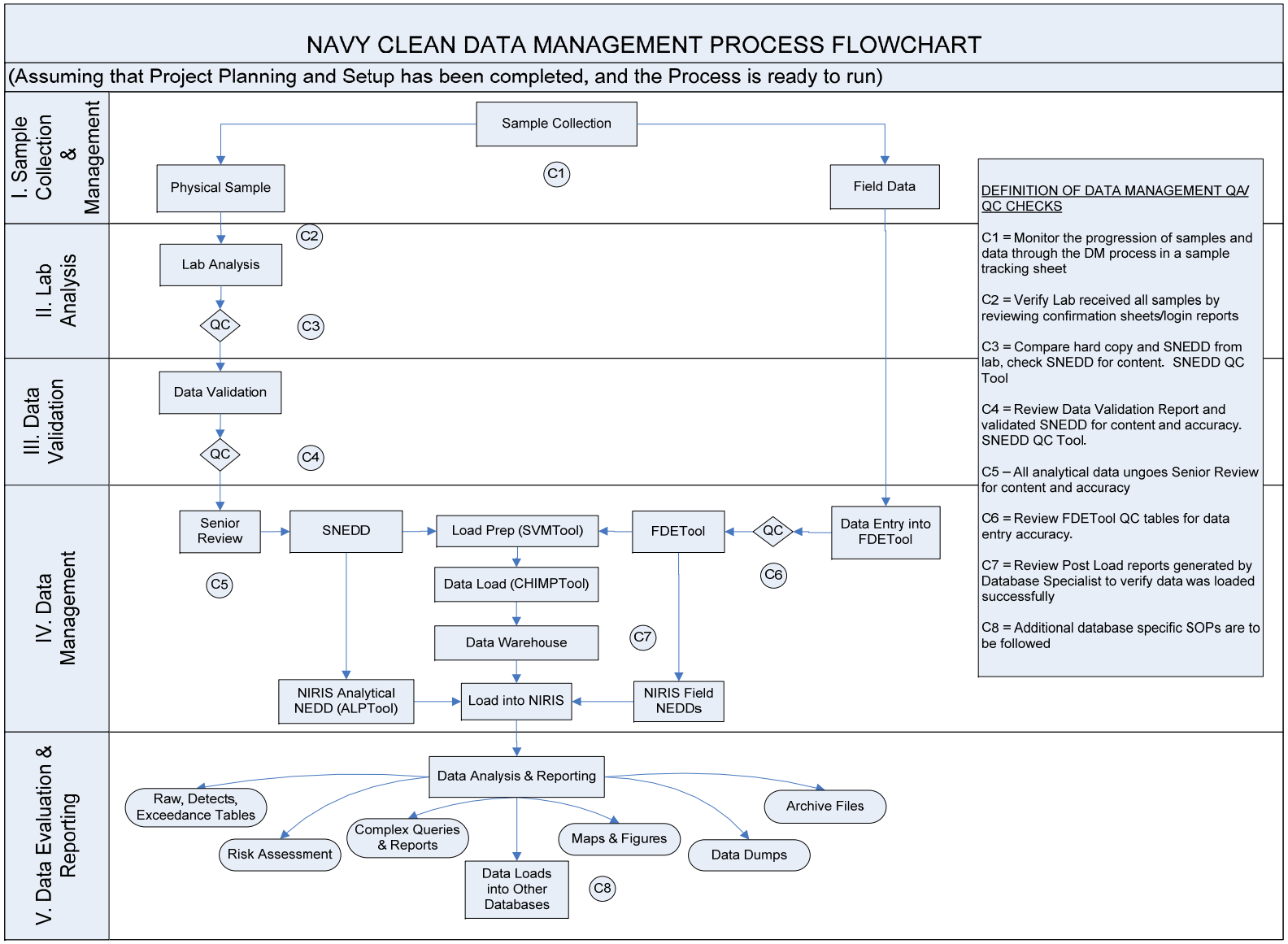


FIGURE 2
DBMS PROCESS

SECTION 4

Phases of Data Management

4.1 Project Planning and Setup

Project planning starts when a new project or task is identified in the program. Evaluation of what is required from data management and visualization occurs to determine the data needs. The Program Critigen Team Lead (Critigen Lead) works with the Program Data Management Lead (PDL) and the project and/or activity manager to determine what is expected and required from the data management and visualization team. Specific items that should be considered are as follows:

- Inputs – Determine what data will be collected and stored in the database. Determine frequency and quantity. Determine what tools will be used to handle data input.
- Historical Data – This is a unique data input and requires special consideration. The PDL ***must*** work with the other technical leads to assess what effort will be required. This step is often missed, and the resulting data quality issues created from inadequate planning in this area can plague the project for its entire duration.
- Outputs – Determine what data will need to be presented in reports, figures, and electronic deliverables. Determine frequency and quality requirements. Determine preliminary data, validated data, and what tools will most effectively handle the output requirements. Discuss how the outputs needed by the team will be requested and documented.
- Visualization – Determine necessity for GIS and CAD.

After the information above is determined, the data management scope, schedule, and budget are developed and endorsed by the Project Manager (PM), PDL, Program GIS Lead (PGL) and Program Chemistry Lead (PCL). The team can then proceed upon client authorization of the overall project budget. Figure 3 shows the process for project planning.

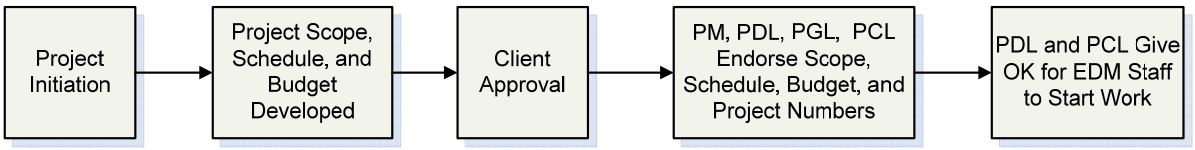


FIGURE 3
PROJECT PLANNING

4.1.1 Database Setup and Administration

CH2M HILL Database

The PDL will oversee the administration of the DBMS, including the design, development, and maintenance of the program database, tools and data management processes. Database and data management process design and development will focus on providing rapid data entry

and data retrieval while promoting data integrity through various automated procedures. The PDL will perform the database maintenance, which consists of the following:

- Assisting with the allocation of sufficient system storage for the program database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting and compacting the database for more efficient operation
- Upgrading database software and associated applications as necessary
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions
- Performing routine virus checks on incoming and outgoing data

The DBMS is comprised of the Data Warehouse and associated SNEDD-Approach tools, and will support the storage, analysis, display, and reporting of the Navy's environmental, analytical, and geotechnical data. The DBMS will consist of primary data tables that store the environmental data, dependent tables that store more details related to the data in the primary tables, and look-up tables that store valid values to provide input to the primary tables. The EIS will maintain the table content and the PDL will manage it.

Valid values are critical to any large relational database. Tables 2 and 3 provide examples of valid values for the Navy CLEAN and Joint Venture Programs' sites, stations, and samples. Inconsistencies in naming conventions, subtle analyte or method spelling differences, and the use of non-standard abbreviations can result in lost data and incorrect conclusions. Most tables and forms in the program database will use look-up tables for acceptable valid values and will not allow the entry of data that do not conform.

The primary purpose of managing data in a relational database environment is to ensure that each data record is unique and that the information contained within each field is consistent with conventions defined in other areas of the database. To ensure that each record is unique, a key field or fields will be identified within each data table. The VDMS Data Warehouse architecture supports this approach and eliminates the possibility of data redundancy.

NIRIS Database

All Navy CLEAN and Joint Venture data must be loaded into the Navy's own internal database system, the Naval Installation Restoration Information Solution (NIRIS). NIRIS is a web-based centralized database that has been implemented across all Naval Facilities Engineering Command (NAVFAC) offices and will be used by the Navy and contractors to manage, evaluate, and visualize data, documents and records for Navy and the Marine Corps sites. NIRIS manages all Environmental Restoration Program (ERP) analytical and spatial data, which includes the Munitions Response and Installation Restoration Program (IRP) data, ensuring institutional memory is preserved, land use controls are maintained, and remedial actions are effective.

CH2M HILL will use the SNEDD Approach to VDMS system to track, collect, review, and prepare Navy-related sample and project data for loading into NIRIS. Project data stored in the

VDMS Data Warehouse must be consistent and comparable with data that is loaded and stored within NIRIS. As such, all associations between VDMS and NIRIS valid values, output reports, and data tables will be tracked and maintained.

4.1.2 Data Security Procedures

Some SNEDD Approach to VDMS applications and data are stored in a secure location with login and password protection. Authorized users will have logins and passwords in advance. The PDL will provide security access to these tools. Access2003 must be installed on the computer that the user will be using to run these applications, and proper licenses distributed. Files received from any subcontractors will be scanned for common viruses using industry standard, current virus protection programs. The file servers storing the data must be running current virus software, with automatic virus signature updates.

NIRIS data are stored in a secure location with login and password protection. Users who require access to NIRIS and the data contained therein will need to follow procedures outlined in the SOP Access to NIRIS to procure security certificates, training, and access rights to installation-specific data. Authorized users of NIRIS will be assigned logins and passwords maintained by the Navy. For further information on NIRIS or obtaining NIRIS access, consult with the Critigen Lead or PDL.

4.1.3 Data Backup and Recovery

All project data management files will reside on CH2M HILL's terminal server, "Gaia," and will have a tape backup or equivalent created in accordance with CH2M HILL's network server management policy.

4.2 Sample Collection and Management

Sample control during the sampling phase is required to ensure the integrity of the associated data. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented using field logbooks and a Chain of Custody (COC). When custody of a sample is transferred from one party to another, the recipient of the sample assumes responsibility for maintaining control of the sample and documenting that control on the COC. Figure 4 shows the process for planning and executing field sampling events.

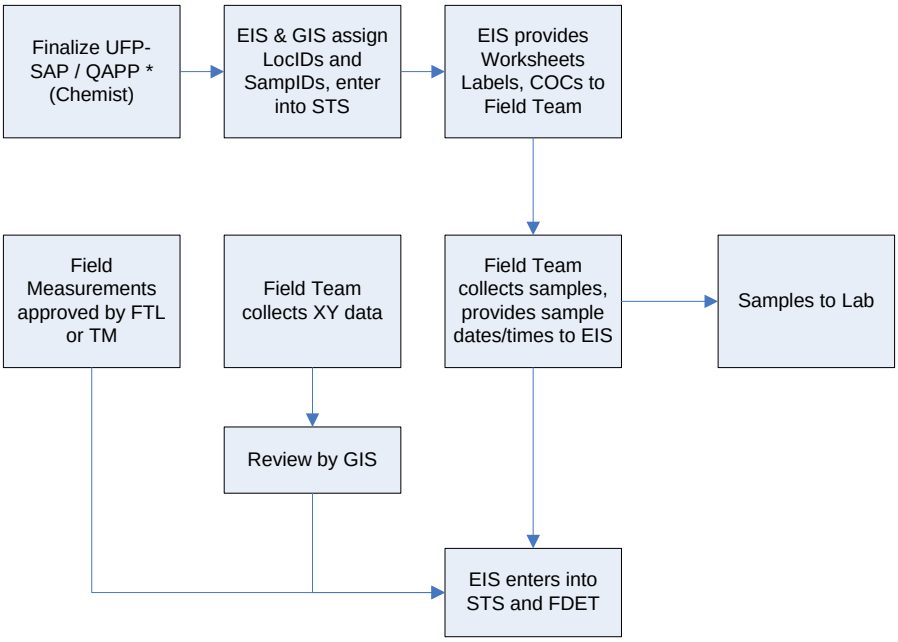


FIGURE 4
FIELD SAMPLING

4.2.1 Sample Tracking Sheet

During the planning stage, the PM specifies the data requirements for the sampling event. The work plan or similar document will provide project-specific data requirements for a given sampling event. The Project Chemist (PC) is responsible for reviewing the Sampling and Analysis Plan and ensuring that the FTL is aware of the number of field and laboratory QC samples required for the sampling event (trip blanks, equipment blanks, field blanks, field duplicates, matrix spikes, and matrix spike duplicates). All of this information is to be entered into the STS.

The STS will be used in advance to identify sampling container and preservation requirements, identify analytical laboratories for samples, aid in the generation of labels for sample bottles before the sampling event, and prepare COC forms after sampling is complete.

4.2.2 Sample Nomenclature Guidelines

The following guidelines are provided for sample nomenclature, COC clarification, and eData expectations.

Station ID (Location)

Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides a key in a database to which any samples collected from that location can be linked to form a relational database structure.

Before beginning fieldwork, the FTL will review the proposed level of effort and coordinate a list of unique station identification names, or station IDs, with the PDL or EIS. The FTL will be

responsible for enforcing the use of the standardized ID system and agreed upon station IDs during all field activities.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, station type, sequential station number, and possibly an additional qualifier as needed. The naming scheme to be used for the identification of a sampling station is documented in Table 2.

For example, if the first sample location at next month's event within Yorktown Site 30 is at a soil location, then the location ID could possibly be YS30-SO391 because that was the next available sequence number for soil locations. This should also be reflected in the Sample ID. QC and IDW station IDs must be established for each site that they are associated with.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a station is mislabelled and ensure there are unique identifiers for every sampling location. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample ID

Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the FTL will review the proposed level of effort and coordinate a list of unique sample identification names, or sample IDs, with the PDL or EIS. The FTL will be responsible for enforcing the use of the standardized ID system and agreed upon sample IDs during all field activities.

Each sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, sample/station type, sequential station number, modifier (as needed), depth (as needed), date, and date modifier (as needed). The naming scheme to be used for the identification of samples is documented in Table 3.

The standardized ID system will identify all samples collected during sampling activities. The system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. For example, a surface soil sample collected from station YS30-SO391 reference above in June of 2009 will result in a sample ID of YS30-SS391-0609.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a sample is mislabelled and ensure there are unique identifiers for every sample. Required deviations to this format in response to field conditions will be documented in the field logbook.

Navy Clean		
First Segment	**Second Segment**	
Facility, Site Number	Station Type	Station Number, Modifier
AA,ANN	AA	NNN_A
Notes: "A"= alphabetic "N"= numeric		

Facility:

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU Number – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG = Background locations (inside base)

QC and IDW Stations
Site ID (First Segment) followed by –QC or -IDW

Station Type:

AGT = Above Ground Tank
AS = Ash
BH = Borehole
CO = Concrete
DP = Direct Push
DR = Drill Rig
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IDW = Investigative Derived Waste
IW = Injection Well
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
QC = Quality Control
RK = Rock
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location
SP = Seep
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
SWS = Surface Water Body (for SW and SD)
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Station Number (i.e., 01, 02, 03…)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well

Example Station IDs:

YS01-DP02 = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1
CHR05-MW02S = Shallow monitoring well location 2, at the Cheatham Annex facility, Range 5.
NMBKL-SD02 = Background sediment location #2 located outside of NNMC
CHBS03-SO05 = Soil location #5, located in reference area outside of Site 3 in Cherry Point
VEW04-QC = QC Station at East Vieques SWMU-4
CAA08-IDW = IDW Station at Cheatham Annex AOC-8

TABLE 2

STATION ID SCHEME

Navy Clean			
First Segment	**Second Segment**	**3rd Segment**	**Fourth Segment**
Site ID Facility, AOC Number	Station/Sample Type, Station Number, Modifier	Depth (As Needed)	Date (MMYY) $_A$
AA,ANN	AANNN$_A$	A	NNNN$_A$
Notes: "A"= alphabetic "N"= numeric			

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG Background locations (inside base)

Sample Type:
AGT = Above Ground Tank
AH = Air - Headspace
AS = Ash
BH = Borehole
CO = Concrete
DR = Drill Rig
DS = Direct Push—Soil
DW = Direct Push—Groundwater
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IW = Injection Well
LF = Free Product
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
RK = Rock
SW = Surface Water
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SB = Subsurface Soil
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location (Composite)
SP = Seep
SS = Surface Soil
SSD = Subsurface Sediment
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Number (e.g., 001, 002, 003)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well
P = Duplicate

Depth:

Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C…

Sample Number:

1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. AB01-MW11P-0506

2. MS/MSD Samples – Append a modifier of '-MS' for matrix spike or '-SD' for matrix spike duplicate to the end of the sample ID.

3. QC & IDW Samples (Blank Samples & Waste Char.) - Format consists of Facility, AOC Number, Qualifier Code, Sequential Qualifier Number-Date (AAANN-AANN-MMDDYY). E.g. LSA05-TB02-061106

Qualifier Codes:
TB = Trip Blank
FB = Field Blank
EB = Equipment Blank
WQ = Source Blank
WS = Waste Char. Soil
WW = Waste Char. Water

4. Drill Rig Samples – Format consists of Facility, AOC Number, Station Type, Station Number, Date. E.g. YS12-DR02-020507

5. Multiple samples - Should multiple samples be collected from the same location in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C…

Example Sample IDs:

WNA01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at the Washington Navy Yard facility.
PIW01-SW023P-0306 = Pineros Island duplicate surface water sample collected at location 23, at SMWU-1 in March 2006.
SSW06-FB01-061106 = The first field blank collected on June 11, 2006 at SMWU-6 in Sabana Seca.

TABLE 3

STATION ID SCHEME

4.2.3 Sample Collection

A photocopy of each field logbook page completed during sampling and of each COC will be made by the FTL and forwarded to the EIS at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

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

4.2.4 Chain-of-Custody

A single COC number per laboratory / cooler should be generated each day (there can be multiple pages to one COC number). MSs and MSDs will be requested at a set frequency for each project (usually one per 20 samples collected). MS and MSD samples should not be taken from field duplicates (FDs) or field blanks. FDs will be requested at a set frequency for each project (usually one per 10 samples). FDs should not be taken from MSs, MSDs, or field blanks. The MS and MSD samples listed on the COC should be spiked and analyzed by the laboratory.

A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made to the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter.

4.2.5 Sample and Document Tracking

The STS will be updated with sample collection and tracking information, and kept current throughout the data management process. All samples collected, resulting deliverables, and deliverable dates will be tracked throughout the data management process to ensure that the project schedule is met and subcontractor invoices are evaluated correctly.

All documentation acquired during the data management process, including Statements of Work (SOWs), Bids, COCs, Field Notes, Sample Tracking Sheets, Login Reports, Corrections-to-File Letters, FDETool QC tables, Post Load Reports, Invoices, and Communication Logs shall be compiled throughout the process to be stored in the appropriate Activity's Project Notebook.

4.2.6 Field Data

Once the field data and samples are collected, necessary field measurements, such as water levels and other data collected in the field should be entered into the FDETool. Any data entered into the FDETool must be exported into an excel file to facilitate a manual QC review of the data. The correction of any anomalies should be verified with the PM and PC. The information entered into the FDETool will be linked with related analytical data reported in the SNEDD within the SVMTool. Field data and laboratory analytical data are linked by sample ID and date/time. This allows verification analytical results for all samples have been received and reported by the laboratory.

4.3 Laboratory Analysis

Figure 5 shows the laboratory analysis process. Upon receipt of samples from the field, the laboratory will verify that the COC forms correctly identify and detail all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged in by the laboratory using information from the COC forms and the project instructions.

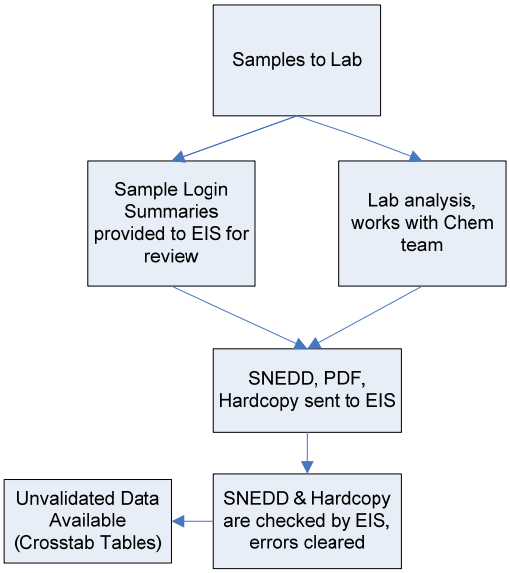


FIGURE 5
LABORATORY ANALYSIS

Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the EIS. Login summaries detailing all samples and analyses received by the lab should be provided daily to the EIS for review. All discrepancies should be corrected to ensure that all samples are analyzed as per project instructions.

The SNEDD-QC-Tool is used to QC the laboratory's SNEDD. Before the laboratory analytical data is formatted into data tables or sent for validation, the laboratory SNEDD must be processed through CH2M Hill's SNEDD-QC-Tool Microsoft Access database application. The SNEDD-QC-Tool includes several automated diagnostic checks to verify format and content compliance with SNEDD specifications.

- The analytical laboratory may, at their discretion, utilize the tool to QC and correct any errors before transmitting the SNEDD to CH2M HILL. The laboratory will forward the checked SNEDD and a hard copy of the data to the EIS, who will manage the SNEDD verification process.
- Upon receipt at CH2M Hill, the EIS will check the SNEDD using the SNEDD-QC-Tool to verify correct format and content. If errors are found, the laboratory will be notified of the errors, and the SNEDD corrected.

The laboratory will attach the signed COCs to their hard copy data deliverables to officially relinquish control of the data back to the Environmental Contractor within the specified turnaround time. Data archiving forms will be generated and affixed to each laboratory report received per Sample Delivery Group (SDG) for cataloguing, tracking, and archiving purposes.

Hard copy data and SNEDDs will be reviewed to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 10% comparison between the hard copy and SNEDD content will be conducted to ensure consistency, resolve discrepancies, and document data error issues (for example, EDD re-submissions, turnaround time problems, hard copy incompleteness). All detected errors should be resolved with the laboratory.

These checks ensure the consistency and the validity of the SNEDD and hardcopy content before the data are reported in preliminary tables or sent for validation. The objective of using the SNEDD-QC-Tool is to ensure that the validation process is performed on consistently high-quality data and minimize the chance of finding data errors later in the validation process, which would require the laboratory to resend corrected data and start the validation process over again.

Preliminary raw and detects tables will be generated from data reported in the SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4 Data Validation

Once the preliminary data verification is complete, the PC is notified by the EIS that the data is available for validation. The PC will notify the data validator in advance of when to expect data and of any samples or analyses that should not be validated (i.e. grain size should not be validated). For internal data validation, the EIS will notify the PC of data availability, and provide the hardcopy data and a QC Association Table.

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

4.4.1 External Data Validation

For external data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the data validator. The PC will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

Data Validators will provide the following materials to the PC within the required turn around time:

- Hardcopy Data Validation Report
- Validated Version of the SNEDD (external validation)

Once returned to CH2M HILL, the SNEDD will be run through the SNEDD-QC-Tool, which includes automated diagnostic checks for validated data to verify format and content compliance with SNEDD validation specifications. The PC will review the validated data to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the SNEDD. All detected errors should be resolved with the data validator.

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

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.2 Internal Data Validation

For internal data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the PC.

The PC will evaluate QC information, associated validation logic, and apply qualifiers to data in the SNEDD and on the laboratory Form Is when QC criteria are not achieved. Qualifier criteria will be based on the Quality Assurance Project Plan. A hardcopy data validation report will be generated. Data archiving forms will be generated and affixed to each Data Validation Report per SDG validated for cataloguing, tracking, and archiving purposes

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.3 Unvalidated Data Preload Check

Occasionally, unvalidated data will need to be loaded into the database. Although the data will not be validated, it will undergo a basic Preload Check by the PC to ensure laboratory compliance with project guidelines and determine results to be reported as the best result where multiple runs were conducted for a given sample/analysis. The PCL will provide input and oversight to ensure that data flags are applied correctly by the PC.

4.4.4 Senior Review

The PCL will verify that the final SNEDD and hardcopy data are complete and acceptable. Any identified discrepancies will be resolved with the assistance of the PC, EIS, laboratory, or validator as needed.

4.5 Data Preparation and Loading

Once the data are considered final and approved by the PCL, they are exported from the SNEDD to the project Data Warehouse. Field and laboratory data are merged into a format that is amenable to the warehouse. The backbone is a SQL-server-based data warehouse.

4.5.1 Data Preparation

As part of the normal process of loading data into the warehouse, data standardization tasks must be completed. A Database Specialist (DBS) will load data into the warehouse using the following three programs: SNEDD-QC-Tool, SVMTool and CH-IMPTool.

A final QC of the data reported in the SNEDD is conducted with the SNEDD-QC-Tool. Any identified discrepancies will be resolved with the assistance of the PCL, PC, or EIS as needed. SNEDDs that pass all of the QA/QC checks in the SNEDD-QC-Tool are then processed with the SVMTool.

The SVMTool links the field data contained in the FDETool to the analytical data contained in the SNEDD. A series of logical QC checks are run to ensure that all data links correctly minimum data requirements are met. The tool then merges the data into a format compatible with the data warehouse structure.

4.5.2 Data Loading

CH2M HILL Loading

The CH-IMPTool runs an additional series of QC checks and adds project-specific formatting, and loads the data into the warehouse. The following tasks need to be completed to load the data for project use:

- **Unit Standardization:** Analytical units and the associated results, reporting limits, and method detection limits will need to be converted to a consistent set of units as required by the project.
- **Resolve Reanalysis and Dilutions:** All samples that had an associated reanalysis or dilution run by the laboratory must have all of the excluded or rejected results marked as not the best result for reporting.
- **Resolve Analytical Overlap and Split Samples:** Analytical overlap occurs when a sample is analyzed by two or more methods that report the same analyte. To resolve any issues not previously resolved, the following logic is used to select the usable result:
  - If the overlapping results are all non-detections, the lowest non-detection result is selected.
  - If the overlapping results are all detected, the highest detected result is selected.
  - If the overlapping results consist of a mixture of detections and non-detections, the highest detected result is selected.

When data are loaded into the warehouse, an automated script will run to identify the “best” result when more than one analytical result exists.

NIRIS Loading

All Navy CLEAN and Joint Venture data must be loaded into NIRIS. Following the successful loading of data into the data warehouse, the DBS will use the FDETool and ALPTool to generate project NIRIS Electronic Data Deliverables (NEDD) files. Field-related NEDDs will be generated from the final version of the FDETool. The final version of the project SNEDD will be processed through the ALPTool to generate the analytical NEDD.

The DBS will use NIRIS's Data Checker Loader Tool to QC and submit the project NEDD files into NIRIS. The NIRIS Regional Database Manager (RDM) will load the data into NIRIS, and will work with the DBS to resolve any potential issue that may arise during loading. Following notification of successful data loading from the RDM, the DBS will query the data from NIRIS for review to ensure data integrity and accuracy.

4.5.3 Data Warehouse

The data warehouse is a Microsoft SQL Server 2005 relational database. This database, and all other "CH" tools used, has a data structure designed to achieve compliance with the Environmental Restoration Program Information Management System (ERPIMS) standard specified by Air Force Center for Engineering and the Environment (AFCEE). ERPIMS is an effective, comprehensive standard for environmental management.

The warehouse will use valid value tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, analyte names, units. These reference tables are critical for maintaining the completeness and accuracy of data sets and are essential for accurate querying of the data.

Data are loaded and stored so that relationships among categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and collection, analysis, and reporting tools used in the DBMS are designed to enforce, for any project data record, entries in fields that refer to other types of data as required by the overall data model.

4.6 Data Reporting

Data reporting includes the following tasks:

- Retrieving data from the data warehouse for project deliverables, data visualization, or consumption by third parties
- Reviewing initial data and producing data queries and draft reports to dissect and disassemble the data
- Producing any requested client and regulatory agency data deliverables

Data for project deliverables, data visualization, or consumption by third parties will be retrieved from the warehouse, and will be equivalent to the real-time state of the project repository database. PMs and GIS Analysts (GAs) will work with the EIS and PCL for quality queries and data for reports.

4.6.1 Tables, Figures, and Diagrams

Once the data have been sufficiently analyzed, the list of requested data reports (tables, figures, diagrams) can be developed and finalized by the project team and submitted to the PCL and PM for review.

All requests for figures or graphics are to be directed to the GA assigned as the Point of Contact (POC) for that particular Navy installation. All requests for analytical data (crosstab tables, data dumps, third party deliverables etc) should be directed to the EIS assigned as the POC for that particular Navy installation. The EIS will generate a data deliverable from the data warehouse

or NIRIS (as needed) suitable for end use and will provide data support to the end user. All requests for data statistics and calculations should be directed to the Risk Assessor assigned to the project.

4.6.2 GIS

The Navy CLEAN program will utilize ESRI's suite of GIS software for the majority of GIS-related tasks. The GIS data model will consist of one or more geodatabases (GDBs) per installation. Each installation will maintain one common installation GDB, which will store the common infrastructure data such as buildings, roads, topography, hyrdography, utilities, etc. The common installation GDB should adhere, as much as possible, to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) data model. All project specific GDBs shall be developed and named for ease of interpretation by the GA.

All station location information for each installation will be pulled directly from the data warehouse and stored in the common installation GDB as a data table. The data warehouse must contain valid coordinate information for the locations to be displayed correctly. Valid coordinate information will be maintained in the data warehouse by the EIS, and updated as necessary by the DBS.

ESRI's ArcMap 9.3 (or the latest version available) will be utilized for spatially displaying the environmental data within maps and figures, as well as for spatial analysis. The GA will need to coordinate efforts with the EIS on all requests that require the display of environmental sample data on a map to ensure that the appropriate data is queried from the data warehouse and linked to the appropriate station location table within the GIS.

4.6.3 Site Information Management System

This is currently not being used on the Navy CLEAN and Joint Venture Programs.

SIMS is a tool for publishing data of sufficient quality from the project. However, the project data warehouse will remain the database of record for the project.

SIMS provides many standard report formats, all of which are used in conjunction with the Query Tool feature, to isolate and retrieve information. Users can generate and save their queries using a graphical point-and-click tool. Reports in a wide variety of formats also can be requested and produced.

4.6.4 Legacy Data

Legacy data are those collected from any contractor other than CH2M HILL and data collected by CH2M HILL that have not been managed in accordance with Navy CLEAN and Joint Venture Program requirements. Legacy data are commonly compiled from various electronic and hard copy sources including spreadsheets, databases, technical reports, and laboratory hard copy data reports. When working with legacy data, usability assessment must be completed for the project team to be able to use the data with confidence. In order to assess the data properly, the legacy data needs to be evaluated by skilled professionals that are familiar with the type of data being evaluated so that any errors identified in the data can be corrected when possible or qualified in a manner to reflect the limitations of the data's use.

The PM has overall responsibility for the selection for inclusion of legacy data into the data management process. The PDL and PCL will work with the PM to establish the data review

and import process, compile a comprehensive data inventory, and identify staff to facilitate data review.

The PDL and PCL will work with the EIS to determine the appropriate intermediary files and tools used to collect the data. The PDL and PCL will oversee the data review and flagging process and approve the data for upload into the Data Warehouse. The EIS is responsible for assembling the field and laboratory data in formats that facilitate data review, aid the PDL and PCL in overseeing the data review and flagging process, schedule, conversion of the data to the proper data warehouse format, and then loading the data into the Data Warehouse after approval by the PDL and PCL.

The GA, PDL, PCL, and PM have the primary responsibility for reviewing the data in their area of expertise and providing the PCL with data usability flags to be associated with each record.

SECTION 5

Project Closeout

The project completion/closeout phase includes the following:

- Archive hard copy and electronic documents
- Conduct project closeout meeting

5.1 Archive Procedures

A large variety of technical data will be generated during the field investigations. The EIS and PC will collect all hard copy and electronic data they are responsible for and verify that the incoming records are legible and in suitable condition for storage. Record storage will be performed in two stages:

- Storage during the project
- Permanent storage following project completion

During the project, CH2M HILL will store data hardcopy reports in CH2M HILL offices. Physical records will be secured in steel file cabinets or shelves, and labelled with the appropriate project identification. Electronic data will be maintained on CH2M HILL's corporate local area network servers.

Information generated from field activities will be documented on appropriate forms and will be maintained in the project file. These include COC records, field logbooks, well construction forms, boring logs, location sketches, and site photographs. In addition, notes from project meetings and telephone conversations will be filed.

Following project completion, both hard copy and electronic data deliverables will be archived. Team staff will provide all hard copies of laboratory and validation reports to the Data Closeout Coordinator to be prepped and shipped to Stone Mountain for archiving. Final laboratory SNEDDs and loading files will be provided to the PDL, to be archived on CH2M HILL's corporate local area network servers.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

5.2 Invoice Review and Approval

The EIS is responsible for tracking all data deliverables throughout the data management process to ensure that the project schedule is maintained, subcontractors comply with all required turn around times, and data provided are complete and acceptable. Following project completion, EISs are to review and provide comments on all laboratory and data validator invoices regarding data quality and schedule compliance prior to approval by the PM.

5.3 Project Closeout

At the end of each project, the PM will notify team staff of project closeout. The PM will coordinate and verify that all pertinent data has been archived. The PM may also review lessons learned, suggest process improvements, or revisions to the DMP and other project documentation as deemed necessary.

Appendix A
Environmental Data Management Work Process

Environmental Data Management Work Process

1.0 Project Planning & Setup	2.0 Sample Collection & Management	3.0 Lab Analysis	4.0 Data Validation	5.0 Data Management	6.0 Data Evaluation & Reporting
1.1 Project Setup	2.1 Sample Management	3.1 Sample Analysis	4.1 Internal Chemical Data Validation	5.1 CH2M HILL Data	6.1 Data Prep & Processing for Reporting
1.2 QAPP, SAP, DMP, DQOs Integration	2.2 Sample Collection	3.2 EDD Management	4.2 External Chemical Data Validation	5.2 Other Contractor & Legacy Data	6.2 Tabular Data Queries & Reports
1.3 Laboratory Setup	2.3 Sample Data Management	3.3 Hard Copy Management	4.3 Senior Review of Validated Data	5.3 Database Maintenance & Administration	6.3 Field Logs and Graphs
1.4 Database Setup					6.4 GIS Queries and Maps

Appendix B
Life of a Sample

A Sample's Life

Step-by-Step Outline of Navy CLEAN and JV Data Management Process, and Roles & Responsibilities

Step 1

Planning Phase

- Staffing Schedules
- Kickoff Meeting – Include the EIS & PC
- Project Instructions (PIs)
  - Sample Nomenclature provided in table
  - Reviewed by DMC (Chelsea Bennet) or Database Specialist

Step 2A

Sample Collection

- Daily collection and shipments of samples
- One COC/cooler; One FedEx slip/cooler
- Coordinate w/ EIS for tracking & Lab notification
- GPS conducted (if applicable)

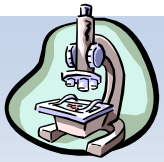
Step 2B

Sample Tracking

- EIS cross checks COC against PIs
- Also reviews lab confirmation sheets to verify all samples were received and in appropriate condition

Step 3

Lab Analysis



- Standard 28-day unless otherwise arranged
- EIS reviews data for accuracy and works with lab to resolve discrepancies
- EIS tracks schedule and keeps PM informed
- EIS inputs STSP information from Log Books
- EIS can generate Unvalidated Raw and Detects Data Tables

Step 4

Data Validation

- PC reviews all data for accuracy against the PIs
- PC sends data from lab to Data Validator
- Delays may occur if there is missing data or data is late from the lab\
- EIS can generate Validated Raw and Detects Data Tables

Step 5

Data Load

- PCL sends data to Database Specialist to be loaded into the Data Warehouse (DW)
- (Sometimes this involves assistance from PM, FTL, PC, and/or EIS)

Step 6

Quality Assurance/ Quality Control

- EIS & PC are notified that data is loaded
- EIS verifies info loaded is correct (Sample, Station, Analyses, Result)
- EIS then helps decide whether info needs to be updated or not
- File and archive all Lab and DV deliverables

Step 7

Report Generation

- Raw, Detects, Exceedance Reports
- Data Requests
- Exceedance Reports (criteria needed prior to this step and selected by PM)
- Human Health Risk Assessment
- Eco Risk Assessment

End of our Sample's Life?

- Data may be used in reports, posted on web, put into GIS, etc
- In that regard, a sample's life doesn't really ever end!
- Hopefully our sample had no exceedances and everyone is happy.

Appendix C
Standard Operating Procedures

Checklist – Archive and NIRIS Load Prep

Checklist – Data QC

Checklist - EIS Project Start-up Questions

Checklist - Generating RDE Tables

Checklist - Historic Data Cleanup

Checklist - SNEDD DM Process

Roles – Data Management Coordinator

Roles – EIS

Roles – Project Manager

Template – STS & QC Association Table

SOP-114 - CHIMPTool

SOP-126 - XTab Reports Tool

SOP - Access to NIRIS

SOP - Cherry Point Exceedance Formatting Wizard

SOP – CLEAN SNEDD Loading with CHIMPTool

SOP - Corrections to File

SOP - Data Archiving Procedures

SOP - Data Shipping

SOP – FDET

SOP – FDET Setup

SOP – NIRIS Importer Validator Tool

SOP – SVMTool

SOP – Valid Value Setup

Appendix D
Electronic Data Deliverable Specifications

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office, not including dashes. Found on Statement of Work. (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012, TO-54 = TO54)
Phase	A8	NR	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)
Installation_ID	A20*	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20*	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15*	R	NIRIS code for the analytical method category (e.g. PCHAR)
Lab_Code	A10*	R	CH2M HILL Code assigned to the laboratory (e.g. COMP)
Lab_Name	A50*	R	The name of the laboratory that conducted the analysis, in all CAPS.
Leachate_Method	A16*	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	R	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)
Extraction_Method	A16*	RA	Code for the extraction method used on sample. (e.g. FLTRES)
Result_Type	A16*	R	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	R	Code for Laboratory Sample (MS, MSD, LBLK, LCS)
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)
QC_Level	A16*	R	QC Level of data package : EPA levels I to IV. (e.g. 3)
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/2007 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab (in 10 characters). (e.g. 03/24/2007)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. Req'd if sample was leached and/or Leachate Method provided. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock, with 8 characters. (e.g. 14:30:05). Req'd if sample was leached and/or Leachate Method provided.
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample. Req'd if Extraction Method provided.
Extraction_Time	HH:MM:SS	RA	Time of day lab extracted the sample. Use 24 hour clock, with 8 characters. Req'd if Extraction Method provided. (e.g. 02:15:00)
Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock, with 8 characters.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Dilution	N10,2	R	Dilution factor used. Default value is 1 (e.g. 10)
Run_Number	N4	R	Number distinguishing multiple or repeat analyses by the same method (incl. RA, RE, DL, etc). Must be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A55*	R	The name of the compound being analyzed.
Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)
Lab_Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.
Validator_Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.
Analysis_Result_Type	A4*	R	Type of analysis performed (allowed: SURR or TRG).
Result_Narrative	A120	RA	Additional information or comments associated with the result.
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria and upper/lower accuracy included. (e.g. CLPA)
QC_Accuracy_Upper	N6,3	RA	Upper QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 25.45)
QC_Accuracy_Lower	N6,3	RA	Lower QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 10.15)
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.
QC_Narrative	A120	RA	Leave blank for Validator. Enter DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit
Detection_Limit	N18,7	RA	Reported Detection Limit
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.
Validator_Name	A50*	R	Leave Blank. Name of Validator in all CAPS. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.