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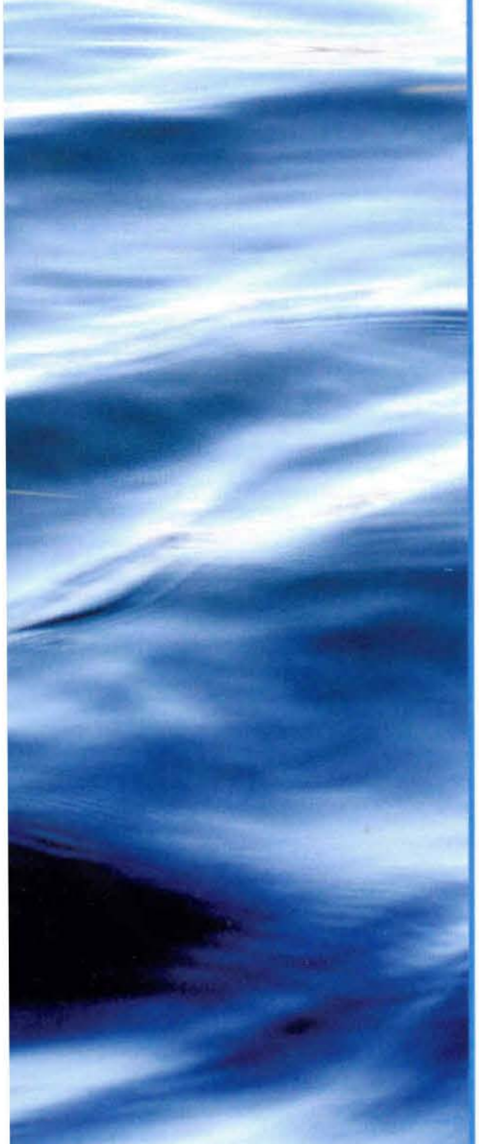
FINAL TIER II SAMPLING AND ANALYSIS PLAN BASEWIDE SITE INSPECTION NRL CHESAPEAKE MD

9/1/2012

CH2M HILL



Final
Tier II Sampling and Analysis Plan

Base-Wide Site Inspection

Naval Research Laboratory - Chesapeake Bay Detachment Chesapeake Beach, Maryland

September 2012

Contract No. N62470-11-D-8012 | CTO-JU01

prepared by CH2MHILL.

Final
Tier II Sampling and Analysis Plan

Base-Wide Site Inspection

Naval Research Laboratory – Chesapeake Bay Detachment
Chesapeake Beach, Maryland

September 2012

Prepared for:
Department of the Navy
Naval Facilities Engineering Command
Washington

Under the
NAVFAC CLEAN 8012 Program
Contract N62470-11-D-8012
CTO-JU01

Prepared by:

CH2MHILL.

Chantilly, Virginia

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QC Review Signatures:	Jeff Woodward / CH2M HILL Project Manager	9/11/12 Date
QC Review Signatures:	Steve Glennie / CH2M HILL Activity Quality Manager	09/11/12 Date
Approval Signature:	NAVFAC Atlantic accepted the draft version on June 25, 2012 Janice Nielsen / NAVFAC Atlantic	Date
Approval Signature:	Nate Delong / NAVFAC Washington	09/10/12 Date
Acceptance Signature:	Kim Lemaster / MDE	Date

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Executive Summary

Introduction

This document fulfills the Preliminary Assessment (PA) portion of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process by building upon information provided in the Initial Assessment Study (NEESA, 1984) and fulfills the Site Inspection (SI) portion by determining if a site-related release has occurred that warrants additional investigation or action. The expanded site background includes the eight Installation Restoration (IR) sites and four Areas of Concern (AOCs) located at the Naval Research Laboratory–Chesapeake Bay Detachment (NRL-CBD) in Chesapeake Beach, Maryland. The IR sites and AOCs identified for investigation include:

- Site 2 – Chemical Burial Site
- Site 3 – Landfill No. 1
- Site 4 – Landfill No. 2
- Site 5 - Landfill No. 3
- Site 7 – Road Oil Application
- Site 9 – Photo processing Waste Discharge
- AOC C – Chemical Burial Site 2
- AOC D – Water Tower

During the course of the expanded historical background search regarding the eight sites and four AOCs; two sites (Sites 6 and 8) and two AOCs (AOC A and AOC B) were determined not to require further investigation and are not included in the Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP) portion of this document. The primary objective of the work described in this UFP-SAP is to determine the presence or absence of environmental impacts that may be associated with historical activities, at the six sites and two AOCs. The potential environmental impacts for each site and AOC will be assessed through collection of environmental data and evaluation of these data using a human health and ecological risk screening process. The specific SI field activities discussed herein includes collecting direct push technology (DPT) soil and groundwater samples, performing geophysical surveys, and test pitting.

CH2M HILL prepared this document under the Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC), Atlantic Division, Comprehensive Long-Term Environmental Action Navy (CLEAN) 8012 Contract N62470-11-D-8012, Contract Task Order JU01, for submittal to NAVFAC Washington and the Maryland Department of the Environment (MDE) which will serve as the lead regulatory agency. This document has been developed using the framework of the Navy's Tier II UFP-SAP. This document is prepared in accordance with CERCLA and as amended by the Superfund Amendments and Reauthorizations Act of 1986 (SARA).

CH2M HILL prepared this UFP-SAP in accordance with the Navy's UFP-SAP policy guidance, to ensure that environmental data collected are scientifically sound, of known documented quality, and suitable for the intended use. The laboratory information cited in this document is specific to TriMatrix Laboratories in Grand Rapids, Michigan and Columbia Analytical Services (CAS) in Rochester, New York. TriMatrix Laboratories was selected based upon a competitive selection process and will support all laboratory requirements for this project with the exception of hexavalent chromium analysis. CAS is a subcontractor to TriMatrix Laboratories and will support hexavalent chromium analytical requirements for this project. If additional laboratory services are requested requiring modification to the existing UFP-SAP, revised worksheets will be submitted to the Navy and regulatory agencies for approval.

This UFP-SAP contains the required elements outlined in the Navy's UFP-SAP Tier II guidance. Tables are embedded within the document and the figures are provided following the text. Historical Supporting Documentation is included as **Appendix A**, Laboratory specific information is included as **Appendix B**, the laboratory's Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) accreditations are included as **Appendix C**, and the Health and Safety Plan (HSP) is included as **Appendix D**.

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Appendices

Figures

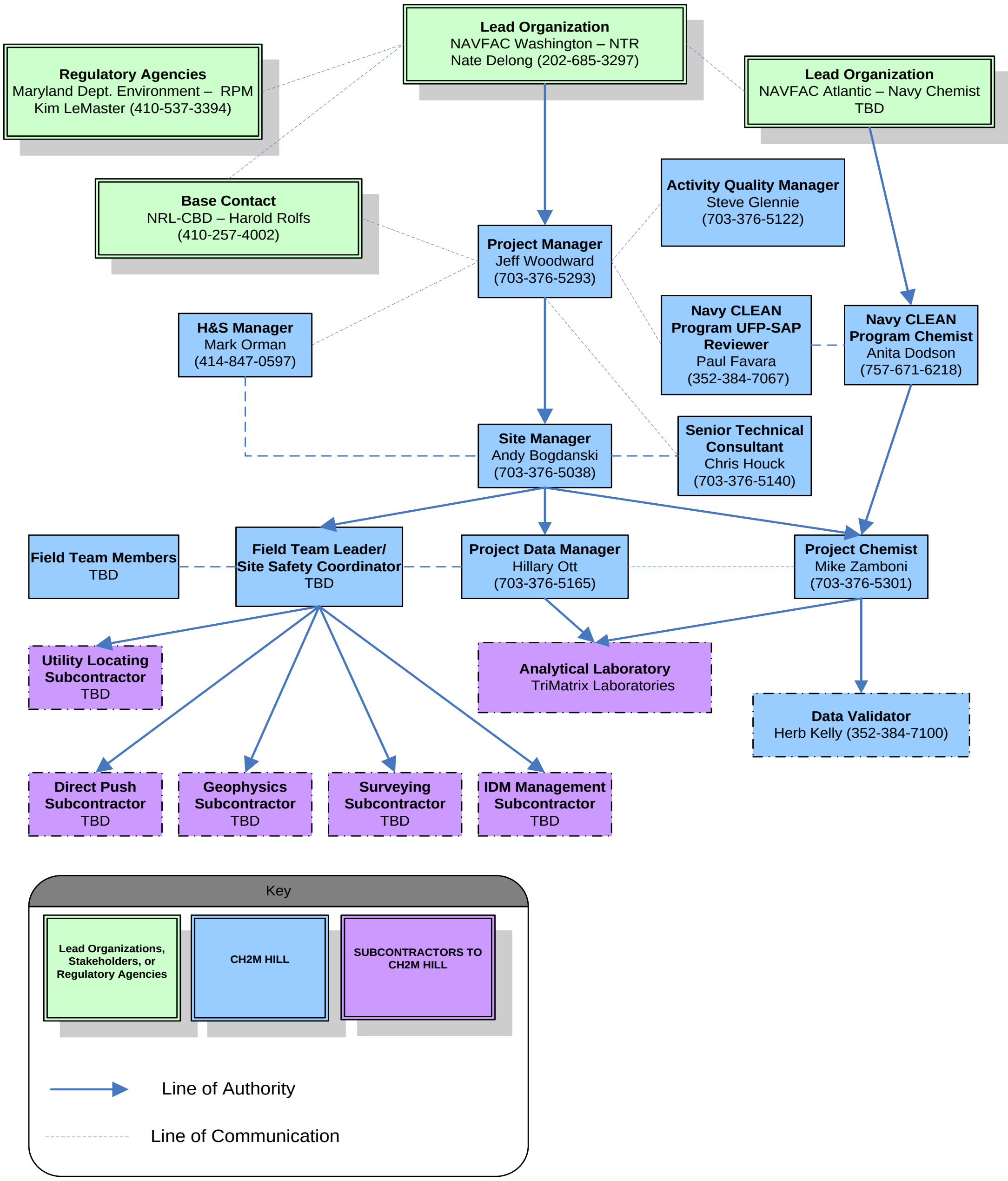
Acronyms and Abbreviations

AM	Activity Manager
amsl	above mean sea level
AOC	area of concern
AQM	Activity Quality Manager
bgs	below ground surface
CA	corrective action
CAS	Columbia Analytical Services
CBD	Chesapeake Bay Detachment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COPC	constituent of potential concern
CSM	conceptual site model
DL	detection limit
DoD	Department of Defense
DQI	data quality indicator
DQO	data quality objective
EDTA	ethylene-diaminetetraacetic
ER	Environmental Restoration
ERA	Ecological Risk Assessment
FOIA	Freedom of Information Act
ft^2	square feet
FTL	Field Team Leader
GC	gas chromatograph
GIS	Geographic Information System
GPC	Gel Permeation Chromatography
GPS	Global Positioning System
GW	groundwater
H&S	health and safety
HHRA	Human Health Risk Assessment
HSO	Health and Safety Officer
HSP	Health and Safety Plan
ICP	inductively coupled plasma
LCS	Laboratory Control Sample
LOD	limit of detection
LOQ	Limit of Quantification
MCL	maximum contaminant level
MDE	Maryland Department of the Environment
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate

NAVFAC	Naval Facilities Engineering Command
NIRIS	Navy Installation Restoration Information System
NPL	National Priorities List
NRL	Naval Research Laboratory
NTR	Navy Technical Representative
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PAL	Project Action Limit
PCB	polychlorinated biphenyl
PDM	Project Data Manager
PID	photoionization detector
PM	Project Manager
PQO	Project Quality Objective
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RPD	relative percent difference
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorizations Act
SI	Site Inspection
SOP	standard operating procedure
SRM	Standard Reference Material
SSC	Site Safety Coordinator
SVOC	semivolatile organic compounds
TBD	to be determined
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
UCL	upper confidence level
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1 Project Organization

1.1 Project Organizational Chart



1.2 Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication with Navy (lead agency)	Naval Facilities Engineering Command (NAVFAC) Washington Navy Technical Representative (NTR)	Nathan Delong	nathan.delong@navy.mil (202) 685-3297	Primary contact for NRL-CBD, can delegate communication to other internal or external points of contact (POCs), as needed. Primary contact for stakeholder agency managers, coordinates as needed. Has 30 days for Uniform Federal Policy (UFP)-Sampling and Analysis Plan (SAP) review.
Communication with Navy	NAVFAC Atlantic Navy Chemist	Janice Nielsen	janice.nielsen@navy.mil (757) 322-8339	Reviews UFP-SAP and provides input for NAVFAC Atlantic
Communication with Maryland Department of the Environment (MDE)	MDE Tier I Project Manager (PM)	Kim LeMaster	klemaster@mde.state.md.us (410) 537-3394	Primary contact for MDE; can delegate communication to other internal or external points of contact, coordinates as needed. Has 60 days for UFP-SAP review. Navy Remedial Project Manager (RPM) will notify MDE via email within 24 hours for field changes affecting the scope or implementation of the UFP-SAP. Upon notification, MDE has 24 hours to approve or comment on field changes.
Communication with NRL-DC	NRL-DC Environmental Section	David Smith	david.smith@nrl.navy.mil (202) 404-2227	Performs review of UFP-SAP
Communication with NRL-CBD	Base Contact	Harold Rolfs	harold.rolfs@nrl.navy.mil (410) 257-4002	Primary contact for NRL-CBD; coordinates as needed.
Technical communications for project implementation and data interpretation	CH2M HILL HILL Activity Quality Manager (AQM)	Steve Glennie	steven.glennie@ch2m.com (703) 376-5122	To be contacted regarding questions/issues encountered in the field, input on data interpretation, as needed Reviews the data as necessary prior to external Regulator discussion

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication regarding overall project status and implementation	CH2M HILL PM	Jeff Woodward	jeff.woodward@ch2m.com (703) 376-5293	Primary contact at CH2M HILL for Navy NTR for Site Inspection (SI) activities, can delegate communication to other internal or external POCs. Oversees the overall project status and execution. Will be informed of project status by CH2M HILL project staff on a daily basis. If field changes occur, works with AQM within 24 hours to address the change. Communicates field results and project status to NAVFAC and MDE during meetings.
Contractor and subcontractor management (with exception of lab sub), planning and identifying resources for the field investigation and reporting, and communication with the CH2M HILL field team	Site Manager/ Lead Scientist	Andrew Bogdanski	andrew.bogdanski@ch2m.com (703) 376-5038	Secondary contact at CH2M HILL for Navy NTR for SI activities. Primary contact for field team before, during and after investigation; communication back to PM, Quality Assurance Office (QAO), and Project Data Manager (PDM) as needed. Primary point of contact for PDM during post-investigation data process; coordinates as needed. Communicates with subcontractors by phone, followed up by e-mail to document decisions and actions within 24 hours. Implements project health and safety (H&S) requirements on a daily basis. Reports H&S near-misses and incidents to the PM immediately by phone.
SAP field changes and field progress reports, communications with PDM during sampling activities, daily communication with the Site Manager	CH2M HILL Field Team Leader (FTL)	To Be Determined (TBD)	TBD	Documents field activities and work plan deviations (made with the approval of Activity Manager [AM], PM, and/or AQM) in field logbooks on a daily basis. Communicates deviations to Site Manager and/or PM on a daily basis and before conducting any actions that may be affected by such communications.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication regarding overall quality of the UFP-SAP	CH2M HILL Navy CLEAN Program UFP-SAP Reviewer	Paul Favara	Paul.favara@ch2m.com (352) 384-7067	Program-level technical and quality review of UFP-SAP before release to stakeholders
H&S expectations and procedures	CH2M HILL Health and Safety Officer (HSO)	Mark Orman	mark.orman@ch2m.com (414) 847-0597	Reviews the Health and Safety Plan (HSP) prior to inclusion in Final UFP-SAP. Directs communication to/from CH2M HILL project team to ensure implementation of appropriate H&S procedures as necessary.
Field Corrective Actions(CAs)	CH2M HILL FTL and PM	TBD Jeff Woodward	TBD jeff.woodward@ch2m.com	Summary of field CAs taken will be provided to the Navy within 2 days of incident that requires field CA.
Lead discussions and inquiry regarding Human Health Risk Assessment (HHRA)	CH2M HILL Human Health Risk Assessor	Roni Warren	roni.warren@ch2m.com (814) 364-2554	Primary POC for field team before, during and after investigation for HHRA concerns. Communicates back to PM, AQM, and PDM as needed.
Lead discussions and inquiry regarding Ecological Risk Assessment (ERA)	CH2M HILL Ecological Risk Assessor	Mike Elias	mike.elias@ch2m.com (703) 376-5095	Primary POC for field team before, during, and after investigation for ERA concerns. Communicates back to PM, AQM, and PDM as needed.
Overseeing staff H&S in the field	CH2M HILL Site Safety Coordinator (SSC)	TBD	TBD	Responsible for daily safety tailgates, weekly observations, and real-time discussions of observations and changes to be implemented with field staff as needed.
Data tracking from field collection to database upload	CH2M HILL Project Data Manager (PDM)	Hillary Ott	hillary.ott@ch2m.com (703) 376-5165	Tracks data from sample collection through database upload as needed. Primary contact for laboratory QAO. Reports lab issues to the PM and Project Chemist (PC) by phone or e-mail within 4 business hours.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Management of analytical lab and data validation subs. Analytical CAs/ Release of analytical data and reporting lab data quality issues	CH2M HILL PC	Mike Zamboni	mike.zamboni@ch2m.com (703) 376-5301	Primary contact with the laboratory QAO. Analytical CAs will be identified by or brought to the attention of the PC on a daily basis. The PC will facilitate resolution on a same-day basis after consulting with the PM and QAM and the Navy Chemist (if changes in the UFP-SAP are warranted) to ensure UFP-SAP requirements are met by the laboratory. No analytical data can be released until validation is completed and approved by the PC. Communications with subcontractors shall be by phone, followed up with an e-mail to document decisions and actions as needed. Informs PM, RPM, and QAO as needed of any laboratory issues that would cause negative impacts to project delivery or would cause the project Data Quality Objectives (DQOs) to not be met.
Reporting laboratory data quality issues	Laboratory PMs	Walt Roudebush (TriMatrix) Deb Patton (CAS)	roudebush@trimatirxlabs.com (616) 975-4561 dpatton@caslab.com (585) 672-7473	Responsible for audits, CAs, checks of quality assurance (QA) performance within the laboratory, as needed.
Validation of analytical laboratory data	CH2M HILL Data Validator	Herb Kelly	herb.kelly@ch2m.com (352) 384-7100	Completes data validation of analytical laboratory data within 2 weeks of receipt of preliminary data.

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2 Project Approach

2.1 Project Planning Session Participants Sheet

Project Name: Base-Wide Site Inspection **Projected Date(s) of Sampling:** Summer 2012 **Project Manager:** Jeff Woodward/ CH2M HILL		**Site Name(s):** Sites 2,3,4,5,6,7,8,9 **Site Location:** NRL-CBD, Chesapeake Beach, Maryland		
Date of Session: February 1, 2012 **Scoping Session Purpose:** Review the sampling approach for the SI				
Name	**Title/Project Role**	**Affiliation**	**Phone #**	**E-mail Address**
Nate Delong	RPM	NAVFAC Washington	202-685-3279	nathan.delong@navy.mil
Kim LeMaster	RPM	MDE	410-537-3394	klemaster@mde.state.md.us
Jeff Woodward	PM	CH2M HILL	703-376-5293	jeff.woodward@ch2m.com
Andy Bogdanski	Staff Scientist	CH2M HILL	703-376-5038	andrew.bogdanski@ch2m.com
Dave Smith	Environmental Supervisor	NRL	202-404-2227	david.smith@nrl.navy.mil

Comments/Decisions:

The goal of this meeting was to introduce the project team, discuss the previous identified Environmental Restoration (ER) sites at NRL-CBD and to discuss and concur upon the sampling and analysis approach for the Base Wide Site Inspection to be presented in a UFP-SAP.

Eight ER sites were presented in the Initial Assessment Study (IAS) (NEESA, 1984) as environmental sites located at NRL-CBD; during additional historical research three potential AOCs were also identified. The objective of the SI is to determine the presence or absence of site-related contamination.

- MDE indicated that during the geophysical investigations it may be advisable to start grids from the outside edge of the site boundary and work towards the middle of the site in an attempt to identify the background "signature".
- NRL inquired about any historical documents regarding the building construction (Buildings 301, 307, and 314) at Site 3. CH2M HILL has not found any documentation but through talking with NRL-CBD personnel (Bill Drury) it was noted that the buildings are slab on grade and it is likely that minimal ground disruption (vertically) occurred during construction.
- MDE stated that it is important to document whether mercury was potentially released to the environment, specifically in the groundwater aquifer, and to characterize the hydrology in the area of Site 8.
- MDE recommended that during the human health and ecological risk screenings that United States Environmental Protection Agency (USEPA) Region 3 protocol is followed.

Action Items:

- CH2M HILL will provide both Tier I and Tier II UFP-SAP templates for MDE review
- MDE will review the UFP-SAP templates and provide input as to which template format is preferred.
- Following MDE input CH2M HILL will complete the UFP-SAP for Navy review with MDE review to follow.

Consensus Decisions:

- MDE will serve as the lead regulatory agency during the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at NRL-CBD
- MDE is in agreement that No Further Action (NFA) is warranted for Site 6 – Power Plant Oil Spill
- MDE is in agreement with the overall sampling approach including media to be sampled and number of locations for each of the ER sites that will be covered during the Site Inspection (SI)

2.2 Regulatory Background

This section provides an abbreviated regulatory background of the project to date. Based upon the correspondence between MDE and NAVFAC Washington the project is in the Preliminary Assessment (PA)/SI phase of work under the CERCLA process.

- December 16, 2009 – MDE letter to NAVFAC Washington (**Appendix A.1**)
  - Request for information regarding evidence of actual or potential releases of hazardous materials at the facility
  - USEPA Region 3 indication that facility does not currently warrant National Priorities List (NPL) status
  - Request for Navy to address facility accordingly (via CERCLA process)
- April 9, 2010 – NAVFAC Washington response letter to MDE (**Appendix A.1**)
  - Included available documents as attachments including:
    - ➢ The IAS which serves as a PA type document
    - ➢ The IAS is the main document for the initial facility history and identification of the eight environmental response sites on NRL-CBD
- September 22, 2010 – MDE response letter to NAVFAC Washington (**Appendix A.1**)
  - Request to perform additional activities to address PA/SI requirements under CERCLA
  - Request to coordinate with MDE (as state agency required by CERCLA)
  - Request for further investigation (e.g., unpermitted landfills)
- October 22, 2010 – NAVFAC Washington response letter to MDE (**Appendix A.1**)
  - Indication that Navy is in process of obtaining funding to conduct Base-wide PA/SI

2.3 Background and History

Based upon the correspondence between NAVFAC and MDE, the purpose of the facility background and that of the individual sites presented below is to fulfill the PA portion of the CERCLA process as requested by MDE in their September 22, 2010 letter which indicated that previous PA documentation was inadequate and was not coordinated with MDE. In general, there is limited documentation about historic activities at the eight environmental response sites and the three Areas of Concern (AOCs). Most of the historical knowledge associated with the sites is derived from the IAS conducted by the Navy (NEESA, 1984). In addition, to support the PA phase of work conducted during preparation of this UFP-SAP, historical information searches were conducted, including the review of historical aerial photographs (**Appendix A.2**) and photographs obtained from NRL-CBD (**Appendix A.3**), interviews with personnel from NAVFAC-Washington, NRL-Washington DC (NRL-DC) and NRL-CBD (**Appendix A.4**), review of documents from NRL-CBD (**Appendix A.5**) and Freedom of Information Act (FOIA) records searches conducted with MDE and USEPA Region 3 (**Appendix A.6**). A list of documents that were used to develop the facility and site backgrounds are provided in **Appendix A.7**.

2.3.1 Facility Location and Description

NRL-CBD is located at 5813 Bayside Road in Calvert County, Maryland south of the town of Chesapeake Beach, Maryland. NRL-CBD is located approximately 40 miles southeast of Washington, DC and occupies approximately 160 acres along the western shoreline of the Chesapeake Bay (**Figure 1**). The facility is bounded by the Chesapeake Bay to the east and residential housing areas to the north, south, and west. The facility is separated into an eastern and western portion, separated by Bayside Road (Maryland State Route 261).[1]

The mission of NRL-CBD is to provide and maintain facilities for use by the research divisions of the Naval Research Laboratory in Washington, D.C. for the testing, development, and evaluation of radar, radio, optical and fire control equipment, along with other research projects requiring a maritime environment or open skies, but with land-based support facilities (NEESA, 1984).

The original acquisition of land for NRL-CBD was made in 1941 and construction progressed rapidly during the war years. Major expansion occurred in 1953-54 with construction of a large laboratory building, shop facilities, and complete utility systems (NEESA, 1984).

2.3.2 Site Description and History

Site 2 – Chemical Burial Site

Site 2, also known as the Chemical Burial Site, is located on the western portion of the NRL-CBD property (**Figure 2**). The extent of the site has not been previously documented, however a historical photograph dated April 1955 (**Appendix A.3**) shows ground disturbance (e.g., clearing) at the site that corresponds to an area of 4,263 square feet (ft^2). Today the site is largely wooded and relatively flat with a maximum elevation of approximately 150 feet above mean sea level (amsl).

The chemical burial site was reportedly used as a disposal and/or burning area for chemical wastes which were generated at NRL-DC and brought to NRL-CBD. The operating dates for this site are not fully documented as the IAS only presents two disposal events, one in October 1968 and a second event from a period of May to October 1969, in which chemicals were burned and/or disposed of at the site. However, a facility drawing obtained from NRL-CBD dated January 1960 (**Appendix A.3**) shows an area coinciding with the location of Site 2 labeled as "hazardous area, buried gas cylinders, drums etc." In addition, land disturbance is shown in historical photograph as early as April 1955.

In October 1968, 400 pounds of chemicals were reportedly taken to the site and consisted of benzene, toluene, waste oil, ether, lithium hydride, acetone, alcohol, paint thinner, sulfuric acid, and nitric acid (NEESA, 1984). During the second disposal event that occurred from May to October 1969, wastes comprised of 1,200 pounds of unspecified chemicals were taken to the site. This latter disposal event corresponded to a time frame when the chemistry department at NRL-DC was consolidated, and disposal activities during this time period are therefore, not characteristic of the normal amounts of chemicals produced in a normal 5-month period at NRL-DC (NEESA, 1984). The IAS reports that memoranda from the Safety Department provided provisions regarding the establishment of burning holes (e.g., at least 4 feet deep and 6 feet square) and methods for igniting the waste material (i.e., containers should be soaked with kerosene and gasoline) (NEESA, 1984).

Site 3 – Landfill No. 1

Site 3, also known as Landfill No. 1 or "Old Junk Row", is located on the western portion of NRL-CBD, south and adjacent to the main access road (**Figure 2**). According to the IAS, the site consisted of 4 to 6 25-foot by 25-foot by 20-foot deep excavation pits occupying 3,750 ft^2 (NEESA, 1984). However, after land-filling operations ceased the

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[1] In addition to the facility at 5813 Bayside Drive, NRL-CBD also operates a boat from a small dock area (referred to as the Navy Dock) located in downtown Chesapeake Beach, Maryland (approximate address 8050 Bayside Road, Latitude = 38°41'30.05" North, Longitude = 76°32'06.00" West). The Navy Dock is approximately 1.7 miles north of the main NRL-CBD facility.

site was used as open storage during which time “best management practices” were followed, and the potential for undocumented spills remains. A photo from April 1958 (**Appendix A.3**) shows the site during the time it was used as open storage. Based on use of the site as a storage area, the current site occupies an area of 81,411 ft^2. The site is relatively flat with an approximate elevation of 125 feet amsl. The area occupying the site is currently used as maintained office space consisting of three research buildings (Buildings 301, 307 and 314) and a parking lot.

Landfill No. 1 was operational from 1942 through 1950. As previously mentioned, the landfill consisted of four to six pits and accepted three types of waste: municipal waste such as household garbage and tree trimming refuse; shop wastes such as wooden boxes, cardboard cartons, oily rags, absorbent materials, empty oil and lubricant cans, and paint sludge’s; and non-toxic laboratory waste such as paper towels, cardboard boxes, and small quantities of waste solvents (NEESA, 1984). Once the landfill was filled with refuse to within four feet of ground surface, the remaining space was backfilled with excavated soil to ground surface (NEESA, 1984). After the landfill was closed, the area on top of the landfill was designated “Old Junk Row” and used as open storage for disabled heavy equipment, demolition debris, and out-of-service laboratory equipment used in radar, sonar and optics research (NEESA, 1984). During a site visit while the IAS was being conducted, crusted and stained soils were observed in the area. In the late 1980s research buildings were constructed at the site in association with development of the Fire Testing Area.

Site 4 – Landfill No. 2

Site 4, also known as Landfill No. 2, is located on the western portion of NRL-CBD and is located west and adjacent to Site 3 (**Figure 2**). Landfill No. 2 was operational from 1950 through 1958. The IAS presents a similar site description for Site 4 as the one which was presented for Site 3 (i.e., 4 to 6 pits which were 25-feet by 25-feet by 20-feet deep) with the exception that no open storage was conducted on the site after the landfill was closed. Based on ground disturbance observed in historical photos dated March 1955 and April 1958 (**Appendix A.3**), the site boundary has been increased to encompass an area of 21,637 ft^2. Currently, the site is a relatively flat large open mowed grassy area with an approximate elevation of 135 feet amsl. During a recent site visit several small depressions were observed on the ground surface within the area of Site 4.

Site 5 – Landfill No. 3

Site 5, also known as Landfill No. 3 or “New Junk Row”, is located on the western portion of NRL-CBD (**Figure 2**). Landfill No. 3 was operational from 1958 through 1968. Similar to Sites 3 and 4, the IAS states that the site consisted of four to six pits (25-feet by 25-feet by 20-feet deep) and occupied an area of 3,750 ft^2. However, an aerial photograph dated May 1964 (**Appendix A.2**) shows ground disturbance in an area that is 56,114 ft^2 in size. In addition to the landfill pits, the IAS states that two burn pits were located on site as well. After the land-filling operations were complete, the site was designated as “New Junk Row” and used for the open storage of assorted debris consisting of rusted laboratory equipment, heavy equipment and missile packing crates. During a site visit conducted during the IAS, two empty drums with no labels were observed and areas where open burning took place were noted to have oil-stained soil patches and were devoid of grass cover (NEESA, 1984). Currently, the site is largely wooded with a grass clearing where the former access road used to be located and is relatively flat with an approximate maximum elevation of 155 feet amsl.

Site 6 – Power Plant Oil Spill

Site 6, also known as the power plant oil spill, is located on the central portion of NRL-CBD (**Figure 2**). The site reportedly originated in 1973 when a 6-inch diameter underground main supplying No. 6 fuel oil to the boiler located in Building 79 malfunctioned (NEESA, 1984). The main was reported to be 6 to 12 inches below ground surface and approximately 75 gallons of fuel oil leaked into an area 12 to 15 feet long and 2 feet wide (NEESA, 1984). Steps were taken to excavate the oil soaked soils and the broken main which generated approximately 1 cubic yard of soils (NEESA, 1984). No sampling was done to determine the extent of contamination and the trench was backfilled with a mixture of the oily soil and clean fill. While the precise location of the leak is not known, it is assumed to be located somewhere along the current path of the piping network that supplies No 4 fuel oil to Building 79 from the four adjacent above ground storage tanks.

During the scoping session for this SI UFP-SAP, MDE was in concurrence that NFA was required for this site for the following reasons:

- A CA was performed at the time of the spill (i.e., removal of 1 cubic yard of soil)
- This area continues to operate with active operations as a power plant and has an oil operations permit (Permit No. 2009-OPT-3363) with the Waste Management Administration of MDE
- The release occurred 39 years ago
- Given the relative viscous nature of fuel oil the potential for migration is limited

Therefore, Site 6 is not included in the SI phase and is not included in subsequent sections of this UFP-SAP. The NFA decision will also be documented in the SI Report.

Site 7 – Road Oil Application

Site 7, also known as Road Oil Application, encompasses the historic dirt roads located on the portion of NRL-CBD located west of Bayside Road (**Figure 3**). As shown in **Figure 3** roads from 1938, 1944 and 1952, which approximately span the years of the reported site use, were obtained from historic aerial photography (**Appendix A.2**). From 1940 through 1952, waste oils were reportedly spread twice a year on dirt roads located on NRL-CBD west of Maryland State Route 261 for use as dust control measures during dry periods (NEESA, 1984). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were also dumped in with the waste oil (NEESA, 1984). It was reported, but not confirmed, that a small volume (less than 10 pints/year) of polychlorinated biphenyl (PCB)-contaminated liquids may have also been mixed with the waste oils (NEESA, 1984). Approximately one to two 55-gallon drums per year of spent oil was sprayed onto the road surfaces during this process. Today these former dirt roads either no longer exist or they have been improved with asphalt and are used as the current base access roads.

Site 8 – Well Mercury Contamination

Site 8, also known as Well Mercury Contamination, is located on the west-central portion of NRL-CBD inside Building 81, which serves as pump house No.6 (**Figure 2**). In March 1978, it was discovered by NRL-CBD personnel that a flow meter containing mercury had discharged between 7 and 14.5 pounds of metallic elemental mercury into the line leading from the well located inside pump house No. 6 (NEESA, 1984). Following discovery of the leak, a series of steps were taken as CAs:

- The well and associated plumbing were isolated from the community water supply.
- The contaminated water was removed by flushing the entire distribution system with water from the reservoir tower several times.
- The most highly contaminated portions of the system (iron pipe area, valve pit area and the 4-inch inner sleeve of well No. 6) were cleaned using ethylene-diaminetetraacetic (EDTA) and citric acids. The wastewater that was generated during the cleaning (approximately 1,500 gallons) was measured to have mercury concentrations of 0.16 milligrams per liter (mg/L). This wastewater was then diluted to 3,000 gallons and transported to the NRL-DC facility and disposed of in a crushed lime neutralization pit under consultation with USEPA (NEESA, 1984). [2]

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[2] This site was identified as Area of Concern (AOC) A (Mercury Lime Bed) at NRL-DC and was investigation and recommended for no further action as identified in the *Facility Assessment Report, Naval Research Laboratory, Washington, D.C.* CH2M HILL. October 2008.

- Since the duration of the problem before it was discovered was unknown, personnel using the water system were tested for mercury poisoning. The test results indicated normal urine levels of mercury (about 5 micrograms per liter [μg/L] or less) in residents at CBD (NEESA, 1984).
- A program was initiated to determine:
  - The extent of the spread of elemental mercury in the community water system
  - The concentration of mercury in the water system
  - The location of the bulk of the mercury within the system (NEESA, 1984)
- Sampling of existing wells on the site (e.g., Pumphouse #7) indicated the mercury did not migrate through the aquifer (NEESA, 1984; **Appendix A.5**).
- Monitoring of groundwater extracted from the production well in pumphouse #6 was conducted for a period of eight months after the spill was detected. Mercury concentrations in groundwater were evaluated and monitoring stopped in October 1978 when statistical analysis showed the concentrations of mercury were consistently below the Federal Drinking Water Standards (2 μg/L) (NEESA, 1984).
- In addition, during the eight month period after the spill, water from the distribution system was sampled for mercury. Samples were collected from the water faucets in the residential households on NRL-CBD. Results from this sampling indicated that mercury concentrations were below the Federal Drinking Water Standards (2 μg/L), when monitoring was discontinued (**Appendix A.5**).

NFA is recommended for Site 8 based on several factors:

- The extensive effort that was performed to isolate the well from the water distribution system at the time of the spill and the multiple flushing's of the distribution system.
- Groundwater sampling for mercury was conducted for an 8 month period following the release with results indicating that mercury concentrations were below the maximum contaminant level (MCL) (2 μg/L).
- The sampling results indicated that mercury concentrations in the potable water supply from the production well and distribution system were below the MCL (2 μg/l).

It is unlikely that any mercury was released into the aquifer of the production well No. 6 based on the understanding of the release mechanism of the elemental mercury, the relatively small volume spilled, the use of the production well No. 6 for groundwater extraction, and the purging and extraction associated with the decontamination efforts performed. Site 8 will not be evaluated during the SI phase and is not included in further sections of this SI UFP-SAP. The NFA recommendation will be documented in the SI Report.

Site 9 – Photo Processing Waste Discharge

Site 9, also known as Photo-processing Waste Discharge, is associated with a photo lab that was housed inside former Building 43 (**Figure 2**). Waste water from the photo-processing lab was reportedly disposed through a drain that discharged to the ground immediately outside the building (NEESA, 1984). Recent discussions with current base personnel indicated that the former photo lab was located in the southeastern corner of Building 43. This operation reportedly occurred from the late 1950s until the early 1960s and from the late 1960s until 1975 (NEESA, 1984). The photograph laboratory was used once or twice during each year of operation, generating 10 to 15 gallons of waste solution (e.g., sodium thiosulfate, hydroquinone) per event (NEESA, 1984). For the purpose of defining a site boundary, a 20-foot boundary around the former building 43 was established, which would likely include the area of the direct discharge. The site boundary around the former building 43 is 8,486 ft^2 in size. The building has been demolished and the site is relatively level and covered with grass with an approximate maximum elevation of 128 feet amsl. The road network that surrounds the former building is still intact.

AOC A – Fire Testing Area

AOC A, or the Fire Testing Area, is a complex of buildings and structures which are located on the western portion of NRL-CBD (**Figure 2**). The fire testing area has been in use since 1968 and has undergone various improvements. The area primarily consists of a concrete testing pad on which fire extinguishing agents are tested though the open burning of petroleum products, including gasoline, diesel, JP-4, and JP-5 (NRL, 1988). Collection pits were created at the site to collect the resultant fluids from the testing procedures. The area also contains office buildings and several structures used to replicate naval ships and submarines. This area was investigated in the late 1980s and soil sampling results indicated that NFA was warranted. MDE provided concurrence with the NFA recommendation in 1989 (MDE, 1989). In 2009, groundwater associated with the site was investigated by CH2M HILL with results from the investigation indicating that NFA was recommended for groundwater (CH2M HILL, 2009). AOC A will not be evaluated during this SI and is not included in further sections of this UFP-SAP SI.

AOC B – Quarters

AOC B, or the Quarters, refers to three areas on NRL-CBD which were used as housing for officers and enlisted men. The quarters were used from the 1940s through the 1970s as residential housing for naval officers and enlisted men who were stationed at NRL-CBD. There are three distinct areas that make up the quarters:

- The Officers Quarters
- Hollow Drive Duplexes
- Quarters W (**Figure 2**)

In 2002, Michael Baker Jr. Inc. completed an *Environmental Baseline Study* for Quarters W, which indicated that there were no known CERCLA related releases associated with this area (Baker, 2002a). However, there was a concern that lead based paint and asbestos may be found at the quarters. This concern was investigated and led to the *Asbestos and Lead Based Paint Survey* report, prepared by Michael Baker Jr. Inc., which indicated that the Quarters W contained asbestos and lead based paint, while the Officer's Quarters and the Hollow Drive Duplexes only contained lead based paint (Baker, 2002b). By the end of 2011 all of the quarters were demolished and removed from NRL-CBD and the areas are now open grassy areas which have been planted with trees and shrubs. Since the structures no longer remain and no CERCLA related releases are associated with these areas, NFA is recommended for AOC B. AOC B will not be evaluated during this SI and is not included in further sections of this UFP-SAP SI. The NFA recommendation will be documented in the SI Report.

AOC C - Chemical Burial Site 2

AOC C, also known as Chemical Burial Site 2, is located on the western portion of NRL-CBD, south of Site 5 and west of Site 2 (**Figure 2**). Very little is known about the history of AOC C, but It is possible that the site history for AOC C may be consistent with the practices that were used at Site 2 (i.e. area used for chemical burial and/or burning). AOC C's site use is thought to be consistent with Site 2 since both Site 2 and AOC C are shown on the same facility drawing dated from January 1960 (**Appendix A.3**) and are labeled similarly. The extent of AOC C has been defined within an area of 8,925 ft^2 as identified on the 1960 facility drawing. In a 1963 facility drawing (**Appendix A.3**), AOC C is no longer identified and historical aerial photography from this time frame does not show any signs of land disturbance. Currently AOC C is completely wooded and shows no signs of disturbance or historical site use. AOC C will be evaluated during this SI since chemical disposal practices and potential releases at this site cannot be ruled out.

AOC D – Water Tower

AOC D, known as the water tower, is located on the western portion of NRL-CBD adjacent to Site 8 (**Figure 2**). The date of construction for the water tower is not available; however, the water tower is first shown in aerial photographs beginning in 1955 and currently remains onsite (Appendix A.3). The water tower has a reported capacity of 400,000-gallons for use as part of the potable water supply for the base. Although there are no documented releases from this area; it is assumed that the water tower likely was painted and re-coated with lead based paint several times during the time period when lead based paint was readily available. AOC D will be evaluated during this SI for lead in surface soil.

2.3.3 Site Geology

The site specific geology has not been characterized for the sites identified for evaluation in the SI (Sites 2, 3, 4, 5, 7, 9 and AOC C and D) because no previous investigations have been conducted.

NRL-CBD is located in the Atlantic Coastal Plain physiographic province. The sediments of the Coastal Plain are a thick sequence of unconsolidated sands, clays, and gravels and at times, indurated lime or iron-cemented sands (NEESA, 1984). The two primary formations which underlie NRL-CBD are the Choptank formation, which ranges from 75 to 100 feet thick, and the underlying Calvert formation, which is approximately 150 feet thick (NEESA, 1984).

The shallow subsurface geology at all of the sites is anticipated to consist of unconsolidated sands and clays typically encountered in the Choptank formation. Subsurface information collected during the SI will identify the vertical sequence and thickness of shallow unconsolidated sediments beneath each of the sites.

2.3.4 Site Hydrology

The site-specific hydrogeology of the sites identified for evaluation in the SI (Sites 2, 3, 4, 5, 7, 9 and AOC C and D) are currently unknown because no previous investigations have been conducted.

The regional hydrogeologic system of the Atlantic Coastal Plain at NRL-CBD consists of several aquifers. From shallowest to deepest, these are:

- The shallow water table aquifer
- The Piney Point-Nanjemoy aquifer
- The Aquia aquifer

The surficial water table aquifer occurs in the unconsolidated deposits of the Choptank formation and is unconfined. The Calvert formation, as one formation of the low-permeability Chesapeake Group, is beneath the shallow water table aquifer and functions primarily as a confining unit to the underlying aquifer (Piney Point-Nanjemoy). The Piney Point-Nanjemoy and Aquia aquifers are deeper, confined aquifers. The Aquia aquifer is the primary source of potable water for NRL-CBD and surrounding areas (NEESA, 1984).

The surficial aquifer is recharged by precipitation falling directly on the ground surface and infiltrating to the water table. Groundwater in the shallow water table aquifer beneath the sites is anticipated to be unconfined. The groundwater flow direction is anticipated to be to the northeast, following the surface topography, and ultimately towards the Chesapeake Bay. The surficial aquifer is not used by the facility as a water supply source. Surface drainage associated with run off at the sites is also anticipated to be to the northeast and is expected to flow into the unnamed tributary located on base (**Figure 2**).

2.3.5 Habitats and Biota

The areas being evaluated during the SI are comprised of two distinctly different habitat types. Sites 2, 5, and AOC C are comprised of wooded habitat, while Sites 3, 4, 7, 9 and AOC D are comprised of primarily mowed mixed grass habitats that are bordered by wooded habitat on one or more sides. The wooded areas are covered by mostly mature upland forest with little scrub shrub understory. The trees in the wooded areas are primarily deciduous, with some scattered stands of evergreen trees. Trees within Sites 3, 4, and 9 were removed as part of historic site activities. These areas occur within the developed portions of the sites and the seeded grasses in these areas are regularly mowed as part of site maintenance activities. Site 7 encompasses the areas bordering the roadways, and habitats within these areas are also comprised of mostly mowed mixed grass communities. The wooded onsite habitats are expected to support a variety of both lower trophic-level terrestrial invertebrate species (e.g., earthworms) and higher trophic-level birds and mammals typical of eastern deciduous woodland habitats. The mowed mixed grass communities are also expected to support lower trophic-level terrestrial invertebrates, but are expected to support a more limited range of mostly urban-adapted wildlife species that typically use mowed lawn habitats, such as eastern gray squirrels and American robin.

2.3.6 Previous Investigations

No previous investigations have been conducted at Sites 2, 3, 4, 5, 7, 9 or AOCs C and D. Site 8 has previously been investigated by the Navy as part of the clean up actions. A summary of the actions taken is documented in the *Initial Assessment Study of Naval Research Laboratory Washington D.C* (NEESA, 1984). Soils at AOC A have previously been investigated by the Navy. MDE also previously concurred with NFA for AOC A based on historical correspondence. Groundwater at AOC A has been previously investigated and is documented in the *Final Fire Testing Area Site Assessment Report, Naval Research Laboratory, Chesapeake Bay Detachment, Chesapeake Beach, Maryland* (CH2M HILL, 2009). AOC B, the Quarters, has previously been investigated by the Navy and is documented in the *Final Environmental Baseline Survey for the Naval Support Activity Washington, Quarters W Housing Area, Naval Research Laboratory, Chesapeake Beach Detachment, Chesapeake Beach, Maryland* (Baker, 2002).

Human Health Risk Assessment

No HHRA or risk-based screening has been conducted any of the sites or AOCs.

Ecological Risk Assessment

No ERA or risk-based screening has been conducted any of the sites or AOCs.

2.4 Conceptual Site Model

Because Sites 2, 3, 4, 5, 7, 9 and AOCs C and D are currently in the SI phase, much of the information contained in the conceptual site models (CSMs) is preliminary (**Figure 4a, Figure 4b, Figure 4c**). As more information is obtained, the CSM will be updated and refined.

The CSM relates potentially exposed receptor populations with potential source areas based on physical site characteristics and complete exposure pathways. Important components of the CSM are the identification of potential source areas, transport pathways, exposure media, exposure pathways and routes, and receptor groups. Actual or potential exposures of humans and ecological receptors to contaminants associated with a site are determined by identifying the most likely and most important pathways of contaminant release and transport. A complete exposure pathway has three components:

- A source of chemicals that results in a release to the environment
- A pathway of chemical transport through an environmental medium
- An exposure or contact point for a human and/or ecological receptor

It is noted that at the SI phase, the primary objective is release assessment. Therefore, it is not necessary at this stage to understand or evaluate all elements of a comprehensive CSM. For an SI, an understanding of the sources and areas most likely affected by past releases is the most important element. Further refinement of the CSM may be performed based on the findings of the SI.

2.4.1 Potential Source Areas

This section summarizes the potential source areas for each of the Sites to be investigated during the SI. The information provided is consistent with the information provided earlier in the site history provided in Section 2.2.2

Site 2

From the 1950s until the 1960s, Site 2 was used as an area for chemical burial and/or burning. Based on the history of the site, the likely potential sources of site-related constituents would be the burial and/or burning pits.

Site 3

From 1942 until 1950, Site 3 was used as a landfill for municipal, shop and laboratory wastes and after the landfill closed the site was used for storage. Based on the history of the site, the likely potential sources of site-related constituents are the disposal pits and undocumented releases during the time the site was used as a storage area.

Site 4

From 1950 until 1958, Site 4 was used as a landfill for municipal, shop and laboratory wastes. Based on the history of the site, the likely potential sources of site-related constituents are the disposal pits.

Site 5

From 1958 until 1968, Site 5 was used as a landfill for municipal, shop and laboratory wastes and after the landfill was closed the site was used for storage. Based on the history of the site, the likely potential sources of site-related constituents are the disposal and burn pits. In addition, undocumented releases from the time when the site was used as open storage may serve as a source.

Site 7

From 1940 until 1952, Site 7 consisted of unpaved roads located on the portion of NRL-CBD located west of Bayside Road. The unpaved roads were treated with waste oils for dust control. Based on the history of the site, the likely sources of site-related constituents are the former oiled roadways, which are documented to have potentially contained PCB contaminated oil.

Site 9

From the late 1950s until 1975, Site 9 contained a photo-processing lab. Based on the history of the site, the likely source of site-related constituents is the former drain pipe through which the photo processing wastes were reportedly disposed. The building and drain pipes have been since demolished and removed from the site.

AOC C

During the 1960s, AOC C may have been used as an area of chemical burial and/or burning. The likely potential sources of site-related constituents are the former burial and/or burning pits.

AOC D

Lead based paint associated with routine maintenance of the water tower conducted during the 1950s through 1970s is thought to serve as a potential source for lead which may be found in surface soils at the site.

2.4.2 Release Mechanisms and Transport Pathways

A transport pathway describes the mechanisms whereby site-related constituents, once released, may be transported from a source area to exposure media (such as surface soil) where receptor exposures may occur. The primary mechanisms for constituent transport from the potential source areas are:

- Infiltration/leaching of constituents from the potential source areas into surface and subsurface soils and/or groundwater
- Additional transport pathways may include:
- Overland flow/surficial runoff
- Suspension/deposition of particulates via wind
- Volatilization from soils

2.4.3 Human Health Exposure Pathways and Receptors

Access to NRL-CBD is restricted, however once on the facility; humans can be exposed to soil and groundwater at the individual sites. Current receptors may include adult/adolescent trespassers and visitors, and adult industrial workers exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions. Additionally, current receptors could also be exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site.

Future receptors include the current receptors. In addition, although there are no plans for redevelopment at NRL-CBD, the future receptors also include future residents and construction workers. Future receptors could be exposed to the surface and subsurface soil if future development activities occur at the site (for example, construction of residential housing or industrial buildings), or if piping or excavation work results in exposing subsurface soil. Exposure routes for future exposure to surface and subsurface soil are the same as those for current exposure to surface soil. Although shallow groundwater is not used as a water supply at the facility, as a conservative approach to evaluate potential future risks it is assumed that shallow groundwater beneath the sites could be used as a future water supply source. Potential future receptors for shallow groundwater could include future residents or industrial workers who use the water as a potable water supply. Residents could be exposed to the groundwater through incidental ingestion, and dermal contact, and inhalation of volatile emissions while showering. Industrial workers could be exposed to the groundwater through ingestion. Additionally, if shallow groundwater is within 15 feet of the ground surface, future construction workers could be exposed through dermal contact and inhalation of volatile emissions in an open excavation. Future residents could also be exposed to volatiles in indoor air associated with vapor intrusion from shallow groundwater into indoor air.

2.4.4 Ecological Exposure Pathways and Receptors

Based on the woodland and mowed mixed grass communities present on the areas being evaluated, there are potentially complete exposure pathways for lower trophic-level terrestrial receptors (primarily terrestrial plants and soil invertebrate communities) and higher trophic-level birds and mammals typical of eastern deciduous woodland and mowed lawn habitats. Potential exposure pathways for lower-trophic-level receptors primarily consist of direct exposure to chemicals in surface soil. Terrestrial plants also could be exposed to chemicals through roots during water and nutrient uptake. Upper-trophic-level receptors (birds and mammals), could be exposed to chemicals present at the areas identified for investigation via the following potential exposure pathways:

- Incidental ingestion of chemicals from surface soil while foraging or grooming
- Ingestion of chemicals that have accumulated in prey
- Direct (dermal) contact with chemicals in surface soils
- Inhalation of gaseous chemicals or chemicals adhered to suspended particulate matter

Of the potential exposure wildlife exposure pathways, the incidental ingestion of chemicals from soil and the ingestion of chemicals that have accumulated in prey (if the chemical has potential to bioaccumulate) are expected to represent the pathways of greatest potential exposure to potential wildlife receptors.

2.5 Problem Definition

Based on the historical use of Sites 2, 3, 4, 5, 7, 9 and AOCs C and D and supporting documentation, the potential presence of constituents regulated under CERCLA cannot be confidently ruled out without sample collection. Therefore, an SI is warranted to determine if a CERCLA-related release occurred at each of the sites and, if so, whether they warrant further investigation or action. The environmental questions/problems to be addressed by the SI are:

1. **Have previous historical activities at Sites 2, 3, 4, 5, 7, 9 or AOCs C and D resulted in a release of constituents to the surface soil, subsurface soil or groundwater?**

   Surface and subsurface soil and groundwater samples will be collected and analyzed to determine whether a site related release has occurred to the surrounding media. Results will be compared to project action limits (PALs). If the results exceed the PALs, a site-specific release will be suspected. An SI Report will be prepared and the appropriate path forward for the site will be discussed with the NRL-CBD partnering team. If the results do not exceed PALs, no site-specific release will be suspected, and an SI Report with a NFA Declaration will be prepared.

2. **Do the concentrations detected in soil and groundwater suggest potential unacceptable human health or ecological risks?**

   The analytical data collected during the SI will be used to conduct human health and ecological risk screenings to determine whether the concentrations of constituents detected in the soil and groundwater present potentially unacceptable human health or ecological risk. If after the risk screenings are complete the analytical data demonstrates that no unacceptable human health or ecological risks exist at the site(s) then a NFA declaration will be prepared.

3. **Do media-specific concentrations warrant further investigation or remedial action to meet the Navy's preferred objective of unrestricted land use for the sites?**

   If the results of the human health and/or ecological risk screenings indicate that a potential unacceptable risk exists that is attributable to Sites 2, 3, 4, 5, 7, 9 or AOCs C and D, further investigation or action will be taken, the details of which will be determined by the Partnering Team.

2.6 Data Quality Objectives/Systematic Planning Process Statements

Who will use the data?

CH2M HILL, in conjunction with the Tier I Partnering Team (Navy and MDE), will use the data collected during the SI.

What are the PALs?

In order to determine if constituents detected in the soil and groundwater suggest potentially unacceptable human health or ecological risks, the analytical results will be used to complete human health and ecological risk screenings. The results of the risk screenings will indicate whether further investigation and/or action is warranted. The risk screenings will be performed using the human health and ecological based PALs summarized below (the PALS are listed in **Tables B1-1** through **B1-10** of **Appendix B**):

- **Human Health -** The concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, and metals detected in soil will be compared to USEPA regional screening levels (RSLs) for residential soil to evaluate whether unrestricted land use is possible at Sites 2, 3, 4, 5, 7, 9 and AOCs C and D. The concentrations of VOCs, SVOCs, PCBs, and total and dissolved metals detected in groundwater will be compared to USEPA tap water RSLs. RSLs based on carcinogenic end points and adjusted RSLs (based on non-carcinogenic end points divided by 10) will be the PALs for the human health risk screening for soil and groundwater. If a constituent concentration exceeds the respective RSL (the PAL), the constituent will be identified as a COPC.

- **Ecological Risk -** For lower-trophic-level receptors, concentrations of VOCs, SVOCs, PCBs, and metals detected in the surface soil data will be compared to USEPA Region III Biological Technical Assistance Group (BTAG) surface soil screening values. The BTAG surface soil screening values will serve as the PALs for the ecological risk screening. The potential for chemicals to represent a possible risk to higher trophic-level wildlife will also be qualitatively screened in the SI.

- **Investigation-Derived Media** – The primary PALs for the IDM will be the concentrations contained within 40 Code of Federal Regulations (CFR) 261.24, Table 1—Maximum Concentration of Contaminants for the Toxicity Characteristic. The results of the waste characterization analyses for investigation-derived media (IDM) generated during the SI will be compared to the PALs and the disposal facility acceptance criteria for offsite disposal/treatment as appropriate.

How will the data be used?

The data will be used to accomplish the following primary objectives:

- Identify if a release has occurred to the soil or groundwater at any of the sites.
- Assess whether potentially unacceptable human health and ecological risks attributable to CERCLA-related releases are present at the sites.
  - Groundwater samples will be analyzed for total and dissolved metals to enable the project team to evaluate the concentrations of parameters which are present and available in the environment. Total and dissolved metal concentrations are compared monitoring well by monitoring well for the human health risk screening to determine if there are differences. If there is an order of magnitude difference between the concentration of total and dissolved metals in a well, dissolved metal concentrations are used for the risk calculation (consistent with EPA guidance); otherwise total metal concentrations are used.
- Provide the Navy, CH2M HILL, and MDE with sufficient information to determine whether an expanded investigation or action is necessary to achieve site closure or a remedy in place.
- Use concentration data for IDM to classify waste solids and liquids for appropriate transportation and disposal/treatment.

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

- This UFP-SAP provides details for collection and analysis of surface soil, subsurface soil and groundwater samples for Sites 2, 3, 4, 5, 7, 9, and AOCs C and D.
- VOCs, SVOCs, PCBs, and metals analysis are needed to determine concentrations of constituents in surface/subsurface soil and groundwater samples. The rationale for the sampling design, including matrices, locations, and analytical protocol, is provided in Section2.9.
- IDM samples will be analyzed for a full Toxicity Characteristic Leaching Procedure (TCLP) suite, ignitability, corrosivity, and reactivity.
- All samples will be collected in general accordance with the standard operating procedures (SOPs) listed in the Field SOP Reference Table.

How "good" must the data be to support the environmental decision?

- The field activities associated with this investigation will support an SI; therefore, the data quality must be adequate to evaluate potential risks (ecological and human health) and support risk-reducing remedial actions that may occur in the future. Ensuring data are adequate for this purpose will be accomplished by employing appropriate sampling methods, sample handling and shipping procedures, analytical protocols, identifying PALs, and validating the resulting data, including QA/quality control (QC) samples to verify proper sampling and analysis protocol. Each of these is further discussed below.
- **Data Validation** – Validation of data increases the level of confidence in a data set for a particular data use. The particular type and level of validation necessary to achieve acceptable confidence is subjective, and the appropriate type and level of data validation is not an absolute. Rather, the level of validation is specific to the data use and data user. For this SI data set, analyses for potential contaminants will be validated using guidance from the validation criteria outlined by USEPA. The validation criteria and guidance documents are listed in the Data Verification and Validation (Steps I and IIa/IIb) Process Table. These documents will help the validator create a thorough and systematic approach to the validation process. The data validator will also recalculate 10 percent of the results from the raw laboratory data, which may identify laboratory errors in identification or quantification, if present.

- **QA/QC Samples** – During the SI, QA/QC samples will be collected in the field along with the various soil and groundwater samples as a check on sampling and analytical protocol. Like data validation, the appropriate type and quantity of QA/QC samples is not an absolute. For this SI, field duplicates will be collected at a frequency of 1 per 10 field samples. Field duplicates help assess sample collection techniques and laboratory precision. Matrix spike/matrix spike duplicates (MS/MSDs) will be collected at a frequency of 1 pair per 20 field samples. The frequency is such that there is one MS/MSD pair per laboratory analytical batch. MS/MSD samples are often required by the analytical method and/or data validation guidance. Equipment blanks are collected at a frequency of one per day per type of decontaminated equipment. Equipment blanks help assess equipment decontamination techniques and identify when contamination may have been carried over from one sample location to another. It is important to maintain this equipment blank frequency to not associate too many locations with a potentially contaminated equipment blank. Field blanks are collected at a frequency of one per week and are used to assess potential contamination from ambient field conditions.
- **Data Quality Evaluation** –All data sets will undergo a DQE before the data are used to make site-specific evaluations.

How will data be used when the limit of detection (LOD) is greater than the PAL?

- The Reference Limits and Evaluation Tables present analytical methodology and limits (**Tables B1-1** through **B1-10**; **Appendix B**). In addition to listing the particular analytes, PALs, and limits, this table identifies where LODs are greater than PALs. Although this information was taken into consideration when planning analytical protocol for the site and could lead to some uncertainty, it does not prevent conclusions from being drawn with respect to the objectives of the SI for the following reasons:
  - If a particular analyte has an LOD greater than a screening level and there are sufficient other analytes in the same constituent group that would likely be detected in the event of a release with an LOD less than the screening values, then determinations for further action at the site can be made with sufficient confidence.
  - Even though some LODs are greater than the respective PALs, detection limits (DLs) are closer to and could be less than the applicable PALs. The laboratory instrumentation would likely detect a constituent if present at a concentration greater than its DL; such a result would be reported as estimated because it is less than the limit of qualification (LOQ).

How much data should be collected (number of samples for each analytical group, environmental media)?

Detailed information on matrices to be sampled, number of samples to collect, and analyses for each sample are provided in the Analytical Groups table (**Section 2.9.4**). The quantities and types of QA/QC samples are detailed in the Sample Details Table (**Table 3-2**).

The Reference Limits and Evaluation Tables section presents the constituents to be analyzed for and the associated quantitation limits (QLs) for the SI (**Appendix B**).

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

- Sampling will be performed during the SI field sampling event, tentatively scheduled for the Fall of 2012.
- All sampling will be performed in general accordance with procedures described in the SOPs listed in the Field SOPs Reference Table (**Section 3.2**).

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

- A CH2M HILL field team will collect the samples during the SI sampling event.
- Samples will be shipped for analysis via overnight courier to an offsite Navy-approved laboratory under subcontract to CH2M HILL.

- All analytical data will be submitted to CH2M HILL. Once received and reviewed by CH2M HILL, all analytical data will validated internally.
- Field data such as field observations will also be generated during the sampling event and recorded in a field notebook.
- All analytical data will be documented in the Base-Wide SI report to be prepared and submitted to the Navy as a preliminary draft for review before distribution to MDE for regulatory review and approval. The final approved report 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 CLEAN program contract. Data will be uploaded to the Naval Installation Restoration Information Solution (NIRIS) for use and archiving by the Navy. At the end of the project, paper copies of archived laboratory data and validation reports will be returned to the Navy.

2.7 Project Quality Objectives (PQOs) listed in the form of if/then qualitative and quantitative statements.

Human Health

- If site-specific data do not exceed the reference limits listed in **Appendix B**, and the data adequately identify the areas with the highest expected concentrations, then a NFA Decision Document will be prepared with regulatory approval.
- If site specific data exceed the reference limits listed in **Appendix B**, and if a more realistic evaluation of the data can be performed, as listed below, then determine if constituent level warrant further action.
  - If outcomes of the additional evaluation indicate that further action is not warranted, and the data adequately identify the areas with the highest expected concentrations, then a NFA Decision Document will be prepared with regulatory approval.
  - If outcomes of the additional evaluation indicate the potential for unacceptable human health risks and that further action is warranted, then the need for collection of background samples will be evaluated by the Navy and MDE.

More Realistic Evaluations

A more realistic evaluation for potential human health risks will be performed only if any of the maximum detected concentrations exceed the screening values. The more realistic evaluation will be a risk ratio evaluation. A corresponding risk level will be calculated 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 for soil or the tap water RSL for groundwater, presented in the USEPA RSL table. The noncarcinogenic based RSLs are not adjusted by 10 as is in the initial human health risk screening step; but they are used as presented in the USEPA RSL table to correspond to the acceptable risk level. 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.

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 constituents of potential concern (COPCs) and further evaluated. A corresponding risk value is calculated for these COPCs using the 95 percent upper confidence limit (UCL) of the mean of the data set if more than 5 samples are available. The 95 percent UCL of the arithmetic mean of the data set is calculated using USEPA's ProUCL statistical software program. 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 $5x10^{-5}$, calculated using the 95 percent UCL, the potential for unacceptable human health risks associated with exposure to the site exist. RSLs are listed in **Appendix B**.

Ecological Risk

The ERA will be conducted in accordance with Steps 1 and 2 of the 8 step ERA process as presented in USEPA 540-12-97-006, *Ecological Risk Assessment Guidance for Superfund Sites (ERAGS)* and relevant updates. Consistent with this guidance and with the level of ecological evaluation typically conducted for an SI, the ERA will first focus on completing a screening-level problem formulation and a conservative screening of ecological risk. The screen of ecological risk will compare the maximum chemical concentrations detected in abiotic media at each site to conservative literature-based ecological screening values.

- If a chemical is detected at a maximum concentration below its ecological screening value, then it will be concluded there is minimal/no potential for ecological risk and no further evaluation is warranted.
- If a potential risk is indicated by the exceedance of an ecological screening value, then it will be concluded the chemical cannot be eliminated as a potential risk to ecological receptors and additional qualitative evaluation will be completed to further characterize the potential for ecological risk. This additional evaluation is likely to include consideration of one or more of the following:
  - Size of the site and the potential for adverse effects to ecological receptors;
  - Quality and composition of the habitat present on the site and in surrounding areas, and the receptors likely to be present onsite;
  - Frequency and magnitude of screening value exceedance;
  - Spatial pattern of screening value exceedance;
  - Applicability of alternate screening values and ecological toxicity data; and,
  - Additional site-specific factors that might be relevant to assessing potential exposure (e.g., soil type, chemical fate and transport).

The results of the additional evaluation will be used in conjunction with the initial screening outcomes to draw overall screening-level conclusions about the potential for adverse effects to ecological receptors and to make recommendations about the need for additional evaluation (i.e. collection and comparison to background samples).

2.8 Field Quality Control Samples

Tables 2-1 through **2-4** provide the field QC samples.

TABLE 2-1
Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Soil, Subsurface Soil, Groundwater

Analytical Group: VOCs

Concentration Level: Medium

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

Notes:

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

TABLE 2-2
Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Soil, Subsurface Soil, Groundwater

Analytical Group: SVOCs, PCBs

Concentration Level: Medium / Low

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

Notes:

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

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

TABLE 2-3
Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Soil, Subsurface Soil, Groundwater

Analytical Group: METAL, FMETAL, Hexavalent Chromium

Concentration Level: Medium / Low

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

Notes:

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

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

TABLE 2-4
Measurement Performance Criteria Table for Field QC Samples

Matrix: Surface Soil

Analytical Group: WCHEM

Concentration Level: Low

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

2.9 Sampling Design and Rationale

2.9.1 General Approach

The general approach for investigating areas where solid waste may have been disposed (Sites 2, 3, 4, 5 and AOC C) will be based upon a multi-step approach to determine the locations of the samples to be collected. **Figure 5** presents the decision diagram for the steps to be followed during the field investigation activities to determine the soil sampling locations. If the geophysical investigation identifies areas of suspected ground disturbance (based on ground conductivity changes) and are confirmed by the test pitting; then the sampling locations will be biased around the areas of ground disturbance which are likely to represent disposal or burn pits. If no areas of ground disturbance are found during the geophysical survey then the sampling locations shall be spatially distributed across the site.

The sampling approach for Site 7 is based upon the historic dirt roadways located west of Rt. 261 up until 1952 on NRL-CBD. Two study areas were selected to represent all the dirt roads on the western portion of NRL-CBD. The study areas were based upon how the historic roads currently exist today. The first study area (Paved Study Area) consists of historic roads which currently remain at the facility and have since been improved with asphalt. The second study area (Unpaved Study Area) consists of current unpaved areas associated with historic roads which no longer exist. A series of DPT soil samples will be collected from each study area, as explained in detail below, to determine if contamination exists associated with the former dirt road network.

The sampling approach for Site 9 will be to spatially distribute the four DPT locations across the site since the exact location of the drain pipe associated with the photo lab located in the southeast corner of former Building 43 is unknown.

The sampling approach for AOC D will be to spatially distribute the four surface soil locations across the site within the footprint of the existing tower.

Site 2 and AOC C

Up to 11 soil samples (six surface soil and five subsurface soil) will be collected from six locations at each of the sites using direct push technology. Five of the locations will be co-located for surface soil and subsurface soil with an additional location for surface soil collected from the area above the “foot print” of the disposal or burn pit, if determined during the geophysical survey. If no disposal or burn pits are found during the geophysical survey then the five co-located sampling locations shall be spatially distributed across the site and the additional surface soil sample will not be collected. Soil cores will be collected continuously from ground surface to a depth of 30 feet or until groundwater or refusal is encountered, whichever occurs first. Surface soil samples will be collected from 0.0 to 0.5 feet while the subsurface soils sample will be collected from the interval which displays the greatest likelihood of contamination based upon field observations (e.g., staining, high photoionization detector [PID] readings). Groundwater at Site 2 and AOC C will be sampled from one location each. The groundwater sample will be collected from the location which, during the soil sampling, presented the greatest likelihood of contamination based upon field observations. If no signs of soil contamination are present then the soil sample will be collected from the interval immediately above the water table.

Sites 3, 4, and 5

Up to 11 soil samples (six surface soil and five subsurface soil) will be collected from six locations at each of the sites as described above. Soil cores will be collected continuously from ground surface to a depth of 24 feet. Surface soil samples will be collected from 0.0 to 0.5 feet while subsurface soil samples will be collected from the interval displaying the greatest likelihood of contamination. If no signs of contamination (e.g., soil staining, high PID readings) are present then subsurface soil samples will be collected from 20.0 to 22.0-feet below ground surface (bgs), which would be the depth interval immediately below the bottom of the landfills as reported in the IAS. Groundwater samples at Sites 3, 4, 5 will be sampled from three locations per site (i.e., a combined total of nine samples). Groundwater samples will be collected from the locations, during the soil sampling, indicated the greatest likelihood of contamination based upon field observations.

Site 7

In the paved study area, a series of 10 DPT locations will be equally spaced along the approximate 2,000-foot stretch of roadway in the study area (**Figure 6**). The paved study area is where potential impacts associated with Site 7 are most likely to be identified because the road locations are known and because the former road network was covered with asphalt, which may have prevented leaching of precipitation through the former roads. Work will be performed in the paved study area first to visually characterize the former road, which will aid in selecting samples for the unpaved study area. Soil cores will be collected from ground surface to a depth of 4 feet to identify the former roadway base. One subsurface soil sample will be collected for analysis from each DPT location from the depth interval immediately below the former dirt roadbed, as evidenced based upon field observations. If the former dirt road bed is unable to be determined then the soil samples will be collected from the bottom of the boring (i.e., 2 to 4 feet bgs).

In the unpaved study area, a series of three 40-foot long transects, each with nine DPT locations, will be established perpendicular to the direction of the historic road network (**Figure 6**). While the historic road in the unpaved study area is known to a certain degree based upon historic aerial photographs, the exact location of the roads is not visible due to potentially significant reworking of surface soils near the former roads. Soil cores will be collected continuously from the surface to a depth of 8 feet at each of the nine DPT locations along the length of each transect. The cores will be used to establish where the historic road existed based upon field observations (e.g., signs of soil staining, PID readings). Three co-located surface soil and subsurface soil sample will be collected for analysis (total of nine surface soil and nine subsurface soil samples) from along each transect that most likely represents the historic roads. If the historic road network is not able to be determined in the field then the analytical samples will be collected from the boring located on the centerline of the historic 1944 road and the next adjacent location to the north and south. Surface soil samples will be collected from 0 to 0.5 foot bgs while subsurface soil samples will be collected from the interval which displays the greatest likelihood of contamination based upon field observations. If no signs of contamination are evidenced from the field observations then the subsurface soil sample will be collected from the bottom of the boring (i.e., 6.0 -8.0 feet bgs).

Site 9

Soil cores will be collected from four DPT locations from ground surface to a depth of 20 feet or until groundwater is encountered whichever occurs first (**Figure 7**). One co-located surface and subsurface soil sample will be collected from each DPT location for analysis. Surface soil will be collected from 0.0 to 0.5 feet bgs while subsurface soil will be collected from the interval above the water table which displays the greatest potential for contamination based upon field observations. If no signs of contamination are observed then the subsurface soil sample will be collected from the depth interval directly above the water table. One groundwater sample will be collected from the DPT location demonstrating the greatest potential for contamination based upon field observations. If no signs of contamination can be discerned during the soil sampling then the presumed down-gradient location on the northeast side of the former building will be sampled.

AOC D

Four surface soils samples will be collected from a depth of 0-0.5-ft bgs within the footprint of the existing water tower structure (**Figure 8**). Subsurface soils and groundwater will not be collected as part of the evaluation at this site.

2.9.2 Sampling Rationale

The sampling rationale is based upon the contaminants that are most likely to have impacted the surrounding media based upon the reported historical site use and which may present a potential risk to human health and/or the environment. The data will be used to evaluate the presence of COPCs in the soil and groundwater at the sites. In addition, during the external project scoping session the Navy and MDE agreed that surface soil, subsurface soil and groundwater samples should be collected to evaluate the presence or absence of site related constituents, and the number of sample locations presented in this UFP-SAP were sufficient to provide coverage of the sites for the SI phase of work.

Dissolved metals associated with the groundwater sampling will be field filtered during the sample collection. The filtered samples will be collected to remove turbidity that may be introduced during sampling to provide a more representative sample of the aquifer conditions. Often contaminants will adsorb to soil particulates that are suspended in turbid water, causing the analytical results to be reported higher than what is representative of the groundwater. The results from turbid groundwater samples are often more indicative of contamination in the soil than what is represented in the groundwater. An explanation of how the filtered data will be used during the risk screening was previously presented in Section 2.6.

2.9.3 Sample Matrices

Sample matrices are limited to surface soil, subsurface soil and groundwater to determine if site related constituents have been released.

2.9.4 Analytical Groups

Analyses for the various media will consist of the following:

Matrix	Depth of Samples	Analysis	Method	Number of Samples[1]	Rationale	Sampling Strategy
Sites 2, 3, 4, 5 and AOC C						
Surface Soil	0 – 0.5 foot bgs	Target Compound List (TCL) VOCs TCL SVOCs including polycyclic aromatic hydrocarbons (PAHs), TCL PCBs, TAL metals, mercury, cyanide, hexavalent chromium*, pH, grain size, and total organic carbon	8260B 8270C/8270-SIM 8082 6010C/6020A/ 7471A/ 9014/7199 9045C/ ASTM D422 Lloyd Kahn	6	Determine if a site related release has occurred to surface soil.	Surface soil samples and subsurface samples will be collected using direct push sampling methods.
Subsurface Soil	TBD	TCL VOCs TCL SVOCs incl. PAHs, TCL PCBs, TAL metals, mercury, cyanide, hexavalent chromium*	8260B 8270C/8270-SIM 8082 6010C/6020A/ 7471A/ 9014/7199	5	Determine if a site related release has occurred to subsurface soil.	
Site 2 and AOC C Groundwater	N/A	TCL VOCs, TCL SVOCs incl. PAHs, TCL PCBs, total and dissolved Target Analyte List (TAL) metals, total and dissolved mercury, cyanide and dissolved hexavalent chromium	8260B 8270C/8270-SIM 8082A 6010C/6020A/ 7470A/ 9014/7199	1	Determine if a site related release has occurred to groundwater.	Groundwater samples will be collected using direct push groundwater sampling methods.
Sites 3, 4 and 5 Groundwater	N/A	TCL VOCs, TCL SVOCs incl. PAHs, TCL PCBs, total and dissolved TAL metals, cyanide, total and dissolved mercury and dissolved hexavalent chromium*	8260B 8270C/8270-SIM 8082 6010C/6020A/ 7470A/ 9014/7199	3	Determine if a site related release has occurred to groundwater.	

[1] The number of samples listed is per site.

Matrix	Depth of Samples	Analysis	Method	Number of Samples[1]	Rationale	Sampling Strategy
Site 7						
Surface Soil	0 – 0.5 foot bgs	TCL VOCs, TCL PCBs, TAL Metals, mercury, cyanide, hexavalent chromium*, pH, grain size and total organic carbon	8260B 8082 6010C/6020A/ 7471A/ 9014/7199 9045/ ASTM D422 Lloyd Kahn	9	Determine if a site related release has occurred to surface soil.	Surface soil samples and subsurface samples will be collected using direct push sampling methods.
Subsurface Soil	TBD	TCL VOCs TCL PCBs, TAL Metals, mercury, cyanide, hexavalent chromium*	8260B 8082 6010C/6020A/ 7471A/ 9014/7199	19	Determine if a site related release has occurred to subsurface soil.	
Site 9						
Surface Soil	0 – 0.5 foot bgs	TCL VOCs, TCL SVOCs incl. PAHs, TCL PCBs, TAL Metals, mercury, cyanide, hexavalent chromium, pH, grain size and total organic carbon	8260B 8270C/8270-SIM 8082 6010C/6020A/ 7471A/ 9014/7199 9045/ ASTM D422 Lloyd Kahn	4	Determine if a site related release has occurred to surface soil.	Surface soil samples and subsurface samples will be collected using direct push sampling methods.
Subsurface Soil	TBD	TCL VOCs, TCL SVOCs incl. PAHs, TCL PCBs, TAL Metals, mercury, cyanide, hexavalent chromium	8260B 8270C/8270-SIM 8082 6010C/6020A/ 7471A/ 9014/7199	4	Determine if a site related release has occurred to subsurface soil.	
Groundwater	N/A	TCL VOCs, TCL SVOCs incl. PAHs, TCL PCBs, total and dissolved TAL metals, cyanide, total and dissolved mercury and dissolved hexavalent chromium	8260B 8270C/8270-SIM 8082A 6010C/6020A/ 7470A/ 9014/7199	1	Determine if a site related release has occurred to groundwater.	Groundwater samples will be collected using direct push groundwater sampling methods.
AOC D						
Surface Soil	0 – 0.5 foot bgs	Lead	6020A	4	Determine if a site related release has occurred to surface soil.	Surface soil samples and will be collected using direct push sampling methods.

*1 sample from each matrix (i.e. surface soil, subsurface soil, and groundwater) will be analyzed for hexavalent chromium.

2.9.5 Sampling Frequency and Seasonal Considerations

One round of sampling will be conducted during this investigation. Sampling is currently scheduled to be performed during the summer of 2012.

2.10 Data Management

2.10.1 Analysis Tasks

The analytical laboratory will process and prepare samples for analyses and will analyze all samples in accordance with the Sample Details Table (**Table 3-2**) and the laboratory specific analytical SOPs (**Tables A2-1** and **A2-2** in **Appendix B**).

2.10.2 Quality Control Tasks

- Implement SOPs for field and laboratory activities being performed
- QC samples are described the Laboratory QC Samples Table (**Tables A3-1** to **A3-18** in **Appendix B**)

2.10.3 Secondary Data

- No secondary data will be used.

2.10.4 Data Validation, Review, and Management Tasks

- Perform database setup and management
- Perform data validation internally in accordance with the Data Verification and Validation (Steps I and IIa/IIb) Process Table
- Incorporate validated data into CH2M HILL's Data Warehouse and Geographic Information System, and the Navy's Navy Installation Restoration Information Solution (NIRIS) database.

2.10.5 Documentation and Reporting

- The fieldwork and data will be documented in the final Sites 2, 3, 4, 5, 6, 7, 8, 9 and AOC A, B, C, D SI report.

2.10.6 Data Tracking, Storage, Archiving, Retrieval and Security

- Records will be maintained and archived.

Tracking, storage, and archiving is performed by the Project Data Manager. The person ultimately responsible for all these activities is the CH2M HILL PM.

TABLE 2-5
Data Verification and Validation (Steps I and IIa/IIb) Process Table

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

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

Notes:

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

[2] Internal or external is in relation to the data generator.

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3 Field Project Implementation

3.1 Field Project Instructions

3.1.1 Pre-Field Tasks

Before fieldwork begins, utility locating, geophysical, direct-push, test pitting and land surveying subcontractors will be procured. Also, the FTL, SSC, and other field team members will be identified to complete the field sampling event.

3.1.2 Field Tasks

Applicable SOPS for project tasks outlined in this section are listed in the Field SOPs Reference Table (**Section 3.2**).

Mobilization

Following approval of this UFP-SAP, CH2M HILL will begin mobilization activities. Before mobilization, all field team members will review this UFP-SAP and the project-specific HSP. A field team kickoff meeting will be held to ensure that personnel are familiar with the scope of field activities and safety issues. Mobilization activities will include coordination with NRL-CBD personnel and the preparation of field equipment.

Utility Location

Before mobilizing the direct-push subcontractor, Miss Utility will be contacted and a dig ticket obtained. Additionally, the field team will mark all sample locations using a portable global positioning system (GPS) unit and a third-party utility locating subcontractor will mark all underground utilities and/or anomalies around the sampling locations using industry standard color coded paint or flags.

Geophysical Survey

A geophysical survey using an EM-31 will be conducted by a subcontractor for Sites 2, 3, 4, 5 and AOC C to determine if the “footprint” of the disposal/burn pits can be discerned from the surrounding site. The EM-31 was chosen based upon its ability to detect both metallic and non-metallic items in the subsurface soils. The EM-31 is capable of detecting disturbed areas to depths of 20 feet which falls within the range of depths where waste and chemicals are thought to have been placed. The survey will cover 100 percent of the sites and the geophysical transects will be spaced 25 feet apart, which is the reported width of the disposal/burn pits. The transects will be recorded with either a GPS unit or surveyed, so that data generated during the geophysical investigation can be spatially incorporated into the Geographic Information System (GIS) files. If the results from the geophysical survey indicate that potential footprint(s) for the disposal/burn pits exists then they will be marked in the field and confirmed by testing pitting.

Test Pitting

Test pits will be dug by a subcontractor to confirm the presence of waste materials if disposal/burn pits are identified during the geophysical survey. One test pit will be dug along the edge of each disposal/burn pit identified to a depth not to exceed 10 feet. During the excavation of the test pits, cover material and waste materials that are encountered will be segregated and temporarily stockpiled. Conditions regarding the soil cover (e.g., soil type, cover thickness) will be recorded in addition to subsurface information (e.g., soil type, waste materials observed). The test pit will then be backfilled first with any waste material which was encountered and then with the soil cover material. The test pits will be completed so that the surface topography is returned as close as possible to its original state.

DPT Soil Sample Collection

Soil samples will be collected through the use of a DPT rig using MacroCore samplers or equivalent with acetate liners. For Sites 2, 3, 4, and 5, the sample locations will be located based upon the flow chart in Figure 5. The samplers will be pushed to the desired depth interval (see Section 2.9.1) and retracted so that the soil cores can be logged by the CH2M HILL geologist for lithology and field observations. Analytical samples will be collected and analyzed as outlined on the Sample Details Table (**Table 3-2**). Relevant site-specific observations, onsite conditions, and sampling activities will be recorded in the field logbook as described in the SOPs. Samples will be collected in laboratory-prepared sampling containers, packed on ice, and shipped overnight to an offsite laboratory every evening.

DPT Groundwater Sampling

Groundwater samples will be collected through the use of pre-packed monitoring wells. A 10-foot section of .1-inch slotted screen will be set in the groundwater bearing zone. A groundwater sample will be collected through the use of a peristaltic pump or of similar method. Groundwater will be purged to reduce turbidity to the extent practical. If groundwater is slow to produce then the well shall be evacuated and allowed to recharge. Once the well has recharged approximately to the static water level, sample collection may begin. Groundwater samples which are required to be “field filtered” will pass through a 0.45 micron filter prior to preservation. All samples will be collected in laboratory-prepared sampling containers, packed on ice, and shipped overnight to an offsite laboratory every evening.

Equipment Decontamination

Non-disposable sampling equipment will be decontaminated before use and after each use as described in the SOPs. Equipment will be decontaminated with alternating rinses of deionized water, phosphate-free laboratory detergent, and methanol, and allowed to dry between each use. Disposable equipment, such as tubing for groundwater sampling and acetate liners for direct-push soil sampling, will be disposed of following use.

Investigation-derived Media Handling

Investigation-derived media (IDM) generated during the field sampling may include soil cuttings, purge water and solutions used to decontaminate non-disposable sampling equipment. Soil cutting generated during the DPT sampling will be returned to the borehole to the extent practical to minimize IDM. IDM will be stored in Department of Transportation-approved 55-gallon drums, at an IDM staging location, as directed by NRL-CBD. One solid and one liquid sample will be characterized for appropriate offsite disposal. IDM will be removed from the site within 90 days of generation.

GPS Locating

All sample locations (test pits and DPT soil and groundwater) shall be recorded utilizing a hand held global positioning system. The sample coordinates will be uploaded to NIRIS following completion of the investigation.

Quality Control

QC samples will be collected as outlined on the Sample Details table (**Table 3-2**).

Sample Details Table

Table 3-2 provides the details for the collection of analytical samples associated with this investigation.

3.2 Field SOPs Reference Table

TABLE 3-1
Field SOPs Reference Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of SOP	Equipment Type	Modified for Project Work?	Comments
SOP B.01	*Equipment Blank and Field Blank Preparation, reviewed 5/2011*	CH2M HILL	Sample bottles, gloves, blank liquid, preservatives	No	
SOP B.02	*Chain-of-Custody (COC), reviewed 5/2011*	CH2M HILL	Chain-of-custody	No	
SOP B.03	*Decontamination of Personnel and Equipment, reviewed and revised 5/2011*	CH2M HILL	Deionized water, distilled water, potable water, Liquinox, plastic pails or tubs, 55-gallon drum, gloves, decon pad	No	
SOP B.04	*Decontamination of Drilling Rigs and Equipment, reviewed 5/2011*	CH2M HILL	Portable steam cleaner, potable water, Liquinox, buckets, brushes, distilled water, methanol, American Society for Testing and Materials Type-II water, aluminum foil	No	
SOP B.05	*Direct-Push Soil Sample Collection, reviewed 5/2011*	CH2M HILL	Truck-mounted hydraulic percussion hammer, sampling rods, sampling tubes and acetate liners, pre-cleaned sample containers and stainless steel sampling implements	No	
SOP B.06	*Homogenization of Soil and Sediment Samples, reviewed 5/2011*	CH2M HILL	Sample containers, stainless steel spoons or spatulas, stainless steel pans	No	
SOP B.07	*Preparing Field Log Books, reviewed 5/2011*	CH2M HILL	Logbook, indelible pen	No	
SOP B.08	*MultiRAE Photoionization Detector, reviewed 5/2011*	CH2M HILL	MultiRAE, calibration gas	No	

TABLE 3-1
Field SOPs Reference Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of SOP	Equipment Type	Modified for Project Work?	Comments
SOP B.09	*Soil Sampling, reviewed and revised 5/2011*	CH2M HILL	Stainless steel trowel, shovel, scoop, coring device, hand auger, etc; stainless steel split-spoon samplers, thin-walled sampling tubes, drilling rig or soil-coring rig, stainless steel pan or bowl, sample containers	No	
SOP B.10	*Soil Sampling for volatile organic compounds (VOCs) Using the EnCore Sampler, reviewed 5/2011*	CH2M HILL	EnCore Sampler, T-Handle	No	
SOP B.11	*Locating and Clearing Underground Utilities, reviewed 5/2011*	CH2M HILL	Magnetic field methods, optical methods, ground-penetrating radar, electromagnetic induction	No	
SOP B.12	*Packaging and Shipping Procedures for Low-Concentration Samples; reviewed 5/2011*	CH2M HILL	Lab-supplied coolers	No	
SOP B.13	*Disposal of Waste Fluids and Solids, reviewed 5/2011*	CH2M HILL	DOT-approved 55-gallon steel drums or Baker tanks, funnel for transferring liquid into drum, tools for securing drum lids, labels, paint/marking pens, plastic sheets	No	
SOP B.14	*Civil Surveying, reviewed 5/2011*	CH2M HILL	Logbook, 20-second or better theodolite or transit, GPS unit, electronic distance meter	No	
SOP B.15	*Electromagnetic Induction, reviewed 5/2011*	CH2M HILL	EM-31	No	
SOP B.16	*Trenching for Landfill Delineation*	CH2M HILL	Backhoe	No	

TABLE 3-1
Field SOPs Reference Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of SOP	Equipment Type	Modified for Project Work?	Comments
SOP B.17	*Direct Push Groundwater Sample Collection, reviewed May 2011*	CH2M HILL	DPT rig, pre-packed well, tubing, peristaltic pump	Yes	A pre-packed monitoring well screen will be temporarily installed instead of the direct push groundwater screen sampler to obtain groundwater.
SOP B.18	*Logging of Soil Borings, reviewed May 2011*	CH2M HILL	Tape measure, field logbook, Munsell chart, USCS charts	No	

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TABLE 3-2
Sample Details Table

				Soil Samples										Aqueous Samples								
Navy CLEAN 8012 CTO-JU01 NRL-CBD Soil and Groundwater Sampling (Summer 2012, tentative) TriMatrix Laboratories, Inc. 5560 Corporate Exchange Ct.SE Grand Rapids, MI 49512 Walt Roudebush: (616) 975-4561 Columbia Analytical Services, Inc (HexCr Only) 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton: (585) 672-7473			**Analysis Group**	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
AOC-C																						
SS	CBD-AOC-DP01	CBD-AOC-SS01-MMYY	0 - 6 inches	X	X	X	X	X	X	X	X	X	X									
		CBD-AOC-SS01P-MMYY		X	X	X	X	X	X	X												
SB		CBD-AOC-SB01-TDBD	TBD	X	X	X	X	X	X	X												
SB		CBD-AOC-SB01-TDBD-MS	TBD	X	X	X	X	X	X	X												
SB		CBD-AOC-SB01-TDBD-SD	TBD	X	X	X	X	X	X	X												
GW		CBD-AOC-GW01-MMYY	TBD											X	X	X	X	X	X	X	X	X
		CBD-AOC-GW01P-MMYY												X	X	X	X	X	X	X	X	X
SS	CBD-AOC-DP02	CBD-AOC-SS02-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-AOC-SB02-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-AOC-DP03	CBD-AOC-SS03-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-AOC-SB03-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-AOC-DP04	CBD-AOC-SS04-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-AOC-SB04-TDBD	TBD	X	X	X	X	X	X													

TABLE 3-2 (CONTINUED)
Sample Details Table

Navy CLEAN 8012 CTO-JU01
NRL-CBD Soil and Groundwater Sampling
(Summer 2012, tentative)

TriMatrix Laboratories, Inc.
5560 Corporate Exchange Ct.SE
Grand Rapids, MI 49512
Walt Roudebush: (616) 975-4561

Columbia Analytical Services, Inc (HexCr Only)
1565 Jefferson Road, Building 300, Suite 360
Rochester, NY 14623
Deb Patton: (585) 672-7473

				Soil Samples										Aqueous Samples								
			Analysis Group	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SS	CBD-AOC-DP05	CBD-AOC-SS05-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-AOC-SB05-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-AOC-SO06	CBD-AOC-SS06-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
QC	CBD-AOC-QC	CBD-AOC-FBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-AOC-EBMMDDYY-SO	NA											X	X	X	X	X	X			X
		CBD-AOC-EBMMDDYY-GW	NA											X	X	X	X	X	X	X	X	X
		CBD-AOC-TBMMDDYY	NA											X								
Site 02																						
SS	CBD-S02-DP01	CBD-S02-SS01-MMYY	0 - 6 inches	X	X	X	X	X	X	X	X	X	X									
		CBD-S02-SS01-MMYY-MS		X	X	X	X	X	X	X												
		CBD-S02-SS01-MMYY-SD		X	X	X	X	X	X	X												
SB		CBD-S02-SB01-TDBD	TBD	X	X	X	X	X	X	X												
		CBD-S02-SB01P-TDBD		X	X	X	X	X	X	X												
GW		CBD-S02-GW01-MMYY	TBD											X	X	X	X	X	X	X	X	X
		CBD-S02-GW01-MMYY-MS												X	X	X	X	X	X	X	X	X
		CBD-S02-GW01-MMYY-SD												X	X	X	X	X	X	X	X	X
SS	CBD-S02-DP02	CBD-S02-SS02-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S02-SB02-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S02-DP03	CBD-S02-SS03-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S02-SB03-TDBD	TBD	X	X	X	X	X	X													

TABLE 3-2 (CONTINUED)
Sample Details Table

Navy CLEAN 8012 CTO-JU01
NRL-CBD Soil and Groundwater Sampling
(Summer 2012, tentative)

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				Soil Samples										Aqueous Samples								
			Analysis Group	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SS	CBD-S02-DP04	CBD-S02-SS04-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S02-SB04-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S02-DP05	CBD-S02-SS05-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S02-SB05-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S02-SO06	CBD-S02-SS06-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
QC	CBD-S02-QC	CBD-S02-FBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-S02-EBMMDDYY-SO	NA											X	X	X	X	X	X			X
		CBD-S02-EBMMDDYY-GW	NA											X	X	X	X	X	X	X	X	X
		CBD-S02-TBMMDDYY	NA											X								
Site 03																						
SS	CBD-S03-DP01	CBD-S03-SS01-MMYY	0 - 6 inches	X	X	X	X	X	X	X	X	X	X									
SB		CBD-S03-SB01-TDBD	TBD	X	X	X	X	X	X	X												
		CBD-S03-SB01P-TDBD		X	X	X	X	X	X	X												
		CBD-S03-SB01-TDBD-MS		X	X	X	X	X	X	X												
		CBD-S03-SB01-TDBD-SD		X	X	X	X	X	X	X												
GW		CBD-S03-GW01-MMYY	TBD											X	X	X	X	X	X	X	X	X
		CBD-S03-GW01P-MMYY												X	X	X	X	X	X	X	X	X
SS	CBD-S03-DP02	CBD-S03-SS02-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S03-SB02-TDBD	TBD	X	X	X	X	X	X													
GW		CBD-S03-GW02-MMYY	TBD											X	X	X	X	X	X	X	X	

TABLE 3-2 (CONTINUED)
Sample Details Table

Navy CLEAN 8012 CTO-JU01
NRL-CBD Soil and Groundwater Sampling
(Summer 2012, tentative)

TriMatrix Laboratories, Inc.
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Grand Rapids, MI 49512
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1565 Jefferson Road, Building 300, Suite 360
Rochester, NY 14623
Deb Patton: (585) 672-7473

				Soil Samples										Aqueous Samples								
			Analysis Group	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SS	CBD-S03-DP03	CBD-S03-SS03-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S03-SB03-TDBD	TBD	X	X	X	X	X	X													
GW		CBD-S03-GW03-MMYY	TBD											X	X	X	X	X	X	X	X	
SS	CBD-S03-DP04	CBD-S03-SS04-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S03-SB04-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S03-DP05	CBD-S03-SS05-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S03-SB05-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S03-SO06	CBD-S03-SS06-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
QC	CBD-S03-QC	CBD-S03-FBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-S03-EBMMDDYY-SO	NA											X	X	X	X	X	X			X
		CBD-S03-EBMMDDYY-GW	NA											X	X	X	X	X	X	X	X	X
		CBD-S03-TBMMDDYY	NA											X								
Site 04																						
SS	CBD-S04-DP01	CBD-S04-SS01-MMYY	0 - 6 inches	X	X	X	X	X	X	X	X	X	X									
		CBD-S04-SS01P-MMYY		X	X	X	X	X	X	X												
SB		CBD-S04-SB01-TDBD	TBD	X	X	X	X	X	X	X												
GW		CBD-S04-GW01-MMYY	TBD											X	X	X	X	X	X	X	X	X
SS	CBD-S04-DP02	CBD-S04-SS02-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S04-SB02-TDBD	TBD	X	X	X	X	X	X													
GW		CBD-S04-GW02-MMYY	TBD											X	X	X	X	X	X	X	X	

TABLE 3-2 (CONTINUED)
Sample Details Table

Navy CLEAN 8012 CTO-JU01 NRL-CBD Soil and Groundwater Sampling (Summer 2012, tentative) TriMatrix Laboratories, Inc. 5560 Corporate Exchange Ct.SE Grand Rapids, MI 49512 Walt Roudebush: (616) 975-4561 Columbia Analytical Services, Inc (HexCr Only) 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton: (585) 672-7473				Soil Samples										Aqueous Samples								
			Analysis Group	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SS	CBD-S04-DP03	CBD-S04-SS03-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S04-SB03-TDBD	TBD	X	X	X	X	X	X													
GW		CBD-S04-GW03-MMYY	TBD											X	X	X	X	X	X	X	X	
SS	CBD-S04-DP04	CBD-S04-SS04-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S04-SB04-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S04-DP05	CBD-S04-SS05-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S04-SB05-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S04-SO06	CBD-S04-SS06-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
QC	CBD-S04-QC	CBD-S04-FBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-S04-EBMMDDYY-SO	NA											X	X	X	X	X	X			X
		CBD-S04-EBMMDDYY-GW	NA											X	X	X	X	X	X	X	X	X
		CBD-S04-TBMMDDYY	NA											X								
Site 05																						
SS	CBD-S05-DP01	CBD-S05-SS01-MMYY	0 - 6 inches	X	X	X	X	X	X	X	X	X	X									
		CBD-S05-SS01P-MMYY		X	X	X	X	X	X	X												
SB		CBD-S05-SB01-TDBD	TBD	X	X	X	X	X	X	X												
		CBD-S05-SB01P-TDBD		X	X	X	X	X	X	X												
GW		CBD-S05-GW01-MMYY	TBD											X	X	X	X	X	X	X	X	X
SS	CBD-S05-DP02	CBD-S05-SS02-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S05-SB02-TDBD	TBD	X	X	X	X	X	X													

TABLE 3-2 (CONTINUED)
Sample Details Table

				Soil Samples										Aqueous Samples								
Navy CLEAN 8012 CTO-JU01 NRL-CBD Soil and Groundwater Sampling (Summer 2012, tentative) TriMatrix Laboratories, Inc. 5560 Corporate Exchange Ct.SE Grand Rapids, MI 49512 Walt Roudebush: (616) 975-4561 Columbia Analytical Services, Inc (HexCr Only) 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton: (585) 672-7473			**Analysis Group**	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
GW		CBD-S05-GW02-MMYY	TBD											X	X	X	X	X	X	X	X	
SS	CBD-S05-DP03	CBD-S05-SS03-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S05-SB03-TDBD	TBD	X	X	X	X	X	X													
GW		CBD-S05-GW03-MMYY	TBD											X	X	X	X	X	X	X	X	
SS	CBD-S05-DP04	CBD-S05-SS04-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S05-SB04-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S05-DP05	CBD-S05-SS05-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
SB		CBD-S05-SB05-TDBD	TBD	X	X	X	X	X	X													
SS	CBD-S05-SO06	CBD-S05-SS06-MMYY	0 - 6 inches	X	X	X	X	X	X		X	X	X									
QC	CBD-S05-QC	CBD-S05-FBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-S05-EBMMDDYY-SO	NA											X	X	X	X	X	X			X
		CBD-S05-EBMMDDYY-GW	NA											X	X	X	X	X	X	X	X	X
		CBD-S05-TBMMDDYY	NA											X								
Site 07																						
SS	CBD-S07-DP01	CBD-S07-SS01-MMYY	0 - 6 inches	X		X	X	X	X	X	X	X	X									
		CBD-S07-SS01P-MMYY		X		X	X	X	X	X												
		CBD-S07-SS01-MMYY-MS		X		X	X	X	X	X												
		CBD-S07-SS01-MMYY-SD		X		X	X	X	X	X												

TABLE 3-2 (CONTINUED)
Sample Details Table

				Soil Samples										Aqueous Samples								
Navy CLEAN 8012 CTO-JU01 NRL-CBD Soil and Groundwater Sampling (Summer 2012, tentative) TriMatrix Laboratories, Inc. 5560 Corporate Exchange Ct.SE Grand Rapids, MI 49512 Walt Roudebush: (616) 975-4561 Columbia Analytical Services, Inc (HexCr Only) 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton: (585) 672-7473			**Analysis Group**	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SB		CBD-S07-SB01-TDBD	TBD	X		X	X	X	X	X												
		CBD-S07-SB01P-TDBD		X		X	X	X	X	X												
		CBD-S07-SB01-TDBD-MS		X		X	X	X	X	X												
		CBD-S07-SB01-TDBD-SD		X		X	X	X	X	X												
SS	CBD-S07-DP02	CBD-S07-SS02-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB02-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP03	CBD-S07-SS03-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB03-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP04	CBD-S07-SS04-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB04-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP05	CBD-S07-SS05-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB05-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP06	CBD-S07-SS06-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB06-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP07	CBD-S07-SS07-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB07-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP08	CBD-S07-SS08-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB08-TDBD	TBD	X		X	X	X	X													
SS	CBD-S07-DP09	CBD-S07-SS09-MMYY	0 - 6 inches	X		X	X	X	X		X	X	X									
SB		CBD-S07-SB09-TDBD	TBD	X		X	X	X	X													

TABLE 3-2 (CONTINUED)
Sample Details Table

Navy CLEAN 8012 CTO-JU01
NRL-CBD Soil and Groundwater Sampling
(Summer 2012, tentative)

TriMatrix Laboratories, Inc.
5560 Corporate Exchange Ct.SE
Grand Rapids, MI 49512
Walt Roudebush: (616) 975-4561

Columbia Analytical Services, Inc (HexCr Only)
1565 Jefferson Road, Building 300, Suite 360
Rochester, NY 14623
Deb Patton: (585) 672-7473

				Soil Samples										Aqueous Samples								
			Analysis Group	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	**24 hours**
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SB	CBD-S07-DP10	CBD-S07-DP10-TDBD	TBD	X		X	X	X	X													
		CBD-S07-DP10P-TDBD		X		X	X	X	X													
SB	CBD-S07-DP11	CBD-S07-SB11-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP12	CBD-S07-SB12-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP13	CBD-S07-SB13-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP14	CBD-S07-SB14-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP15	CBD-S07-SB15-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP16	CBD-S07-SB16-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP17	CBD-S07-SB17-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP18	CBD-S07-SB18-TDBD	TBD	X		X	X	X	X													
SB	CBD-S07-DP19	CBD-S07-SB19-TDBD	TBD	X		X	X	X	X													
QC	CBD-S07-QC	CBD-S07-FBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-S07-EBMMDDYY	NA											X	X	X	X	X	X			X
		CBD-S07-TBMMDDYY	NA											X								
Site 09																						
SS	CBD-S09-DP01	CBD-S09-SS01-MMYY	0 - 6 inches	X	X		X	X	X	X	X	X	X									
		CBD-S09-SS01P-MMYY		X	X		X	X	X	X												
SB		CBD-S09-SB01-TDBD	TBD	X	X		X	X	X	X												
GW		CBD-S09-GW01-MMYY	TBD											X	X		X	X	X	X	X	X
		CBD-S09-GW01P-MMYY												X	X		X	X	X	X	X	X

TABLE 3-2 (CONTINUED)
Sample Details Table

				Soil Samples										Aqueous Samples								
Navy CLEAN 8012 CTO-JU01 NRL-CBD Soil and Groundwater Sampling (Summer 2012, tentative) TriMatrix Laboratories, Inc. 5560 Corporate Exchange Ct.SE Grand Rapids, MI 49512 Walt Roudebush: (616) 975-4561 Columbia Analytical Services, Inc (HexCr Only) 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton: (585) 672-7473			**Analysis Group**	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml NaHSO$_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO$_3$ to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO$_3$ to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
		CBD-S09-GW01-MMYY-MS												X	X		X	X	X	X	X	X
		CBD-S09-GW01-MMYY-SD												X	X		X	X	X	X	X	X
SS	CBD-S09-DP02	CBD-S09-SS02-MMYY	0 - 6 inches	X	X		X	X	X	X	X	X	X									
SB		CBD-S09-SB02-TDBD	TBD	X	X		X	X	X	X												
SS	CBD-S09-DP03	CBD-S09-SS03-MMYY	0 - 6 inches	X	X		X	X	X	X	X	X	X									
SB		CBD-S09-SB03-TDBD	TBD	X	X		X	X	X	X												
		CBD-S09-SB03-TDBD-MS		X	X		X	X	X	X												
		CBD-S09-SB03-TDBD-SD		X	X		X	X	X	X												
SS	CBD-S09-DP04	CBD-S09-SS04-MMYY	0 - 6 inches	X	X		X	X	X	X	X	X	X									
SB		CBD-S09-SB04-TDBD	TBD	X	X		X	X	X	X												
QC	CBD-S09-QC	CBD-S09-FBMMDDYY	NA											X	X		X	X	X			X
		CBD-S09-EBMMDDYY-SO	NA											X	X		X	X	X			X
		CBD-S09-EBMMDDYY-GW	NA											X	X		X	X	X	X	X	X
		CBD-S09-TBMMDDYY	NA											X								
AOC-D (SW-846 6020A Pb-only)																						
SS	CBD-AOD-SO01	CBD-AOD-SS01-MMYY	0 - 6 inches				X[5]															
		CBD-AOD-SS01P-MMYY					X[5]															
SS	CBD-AOD-SO02	CBD-AOD-SS02-MMYY	0 - 6 inches				X[5]															
SS	CBD-AOD-SO03	CBD-AOD-SS03-MMYY	0 - 6 inches				X[5]															
SS	CBD-AOD-SO04	CBD-AOD-SS04-MMYY	0 - 6 inches				X[5]															

TABLE 3-2 (CONTINUED)

Sample Details Table

Navy CLEAN 8012 CTO-JU01 NRL-CBD Soil and Groundwater Sampling (Summer 2012, tentative) TriMatrix Laboratories, Inc. 5560 Corporate Exchange Ct.SE Grand Rapids, MI 49512 Walt Roudebush: (616) 975-4561 Columbia Analytical Services, Inc (HexCr Only) 1565 Jefferson Road, Building 300, Suite 360 Rochester, NY 14623 Deb Patton: (585) 672-7473				Soil Samples										Aqueous Samples								
			Analysis Group	VOCs	SVOCs	PCBs	METALs				WCHEM		GRAINSIZE	VOCs	SVOCs	PCBs	METALs			FMETALs (field-filtered)		
			Preparation and Analytical Method	SW-846 5035 / 8260B	SW-846 3550C / 8270C and 8270_SIM	SW-846 3550C / 8082	SW-846 3050B / 6010C and 6020A	SW-846 7471A (Hg)	SW-846 9010C / 9014 (CN)	SW-846 3060A / 7199 (HexCr)	SW-846 9045C (pH)	Lloyd Kahn (TOC)	ASTM D422	SW-846 5030 / 8260B	SW-846 3550C / 8270C and 8270-SIM	SW-846 3510C / 8082A	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 9010C / 9014	SW-846 3010A / 6010C and 6020A	SW-846 7470A (Hg)	SW-846 7199 (HexCr)
			Analytical Laboratory / SOP Reference[1]	TriMatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	CAS-R / GEN-7199	TriMatrix / GR-07-113	TriMatrix / GR-05-132	TriMatrix / GR-16-119	Trimatrix / GR-04-104	TriMatrix / GR-04-103	TriMatrix / GR-03-128	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	TriMatrix / GR-05-122	TriMatrix / GR-01-100, GR-01-129	TriMatrix / GR-01-123	CAS-R / GEN-7199
			Data Package Turnaround Time	28 Calendar Days																		
			Container Type / Volume required	1X 40mL w. 5ml MeOH; 2X 40mL w. 5ml $NaHSO_4$	1X 8oz WM glass / 60g		1X 8oz WM HDPE / 50g			1X 4oz WM HDPE / 2.5g	1X 8oz WM glass / 50g		32oz WM HDPE / 1000g	3X 40mL vials / 40mL	2X 1L amber / 1L	1X 1L amber / 0.5L	1X 500mL HDPE / 150mL		1X 500mL HDPE / 50mL	1X 500mL HDPE / 150mL		1X 250mL HDPE / 10mL
			Preservative	≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen			≤6°C but not frozen	≤6°C but not frozen		≤6°C but not frozen	HCl to pH < 2; ≤6°C but not frozen	≤6°C but not frozen	≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		NaOH to pH > 12; ≤6°C but not frozen	HNO_3 to pH < 2; ≤6°C but not frozen		≤6°C but not frozen
			Holding Time[2] (Preparation / Analysis)	14 days	14 days to extract, 40 days to analyze		180 days	28 days	14 days	30 days to digest; 7 days to analyze	7 days	14 days	None	14 days	7 days to extract, 40 days to analyze		180 days	28 days	14 days	180 days	28 days	24 hours
Matrix	**Station ID**	**Sample ID**	**Sampling Depth[4]**																			
SS	CBD-AOD-SO05	CBD-AOD-SS05-MMYY	0 - 6 inches				X[5]															
QC	CBD-AOD-QC	CBD-AOD-FBMMDDYY	NA														X[5]					
		CBD-AOD-EBMMDDYY-SO	NA														X[5]					
Total No. Samples to the Lab:				113	78	102	119	113	113	41	43	43	43	46	39	32	41	39	39	25	25	33

Notes:

1 For a complete reference of laboratory SOPs, see the Analytical SOP References Table.

2 Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/analyzed.

3 Field QC counts may change depending on the duration of field event. Frequency of QA/QC sample collection is noted on the Measurement Performance Criteria Table in Section 2.4 of the UFP-SAP and is as follows :

Field Duplicate - One per 10 field samples
MS/MSD - One pair per 20 field samples of similar matrix (including field duplicates)
Equipment Blank- For disposable equipment, one per week of sampling; for decontaminated equipment, one per type of sampling equipment, per day of sampling
Field Blank- No field blanks will be collected for this project
MMYY - 2 digit month and 2 digit year
MMDDYYYY - 2 digit month then 2 digit day followed by 4 digit year

4 The determination for the TBD sampling depths is site-specific and can be found in the applicable Sections 2.9.1 of this UFP-SAP.

5 Samples at AOC-D require analysis for SW-846 6020A lead-only.

4 References

CH2M HILL. 2008. *Facility Assessment Report, Naval Research Laboratory, Washington, D.C*. October.

CH2M HILL. 2009. *Final Fire Testing Area Site Assessment Report, Naval Research Laboratory Chesapeake Bat Detachment, Chesapeake Beach, Maryland*. November.

Naval Energy and Environmental Support Activity (NEESA). 1984. *Initial Assessment Study of Naval Research Laboratory, Washington D.C*. March.

Maryland Department of the Environment. Hazardous and Solid Waste Management Administration. 1989. *Letter Dated May 4.*

Baker Environmental, Inc. (Baker). 2002a. *Final Environmental Baseline Survey for the Naval Support Activity Washington Quarters W Housing Area, Naval Research Laboratory Chesapeake Beach Detachment, Chesapeake Beach, Maryland.* December.

Michael Baker Jr. Inc. 2002b. *Final Asbestos and Lead Based Paint Survey for Naval Support Activity Washington, Naval Research Laboratory, Chesapeake Beach Detachment, Chesapeake Beach, Maryland*. December.

United States Environmental Protection Agency (USEPA). 1994. *Region III Modifications to the National Functional Guidelines for Organic Data Review.* September

USEPA. 1993. *Region III Modifications to the Laboratory Data Validation Guidelines for Inorganic Data Review*. April.

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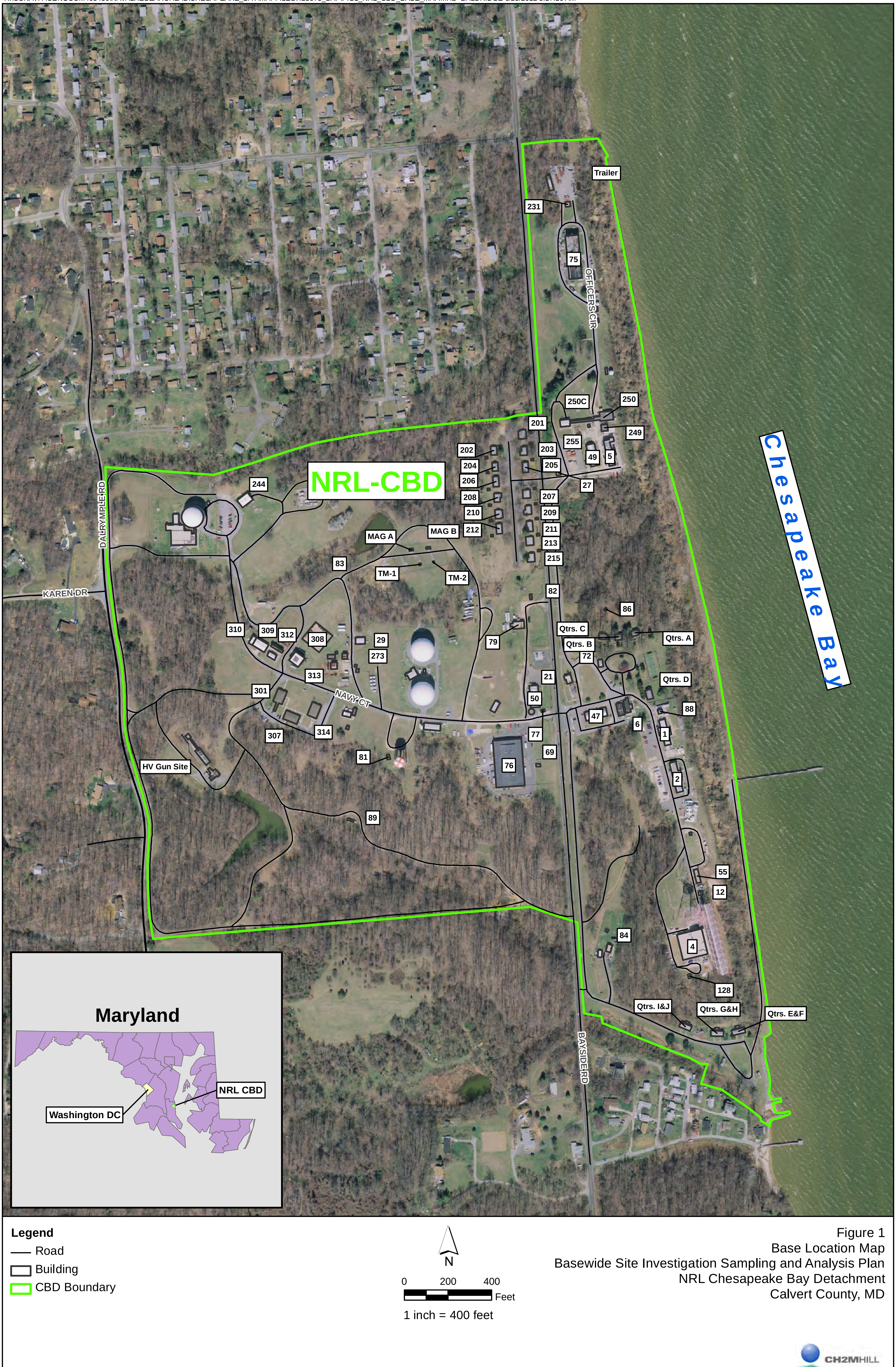
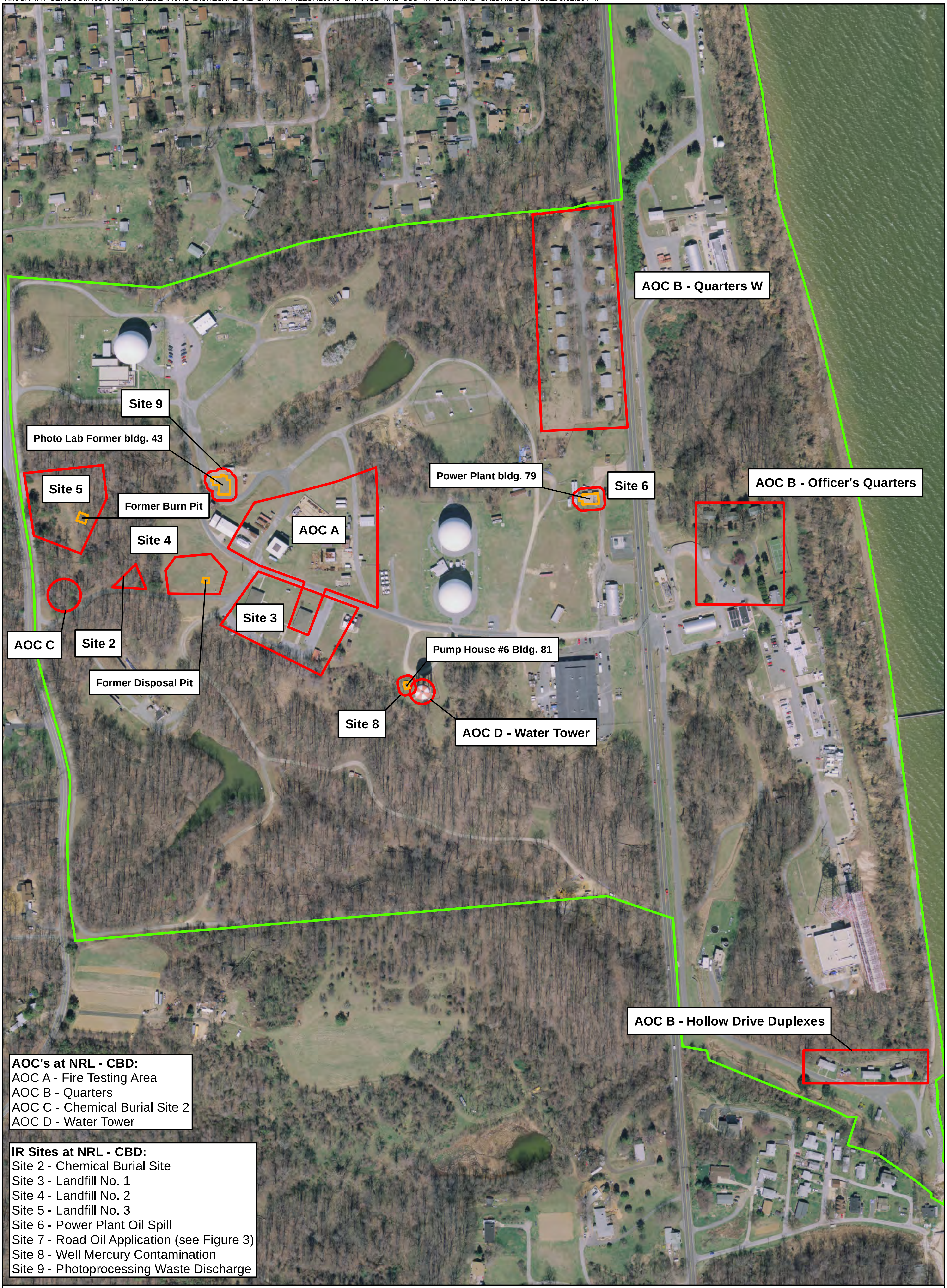


Figure 1
Base Location Map
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

R:\USNAVFACENGCOM405450\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_SAP\FIG2_NRL_CBD_IR_SITES.MXD BALDRIDGE 9/4/2012 3:32:29 PM



Legend

- IR Site Feature
- IR Site and AOC Boundary
- CBD Boundary

N

0 150 300 Feet

1 inch = 300 feet

Figure 2
IR Site and AOC Location Map
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

CH2MHILL

V:\USNAVFACENGCOM\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_SAP\FIG3_SITE7_ROAD_OIL_APPLICATION.MXD BALDRIDG 4/20/2012 10:45:48 AM

Note:
Site 7 includes all historic dirt roads on NRL-CBD west of Rt. 261 until 1952.

Legend

- 1952 Roads
- 1944 Roads
- 1938 Roads
- CBD Boundary

N

0 75 150 300 Feet

1 inch = 300 feet

Figure 3
Site 7 - Road Oil Application
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

CH2MHILL

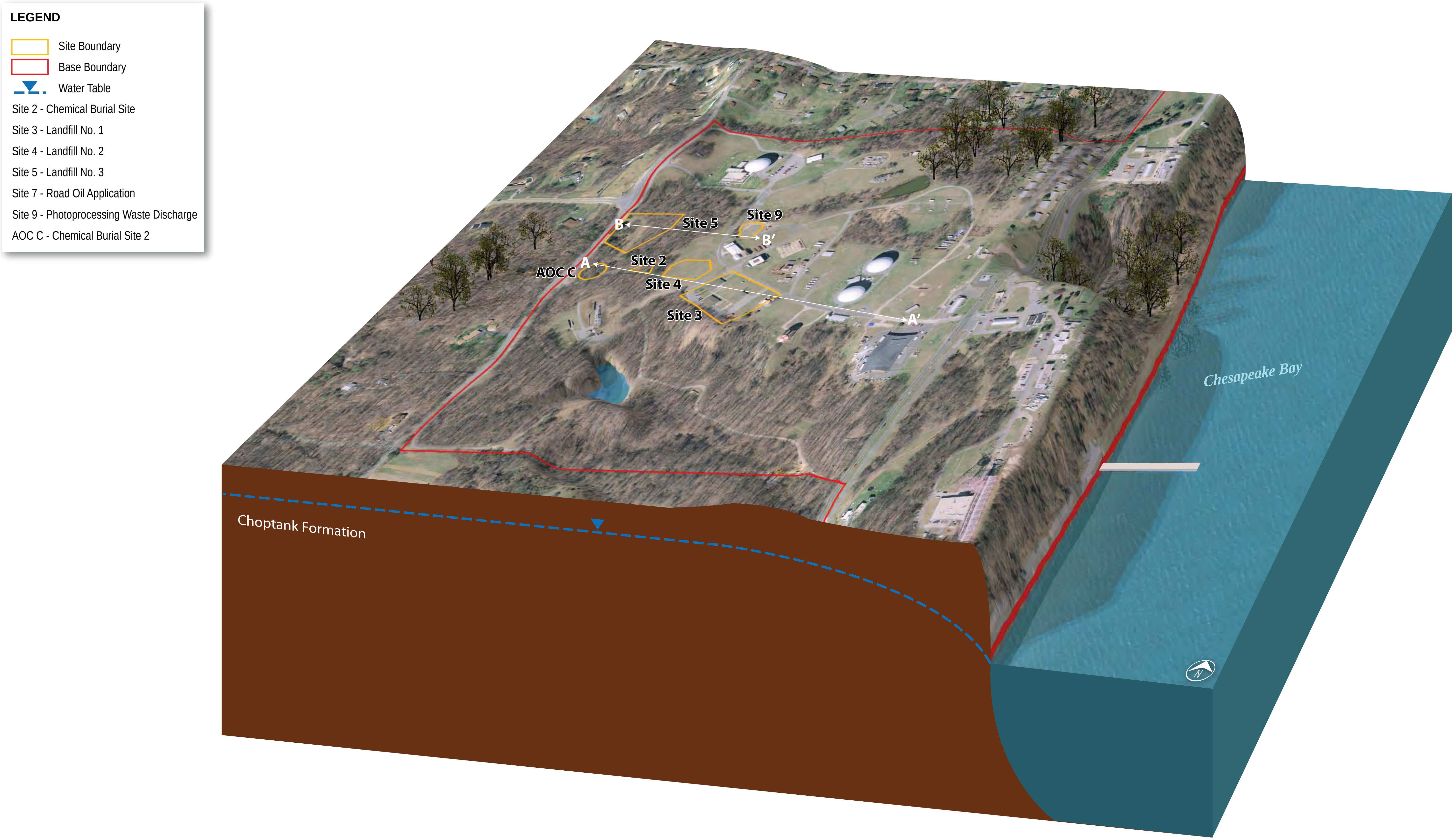


FIGURE 4a
Conceptual Site Model
Sampling and Analysis Plan
Naval Research Laboratory - Chesapeake Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

LEGEND

- Site Boundary
- Base Boundary
- Flow Direction
- Water Table
- Potential Migration Pathway*

Site 2 - Chemical Burial Site
Site 3 - Landfill No. 1
Site 4 - Landfill No. 2
AOC C - Chemical Burial Site 2

*Infiltration/leaching of constituents from the potential source areas into surface and subsurface soils and/or groundwater.

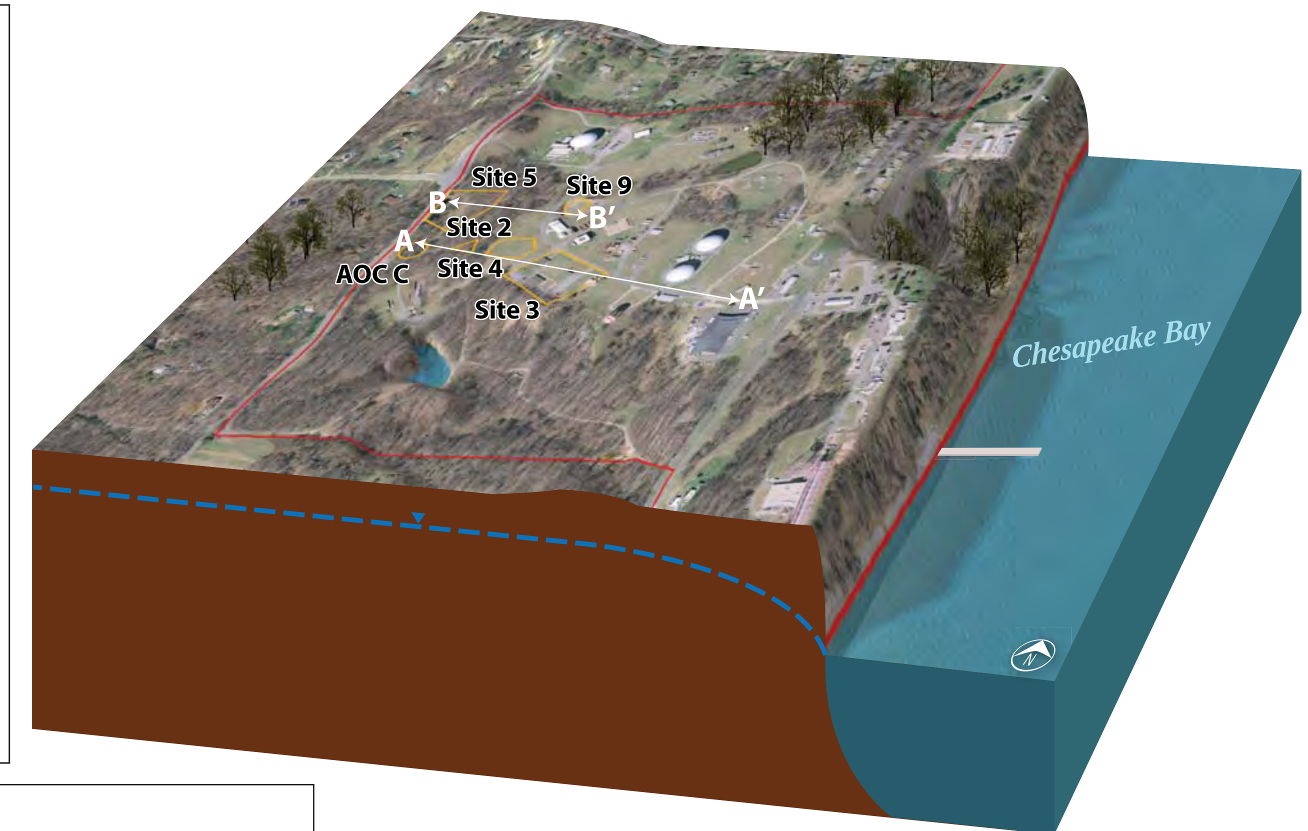
Human Health Exposures and Receptors

Media – Soil

- Current adult/adolescent trespassers and visitors, and adult industrial workers exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions.
- Future adult/adolescent trespassers and visitors, adult industrial workers, adult and child residents, and construction workers exposed to surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions.

Media - Groundwater

- Current and future adult industrial workers as well as future adult and child residents exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site.
- Future construction workers exposed to shallow groundwater through dermal contact and inhalation of volatile emissions in an open excavation, if shallow groundwater is within 15 feet of the ground surface.
- Future residents or industrial workers who use the water as a potable water supply. Future residents receptors could be exposed to the groundwater through ingestion, and dermal contact and inhalation of volatile emissions while showering. Future industrial workers could be exposed to the groundwater through ingestion.



Ecological

Wooded

- **Features:** Edge, densely wooded cover
- **Receptors:** Soil invertebrates, terrestrial plants, ground foraging (mourning dove) and predatory (owl) birds, and small mammals (mouse, shrew)

Ecological

Open Field

- **Features:** Short-grassed, open areas between woods and developed areas
- **Receptors:** Soil invertebrates, terrestrial plants, ground foraging (robin) and predatory (hawk) birds, and small mammals (mouse, shrew)

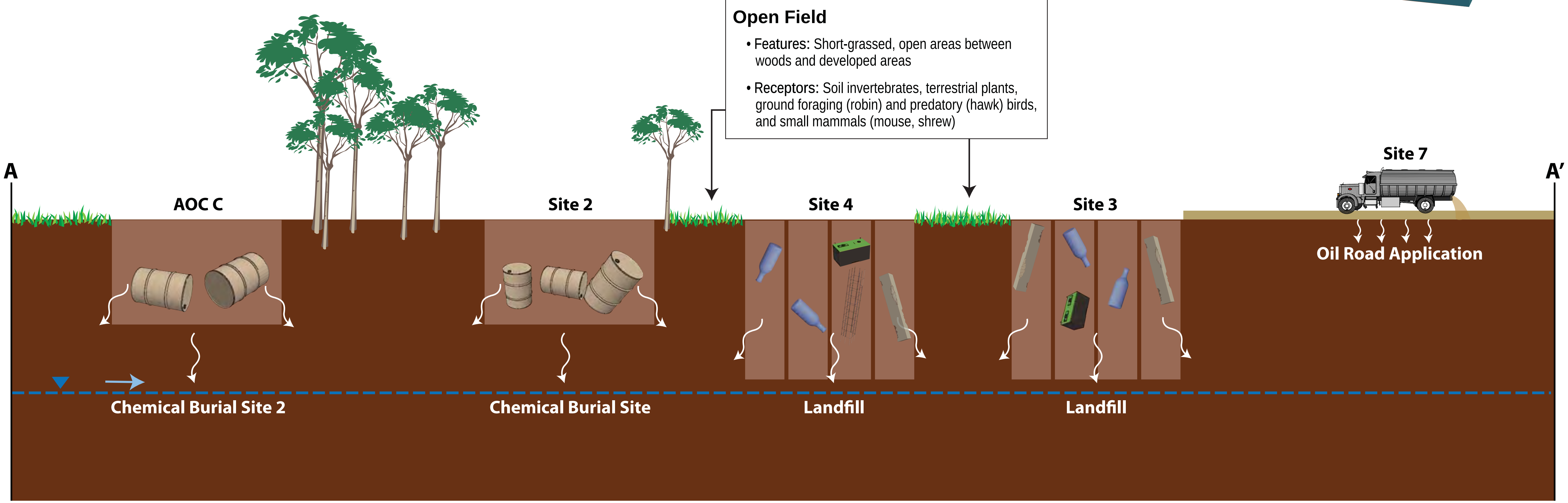


FIGURE 4b
Conceptual Site Model
Sampling and Analysis Plan
Naval Research Laboratory - Chesapeake Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

CH2MHILL

LEGEND

- Site Boundary
- Base Boundary
- Flow Direction
- Water Table
- Potential Migration Pathway*

Site 5 - Landfill No. 3

Site 9 - Photoprocessing Waste Discharge

*Infiltration/leaching of constituents from the potential source areas into surface and subsurface soils and/or groundwater.

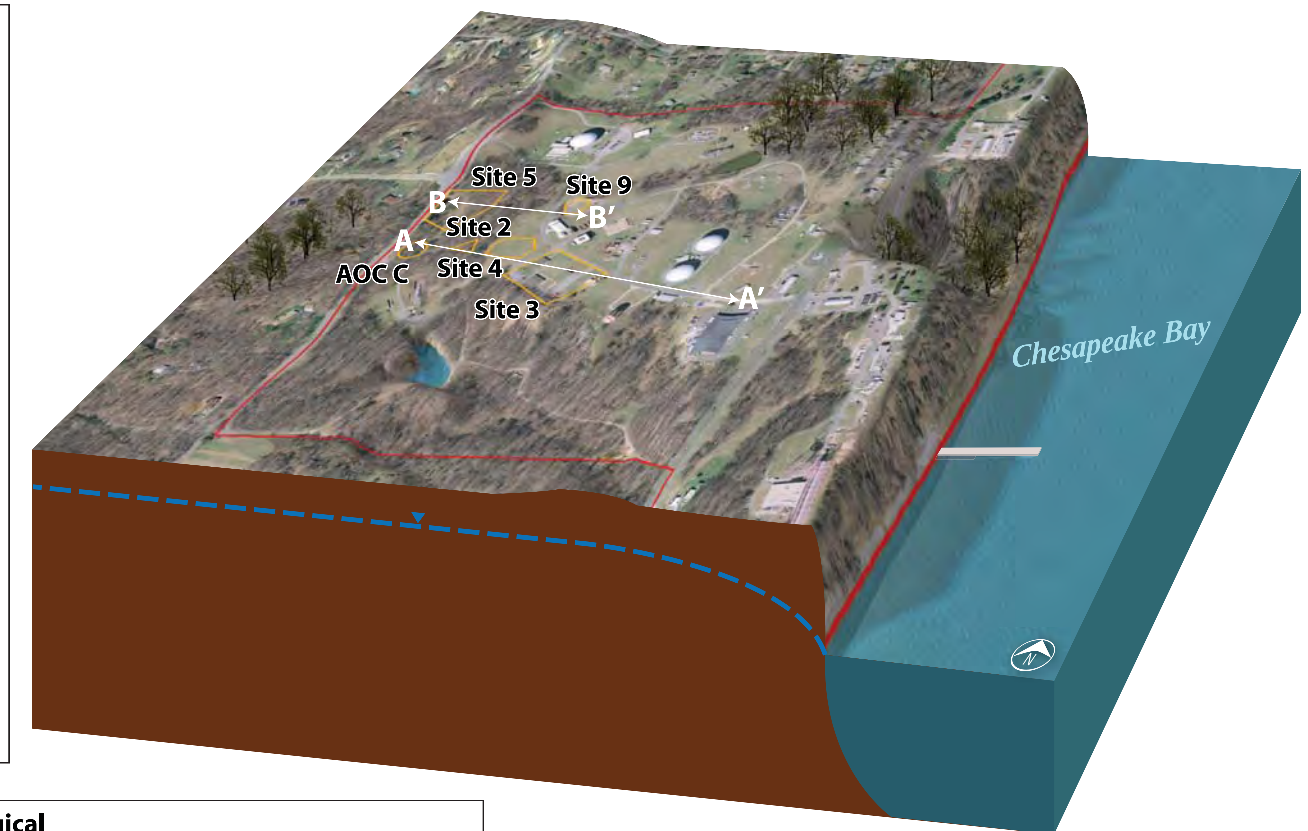
Human Health Exposures and Receptors

Media – Soil

- Current adult/adolescent trespassers and visitors, and adult industrial workers exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions.
- Future adult/adolescent trespassers and visitors, adult industrial workers, adult and child residents, and construction workers exposed to surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions.

Media - Groundwater

- Current and future adult industrial workers as well as future adult and child residents exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site.
- Future construction workers exposed to shallow groundwater through dermal contact and inhalation of volatile emissions in an open excavation, if shallow groundwater is within 15 feet of the ground surface.
- Future residents or industrial workers who use the water as a potable water supply. Future residents receptors could be exposed to the groundwater through ingestion, and dermal contact and inhalation of volatile emissions while showering. Future industrial workers could be exposed to the groundwater through ingestion.



Ecological

Wooded

- **Features:** Edge, densely wooded cover
- **Receptors:** Soil invertebrates, terrestrial plants, ground foraging (mourning dove) and predatory (owl) birds, and small mammals (mouse, shrew)

Ecological

Open Field

- **Features:** Short-grassed, open areas between woods and developed areas
- **Receptors:** Soil invertaebrates, terrestrial plants, ground foraging (robin) and predatory (hawk) birds, and small mammals (mouse, shrew)

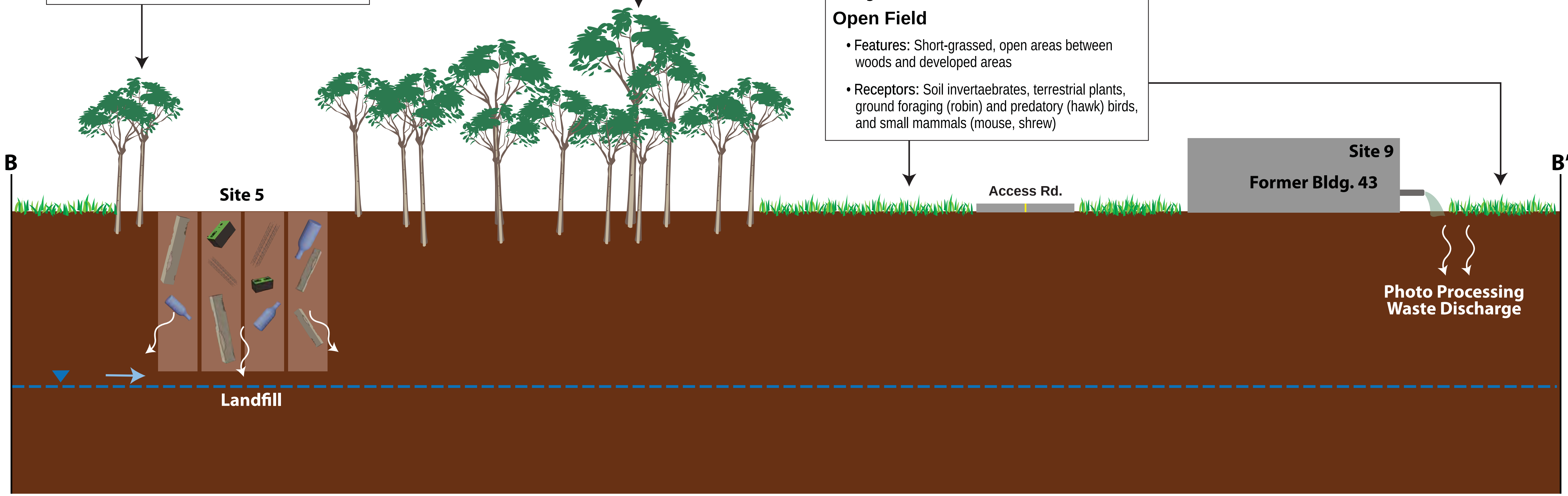
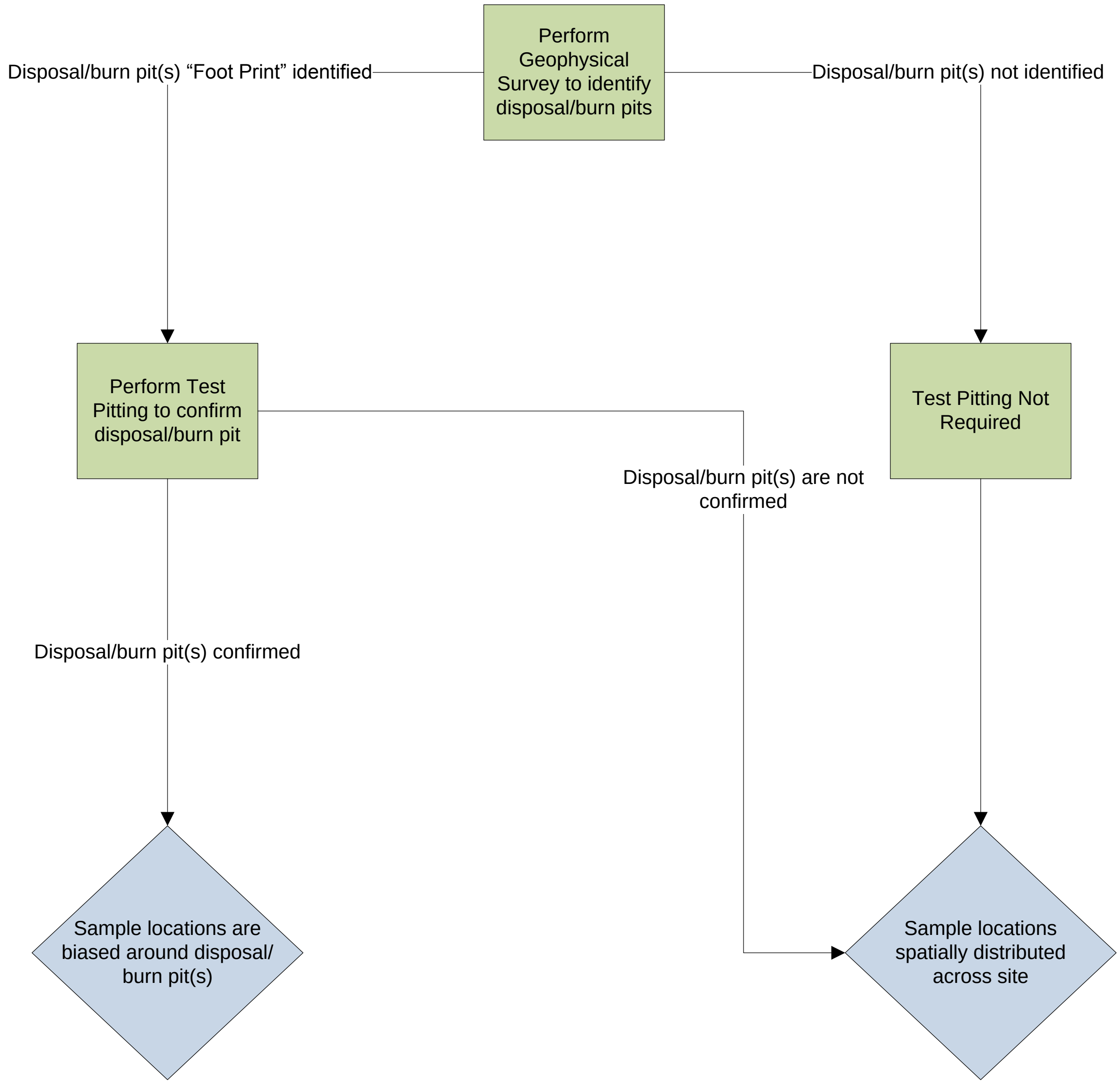
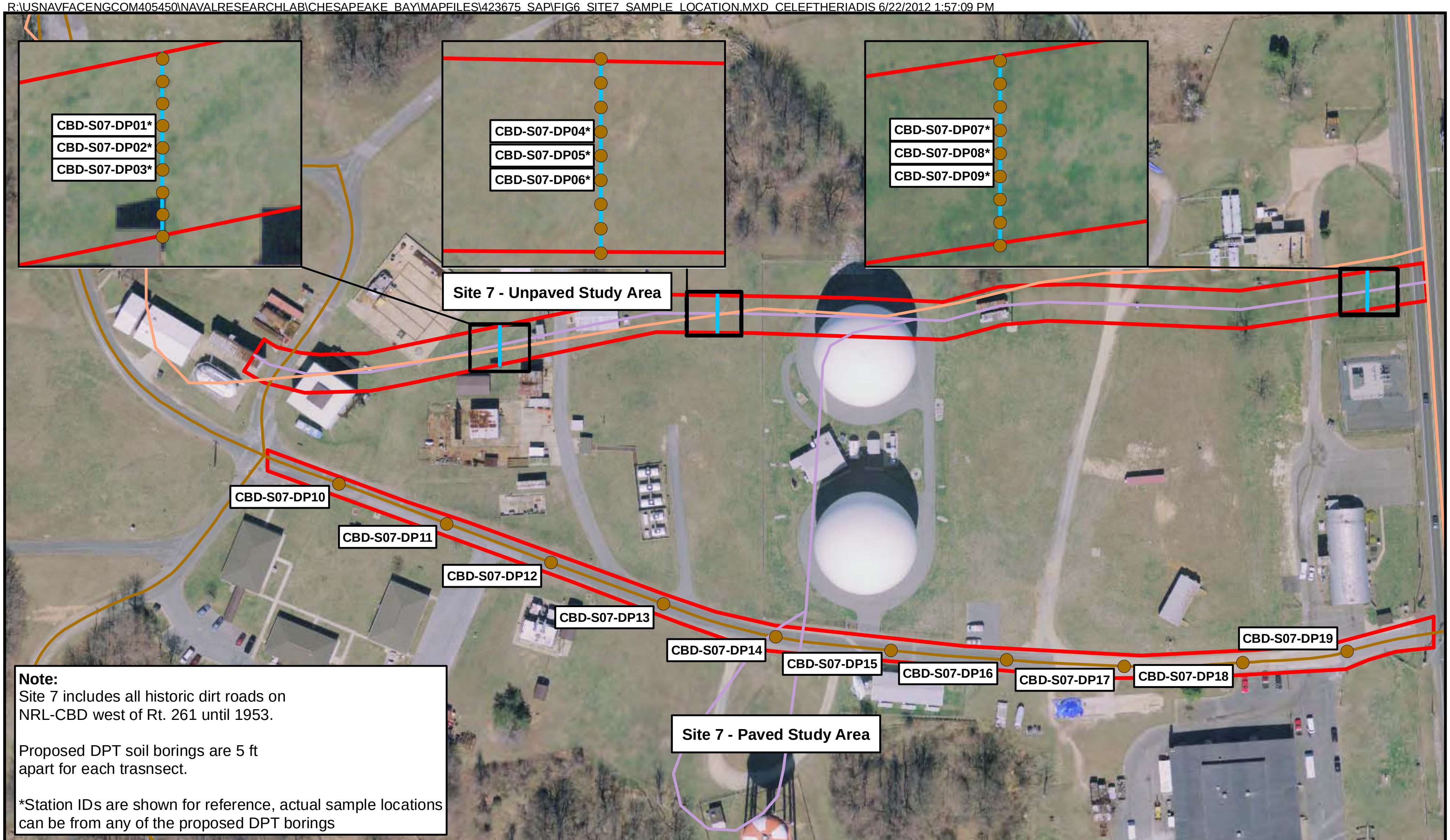


FIGURE 4c
Conceptual Site Model
Sampling and Analysis Plan
Naval Research Laboratory - Chesapeake Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

Figure 5
Sample Location Decision Diagram
Sites 2,3,4,5 and AOC C
NRL-CBD



R:\USNAVFACENGCOM405450\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_SAP\FIG6_SITE7_SAMPLE_LOCATION.MXD CELEFTHERIADIS 6/22/2012 1:57:09 PM



Note:
Site 7 includes all historic dirt roads on NRL-CBD west of Rt. 261 until 1953.

Proposed DPT soil borings are 5 ft apart for each trasnsect.

*Station IDs are shown for reference, actual sample locations can be from any of the proposed DPT borings

Legend

- Proposed DPT soil boring
- Soil boring transect
- 1938 Roads
- 1944 Roads
- 1952 Roads
- Study Area Boundary
- CBD Boundary

N

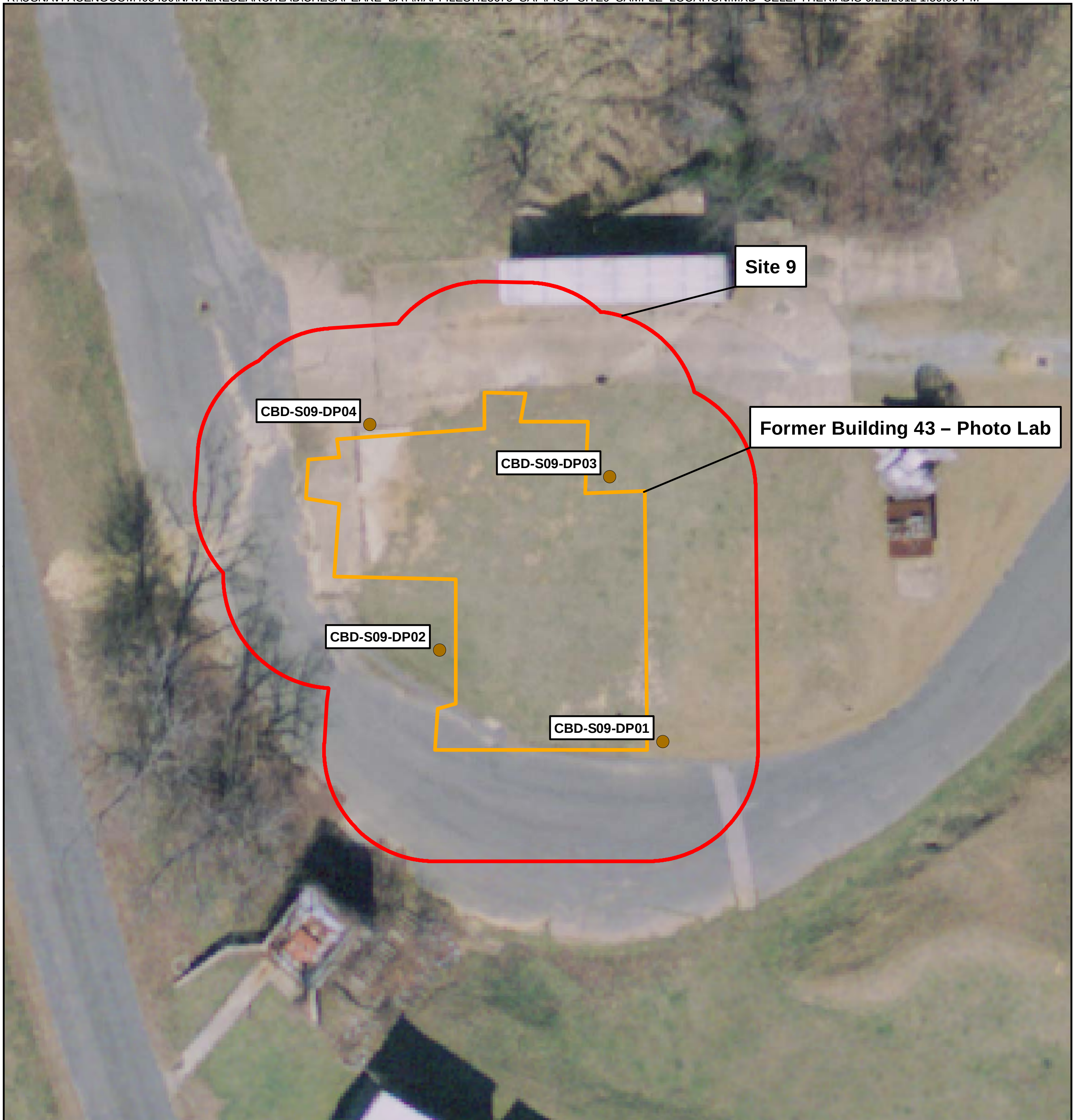
0 75 150 Feet

1 inch = 150 feet

Figure 6
Site 7 - Sample Location Map
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

CH2MHILL

R:\USNAVFACENGCOM405450\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_SAP\FIG7_SITE9_SAMPLE_LOCATION.MXD CELEFTHERIADIS 6/22/2012 1:59:09 PM



Legend

- Proposed DPT soil boring
- IR Site Feature
- IR Site and AOC Boundary

N

0 12.5 25 Feet

1 inch = 25 feet

Figure 7
Site 9 Sample Location Map
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

CH2MHILL

R:\USNAVFACENGCOM405450\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_SAP\FIG8_AOC_D_SAMPLE_LOCATION.MXD BALDRIDGE 9/5/2012 9:37:47 AM

Legend

- Proposed Surface Soil Sample Location
- IR Site Feature
- IR Site and AOC Boundary

0 12.5 25 Feet

1 inch = 25 feet

N

Figure 8
AOC D Sample Location Map
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

CH2MHILL

Appendix A
Historical Supporting Documents

Appendix A.1
MDE and NAVFAC Washington Correspondence

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

December 16, 2009

NAVFAC Washington
Attn: Ms. Paula Gilbertson
Washington Navy Yard, Building 212
1314 Harwood Street, SE
Washington, DC 20374-5018

RE: Naval Research Laboratory (NRL), Chesapeake Beach Detachment

Dear Ms. Gilbertson:

The Federal Facilities Division (FFD) of the Maryland Department of the Environment's Hazardous Waste Program has been involved in the munitions response activities at the subject facility for the last several years. However, the FFD has no record of state involvement in environment response activities by the Navy to address Hazardous, Toxic or Radiological materials that may have been used, released, leaked, spilled or disposed during the operational history of the facility.

Assuming that the Navy established this research and test facility during the early 1940s, the facility operated under what might be considered 'best practices' regarding environmental management for nearly 30 years. "Best Practices" at other federal facilities that were operational during this time period have resulted in significant releases to the environment of solvents, metals, acids, pesticides, petroleum and military unique contaminants. Waste material were buried or burned in unpermitted landfills that have released contaminants to soil, ground water or surface water. Often waste from more urban facilities in the same command were disposed at remote or satellite facilities, which can compound potential hazards. Spills or other types of releases of petroleum products are also quite typical. Additionally, mismanagement of pesticides, spent solvents, waste oil and poor management of electrical equipment containing Polychlorinated Biphenyls was not uncommon.

Considering the proximity of the facility to the Chesapeake Bay and the current emphasis on restoring this water body, the FFD is concerned that the Navy may not be in compliance with the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. SARA imposed certain requirements regarding state and community involvement in remedial decision making. Consequently, the FFD requests that the Navy provide documentary evidence of the actual or potential release of hazardous materials at the site, an inventory of landfills, burn pits and other disposal activities, documentary evidence of the Navy's site assessment including a comprehensive listing of chemicals used at the facility since activation including total quantities and all monitoring or sampling activities, including results, that have occurred at the site.

The FFD has also contacted EPA Region III regarding the 'Docket' status of the facility. While the EPA may have determined that the facility does not warrant National Priorities List (NPL) status, SARA requires the Navy to address facilities not on the NPL in the same manner as if site were included on the NPL. Sites not on the NPL are subject to the state's regulatory authority if the Navy does not adequately address potential or threatened releases through the CERCLA process.

If you have any questions, please contact me at (410) 537-3475.

Sincerely,

John Fairbank, Chief
Federal Facilities Division

JF:jf

cc: Mr. Ben Mykijewycz
Mr. Horacio Tablada
Mr. Harold L. Dye, Jr

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

SEP 28 1989

Commanding Officer
U.S. Naval Research Laboratory
4555 Overlook Avenue S.W.
Washington, D.C. 20375

RE: Hazardous Waste Site Identification
EPA CERCLA ID No. DC-004

Dear Commader:

This letter is in response to the preliminary assessment (PA) of hazardous wastes which was submitted to this office for review. Based on this information, the Environmental Protection Agency (EPA) has developed a hazard ranking score (HRS) for the areas covered in the PA. Based on this HRS we have determined that no further remedial action is planned (NFRAP) at present. Accordingly there are two enclosures regarding the data your office submitted. The first is a review package developed by EPA based on the information you sent EPA and upon which we based our decision. The second is a draft of the guidance package, developed by EPA which is intended to address data requirements for the recently proposed (FR 12/23/88) revised HRS. These enclosures are sent for your review. If, based on your review, you feel that your facility has not been properly assessed, or if you are aware of a condition, either now or in the future, which would alter EPA's determination, please let us know.

If you have any questions regarding this matter please call me at (215) 597-0823.

Sincerely,

James P. Harper

James P. Harper
Site Investigation Office

Enclosures: 2

April 9, 2010

Maryland Department of the Environment
Attn: John Fairbank
1800 Washington Boulevard
Baltimore, MD 21230

RE: Naval Research Laboratory (NRL), Chesapeake Beach Detachment

Dear Mr. Fairbank,

We have received your letter dated December 16, 2009, requesting any documents the Navy is in possession of regarding evidence of actual or potential release of hazardous materials at NRL, Chesapeake Beach Detachment.

After researching our files, we are pleased to send you copies of the following documents from our records:

- *Initial Assessment Study of Naval Research Laboratory*, Naval Energy and Environmental Support Activity, March 1984
- *Response Letter to the Initial Assessment Study*, United States Environmental Protection Agency, September 1989
- *Hazard Ranking Score for NRL-Chesapeake Beach Detachment (Site 02)*, Argonne National Laboratory, March 1988
- *Environmental Baseline Survey for Quarters W Housing Area*, Engineering Field Activity – Chesapeake, December 2002

In addition to the documents listed above, the NRL has additional soil and groundwater data which is being compiled and will be forwarded under separate cover.

If you have any questions, please feel free to contact me at (202)685-3305.

Sincerely,

Paula Gilbertson, P.E.
Environmental Restoration Program Manager
NAVFAC Washington

MDE
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

September 22, 2010

NAVFAC Washington
Attn: Ms. Paula Gilbertson
Washington Navy Yard, Building 212
1314 Harwood Street, SE
Washington, DC 20374-5018

RE: Naval Research Laboratory (NRL), Chesapeake Beach Detachment (CBD)

Dear Ms. Gilbertson:

The Federal Facilities Division (FFD) of the Maryland Department of the Environment's Hazardous Waste Program has received the package of information the Navy provided in response to the FFD's letter of December 16, 2009. A cursory review of the information provided and discussions with the US Environmental Protection Agency's Region III has not resolved the FFD's concerns regarding the adequacy of the Navy's compliance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986

The presence of unpermitted landfills at the site alone warrants further investigation. Disposal of waste in an unpermitted fill or dump has been an illegal act in Maryland since 1914 (§ 9-204(d)). Considering the proximity of the facility to the Chesapeake Bay and the current emphasis on restoring this water body, the FFD is concerned that the Navy is not in full compliance with CERCLA and consequently may be subject to State environmental laws and regulations.

The information that has been provided indicates that the NRL CBD facility disposed of hazardous material on site in an unregulated manner and was responsible for a release of mercury to a potable aquifer. The decisions not to conduct further response actions at the facility were not coordinated with the State as required by CERCLA. Further the facility has not performed an adequate Preliminary Assessment or Site Inspection to meet the requirements of the EPA's Docket Listing which remains unresolved.

The FFD has discussed the site with EPA Region III regarding the 'Docket' status of the facility and has requested that the Region and the facility comply with the Docket requirements. Should the EPA not find that the facility warrants National Priorities List (NPL) status, SARA requires the Navy to address facilities not on the NPL in the same manner as if site were included on the NPL. Sites not on the NPL are subject to the state's regulatory authority if the Navy does not adequately address potential or threatened releases through the CERCLA process. Under the Department of Defense State Memorandum of Agreement, the State may take enforcement actions against a facility following a Dispute Resolution Process, to that end, the FFD requests that the Navy identify their Tiers of the dispute process within thirty days of your receipt of this letter.

If you have any questions, please contact me at (410) 537-3475.

Sincerely,

John Fairbank, Chief
Federal Facilities Division

JF:jf

cc: Mr. Ben Mykijewycz
Mr. Horacio Tablada
Mr. Harold L. Dye, Jr

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON
1314 HARWOOD STREET SE
WASHINGTON NAVY YARD DC 20374-5018

IN REPLY REFER TO:
5420
EV
22 Oct 10

Maryland Department of the Environment
Attn: John Fairbank
1800 Washington Boulevard
Baltimore, MD 21230

Dear Mr. Fairbank:

SUBJECT: NAVAL RESEARCH LABORATORY (NRL), CHESAPEAKE BEACH DETACHMENT

We have received your letter dated September 22, 2010, regarding the FFD's continued concerns regarding the adequacy of the Navy's compliance with CERCLA at the subject Naval Installation.

In response, the Navy is currently in the process of obtaining funding to conduct a base-wide Preliminary Assessment/Site Investigation (PA/SI) at the installation with work commencing in late FY10 or early FY11. The remedial project manager (RPM) is Nate Delong. He can be reached at (202) 685-3279.

Per your request, the Navy's Tiers of the dispute resolution process are as follows.

Informal: NAVFAC Washington RPM
Level 1: NAVFAC Washington Commanding Officer, or designee
Level 2: NAVFAC Headquarters designee
Level 3: Secretary of Navy designee

If you have any questions, please feel free to contact me at (202)685-3305.

Sincerely,

Paula Gilbertson, P.E.
Environmental Restoration
Program Manager
NAVFAC Washington

CC: Kathy Edwards/Code 3546, Naval Research Laboratory

Appendix A.2
Historical Aerial Photographs

1938 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeak Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

CH2MHILL

1952 historic imagery

Installation Restoration (IR) Sites

Naval Research Laboratory -

Chesapeake Bay Detachment (NRL-CBD)

Chesapeake Beach, Maryland

N

0 150 300 600 Feet

1 inch = 600 feet

CH2MHILL

V:\USNAVFACENGCOM\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_MSMS\NRL_CBD_1957_AERIAL.MXD BALDRIDG 11/9/2011 6:46:30 PM

1957 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeak Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

N

0 150 300 600 Feet

1 inch = 600 feet

CH2MHILL

V:\USNAVFACENGCOM\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_MSMS\NRL_CBD_1960_AERIAL.MXD BALDRIDG 11/9/2011 6:48:35 PM

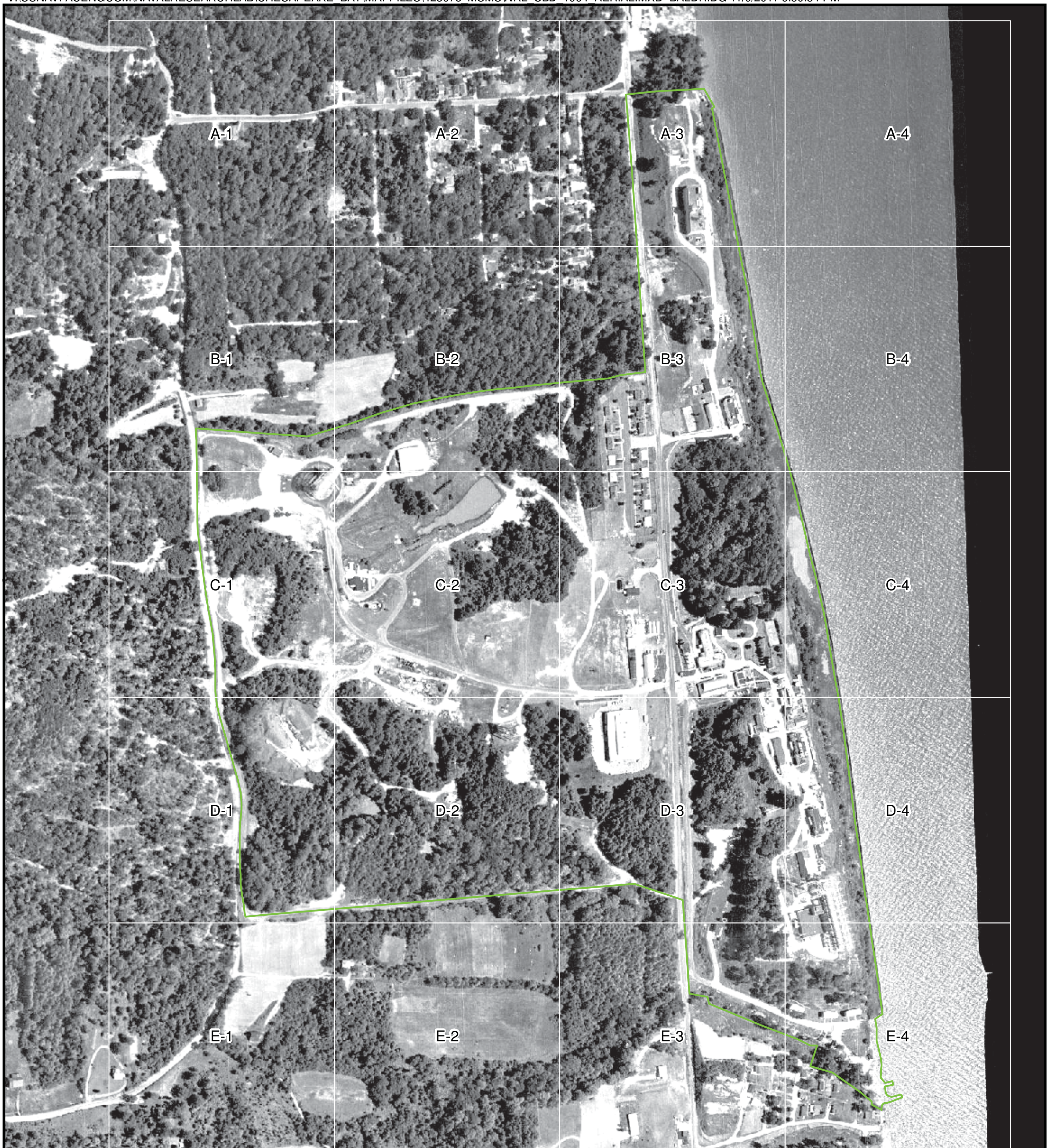
1960 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeak Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

N

0 150 300 600
Feet

1 inch = 600 feet

CH2MHILL



1964 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeak Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

N

0 150 300 600
Feet

1 inch = 600 feet

CH2MHILL

V:\USNAVFACENGCOM\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_MSMS\NRL_CBD_1969_AERIAL.MXD BALDRIDG 11/9/2011 6:52:50 PM

1969 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeake Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

N

0 150 300 600 Feet

1 inch = 600 feet

CH2MHILL

V:\USNAVFACENGCOM\NAVALRESEARCHLAB\CHESAPEAKE_BAY\MAPFILES\423675_MSMS\NRL_CBD_1970_AERIAL.MXD BALDRIDG 11/9/2011 6:54:48 PM

1970 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeake Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

N

0 150 300 600
Feet

1 inch = 600 feet

CH2MHILL

1971 historic imagery
Installation Restoration (IR) Sites
Naval Research Laboratory -
Chesapeak Bay Detachment (NRL-CBD)
Chesapeake Beach, Maryland

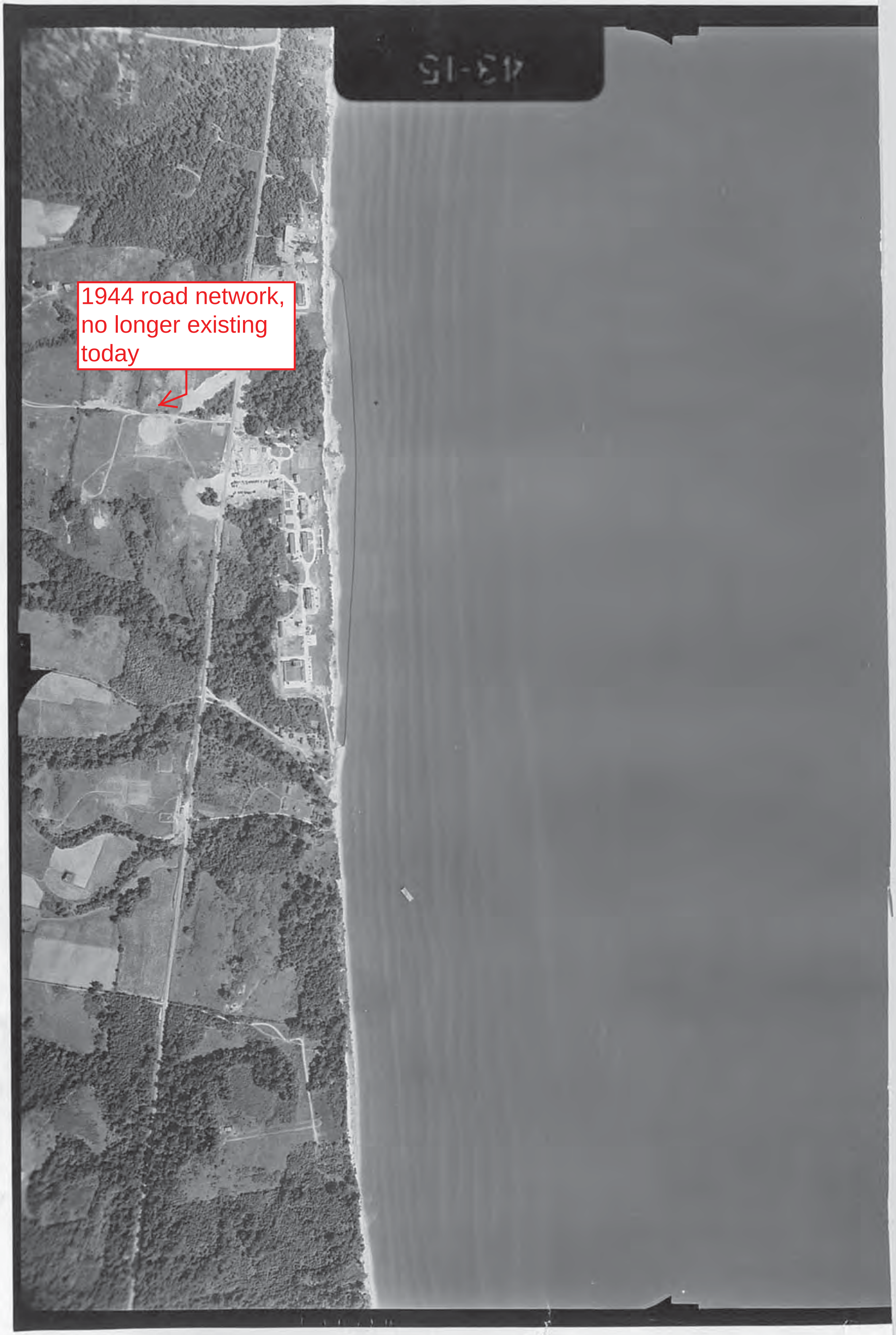
N

0 150 300 600
Feet

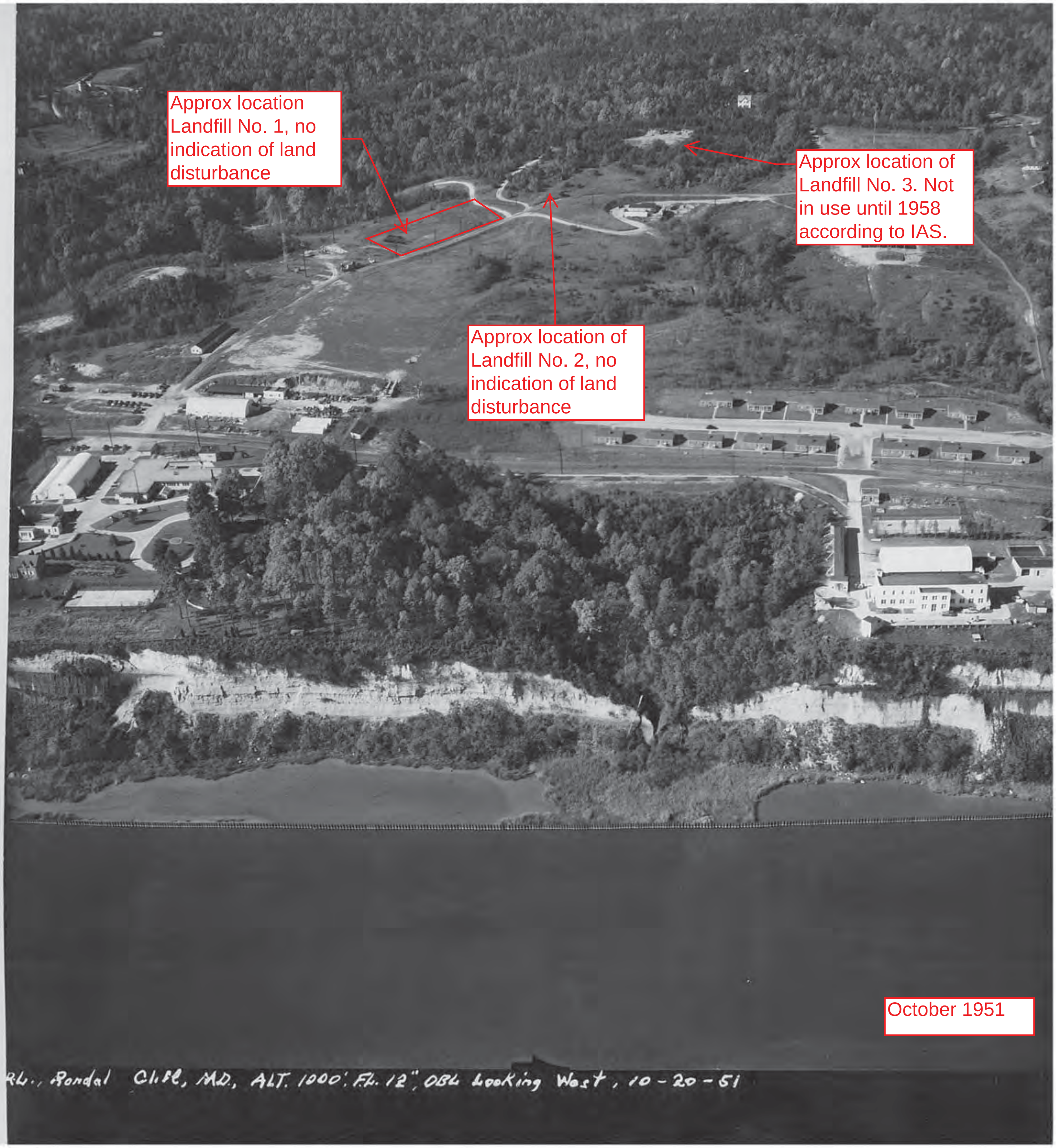
1 inch = 600 feet

CH2MHILL

Appendix A.3
Photographs from NRL-CBD



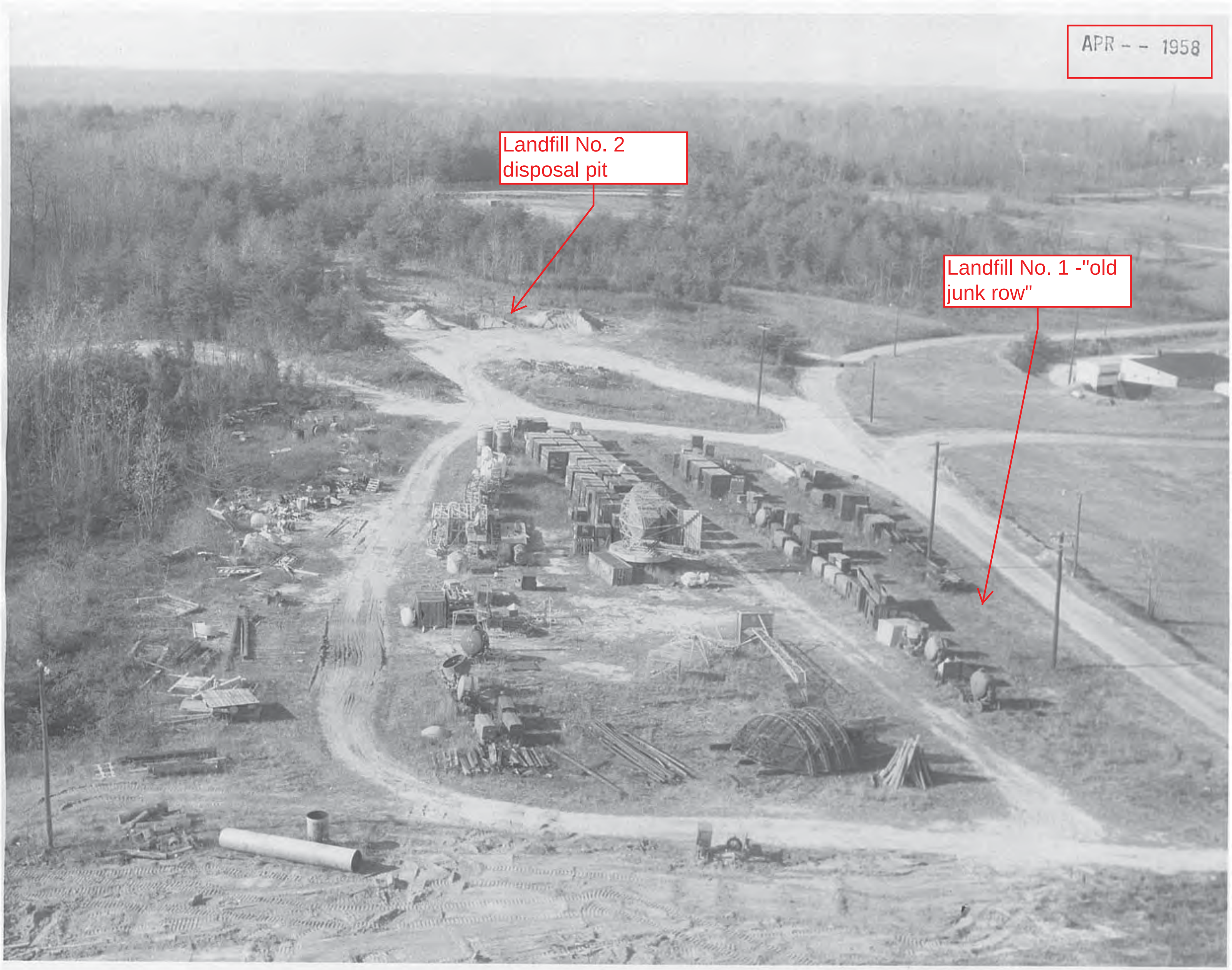
August 1944

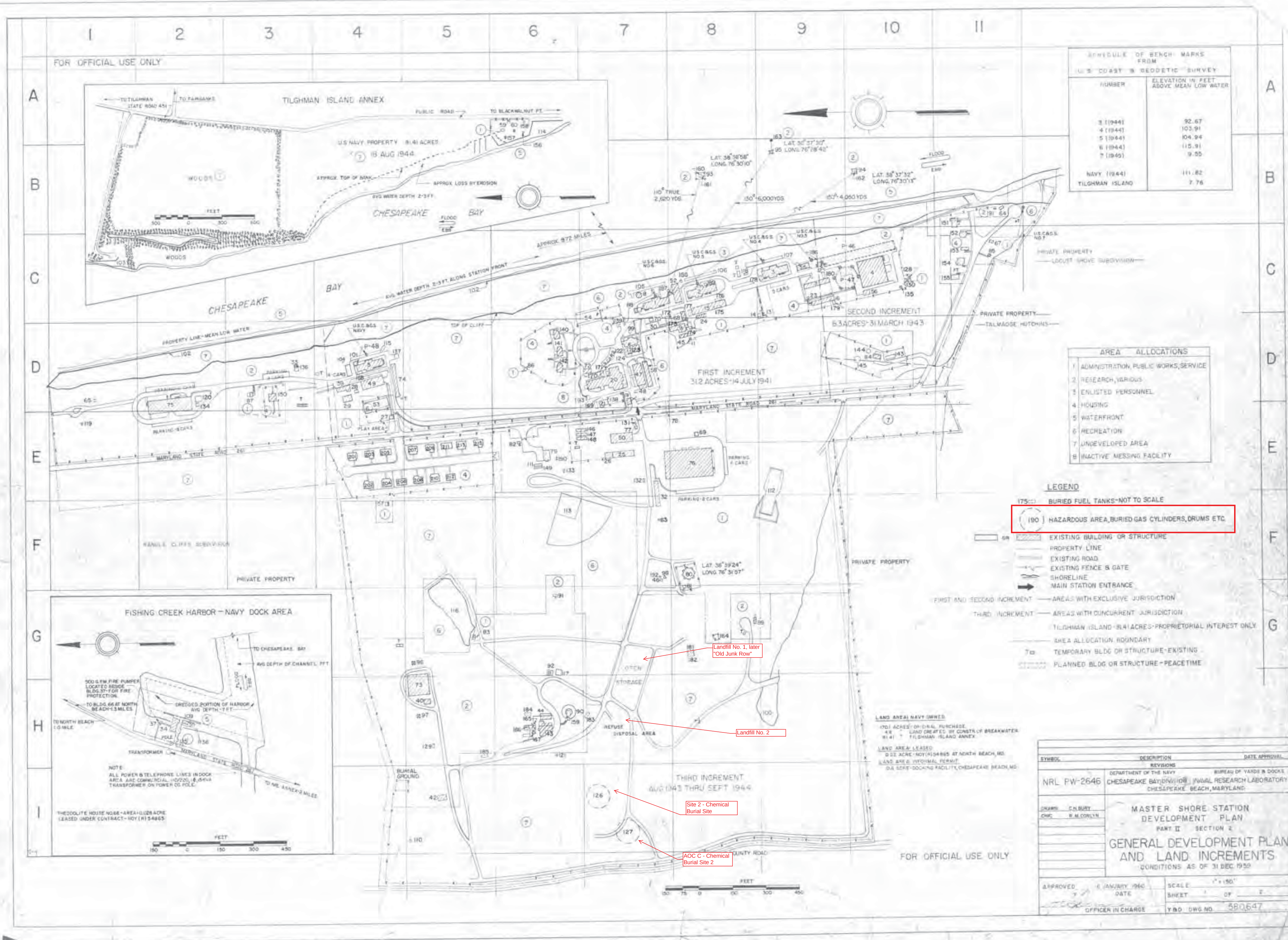


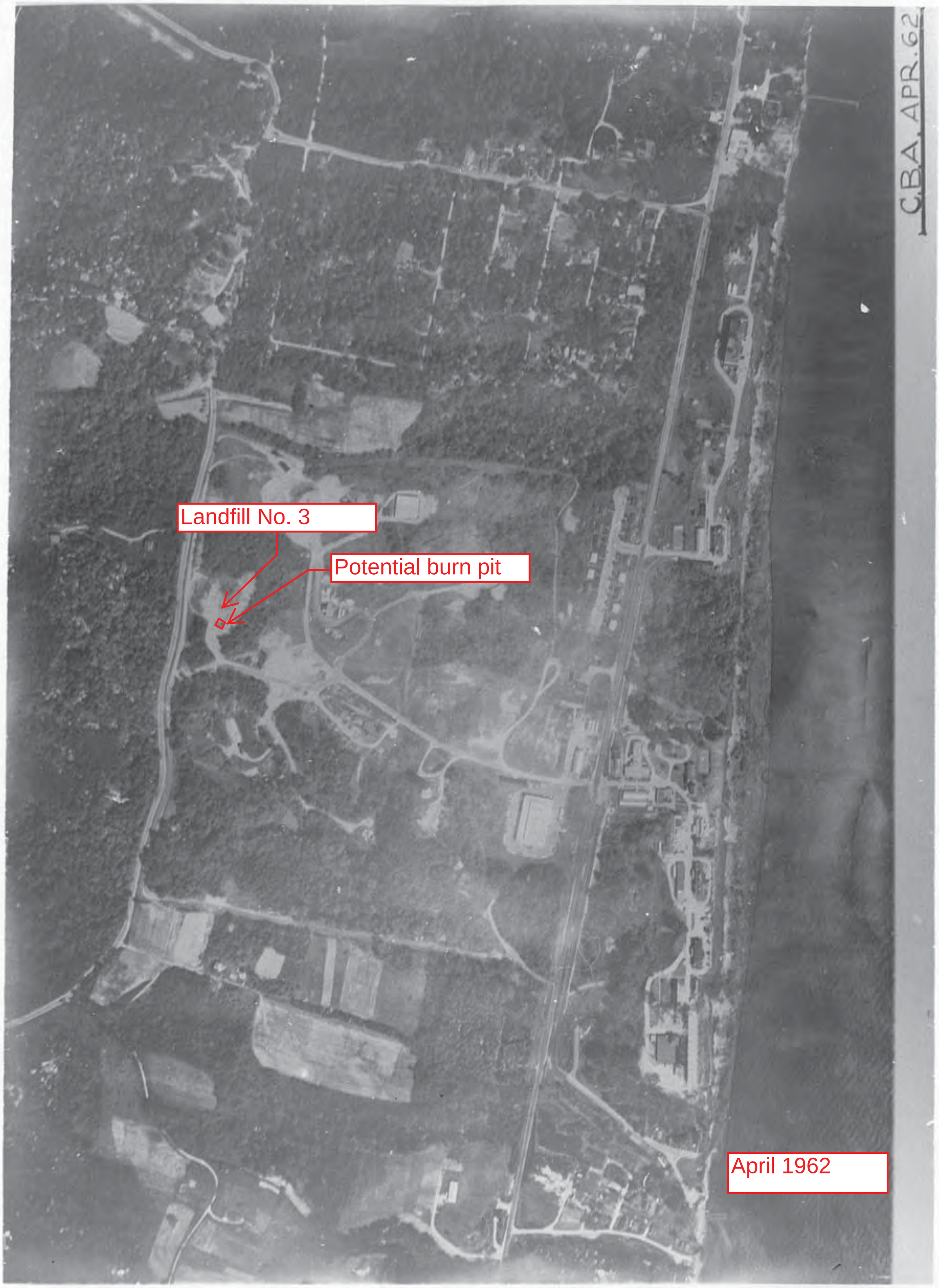
Approx location Landfill No. 1, no indication of land disturbance
Approx location of Landfill No. 3. Not in use until 1958 according to IAS.
Approx location of Landfill No. 2, no indication of land disturbance
October 1951
RL., Rondal Cliff, MD., ALT. 1000'. FL. 12", OBL Looking West, 10-20-51

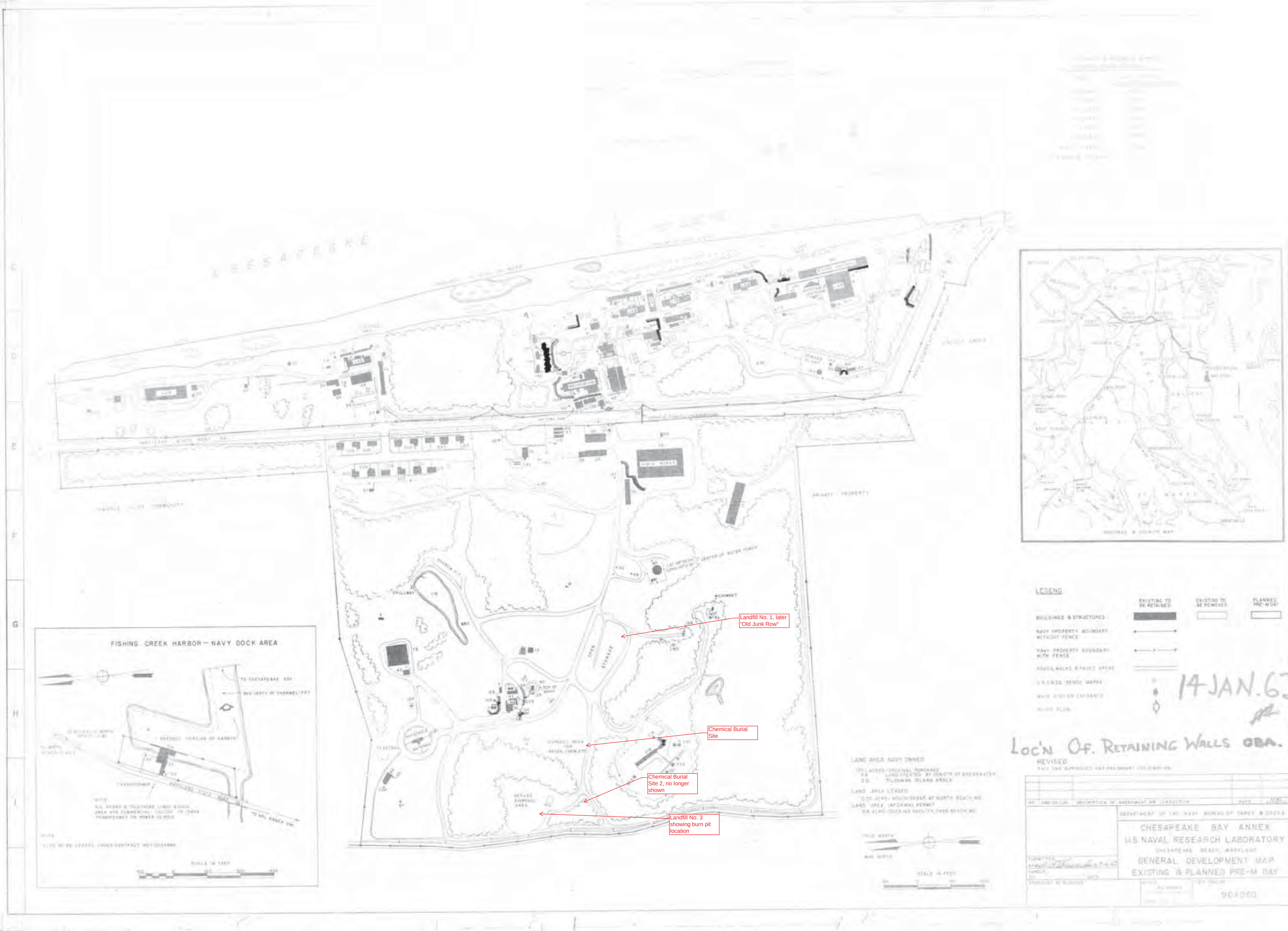
Landfill No. 2
Chemical Burial Site
Landfill No. 1, "old junk row"
April 1955
3 NRL, Chesapeake Bay Annex, Randle Cliff, Md 4/5/55 K-17-12" ALT. 1000' View Looking West


March 1955
Landfill No. 2
Chemical Burial Site
Landfill No. 1 - "old junk row"
NRL, Chesapeake Bay Annex, Randle Cliffs, Md. 3/14/55 CA-8, 6" Altitude 5000'

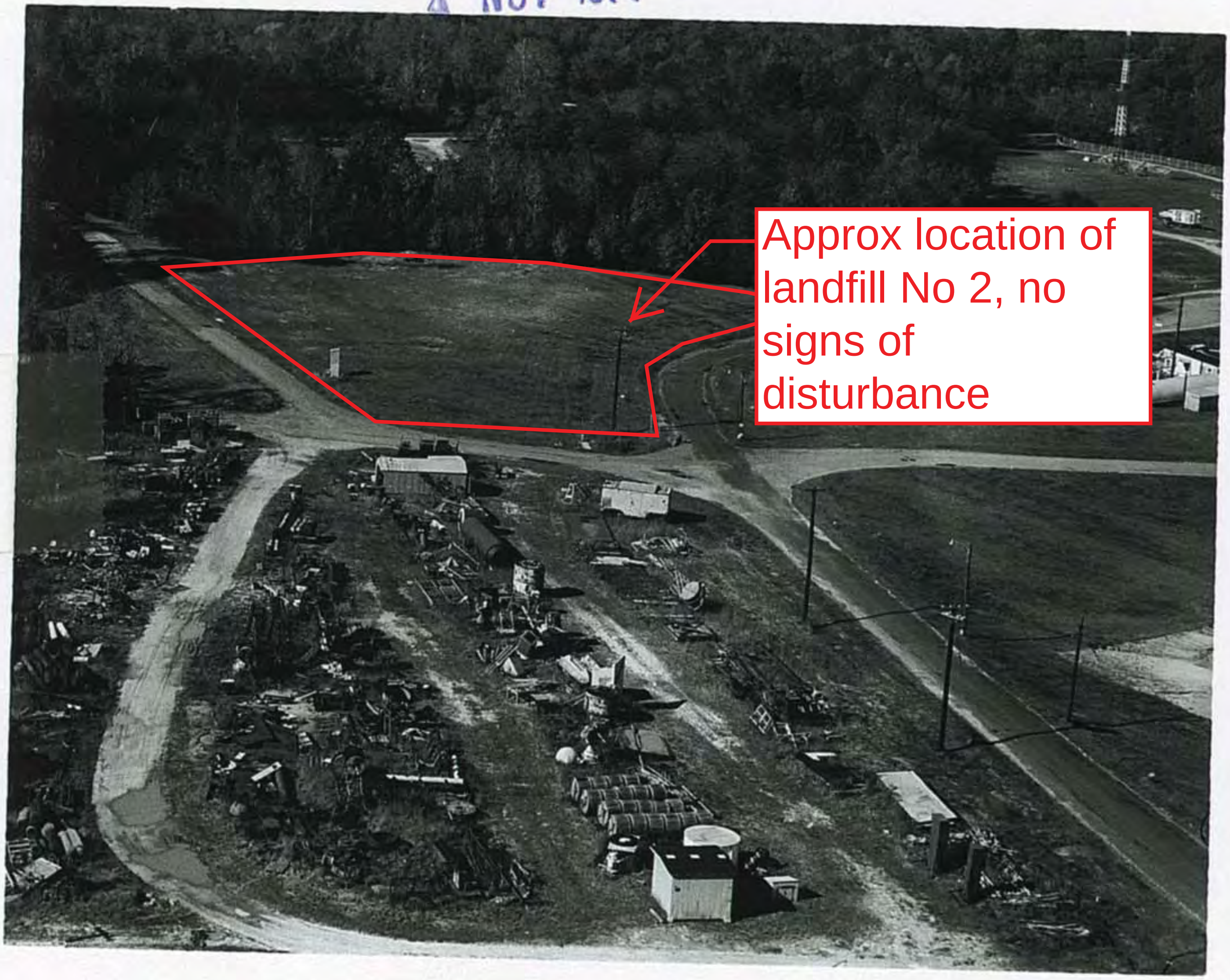

APR - - 1958
Landfill No. 2 disposal pit
Landfill No. 1 -"old junk row"

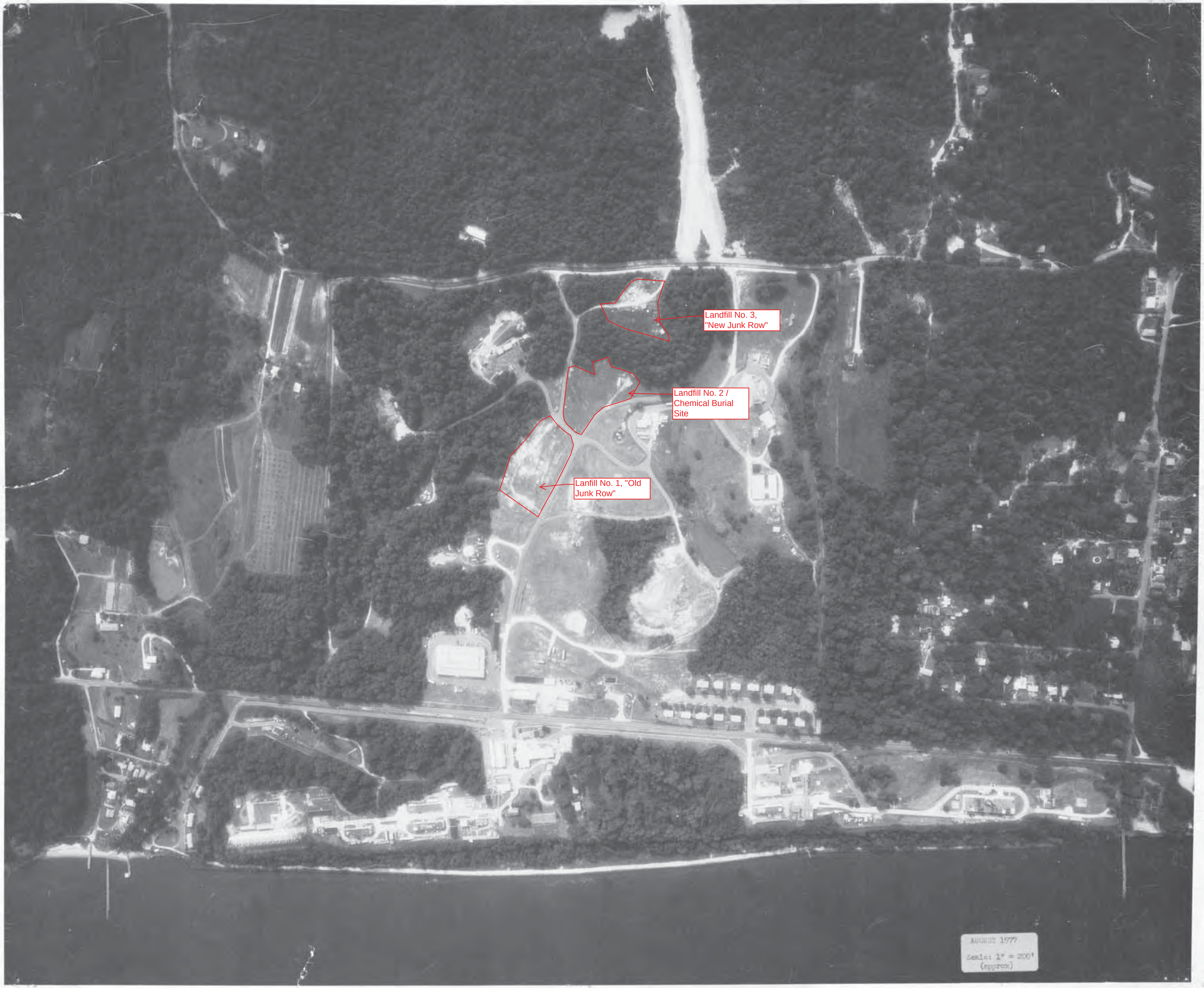

FOR OFFICIAL USE ONLY
TILGHMAN ISLAND ANNEX
U.S. NAVY PROPERTY 18.41 ACRES 18 AUG 1944
CHESAPEAKE BAY
WOODS
CHESAPEAKE
BAY
AVG WATER DEPTH 2-3 FT ALONG STATION FRONT
APPROX 872 MILES
PROPERTY LINE-MEAN LOW WATER
TOP OF CLIFF
SECOND INCREMENT
63 ACRES-31 MARCH 1943
FIRST INCREMENT
312 ACRES-14 JULY 1941
MARYLAND STATE ROAD 261
PRIVATE PROPERTY
TALMADGE HOTCHINS
LOCUST GROVE SUBDIVISION
RANDLE CLIFFS SUBDIVISION
THIRD INCREMENT
AUG 1943 THRU SEPT 1944
OPEN STORAGE
REFUSE DISPOSAL AREA
BURIAL GROUND
FISHING CREEK HARBOR - NAVY DOCK AREA
TO CHESAPEAKE BAY
AVG DEPTH OF CHANNEL 7 FT
DREDGED PORTION OF HARBOR AVG DEPTH 7 FT
NOTE: ALL POWER & TELEPHONE LINES IN DOCK AREA ARE COMMERCIAL
THEODOLITE HOUSE NO.68 - AREA - 0.026 ACRE LEASED UNDER CONTRACT
SCHEDULE OF BENCH MARKS FROM U.S. COAST & GEODETIC SURVEY
NUMBER
ELEVATION IN FEET ABOVE MEAN LOW WATER
3 (1944) 92.67
4 (1944) 103.91
5 (1944) 104.94
6 (1944) 115.91
7 (1945) 9.55
NAVY (1944) 111.82
TILGHMAN ISLAND 7.76
AREA ALLOCATIONS
1 ADMINISTRATION, PUBLIC WORKS, SERVICE
2 RESEARCH, VARIOUS
3 ENLISTED PERSONNEL
4 HOUSING
5 WATERFRONT
6 RECREATION
7 UNDEVELOPED AREA
8 INACTIVE MESSING FACILITY
LEGEND
BURIED FUEL TANKS-NOT TO SCALE
190 HAZARDOUS AREA, BURIED GAS CYLINDERS, DRUMS ETC.
EXISTING BUILDING OR STRUCTURE
PROPERTY LINE
EXISTING ROAD
EXISTING FENCE & GATE
SHORELINE
MAIN STATION ENTRANCE
FIRST AND SECOND INCREMENT — AREAS WITH EXCLUSIVE JURISDICTION
THIRD INCREMENT — AREAS WITH CONCURRENT JURISDICTION
TILGHMAN ISLAND-18.41 ACRES-PROPRIETORIAL INTEREST ONLY
AREA ALLOCATION BOUNDARY
TEMPORARY BLDG OR STRUCTURE-EXISTING
PLANNED BLDG OR STRUCTURE-PEACETIME
Landfill No. 1, later "Old Junk Row"
Landfill No. 2
Site 2 - Chemical Burial Site
AOC C - Chemical Burial Site 2
FOR OFFICIAL USE ONLY
NRL PW-2646
DEPARTMENT OF THE NAVY
BUREAU OF YARDS & DOCKS
CHESAPEAKE BAY DIVISION NAVAL RESEARCH LABORATORY
CHESAPEAKE BEACH, MARYLAND
MASTER SHORE STATION
DEVELOPMENT PLAN
PART II SECTION 2
GENERAL DEVELOPMENT PLAN
AND LAND INCREMENTS
CONDITIONS AS OF 31 DEC 1959
APPROVED 6 JANUARY 1960
OFFICER IN CHARGE
Y&D DWG NO. 580,647


C.B.A. APR. 62
Landfill No. 3
Potential burn pit
April 1962


CHESAPEAKE
FISHING CREEK HARBOR — NAVY DOCK AREA
PUBLIC WORKS
OPEN STORAGE
SPILLWAY
CHIMNEY
PRIVATE PROPERTY
Landfill No. 1, later "Old Junk Row"
Chemical Burial Site
Chemical Burial Site 2, no longer shown
Landfill No. 3 showing burn pit location
LAND AREA NAVY OWNED
LAND AREA LEASED
LAND AREA INFORMAL PERMIT
TRUE NORTH
MAG. NORTH
LEGEND
EXISTING TO BE RETAINED
EXISTING TO BE REMOVED
PLANNED PRE-M DAY
BUILDINGS & STRUCTURES
NAVY PROPERTY BOUNDARY WITHOUT FENCE
NAVY PROPERTY BOUNDARY WITH FENCE
ROADS, WALKS & PAVED AREAS
14 JAN. 63.
Loc'n Of. Retaining Walls OBA.
REVISED
DESCRIPTION OF AMENDMENT OR CORRECTION
DATE
DEPARTMENT OF THE NAVY BUREAU OF YARDS & DOCKS
CHESAPEAKE BAY ANNEX
U.S. NAVAL RESEARCH LABORATORY
CHESAPEAKE BEACH, MARYLAND
GENERAL DEVELOPMENT MAP
EXISTING & PLANNED PRE-M DAY
904060

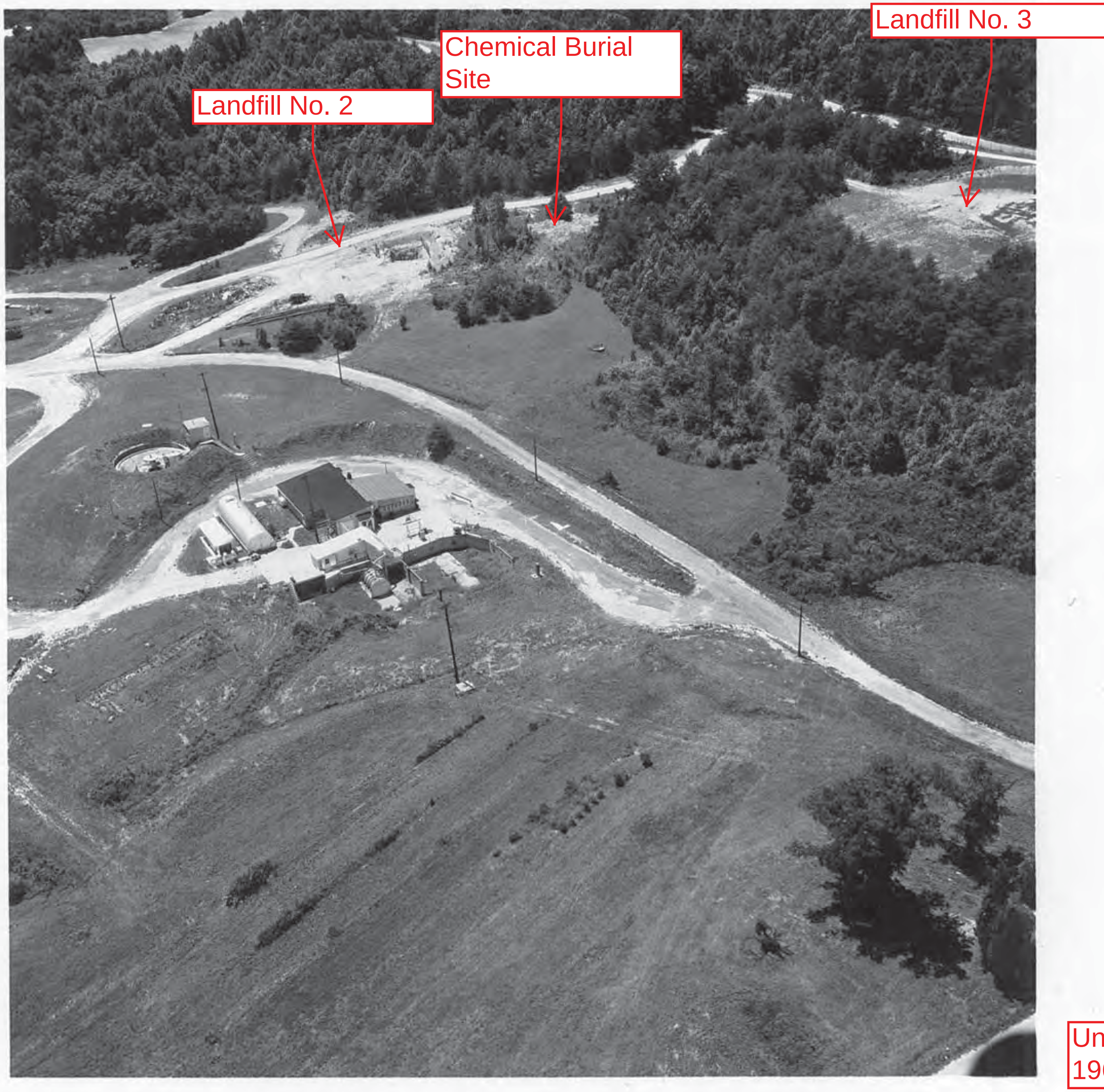
NOV 1971





Landfill No. 3,
"New Junk Row"
Landfill No. 2 /
Chemical Burial
Site
Landfill No. 1, "Old
Junk Row"
AUGUST 1977
Scale: 1" = 200'
(approx)


4199(2)
4-2-89
Chesapeake Beach
Approx location landfill No3/new junk row
Approx location Lanfill No1/old junk row, now buildings
1960 plot indicates chemical burial here
Approx landfill No 2/chemical burial site



Undated. Circa 1960s

Appendix A.4
Interviews with Personnel from NAVFAC-Washington, NRL-DC, and NRL-CBD

Date of Interview Form Completion	**10/25/11**
Interviewee Name	**Nathan Delong**
Title	**Remedial Project Manager**
Organization	**NAVFAC Washington**
Address	**1314 Harwood St, SE Washington Navy Yard, DC 20374**
Phone	**202-685-3279**
Email	**nathan.delong@navy.mil**
CH2M HILL Staff conducting Interview (if applicable)	

1. Background Information

In 1984, the United States Department of the Navy represented by the Naval Energy and Environmental Support Activity completed an Initial Assessment Study (IAS) of the Naval Research Laboratory (NRL).[1] The purpose of the IAS was to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations. The IAS contained information for two NRL facilities: the Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD) located in Chesapeake Beach, Maryland; and the Naval Research Laboratory facility located in Southeast Washington, D.C. (NRL-DC). The subject facility of this interview form is the NRL-CBD facility only (not the NRL-DC facility).

The IAS identified eight potentially contaminated sites at the NRL-CBD facility. Based on the information provided in the IAS, these eight sites are summarized below and their approximate location on the NRL-CBD facility is presented in Figure 1:

- Site 2 (Chemical Burial Site): Waste chemicals from NRL-DC were burned and/or buried at this site located west of existing Building 301. The last known dates of operation were during the years of 1968 and 1969. Only two instances of large-scale disposal were documented at the site: (1) approximately 1,200 pounds (36 cartons of waste chemicals were taken to NRL-CBD for disposal in the period of May to October 1969; and (2) approximately 400 pounds of chemicals in one shipment for burning at the site. The chemicals included: benzene; toluene; waste oil; ether

[1] Naval Energy and Environmental Support Activity, Initial Assessment Study of Naval Research Laboratory, Washington, D.C. March 1984.

lithium hydride; acetone; alcohol; paint thinner; sulfuric acid; and nitric acid.

- Site 3 (Landfill No. 1): This site occupied approximately 3,750 square feet and was located south of existing Building 314 and was operational from 1942 to about 1950. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "Old Junk Row" and was used for open storage of large pieces of unused equipment or demolition debris.

- Site 4 (Landfill No. 2): This site occupied approximately 3,750 square feet and was located west of existing Building 301 and was operational from 1950 to about 1958. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility.

- Site 5 (Landfill No. 3): This site occupied approximately 3,750 square feet and was located near the western facility boundary (close to Dalrymple Road) and was operational from about 1958 to 1968. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "New Junk Row" and was used for storage of assorted debris including rusted laboratory equipment and missile packing crates. In addition to the typical landfill activities, two burning pits were located at the site. The materials burned in these pits consisted of municipal wastes and ten gallons per year of waste solvents.

- Site 6 (Power Plant Oil Spill): In 1973, an oil spill reportedly occurred at the power plant (Building 79) when an underground pipe main (approximately 6 inches in diameter) located 6 to 12 inches underground ruptured releasing approximately 75 gallons of No. 6 fuel oil into the soil. The pipe main supplied the oil from the three outside storage tank to the adjacent boiler room. The problem was corrected by removing approximately one cubic yard of soil and removing the pipe main with replacement with a new above ground pipe main. The old pipe main trench was reportedly backfilled with a mixture of clean earth.

- Site 7 (Road Oil Application): From 1940 to 1952, waste oils were spread on the NRL-CBD facility to control dust during dry periods. The waste oils were reportedly sprayed on the dirt roadways west of Route 261 (Bayside Road). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were mixed in with the waste oil for application. It was also reported, but not confirmed that minimal (less than 10 pints per year) quantities of polychlorinated biphenyl (PCB)-contaminated liquids may also have been mixed with the waste oils.

- Site 8 (Well Mercury Contamination): In March 1978, it was discovered that a mercury-filled flow meter had discharged approximately 7 to 14.5 pounds of mercury into the community water supply at NRL-CBD (near existing Building 81). Cleanup was conducted in two steps: (1) removal of the contaminated water was accomplished by flushing the entire water distribution system with water from the reservoir tower; and (2) the most highly contaminated parts of the system were cleaned using acetic and citric acids. Water supply monitoring for mercury was performed after the spill was detected and discontinued eight months after the spill since measured mercury concentrations were consistently below the Federal Primary Drinking Water Standards.

  Approximately 1,500 gallons of waste cleaning solution were collected during the flushing event and were transported to NRL-DC for disposal.

- Site 9 (Photoprocessing Waste Discharge): Wastewaters from an intermittent photoprocessing operation in former Building 43 (located north of existing Building 309) were discharged through a drainage pipe to the ground immediately outside the building. The operation was conducted for a five- to six-year period from the late 1960s to mid-1970s with operations discontinued in Building 43 in 1975. During each year of operation, the photo lab was used one to two times, generating 10 to 15 gallons of waste photographic solutions (e.g., sodium thiosulfate, hydroquinone) per event.

2. Interview Questions:

The questions identified below are provided to enhance the understanding of the historical activities related to the eight sites summarized above and other potential sites at NRL-CBD.

Site 2 (Chemical Burial Site):

1. Do you have any first-hand knowledge or information regarding the location of this site?

No

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

Yes, there was a HRS performed by the EPA at this site in the 1988. Site 2 received a score of 18.07 (I believe you already have copy of this though).

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No

Site 3 (Landfill No. 1):

1. Do you have any first-hand knowledge or information regarding the location of this site (including the location of "Old Junk Row")?

   No

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "Old Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "Old Junk Row")?

   No

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No

Site 4 (Landfill No. 2):

1. Do you have any first-hand knowledge or information regarding the location of this site?

No

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

No

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No

Site 5 (Landfill No. 3):

1. Do you have any first-hand knowledge or information regarding the location of this site (including "New Junk Row")?

No

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "New Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "New Junk Row")?

No

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No

Site 6 (Power Plant Oil Spill):

1. Do you have any first-hand knowledge or information regarding the location of this spill?

   No

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   No

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No

Site 7 (Road Oil Application):

1. Do you have any first-hand knowledge or information regarding the location of this road oil application at NRL-CBD?

No

2. Do you have any first-hand knowledge or information regarding materials used as part of the road oil application of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

No

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No

Site 8 (Well Mercury Contamination):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   No

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   No

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No

Site 9 (Photoprocessing Waste Discharge):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   No

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   No

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No

Other Potential Sites (Different Sites or Areas than the Eight identified above):

1. Do you have any first-hand knowledge or information regarding other areas or sites at NRL-CBD where waste disposal, waste burial, or other similar historical waste/materials management was performed? If so, please identify/explain the disposal location, type of material/chemical disposed, quantity, media (solid or liquid), approximately timeframe of disposal, and approximate duration of disposal.

No

2. If the answer to the question above is "Yes", are you aware of any reports, drawings, maps, and/or other documents with additional details regarding these other areas/sites?

N/A

3. Do you have any further comments or suggestions related to the interview for our consideration?

No

Date of Interview Form Completion	**10/25/11**
Interviewee Name	**Joseph Rail**
Title	**Remedial Project Manager**
Organization	**NAVFAC Washington**
Address	**1314 Harwood St SE, Bldg 212, Washington Navy Yard, DC 20374-5018**
Phone	**(202) 685-3105**
Email	**Joseph.Rail@navy.mil**
CH2M HILL Staff conducting Interview (if applicable)	**Jeff Woodward**

1. Background Information

In 1984, the United States Department of the Navy represented by the Naval Energy and Environmental Support Activity completed an Initial Assessment Study (IAS) of the Naval Research Laboratory (NRL).[1] The purpose of the IAS was to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations. The IAS contained information for two NRL facilities: the Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD) located in Chesapeake Beach, Maryland; and the Naval Research Laboratory facility located in Southeast Washington, D.C. (NRL-DC). The subject facility of this interview form is the NRL-CBD facility only (not the NRL-DC facility).

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[1] Naval Energy and Environmental Support Activity, Initial Assessment Study of Naval Research Laboratory, Washington, D.C. March 1984.

burning at the site. The chemicals included: benzene; toluene; waste oil; ether lithium hydride; acetone; alcohol; paint thinner; sulfuric acid; and nitric acid.

- Site 3 (Landfill No. 1): This site occupied approximately 3,750 square feet and was located south of existing Building 314 and was operational from 1942 to about 1950. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "Old Junk Row" and was used for open storage of large pieces of unused equipment or demolition debris.

- Site 4 (Landfill No. 2): This site occupied approximately 3,750 square feet and was located west of existing Building 301 and was operational from 1950 to about 1958. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility.

- Site 5 (Landfill No. 3): This site occupied approximately 3,750 square feet and was located near the western facility boundary (close to Dalrymple Road) and was operational from about 1958 to 1968. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "New Junk Row" and was used for storage of assorted debris including rusted laboratory equipment and missile packing crates. In addition to the typical landfill activities, two burning pits were located at the site. The materials burned in these pits consisted of municipal wastes and ten gallons per year of waste solvents.

- Site 6 (Power Plant Oil Spill): In 1973, an oil spill reportedly occurred at the power plant (Building 79) when an underground pipe main (approximately 6 inches in diameter) located 6 to 12 inches underground ruptured releasing approximately 75 gallons of No. 6 fuel oil into the soil. The pipe main supplied the oil from the three outside storage tank to the adjacent boiler room. The problem was corrected by removing approximately one cubic yard of soil and removing the pipe main with replacement with a new above ground pipe main. The old pipe main trench was reportedly backfilled with a mixture of clean earth.

- Site 7 (Road Oil Application): From 1940 to 1952, waste oils were spread on the NRL-CBD facility to control dust during dry periods. The waste oils were reportedly sprayed on the dirt roadways west of Route 261 (Bayside Road). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were mixed in with the waste oil for application. It was also reported, but not confirmed that minimal (less than 10 pints per year) quantities of polychlorinated biphenyl (PCB)-contaminated liquids may also have been mixed with the waste oils.

- Site 8 (Well Mercury Contamination): In March 1978, it was discovered that a mercury-filled flow meter had discharged approximately 7 to 14.5 pounds of mercury into the community water supply at NRL-CBD (near existing Building 81). Cleanup was conducted in two steps: (1) removal of the contaminated water was accomplished by flushing the entire water distribution system with water from the reservoir tower; and (2) the most highly contaminated parts of the system were cleaned using acetic and citric acids. Water supply monitoring for mercury was performed after the spill was detected and discontinued eight months after the spill since measured mercury concentrations were consistently below the Federal Primary Drinking Water Standards.

  Approximately 1,500 gallons of waste cleaning solution were collected during the flushing event and were transported to NRL-DC for disposal.

- Site 9 (Photoprocessing Waste Discharge): Wastewaters from an intermittent photoprocessing operation in former Building 43 (located north of existing Building 309) were discharged through a drainage pipe to the ground immediately outside the building. The operation was conducted for a five- to six-year period from the late 1960s to mid-1970s with operations discontinued in Building 43 in 1975. During each year of operation, the photo lab was used one to two times, generating 10 to 15 gallons of waste photographic solutions (e.g., sodium thiosulfate, hydroquinone) per event.

2. Interview Questions:

The questions identified below are provided to enhance the understanding of the historical activities related to the eight sites summarized above and other potential sites at NRL-CBD.

Site 2 (Chemical Burial Site):

1. Do you have any first-hand knowledge or information regarding the location of this site?

No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No, past disposal practices and closure of this site was well before my employment by the Dept. of Navy.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

Other than the 1984 IAS Report , no.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No.

Site 3 (Landfill No. 1):

1. Do you have any first-hand knowledge or information regarding the location of this site (including the location of "Old Junk Row")?

   No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "Old Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No, past disposal practices and closure of this site was well before my employment by the Dept. of Navy.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "Old Junk Row")?

   Other than the 1984 IAS Report , no.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 4 (Landfill No. 2):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No, past disposal practices and closure of this site was well before my employment by the Dept. of Navy.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   Other than the 1984 IAS Report , no.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 5 (Landfill No. 3):

1. Do you have any first-hand knowledge or information regarding the location of this site (including "New Junk Row")?

   No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "New Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No, past disposal practices and closure of this site was well before my employment by the Dept. of Navy.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "New Junk Row")?

   Other than the 1984 IAS Report , no.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 6 (Power Plant Oil Spill):

1. Do you have any first-hand knowledge or information regarding the location of this spill?

No.

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

Other than the 1984 IAS Report , no.

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No.

Site 7 (Road Oil Application):

1. Do you have any first-hand knowledge or information regarding the location of this road oil application at NRL-CBD?

   No.

2. Do you have any first-hand knowledge or information regarding materials used as part of the road oil application of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No, past site activities and closure of this site was well before my employment by the Dept. of Navy.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   Other than the 1984 IAS Report , no.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 8 (Well Mercury Contamination):

1. Do you have any first-hand knowledge or information regarding the location of this site?

No.

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

Other than the 1984 IAS Report , no.

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No.

Site 9 (Photoprocessing Waste Discharge):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No, past site activities and closure of this site was well before my employment by the Dept. of Navy.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   Other than the 1984 IAS Report , no.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Other Potential Sites (Different Sites or Areas than the Eight identified above):

1. Do you have any first-hand knowledge or information regarding other areas or sites at NRL-CBD where waste disposal, waste burial, or other similar historical waste/materials management was performed? If so, please identify/explain the disposal location, type of material/chemical disposed, quantity, media (solid or liquid), approximately timeframe of disposal, and approximate duration of disposal.

No. My entire involvement with NRL-CBD has been managing five Munitions Response Sites and overseeing a Preliminary Assessment.

2. If the answer to the question above is "Yes", are you aware of any reports, drawings, maps, and/or other documents with additional details regarding these other areas/sites?

NA

3. Do you have any further comments or suggestions related to the interview for our consideration?

None.

Form Completed by Mr. Donnie Jones, NRL-DC, November 29, 2011

2. Interview Questions:

The questions identified below are provided to enhance the understanding of the historical activities related to the eight sites summarized above and other potential sites at NRL-CBD.

Site 2 (Chemical Burial Site):

1. Do you have any first-hand knowledge or information regarding the location of this site?

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Site 3 (Landfill No. 1):

1. Do you have any first-hand knowledge or information regarding the location of this site (including the location of "Old Junk Row")?

NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "Old Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "Old Junk Row")?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 4 (Landfill No. 2):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Site 5 (Landfill No. 3):

1. Do you have any first-hand knowledge or information regarding the location of this site (including "New Junk Row")?

NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "New Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "New Junk Row")?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 6 (Power Plant Oil Spill):

1. Do you have any first-hand knowledge or information regarding the location of this spill?

   no

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   no

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   no

Site 7 (Road Oil Application):

1. Do you have any first-hand knowledge or information regarding the location of this road oil application at NRL-CBD?

NO

2. Do you have any first-hand knowledge or information regarding materials used as part of the road oil application of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 8 (Well Mercury Contamination):

1. Do you have any first-hand knowledge or information regarding the location of this site?

WATER tower

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

no

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

no

Site 9 (Photoprocessing Waste Discharge):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Other Potential Sites (Different Sites or Areas than the Eight identified above):

1. Do you have any first-hand knowledge or information regarding other areas or sites at NRL-CBD where waste disposal, waste burial, or other similar historical waste/materials management was performed? If so, please identify/explain the disposal location, type of material/chemical disposed, quantity, media (solid or liquid), approximately timeframe of disposal, and approximate duration of disposal.

Behind Bldg 76 Public works Bldg

2. If the answer to the question above is "Yes", are you aware of any reports, drawings, maps, and/or other documents with additional details regarding these other areas/sites?

No

3. Do you have any further comments or suggestions related to the interview for our consideration?

No

Date of Interview Form Completion	10-25-11
Interviewee Name	William Drury
Title	Small Craft Operator
Organization	NRL / CBD
Address	5813 Bayside Rd
Phone	410-257-4056
Email	
CH2M HILL Staff conducting Interview (if applicable)	

1. Background Information

In 1984, the United States Department of the Navy represented by the Naval Energy and Environmental Support Activity completed an Initial Assessment Study (IAS) of the Naval Research Laboratory (NRL).[1] The purpose of the IAS was to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations. The IAS contained information for two NRL facilities: the Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD) located in Chesapeake Beach, Maryland; and the Naval Research Laboratory facility located in Southeast Washington, D.C. (NRL-DC). The subject facility of this interview form is the NRL-CBD facility only (not the NRL-DC facility).

The IAS identified eight potentially contaminated sites at the NRL-CBD facility. Based on the information provided in the IAS, these eight sites are summarized below and their approximate location on the NRL-CBD facility is presented in Figure 1:

- Site 2 (Chemical Burial Site): Waste chemicals from NRL-DC were burned and/or buried at this site located west of existing Building 301. The last known dates of operation were during the years of 1968 and 1969. Only two instances of large-scale disposal were documented at the site: (1) approximately 1,200 pounds (36 cartons of waste chemicals were taken to NRL-CBD for disposal in the period of May to October 1969; and (2) approximately 400 pounds of chemicals in one shipment for burning at the site. The chemicals included: benzene; toluene; waste oil; ether

[1] Naval Energy and Environmental Support Activity, Initial Assessment Study of Naval Research Laboratory, Washington, D.C. March 1984.

lithium hydride; acetone; alcohol; paint thinner; sulfuric acid; and nitric acid.

- Site 3 (Landfill No. 1): This site occupied approximately 3,750 square feet and was located south of existing Building 314 and was operational from 1942 to about 1950. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "Old Junk Row" and was used for open storage of large pieces of unused equipment or demolition debris.

- Site 4 (Landfill No. 2): This site occupied approximately 3,750 square feet and was located west of existing Building 301 and was operational from 1950 to about 1958. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility.

- Site 5 (Landfill No. 3): This site occupied approximately 3,750 square feet and was located near the western facility boundary (close to Dalrymple Road) and was operational from about 1958 to 1968. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "New Junk Row" and was used for storage of assorted debris including rusted laboratory equipment and missile packing crates. In addition to the typical landfill activities, two burning pits were located at the site. The materials burned in these pits consisted of municipal wastes and ten gallons per year of waste solvents.

- Site 6 (Power Plant Oil Spill): In 1973, an oil spill reportedly occurred at the power plant (Building 79) when an underground pipe main (approximately 6 inches in diameter) located 6 to 12 inches underground ruptured releasing approximately 75 gallons of No. 6 fuel oil into the soil. The pipe main supplied the oil from the three outside storage tank to the adjacent boiler room. The problem was corrected by removing approximately one cubic yard of soil and removing the pipe main with replacement with a new above ground pipe main. The old pipe main trench was reportedly backfilled with a mixture of clean earth.

- Site 7 (Road Oil Application): From 1940 to 1952, waste oils were spread on the NRL-CBD facility to control dust during dry periods. The waste oils were reportedly sprayed on the dirt roadways west of Route 261 (Bayside Road). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were mixed in with the waste oil for application. It was also reported, but not confirmed that minimal (less than 10 pints per year) quantities of polychlorinated biphenyl (PCB)-contaminated liquids may also have been mixed with the waste oils.

- Site 8 (Well Mercury Contamination): In March 1978, it was discovered that a mercury-filled flow meter had discharged approximately 7 to 14.5 pounds of mercury into the community water supply at NRL-CBD (near existing Building 81). Cleanup was conducted in two steps: (1) removal of the contaminated water was accomplished by flushing the entire water distribution system with water from the reservoir tower; and (2) the most highly contaminated parts of the system were cleaned using acetic and citric acids. Water supply monitoring for mercury was performed after the spill was detected and discontinued eight months after the spill since measured mercury concentrations were consistently below the Federal Primary Drinking Water Standards.

  Approximately 1,500 gallons of waste cleaning solution were collected during the flushing event and were transported to NRL-DC for disposal.

- Site 9 (Photoprocessing Waste Discharge): Wastewaters from an intermittent photoprocessing operation in former Building 43 (located north of existing Building 309) were discharged through a drainage pipe to the ground immediately outside the building. The operation was conducted for a five- to six-year period from the late 1960s to mid-1970s with operations discontinued in Building 43 in 1975. During each year of operation, the photo lab was used one to two times, generating 10 to 15 gallons of waste photographic solutions (e.g., sodium thiosulfate, hydroquinone) per event.

2. Interview Questions:

The questions identified below are provided to enhance the understanding of the historical activities related to the eight sites summarized above and other potential sites at NRL-CBD.

Site 2 (Chemical Burial Site):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Site 3 (Landfill No. 1):

1. Do you have any first-hand knowledge or information regarding the location of this site (including the location of "Old Junk Row")?

   NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "Old Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "Old Junk Row")?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Site 4 (Landfill No. 2):

1. Do you have any first-hand knowledge or information regarding the location of this site?

NO

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 5 (Landfill No. 3):

1. Do you have any first-hand knowledge or information regarding the location of this site (including "New Junk Row")?

   yes,

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "New Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   yes, However during my tenure at this period the only thing Left was old Rusty Metal "ie old Trailer Parts ect"

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "New Junk Row")?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Site 6 (Power Plant Oil Spill):

1. Do you have any first-hand knowledge or information regarding the location of this spill?

   NO

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Site 7 (Road Oil Application):

1. Do you have any first-hand knowledge or information regarding the location of this road oil application at NRL-CBD?

NO

2. Do you have any first-hand knowledge or information regarding materials used as part of the road oil application of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 8 (Well Mercury Contamination):

1. Do you have any first-hand knowledge or information regarding the location of this site?

NO

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 9 (Photoprocessing Waste Discharge):

1. Do you have any first-hand knowledge or information regarding the location of this site?

Yes, location only IE Building and Darkroom

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Other Potential Sites (Different Sites or Areas than the Eight identified above):

1. Do you have any first-hand knowledge or information regarding other areas or sites at NRL-CBD where waste disposal, waste burial, or other similar historical waste/materials management was performed? If so, please identify/explain the disposal location, type of material/chemical disposed, quantity, media (solid or liquid), approximately timeframe of disposal, and approximate duration of disposal.

NA.

2. If the answer to the question above is "Yes", are you aware of any reports, drawings, maps, and/or other documents with additional details regarding these other areas/sites?

3. Do you have any further comments or suggestions related to the interview for our consideration?

Date of Interview Form Completion	**10/25/11**
Interviewee Name	**Harold W. Rolfs**
Title	**Customer Liason Manager**
Organization	**Naval Research Laboratory**
Address	**5813 Bayside Road** **Chesapeake Beach, MD 20732**
Phone	**410-257-4002 410-257-4035(temp) 202-345-7616**
Email	**Harold.rolfs@nrl.navy.mil**
CH2M HILL Staff conducting Interview (if applicable)	

1. Background Information

In 1984, the United States Department of the Navy represented by the Naval Energy and Environmental Support Activity completed an Initial Assessment Study (IAS) of the Naval Research Laboratory (NRL).[1] The purpose of the IAS was to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations. The IAS contained information for two NRL facilities: the Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD) located in Chesapeake Beach, Maryland; and the Naval Research Laboratory facility located in Southeast Washington, D.C. (NRL-DC). The subject facility of this interview form is the NRL-CBD facility only (not the NRL-DC facility).

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- Site 7 (Road Oil Application): From 1940 to 1952, waste oils were spread on the NRL-CBD facility to control dust during dry periods. The waste oils were reportedly sprayed on the dirt roadways west of Route 261 (Bayside Road). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were mixed in with the waste oil for application. It was also reported, but not confirmed that minimal (less than 10 pints per year) quantities of polychlorinated biphenyl (PCB)-contaminated liquids may also have been mixed with the waste oils.

- Site 8 (Well Mercury Contamination): In March 1978, it was discovered that a mercury-filled flow meter had discharged approximately 7 to 14.5 pounds of mercury into the community water supply at NRL-CBD (near existing Building 81). Cleanup was conducted in two steps: (1) removal of the contaminated water was accomplished by flushing the entire water distribution system with water from the reservoir tower; and (2) the most highly contaminated parts of the system were cleaned using acetic and citric acids. Water supply monitoring for mercury was performed after the spill was detected and discontinued eight months after the spill since measured mercury concentrations were consistently below the Federal Primary Drinking Water Standards.

  Approximately 1,500 gallons of waste cleaning solution were collected during the flushing event and were transported to NRL-DC for disposal.

- Site 9 (Photoprocessing Waste Discharge): Wastewaters from an intermittent photoprocessing operation in former Building 43 (located north of existing Building 309) were discharged through a drainage pipe to the ground immediately outside the building. The operation was conducted for a five- to six-year period from the late 1960s to mid-1970s with operations discontinued in Building 43 in 1975. During each year of operation, the photo lab was used one to two times, generating 10 to 15 gallons of waste photographic solutions (e.g., sodium thiosulfate, hydroquinone) per event.

2. Interview Questions:

The questions identified below are provided to enhance the understanding of the historical activities related to the eight sites summarized above and other potential sites at NRL-CBD.

Site 2 (Chemical Burial Site):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   No

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   I have not found any records to date.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   Yes. Photos and drawings.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 3 (Landfill No. 1):

1. Do you have any first-hand knowledge or information regarding the location of this site (including the location of "Old Junk Row")?

   No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "Old Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "Old Junk Row")?

   Yes. Photos and drawings.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 4 (Landfill No. 2):

1. Do you have any first-hand knowledge or information regarding the location of this site?

No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

Yes. Photos and drawings.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No.

Site 5 (Landfill No. 3):

1. Do you have any first-hand knowledge or information regarding the location of this site (including "New Junk Row")?

   No.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "New Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "New Junk Row")?

   Yes. Photos and drawings.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 6 (Power Plant Oil Spill):

1. Do you have any first-hand knowledge or information regarding the location of this spill?

   No.

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   No.

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Site 7 (Road Oil Application):

1. Do you have any first-hand knowledge or information regarding the location of this road oil application at NRL-CBD?

No

2. Do you have any first-hand knowledge or information regarding materials used as part of the road oil application of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

No.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

No.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No.

Site 8 (Well Mercury Contamination):

1. Do you have any first-hand knowledge or information regarding the location of this site?

No.

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

Yes.

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

No.

Site 9 (Photoprocessing Waste Discharge):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   Limited knowledge.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   No.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   Facility Map.

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   No.

Other Potential Sites (Different Sites or Areas than the Eight identified above):

1. Do you have any first-hand knowledge or information regarding other areas or sites at NRL-CBD where waste disposal, waste burial, or other similar historical waste/materials management was performed? If so, please identify/explain the disposal location, type of material/chemical disposed, quantity, media (solid or liquid), approximately timeframe of disposal, and approximate duration of disposal.

No.

2. If the answer to the question above is "Yes", are you aware of any reports, drawings, maps, and/or other documents with additional details regarding these other areas/sites?

N/A

3. Do you have any further comments or suggestions related to the interview for our consideration?

No.

Date of Interview Form Completion	11-9-11
Interviewee Name	EARL D. WALTON
Title	
Organization	
Address	1410 FAIRVIEW DR BERKELEY SPRINGS, WV 25411
Phone	571 251 1780
Email	
CH2M HILL Staff conducting Interview (if applicable)	

1. Background Information

In 1984, the United States Department of the Navy represented by the Naval Energy and Environmental Support Activity completed an Initial Assessment Study (IAS) of the Naval Research Laboratory (NRL).[1] The purpose of the IAS was to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations. The IAS contained information for two NRL facilities: the Naval Research Laboratory - Chesapeake Bay Detachment (NRL-CBD) located in Chesapeake Beach, Maryland; and the Naval Research Laboratory facility located in Southeast Washington, D.C. (NRL-DC). The subject facility of this interview form is the NRL-CBD facility only (not the NRL-DC facility).

The IAS identified eight potentially contaminated sites at the NRL-CBD facility. Based on the information provided in the IAS, these eight sites are summarized below and their approximate location on the NRL-CBD facility is presented in Figure 1:

- Site 2 (Chemical Burial Site): Waste chemicals from NRL-DC were burned and/or buried at this site located west of existing Building 301. The last known dates of operation were during the years of 1968 and 1969. Only two instances of large-scale disposal were documented at the site: (1) approximately 1,200 pounds (36 cartons of waste chemicals were taken to NRL-CBD for disposal in the period of May to October 1969; and (2) approximately 400 pounds of chemicals in one shipment for burning at the site. The chemicals included: benzene; toluene; waste oil; ether

[1] Naval Energy and Environmental Support Activity, Initial Assessment Study of Naval Research Laboratory, Washington, D.C. March 1984.

lithium hydride; acetone; alcohol; paint thinner; sulfuric acid; and nitric acid.

- Site 3 (Landfill No. 1): This site occupied approximately 3,750 square feet and was located south of existing Building 314 and was operational from 1942 to about 1950. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "Old Junk Row" and was used for open storage of large pieces of unused equipment or demolition debris.

- Site 4 (Landfill No. 2): This site occupied approximately 3,750 square feet and was located west of existing Building 301 and was operational from 1950 to about 1958. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility.

- Site 5 (Landfill No. 3): This site occupied approximately 3,750 square feet and was located near the western facility boundary (close to Dalrymple Road) and was operational from about 1958 to 1968. During operation, the landfill accepted municipal waste, shop waste, and non-toxic laboratory waste from the NRL-CBD facility. Once the landfill was closed and covered with excavated soil, this area was designated as "New Junk Row" and was used for storage of assorted debris including rusted laboratory equipment and missile packing crates. In addition to the typical landfill activities, two burning pits were located at the site. The materials burned in these pits consisted of municipal wastes and ten gallons per year of waste solvents.

- Site 6 (Power Plant Oil Spill): In 1973, an oil spill reportedly occurred at the power plant (Building 79) when an underground pipe main (approximately 6 inches in diameter) located 6 to 12 inches underground ruptured releasing approximately 75 gallons of No. 6 fuel oil into the soil. The pipe main supplied the oil from the three outside storage tank to the adjacent boiler room. The problem was corrected by removing approximately one cubic yard of soil and removing the pipe main with replacement with a new above ground pipe main. The old pipe main trench was reportedly backfilled with a mixture of clean earth.

- Site 7 (Road Oil Application): From 1940 to 1952, waste oils were spread on the NRL-CBD facility to control dust during dry periods. The waste oils were reportedly sprayed on the dirt roadways west of Route 261 (Bayside Road). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were mixed in with the waste oil for application. It was also reported, but not confirmed that minimal (less than 10 pints per year) quantities of polychlorinated biphenyl (PCB)-contaminated liquids may also have been mixed with the waste oils.

- Site 8 (Well Mercury Contamination): In March 1978, it was discovered that a mercury-filled flow meter had discharged approximately 7 to 14.5 pounds of mercury into the community water supply at NRL-CBD (near existing Building 81). Cleanup was conducted in two steps: (1) removal of the contaminated water was accomplished by flushing the entire water distribution system with water from the reservoir tower; and (2) the most highly contaminated parts of the system were cleaned using acetic and citric acids. Water supply monitoring for mercury was performed after the spill was detected and discontinued eight months after the spill since measured mercury concentrations were consistently below the Federal Primary Drinking Water Standards.

  Approximately 1,500 gallons of waste cleaning solution were collected during the flushing event and were transported to NRL-DC for disposal.

- Site 9 (Photoprocessing Waste Discharge): Wastewaters from an intermittent photoprocessing operation in former Building 43 (located north of existing Building 309) were discharged through a drainage pipe to the ground immediately outside the building. The operation was conducted for a five- to six-year period from the late 1960s to mid-1970s with operations discontinued in Building 43 in 1975. During each year of operation, the photo lab was used one to two times, generating 10 to 15 gallons of waste photographic solutions (e.g., sodium thiosulfate, hydroquinone) per event.

2. Interview Questions:

The questions identified below are provided to enhance the understanding of the historical activities related to the eight sites summarized above and other potential sites at NRL-CBD.

Site 2 (Chemical Burial Site):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   THERE WAS A LARGE HOLE DUG AT APPROXIMATELY THIS AREA ONE DAY AND THE NEXT DAY THE HOLE HAD BEEN FILLED IN. NO IDEA WHAT IF ANYTHING WAS BURIED THERE

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

I STARTED AT CBD 4-29-68 I HAVE NO KNOWLEDGE OF ANYTHING BEFORE THAT DATE. HOPE I HAVE BEEN SOME HELP

[illegible]
[illegible]

INTERVIEW FORM

SITE INVESTIGATION: NAVAL RESEARCH LABORATORY – CHESAPEAKE BAY DETACHMENT (NRL-CBD), CHESAPEAKE BEACH, MARYLAND

Site 3 (Landfill No. 1):

1. Do you have any first-hand knowledge or information regarding the location of this site (including the location of "Old Junk Row")?

ONLY KNEW THE AREA AS JUNK ROW
NOT THAT ANYTHING WAS BURIED THERE

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "Old Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "Old Junk Row")?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 4 (Landfill No. 2):

1. Do you have any first-hand knowledge or information regarding the location of this site?

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

Site 5 (Landfill No. 3):

1. Do you have any first-hand knowledge or information regarding the location of this site (including "New Junk Row")?

RECALL HOUSEHOLD GARBAGE FROM HOUSING AND SHOPS BEING DUMPED THERE

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site including "New Junk Row" (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site (including "New Junk Row")?

NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 6 (Power Plant Oil Spill):

1. Do you have any first-hand knowledge or information regarding the location of this spill?

THE SPILL WAS IN AREA DESCRIBED ON SITE INVESTIGATION PAPER

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 7 (Road Oil Application):

1. Do you have any first-hand knowledge or information regarding the location of this road oil application at NRL-CBD?

   [illegible]

2. Do you have any first-hand knowledge or information regarding materials used as part of the road oil application of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   [illegible]

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   [illegible]

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   [illegible]

Site 8 (Well Mercury Contamination):

1. Do you have any first-hand knowledge or information regarding the location of this site?

SPILL WAS AT AREA INDICATED ON MAP AS BLDG 58. YOUR REPORT SAYS IT WAS BLDG 81

2. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

NO

3. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

NO

Site 9 (Photoprocessing Waste Discharge):

1. Do you have any first-hand knowledge or information regarding the location of this site?

   THERE WAS A SMALL PHOTO LAB IN BLDG 43 WITH A HOSE THRU THE WALL TO THE OUTSIDE. AT SITE 9.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

   NO

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

   NO

4. Are you aware of any specific information for this site which suggests that the summary description provided from the 1984 IAS is inaccurate or incomplete?

   NO

Other Potential Sites (Different Sites or Areas than the Eight identified above):

1. Do you have any first-hand knowledge or information regarding other areas or sites at NRL-CBD where waste disposal, waste burial, or other similar historical waste/materials management was performed? If so, please identify/explain the disposal location, type of material/chemical disposed, quantity, media (solid or liquid), approximately timeframe of disposal, and approximate duration of disposal.

   THERE WAS SOME SOLID WASTE DUMPED IN THE RAVINE WEST OF BLDG 76 IN THE AREA OF THE YELLOW STORAGE BLDG. IT WAS COVERED WITH DIRT PROBABLY 20-25 YEARS AGO

2. If the answer to the question above is "Yes", are you aware of any reports, drawings, maps, and/or other documents with additional details regarding these other areas/sites?

   NO

3. Do you have any further comments or suggestions related to the interview for our consideration?

Appendix A.5
Historical Documents from NRL-CBD

STATE OF MARYLAND
DEPARTMENT OF HEALTH AND MENTAL HYGIENE
LABORATORIES ADMINISTRATION
REPORT OF DRINKING WATER ANALYSIS

FILE NUMBER B-20 & B-21

Calvert
NAME OF COUNTY

SOURCE OF SAMPLE Navy Base, Randle Cliff COLLECTOR W.T. Blair

SAMPLE TYPE: DISTRIBUTION ______ SOURCE ✓ OTHER ______ (Specify)

COMMUNITY ______ OTHER PUBLIC ______ PRIVATE SUPPLY ✓

REMARKS: well

TRANS CODE (1)	COUNTY (2 3)	PLANT NO. (4 5 6 7)	SAMPLING STATION (8 9 10 11)	DATE COLLECTED (12–17)	CARD NO. (18 19)
	0 4			0 3 1 3 7 8	

FIELD pH (20 21 22) 0 7 . 5 FIELD RESID. CHLORINE: FREE (23 24) ______ TOTAL (25 26) ______

✓	TEST FOR	CODE	RESULTS	✓	TEST FOR	CODE	RESULTS
	pH *	011			CALCIUM	231	
	COLOR *	020			MAGNESIUM	241	
	TURBIDITY *	031			ARSENIC	253	
	ALKALINITY	040			BARIUM	262	
	BICARBONATE ALK.	050			CADIUM	273	
	CARBONATE ALK.	060			CHROMIUM +6	282	
	CARBONATE STAB. pH *	071			COPPER	293	
	ALKALINITY	080			LEAD	302	
	CHLORIDE	091		✓	MERCURY	314	0.150
	FLUORIDE	101			SELENIUM	323	
	HARDNESS	110			SILVER	333	
	IRON	122			ZINC	342	
	MANGANESE	133			OIL (GREASE)	351	
	AMMONIA N. FREE	143			POTASSIUM	361	
	ALBUMINOID	153			SODIUM	371	
	NITRATE	162			TOTAL SOLIDS	381	
	NITRITE	173					
	MBAS	182					
	ALUMINUM	192					
	CYANIDE	202					
	SILICA	210					
	SULFATE	220					

Water Testing Results

* RESULTS REPORTED IN UNITS, ALL OTHERS IN MILLIGR

DATE RECEIVED MAR 14 1978 DATE REPORTED 4/ ______ CHEMIST [illegible] LAB NO. 7573

STATE OF MARYLAND

DEPARTMENT OF HEALTH AND MENTAL HYGIENE

LABORATORIES ADMINISTRATION

REPORT OF DRINKING WATER ANALYSIS

STATE NUMBER B-22+B-23

Calvert
NAME OF COUNTY

SOURCE OF SAMPLE Comdr. Bauer Residence Navy Base, Randle Cliff COLLECTOR W.T. Blair

SAMPLE TYPE: DISTRIBUTION ✓ SOURCE ____ OTHER ____ (Specify)

COMMUNITY ____ OTHER PUBLIC ____ PRIVATE SUPPLY ✓

REMARKS

1	2 3	4 5 6 7	8 9 10 11	12 13 14 15 16 17	18 19
	0 4			0 3 1 3 7 8	
TRANS CODE	COUNTY	PLANT NO.	SAMPLING STATION	DATE COLLECTED	CARD NO.

FIELD pH (20 21 22) 0 7 . 5 FIELD RESID. CHLORINE: FREE (23 24) ____ TOTAL (25 26) ____

✓	TEST FOR	CODE	RESULTS	✓	TEST FOR	CODE	RESULTS
	pH *	011			CALCIUM	231	
	COLOR *	020			MAGNESIUM	241	
	TURBIDITY *	031			ARSENIC	253	
	ALKALINITY	040			BARIUM	262	
	BICARBONATE ALK.	050			CADIUM	273	
	CARBONATE ALK.	060			CHROMIUM +6	282	
	CARBONATE STAB. pH *	071			COPPER	293	
	ALKALINITY	080			LEAD	302	
	CHLORIDE	091		✓	MERCURY	314	0225
	FLUORIDE	101			SELENIUM	323	
	HARDNESS	110			SILVER	333	
	IRON	122			ZINC	342	
	MANGANESE	133			OIL (GREASE)	351	
	AMMONIA N. FREE	143			POTASSIUM	361	
	ALBUMINOID	153			SODIUM	371	
	NITRATE	162			TOTAL SOLIDS	381	
	NITRITE	173					
	MBAS	182					
	ALUMINUM	192					
	CYANIDE	202					
	SILICA	210					
	SULFATE	220					

* RESULTS REPORTED IN UNITS, ALL OTHERS IN MILLIGRAMS PER LITER (PPM)

DATE RECEIVED MAR 14 1978 DATE REPORTED APR ____ CHEMIST [illegible] LAB NO. 7574

DHMH 90-A (5/76)

CBD Water samples 3/22-24/78

Location	Hg m ppb 3/22/78	Hg m ppb 3/24/78	Comments	Sample #s
Quarters A	18	19		3/22-1, 3/24-1
Quarters I	21	12		3/22-2, 3/24-2
W-13	12	8		3/22-3, 3/24-3
Bldg 6 kit. sink	15	11		3/22-4, 3/24-4
P.H. #7 - upper of 2 taps	<.3	<.3	particulates - probably sand *	3/22-5, 3/24-5
P.H. #6 - check side	9.	208	contains Hg droplets *	3/22-6, 3/24-6
P.H. #6 - from well	54.	93	" " " *	3/22-7, 3/24-7
"hollow" area old water	9.9	—		3/22-8
C.W. tap NRL bldg 207	—	<.3		NRL-3/24/78-1

Results of at least 3 runs for each sample, run within 48 hrs of sampling by std. EPA cold-vapor A.A. method.

* being analyzed by x-ray fluorescence to distinguish elemental mercury from sand and other materials.

— L. Cooper 3/27/78

Hg ANALYSES OF

CBD WATER SUPPLY BY NRL CODE 6130

(Preliminary - 3/23/78)

Date Sampled	Location	Results by AA (Atomic Absorption) (ppb)[a,c]	Results by X-ray Fl. (ppb)[a,d]
3/10/78	Quarters A	97	80
3/15/78	? BLDG 6	25	19
before 3/20/78	Quarters J grape juice	< 1[b]	20[e] sol. 21[e] SS (suspended solids)
before 3/20/78	Quarters J orange juice	b	
3/20/78	Quarters J drain trap		
3/20/78	4-yr old emerg. supply (sample #1)	1	
3/20/78	Quarters A (sample #2)	20	12 sol. <1.3 SS
3/20/78	W13 (sample #3)	10	10 sol. <1.3 SS
3/20/78	Quarters J (sample #4)	20	15 sol. <1.3 SS
3/20/78	Pump house #7(a) (sample #5)	1	9 sol. <1.3 SS
3/20/78	Pump house #7(6) (sample #6)	1	

[a] 95% confidence level is within 5 to 10% of values shown except as noted.

[b] Questionable

[c] Sensitivity limit is 0.2 ppb

[d] Sensitivity limit is 1.3 ppb

[e] Larger possible error due to prolonged filtration time required and other variables

STATE OF MARYLAND

DEPARTMENT OF HEALTH AND MENTAL HYGIENE

LABORATORIES ADMINISTRATION

E REPORT OF DRINKING WATER ANALYSIS

OTTLE NUMBER C.L.13 E

Calvert
NAME OF COUNTY

SOURCE OF SAMPLE Naval research lab. Chesapeake Beach division COLLECTOR A. Schutte

SAMPLE TYPE: DISTRIBUTION ✓ SOURCE ______ OTHER ______ (Specify)

COMMUNITY ______ OTHER PUBLIC ______ PRIVATE SUPPLY ______

REMARKS: Att. H. B. (Bldg. #75)

1	2 3	4 5 6 7	8 9 10 11	12 13 14 15 16 17	18 19
	0 4	9 9 9 9	9 9 9 9	0 3 2 8 7 8	
TRANS CODE	COUNTY	PLANT NO.	SAMPLING STATION	DATE COLLECTED	CARD NO.

FIELD pH * (20 21 22) 0 7 6 FIELD RESID. CHLORINE: FREE (23 24) ______ TOTAL (25 26) ______

✓	TEST FOR	CODE	RESULTS	✓	TEST FOR	CODE	RESULTS
	pH *	011			CALCIUM	231	
	COLOR *	020			MAGNESIUM	241	
	TURBIDITY *	031			ARSENIC	253	
	ALKALINITY	040			BARIUM	262	
	BICARBONATE ALK.	050			CADIUM	273	
	CARBONATE ALK	060			CHROMIUM +6	282	
	CARBONATE STAB. pH *	071			COPPER	293	
	ALKALINITY	080			LEAD	302	
	CHLORIDE	091		✓	MERCURY	314	0 0 0 7 /
	FLUORIDE	101			SELENIUM	323	
	HARDNESS	110			SILVER	333	
	IRON	122			ZINC	342	
	MANGANESE	133			OIL, (GREASE)	351	
	AMMONIA N. FREE	143			POTASSIUM	361	
	ALBUMINOID	153			SODIUM	371	
	NITRATE	162			TOTAL SOLIDS	381	
	NITRITE	173					
	MBAS	182					
	ALUMINUM	192					
	CYANIDE	202					
	SILICA	210					
	SULFATE	220					

* RESULTS REPORTED IN UNITS, ALL OTHERS IN MILLIGRAMS PER LITER (PPM)

DATE RECEIVED MAR 28 1978 DATE REPORTED APR [illegible] CHEMIST ______ LAB NO. 81[illegible]

DHMH - 80-A (5/76)

CBD WATER ANALYSES FOR MERCURY[1]

Summary - 31 March 1978

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30
Quarters A cw	97(80[2])		20(12 sol, <1.3 SS)[2]	18	19	7.4	13
Quarters B cw		25(19[2])				13	
Quarters C cw						17	
Quarters D cw						10	
Quarters E cw						18	
Quarters F cw						19	
Quarters G cw						9.7	
Quarters H cw						18	
Quarters I cw				21	12	17	
Quarters J cw			20(15 sol, <1.3 SS)[2]			9.9	
Quarters J Grape Kool-aid[3,4]		20(sol) 21 SS					
6-yr-old emergency supply			1				
Quarters W1 cw						6.0	
Quarters W2 cw						6.7	
Quarters W3 cw						7.5	6.9
Quarters W4 cw						7.2	
Quarters W5 cw						4.5	

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30
Quarters W6 cw						4.7	
Quarters W7 cw						8.3	
Quarters W8 cw						8.3	
Quarters W9 cw						5.6	
Quarters W10 cw						11	
Quarters W11 cw						8.2	
Quarters W12 cw						7.1	
Quarters W13 cw			10(10 sol, <1.3 SS)^2	12	8	10	
Quarters W15 cw						11	
Pump house #7			1(3.3 sol, <1.3 SS)^2	<.2	<.2	<.2	<.2
P.H. #6 from well				54^5sol	93^5sol	272^5sol	67 sol
P.H. #6 check side				9^5sol	208^5sol		5.3 sol
Bldg. 6 coffee mess		25(19^2)		15	11	6.1	9.3
"hollow" area - old water (?)				9.9			
NRL main loc'n, cw Bldg.207,R.313					<.2		
Store in Randales Cliff						.2	
Bay water at pier						<.2	
Tower before flush					7.7		

ample ocation	3/10	3/15	3/20	3/22	3/24	3/28	3/30
ower sludge					.3 sol 5 SS		
ydrant at whirl-ing arm							151
uarters A H.W.[7]						19	
uarters B H.W.						17	
uarters C H.W.						8.3	
uarters D H.W.						5.2	
uarters W1 H.W.						3.5	
uarters W2 H.W.						4.5 sol	
uarters W3 H.W.						62	
uarters W4 H.W.						15.8(18 sol)	
uarters W5 H.W.						18(4.2 sol)	
uarters W6 H.W.						86(5 sol)	
uarters W7 H.W.						101(6.7 sol)	
uarters W8 H.W.						32(5.0 sol)	
uarters W9 H.W.						>1500(14 sol)	
uarters W10 H.W.						57(1.2 sol)	
uarters W11 H.W.						84(4.2 sol)	
uarters W12 H.W.						2.1 sol	
uarters W13 H.W.						224(5.2 sol)	
uarters W15 H.W.						232	

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30
Ice cubes[6] spec.1, Bldg. 4							.3
Ice cubes spec.2, Bldg. 4							1
Ice cubes spec. 1, Bldg. 75							.5
Ice cubes spec. 2, Bldg. 75							<.2
Ice cubes spec. 3, Bldg. 75							<.2
Ice cubes spec. 4, Bldg. 75							<.2
Sediment from hose and tank, water from Pump #6							>1200[5] sol.

[1]Unless otherwise specified, values are in µg/ml (ppb) for total mercury by EPA standard cold vapor AA method, samples generally run within 48 hours of sampling except those dated 3/10 and 3/15 and older stored samples.

[2]By X-ray fluorescence method.

[3]Samples before 3/20/78

[4]sol = soluble Hg, SS = suspended solids

[5]Contained Hg droplet, thus total Hg greater than value reported

[6]Dates preceded March 1978

[7]There is a remote possibility that the values for H.W. (hot water) samples are artificially high due to potential interference from large amounts of organic materials in the sediment. This problem is being evaluated.

CBD WATER ANALYSES FOR MERCURY[1]

Summary - 13 April 1978

Sample Location	3/10 FLUSH	3/15 FLUSH 17	3/20 FLUSH 21st	3/22	3/24 24th FLUSH	3/28	3/30 30th FLUSH	4/4	4/10
Quarters A cw	97(80[2])		20(12 sol, <1.3 SS)[2]	18	19	7.4	13	22	14
Quarters B cw		25(19[2])				13			
Quarters C cw						17			
Quarters D cw						10			
Quarters E cw						18			
Quarters F cw						19			
Quarters G cw						9.7			
Quarters H cw						18			
Quarters I cw				21	12	17			
Quarters J cw			20(15 sol, <1.3 SS)[2]			9.9		28	18
Quarters J Grape Kool-aid[3,4]		20(sol) 21 SS							
6-yr-old emergency supply			1						
Quarters W1 cw						6.0			
Quarters W2 cw						6.7			
Quarters W3 cw						7.5	6.9	12	7.7
Quarters W4 cw						7.2			
Quarters W5 cw						4.5			

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30	4/4	4/10
Quarters W6 cw						4.7			
Quarters W7 cw						8.3			
Quarters W8 cw						8.3			
Quarters W9 cw						5.6			
Quarters W10 cw						11			
Quarters W11 cw						8.2			
Quarters W12 cw						7.1			
Quarters W13 cw			10(10 sol, <1.3 SS)[2]	12	8	10			
Quarters W15 cw						11			
Pump house #7			1(3.3 sol, <1.3 SS)[2]	<.2	<.2	<.2	<.2	.7	<.2
P.H. #6 from well				54[5]sol	93[5]sol	272[5]sol	67 sol	26	248
P.H. #6 check side				9[5]sol	208[5]sol		5.3 sol	~~.26~~	~~248~~
Bldg. 6 coffee mess		25(19[2])		15	11	6.1	9.3	17	9.4
"hollow" area - old water (?)				9.9					
NRL main loc'n, cw Bldg.207,R.313					<.2				
Store in Randales Cliff						.2			
Bay water at pier						<.2			
Tower before flush					7.7				

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30	4/4	4/10
Tower sludge					.3 sol 5 SS				
Hydrant at whirling arm							151		
Quarters A H.W.[7]						19			30 (9.6 sol)
Quarters B H.W.						17			9.6
Quarters C H.W.						8.3			14
Quarters D H.W.						5.2			6.6
Quarters E. H.W.									16
Quarters F H.W.									13
Quarters G H.W.									15
Quarters H H.W.									18
Quarters I H.W.									31
Quarters J H.W.									11

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30	4/4	4/10
Quarters W1 H.W.						3.5			5.9
Quarters W2 H.W.						4.5 sol			6.5
Quarters W3 H.W.						62			4.6
Quarters W4 H.W.						15.8(18 sol)			6.9
Quarters W5 H.W.						18(4.2 sol)			3.4
Quarters W6 H.W.						86(5 sol)			6.9
Quarters W7 H.W.						101(6.7 sol)			5.1
Quarters W8 H.W.						32(5.0 sol)			6.3
Quarters W9 H.W.						>1500(14 sol)			10.
Quarters W10 H.W.						57(1.2 sol)			8.2
Quarters W11 H.W.						84(4.2 sol)			12.0
Quarters W12 H.W.						2.1 sol			5.4
Quarters W13 H.W.						224(5.2 sol)			6.2
Quarters W15 H.W.						232			8.1

Sample Location	3/10	3/15	3/20	3/22	3/24	3/28	3/30
Ice cubes[6] spec.1, Bldg. 4							.3
Ice cubes spec.2, Bldg. 4							1
Ice cubes spec. 1, Bldg. 75							.5
Ice cubes spec. 2, Bldg. 75							<.2
Ice cubes spec. 3, Bldg. 75							<.2
Ice cubes spec. 4, Bldg. 75							<.2
Sediment from hose and tank, water from Pump #6							>1200[5] sol.

[1]Unless otherwise specified, values are in µg/ 1 (ppb) for total mercury by EPA standard cold vapor AA method, samples generally run within 48 hours of sampling except those dated 3/10 and 3/15 and older stored samples.

[2]By X-ray fluorescence method.

[3]Samples before 3/20/78

[4]sol = soluble Hg, SS = suspended solids

[5]Contained Hg droplet, thus total Hg greater than value reported

[6]Dates preceded March 1978

[7]There is a remote possibility that the values for H.W. (hot water) samples are artificially high due to potential interference from large amounts of organic materials in the sediment. This problem is being evaluated.

MERCURY ANALYSES THROUGH OCT. 25, 1978

6130-438A:JCC:cmc

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
3-10-78	1	97(80)	Qtrs A cw	
3-15-78	1	25(19)	Qtrs B cw	
	2	20,21ss	Qtrs J grape Koolaid	Sample from before 3-20-78
	3	25(19)	Bldg 6 coffee mess	
3-20-78	1	1.	Emergency supply	(6 years old)
	2	20(12,(1.3ss)	Qtrs A cw	
	3	10(10,(1.3ss)	Qtrs W13 cw	
	4	20(15,(1.3ss)	Qtrs J cw	
	5	1(3.3,(1.3ss)	Pump House 7	
3-22-78	1	18	Qtrs A cw	
	2	21	Qtrs I cw	
	3	12	Qtrs W13 cw	
	4	15	Bldg 6 coffee mess	
	5	(.2	Pump House 7	
	6	(9)	Pump House 6, check side	contained Hg droplets
	7	(54)	Pump House 6, well	contained Hg droplets
	8	9.9	"Hollow" area	(old water)
3-24-78	1	19	Qtrs A cw	
	2	12	Qtrs I cw	
	3	8	Qtrs W13 cw	
	4	11	Bldg 6 coffee mess	
	5	(.2	Pump House 7	
	6	(208)	Pump House 6 check side	contained Hg droplets
	7	(93)	Pump House 6 well	contained Hg droplets
	8	(.2	NRL 207/313 cw	
	A	7.7	Tower before flush	
	B,C	5(.3)	Tower sludge	
3-28-78	1	7.4	Qtrs A cw	
	2	13	Qtrs B cw	
	3	17	Qtrs C cw	
	4	10	Qtrs D cw	
	5	18	Qtrs E cw	
	6	19	Qtrs F cw	
	7	9.7	Qtrs G cw	
	8	18	Qtrs H cw	
	9	17	Qtrs I cw	
	10	9.0	Qtrs J cw	
	11	6.0	Qtrs W1 cw	
	12	6.7	Qtrs W2 cw	
	13	7.5	Qtrs W3 cw	
	14	7.2	Qtrs W4 cw	
	15	4.5	Qtrs W5 cw	
	16	4.7	Qtrs W6 cw	
	17	8.3	Qtrs W7 cw	
	18	8.3	Qtrs W8 cw	
	19	5.6	Qtrs W9 cw	
	20	11	Qtrs W10 cw	
	21	8.2	Qtrs W11 cw	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	22	7.1	Qtrs W12 cw	
	23	10	Qtrs W13 cw	
	24	11	Qtrs W15 cw	
	25	6.1	Bldg 6 coffee mess	
	26	.2	Store, Randales Cliff	
	27	(272)	Pump House 6 sample tap	contained Hg droplets
	28	<.2	Pump House 7 sample tap	
	29	<.2	Bay water at pier	
	30	19	Qtrs A hw	
	31	17	Qtrs B hw	
	32	8.3	Qtrs C hw	
	33	5.2	Qtrs D hw	
	34	3.5	Qtrs W1 hw	
	35	(4.5)	Qtrs W2 hw	
	36	62	Qtrs W3 hw	
	37	16(18)	Qtrs W4 hw	
	38	18(4.2)	Qtrs W5 hw	
	39	86(5.0)	Qtrs W6 hw	
	40	101(6.7)	Qtrs W7 hw	
	41	32(5.0)	Qtrs W8 hw	
	42	>1500(14)	Qtrs W9 hw	
	43	57(1.2)	Qtrs W10 hw	
	44	84(4.2)	Qtrs W11 hw	
	45	(2.1)	Qtrs W12 hw	
	46	224(5.2)	Qtrs W13 hw	
	47	232	Qtrs W15 hw	
	A	<.2	Qtrs A outside tap	Overlook Ave
3-30-78	1	151	Hydrant at Whirling Arm	
	2	(67)	Pump House 6 well	
	3	<.2	Pump House 7	
	4	6.9	Qtrs W3 cw	
	5	13	Qtrs A cw	
	6	9.3	Bldg 6 coffee mess	
	7	(5.3)	Pump House 6 upper tap	
	8	.3	Bldg 4 ice cubes	spec 1 (3/28)
	9	1	Bldg 4 ice cubes	spec 2 (3/28)
	10	.5	Bldg 75 ice cubes	spec 1 rm 308 (3/28)
	11	<.2	Bldg 75 ice cubes	spec 2 (3/28)
	12	<.2	Bldg 75 ice cubes	spec 3 (3/29)
	13	<.2	Bldg 75 ice cubes	spec 4 (3/29)
	14	(>1200)	1500 gal tank and hose	sediment: contained Hg droplets
4-04-78	1	22	Qtrs A cw	
	2	28	Qtrs J cw	
	3	12	Qtrs W3 cw	
	4	17	Bldg 6 coffee mess	
	5	.7	Pump House 7 sample tap	
	6	26	Pump House 6, well	
4-10-78	1	14	Qtrs A cw	
	2	18	Qtrs J cw	
	3	7.7	Qtrs W3 cw	
	4	9.4	Bldg 6 coffee mess	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	5	<.2	Pump House 7	
	6	248	Pump House 6, well	
	7	30(9.6)	Qtrs A hw	
	8	9.6	Qtrs B hw	
	9	14	Qtrs C hw	
	10	6.6	Qtrs D hw	
	11	16	Qtrs E hw	
	12	13	Qtrs F hw	
	13	15	Qtrs G hw	
	14	18	Qtrs H hw	
	15	31	Qtrs I hw	
	16	11	Qtrs J hw	
	17	5.9	Qtrs W1 hw	
	18	6.5	Qtrs W2 hw	
	19	4.6	Qtrs W3 hw	
	20	6.9	Qtrs W4 hw	
	21	3.4	Qtrs W5 hw	
	22	6.9	Qtrs W6 hw	
	23	5.1	Qtrs W7 hw	
	24	6.3	Qtrs W8 hw	
	25	10	Qtrs W9 hw	
	26	8.2	Qtrs W10 hw	
	27	12	Qtrs W11 hw	
	28	5.4	Qtrs W12 hw	
	29	6.2	Qtrs W13 hw	
	30	8.1	Qtrs W15 hw	
4-17-78	1	13	Qtrs A cw	
	2	12	Qtrs J cw	
	3	8.0	Qtrs W3 cw	
	4	8.4	Bldg 6 coffee mess	
	5	1.4	Pump House 7	
	6	330	Pump House 6 sample tap	
	7	51	Pump House 6 sample tap	4 min. after start-up
	8	51	Pump House 6 boiler drain	
	9	11	open tank bottom drain	
	A	[.026]	Open Tank, sediment	as mg Hg / g of sediment(sand)
4-20-78	A	[.019]	Open Tank, Sediment	as mg Hg / g of sediment(sand)
4-21-78	1	22(13)	14" cast-iron pipe	after breaking
	2	400(70.)	bottom of 14" valve	after removing Tee
	3	460	bottom of 6" valve	tower side of 14" valve
	A	[.54]	Main TEE scrapings	(from Fox)
4-24-78	1	4.8	Qtrs A cw	
	2	5.0	Qtrs W3 cw	
	3	8.3	Qtrs J cw	
	4	5.8	Bldg 6 coffee mess	
	5	224(100)	Pump House 6 sample tap	
	6	31(20)	Pump House 6 sample tap	4 min after start-up
	7	343(96)	Pump House 6 open tank	
	8	.2(<.2)	Pump House 7 sample tap	
	9	392(11.)	14" transite line	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
4-25-78	1	5.6	Bldg 6 coffee mess	time=0800
	2	5.6	Bldg 6 coffee mess	time=0900
	3	4.4	Bldg 6 coffee mess	time=1000
	4	4.5	Bldg 6 coffee mess	time=1100
	5	4.0	Bldg 6 coffee mess	time=1200
	6	6.1	Bldg 6 coffee mess	time=1300
	7	5.6	Bldg 6 coffee mess	time=1400
	8	4.2	Bldg 6 coffee mess	time=1500
	9	2.6	Bldg 6 coffee mess	time=1600
4-28-78	1	6.4	Bldg 6 coffee mess	sample 1
	2	4.7	Bldg 6 coffee mess	sample 2
	3	4.6	Bldg 6 coffee mess	sample 3
	4	4.4	Bldg 6 coffee mess	sample 4
	5	4.1	Bldg 6 coffee mess	sample 5
	6	4.3	Bldg 6 coffee mess	sample 6
	7	9.9	Qtrs A cw	
	8	13.4(8.4)	Qtrs W3 cw	
	9	11.7	Qtrs I cw	
	10	6.2(4.9)	Pump House 6, open tank	
	11	.20(.26)	Pump House 7	
5-3-78	1	4.8	Qtrs A cw	
	2	8.0	Qtrs I cw	
	3	4.6	Qtrs W3 cw	
	4	4.9	Bldg 6 coffee mess	
	5	<.2(<.2)	Pump House 7 sample tap	
	6	15000(350)	Pump House 6 sample tap	at start up
	7	74(68)	Pump House 6 sample tap	2 min after start up
	8	26(19)	Pump House 6 sample tap	4 min after start up
	9	16(10)	Pump House 6 sample tap	10 min after start up
	10	27(15)	Pump House 6 open tank	
5-8-78	1	4.2	Qtrs A cw	
	2	9.0	Qtrs I cw	
	3	4.0	Qtrs W3 cw	
	4	<.2(<.2)	Pump House 7 sample tap	
	5	5.8	Bldg 6 coffee mess	
	6	68	Pump House 6	at start-up
	7	11	Pump House 6	after 2 min
	8	11	Pump House 6	after 4 min
	9	8.0(4.4)	Pump House 6	after 10 min
	10	4.8(3.2)	Pump House 6 open tank	
	11	(35)	Pump House 6 open tank	sand and sediment
5-17-78	1	4.8	Qtrs A cw	
	2	1.0	Qtrs I cw	
	3	2.8	Qtrs W3 cw	
	4	3.7	Bldg 6 coffee mess cw	
	5	<.2	Pump House 7 sample tap	
	6	96(34)	Pump House 6 sample tap	at start-up
5-22-78	1	4.0	Qtrs A cw	
	2	7.2	Qtrs I cw	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	3	<.2	Pump House 7 sample tap	
	4	3.6	Qtrs W3 cw	
	5	3.8	Bldg 6 coffee mess	
	6	63(31)	Pump House 6 sample tap at start up	
5-30-78	1	4.8	Qtrs A cw	
	2	7.6	Qtrs I cw	
	3	<.2	Pump House 7 sample tap	
	4	4.4	Qtrs W3 cw	
	5	2.9	Bldg 6 coffee mess	
	6	127	Pump House 6 sample tap at start-up	
5-31-78	1	7.9	Hot water,before pumping into system	
	2	13.2	Sample tap off standpipe in pit	
	3	21.9	From 400 gallon tank	
	4A	70	Liquid over sludge in 4' riser	
	4B	[.024]	Sludge from 4' riser	
	5	[.0056]	From 8" into 4' riser sludge	
	Rod	[.083]	Dry encrustation from Zn rod	
6-1-78	1	12.4	400 gallon tank hw	
	2	24.1	400 gallon tank before EDTA added	
	3	260	400 gallon tank at 13:40	
	4	590	400 gallon tank at 13:55	
	5	785	400 gallon tank at 14:30	
	6	[.00035]	Bottom of 4' riser	
	7	[.00076]	1.5' from bottom of 4' riser	
	8	760	400 gallon tank at shutdown,15:35	
6-2-78	1	56	Sample from 8" drain at 08:15	
	2	41.2	Sample from 8" drain at 08:15	
	3	36	Sample from 8" drain at 08:15	
	4	17	"Dirt leg" at base of tank	
	5	146	Superchlorinated	
	6	20	14" riser after chlorination,1hr rest	
	7	51	400 gal tank after 2nd clean-up w/ EDTA/citrate	
	8	[.0040]	Sand from bottom of 4' riser after cleaning	
	9	[.023]	Outside scrapings from 14" pipe at waterline	
	10	[.023]	Outside scrapings from 14" pipe " below ledge	
	11	[.089]	Inside scrapings from 4' pipe above water line	
	12	[.0011]	Dip from 14" riser	wet
	13	[.0028]	Dip from 14" riser	wet
6-5-78	1	14	Discharge from 8" drain	
	2	9	4' standpipe	
	3	30	1" valve in pit	
6-6-78	1	6.4	Holding tank after 10 min. circulation	
	2	5.5	4' dirt leg after sitting overnite	
	3	5.6	14" riser after sitting overnite	
6-7-78	1	3.4	Bottom of 4' riser	
	2	2.6	14" riser	
	3	3.3	Open tank (400 gal. tank?)	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	4	4.0	Qtrs.W-3, cw	
	5	7.9	Qtrs.I, cw	
	6	3.2	Bldg #6 Coffee mess	
	7	2.1	Qtrs.A, cw	
	8	.2	Pumphouse #7, Sample tap at start-up	
6-12-78	1	[.95]	Down end of "T" at top of well	
	3	[15.9]	Bottom of 1st pipe section, inside	
	5	[11.1]	Bottom of 2nd pipe section, inside	
	6	[.017]	Bottom of 2nd pipe section, outside	
	8	[10.7]	Bottom of 3rd pipe section, inside	
	10	[13.0]	Bottom of 4th pipe section, inside	
	12	[7.3]	Bottom of 5th pipe section,inside	
	14	[5.0]	Bottom of 6th pipe section, inside	
	16	[6.0]	Bottom of 7th pipe section, inside	
	17	[.067]	Bottom of 7th pipe section, outside	
	19	[3.7]	Bottom of 8th pipe section, inside	
	21	[6.9]	Bottom of 9th pipe section, inside	
	22	[7.0]	Top of 10th pipe section, inside	
	23	[7.2]	Bottom of 10th pipe section, inside	
	24	[5.9]	Bottom of 10th pipe section, inside cufflink	
	25	[10.6]	Top of 11th pipe section, inside	
	27	[.065]	Intake screen debris & around joint	
	28	[.46]	Intake screen debris & around joint	
	29	[.66]	Inside check valve	
	30	[.23]	Top end of pump pipe	
	31	2.9	Bldg.#6, Coffee mess	
	32	620	Pumphouse #6 at start-up, sample tap	
	33	2.7	Qtrs.W-3, cw	
	34	8.3	Qtrs.I, cw	
	35	140	Pumphouse #6, Sample tap 6 min after start-up	
	36	1.45	Qtrs.A, cw	
	37	<.2	Pumphouse #7, Sample tap at start-up	
6-13-78	1	60	Water standing 24hrs in pump before flushing	
	2	120	Start of pump flushing, Test #1	
	3	28	Draining from 1500 gal tank after initial flush	
	4	210	Settled matter from pump-1st flush (Test #2)	
	5	100	EDTA poured through pump 3 times	
	6	1.8	1500 gal tank final drain-off out of pump	
6-14-78	1	38	Well blow-out, 1 min after start	
	2	82(14)	Well blow-out at 09:41	
	3	180(35)	Well blow-out at 09:43	color change
	4	800(180)	Well blow-out at 09:45	
	5	170(11)	Well blow-out at 09:51	
	6	66(20.4)	Well blow-out at 09:57	Last sample
6-15-78	1	18(16)	Well blow-out at 11:11	
	6	110(1.0)	Well blow-out at 11:17	
	12	2400(140)	Well blow-out	
	25	60(27)	Well blow-out at 13:02 (Resumed at 12:57)	
	26	1394(206)	1500 gal tank, Morning's accumulation	
	A	[.0096]	Scrapings from well casing, 509' depth & up	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
6-16-78	1	430(1.0)	Air jet at 525' level at start of pumping	
	2	12300(40)	"Bottom load" 8 min after start of pumping	
	3	20(6.2)	20 min after start of pumping, running clear	
	4	750(59)	Composite from drain of 1500 gal tank	
	A	[.070]	Sludge from 1500 gal tank from 6-15 air pumping	
6-19-78	1	3.3	Qtrs. I cw	Sudsy
	2	7.9	Qtrs.A cw	
	3	2.3	Qtrs.W-3 cw	
	4	3.5	Pump House 7 Sample tap at start-up	
	5	1.9	Bldg. #6 coffee mess	
	6	2560	From lower drain, 1500 gal tank after 1/2 full	
	6A	.55	Filtrate from 6-19-78 #6	
	6B	[.60]	Solids from 6-19-78 #6	
	7	53(40.)	Last water from hose at 528' level	
	8	34(1.6)	From 531' level	
6-20-78	1	1340(284)	Well filled back from 535'-532',top of fill	
	2	3.5	Qtrs.I cw	
	3	7.1	Qtrs.A cw	
	4	2.1	Qtrs.W-3 cw	
	5	<.2	Pumphouse #7 Sample tap	
	6	1.5	Bldg. #6 coffee mess	
	7	20.0	Well depth of 537' at 08:43	
	8	25.6	Well depth of 538' at 09:01	
	9	24.6	Well depth of 539' at 09:31	
	10	25	Well depth of 542' at 10:08	
	11	1.7	Well depth of 535' before pumping stopped @ 17:00	
6-21-78	1	18.4	From EDTA holding tank	
	2	26.2	From EDTA holding tank	
	3	140	From pump cleaning EDTA soln. @ 11:45	
	4	128.	From pump cleaning EDTA soln. @ 12:45	
6-22-78	1	5.3	Drawn from screen	
	2	1.2	Disconnected from lead packer-Drawn from well as a whole	
6-26-78	1	2.6	Qtrs.W-3 cw	
	2	<.2	Pumphouse #7 Sample tap	
	3	3.8	Qtrs.A cw	
	4	4.3	Qtrs.I cw	
	5	4.6	Bldg. #6 coffee mess	
6-27-78	1	38	From "dirt leg" at base of riser (400 kG tank)	
6-28-78	1	2.2	Qtrs. W-3 cw	
	2	<.2	Pumphouse #7 sample tap	
	3	6.7	Qtrs.A cw	
	4	4.9	Qtrs.I cw	
	5	.96	Bldg.#6 coffee mess	
7-3-78	1	1.1	Qtrs. W-3 cw	
	2	<.2	Pumphouse #7 sample tap	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	3	2.2	Qtrs.A cw	
	4	4.6	Qtrs.I cw	
	5	1.7	Bldg.#6 coffee mess	
7-6-78	1	0.14	Pump-washing tank prior to pump immersion	
7-7-78	1	3.1	Pump-washing tank after pump soaked	
7-10-78	1	3.0	Qtrs. W-3 cw	
	2	.31	Pumphouse #7 sample tap	
	3	12.9	Qtrs.A cw	
	4	1.8	Qtrs.I cw	
	5	4.0	Bldg.#6 coffee mess	
7-17-78	1	.83	Qtrs. W-3 cw	
	2	<.2	Pumphouse #7 sample tap (black sand in bottle)	
	3	.6	Qtrs.A cw	
	4	2.1	Qtrs.I cw	
	5	1.3	Bldg.#6 coffee mess	
7-26-78	1	1.1	Qtrs. W-3 cw after 2 minutes	
	2	<.2	Pumphouse #7 sample tap after 2 min.	
	3	1.0	Qtrs.A cw after 2 min.	
	4	2.9	Qtrs.I cw after 2 min.	
	5	.7	Bldg.#6 coffee mess after 2 min.	
8-2-78	1	.7	Qtrs.W-3 cw after 2 minutes	
	2	<.2	Pumphouse #7 sample tap after 2 min.	
	3	1.01	Qtrs.A cw after 2 minutes	
	4	3.9	Qtrs.I cw after 2 minutes	
	5	1.1	Bldg.#6 coffee mess after 2 min.	
8-9-78	1	.6	Qtrs.W-3 cw after 2 minutes	
	2	<.2	Pumphouse #7 sample tap after 2 min.	
	3	3.0	Qtrs.A cw after 2 minutes	
	4	11.1	Qtrs.I cw after 2 minutes	
	5	.2	Bldg.#6 coffee mess after 2 min.	
8-16-78	1	5.7	Qtrs.W-3 cw First water	
	2	.7	Qtrs. W-3 cw after 2 minutes	
	3	<.2	Pumphouse #7 after 2 minutes	
	4	1.5	Qtrs. A cw First water	
	5	1.1	Qtrs. A cw after 2 minutes	
	6	5.1	Qtrs. I cw First water	
	7	2.2	Qtrs. I cw after 2 minutes	
	8	3.7	Bldg. #6 coffee mess First water	
	9	1.2	Bldg. #6 coffee mess after 2 minutes	
8-23-78	1	.5	Qtrs. W-3 cw after 2 minutes	
	2	<.2	Pumphouse #7 after 2 minutes	
	3	1.1	Qtrs. A cw after 2 minutes	
	4	2.4	Qtrs. I cw after 2 minutes	
	5	2.2	Bldg. #6 cw coffee mess after 2 minutes	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
8-30-78	1	0.2	Qtrs W-3 cw after 2 min.	
	2	<.2	Pump House 7	
	3	.9	Qtrs A cw after 2 min.	
	4	1.5	Qtrs I cw after 2 min	
	5	3.8	Bldg 6 coffee mess cw after 2 min.	
9-1-78	1	156(129)	Pump House 6 well bottom sample	
9-6-78	1	800	Pump House 6 blow-out sample 1	
	2	1.1	Pump House 6 blow-out 2 min	
	3	3.0	Pump House 6 blow-out at 4 min	
	4	2.1	Pump House 6 blow out at 10 min	
9-7-79	1	.5	Pump House 6 2nd blow-out 0 min	
	2	1.0	Pump House 6 2nd blow-out 2 min	
	3	11.9	Pump House 6 2nd blow-out 4 min	
	4	<.2	Pump House 6 2nd blow-out 10 min	
9-8-79	1	.7	Pump House 6, pump on 37 min	
	2	1.4	Pump House 6, pump on 10 min	
	3	11.6	Pump House 6, pump on 4 min	
	4	1.9	Pump House 6, pump on 2 min	
	5	6.8	Pump House 6, pump on 0 min	
	6	.6	Pump House 6, pump on 1 hr	
	7	1.3	Pump House 6, pump off 4 hr, on 10 min	
9-9-78	1	10.4(<.2)	Pump House 6 at 0 min	
	2	5.1(<.2)	Pump House 6 at 2 min	
	3	1.1(<.2)	Pump House 6 at 4 min	
	4	.8	Pump House 6 at 10 min	
	5	<.2	Pump House 6 at 8 hr	
9-11-78	1	4.0	Pump House 6 at 0 min	
	2	5.1	Pump House 6 at 2 min	
	3	.7	Pump House 6 at 4 min	
	4	.3	Pump House 6 at 10 min	
9-12-78	1	1.9	Pump House 6 at 0 min	
	2	6.6	Pump House 6 at 2 min	
	3	2.1	Pump House 6 at 4 min	
	4	.8	Pump House 6 at 10 min	
	5	<.2	"stream fall"	
9-13-78	1	1.8	Pump House 6 at 0 min	
	2	1.9	Pump House 6 at 2 min	
	3	.3	Pump House 6 at 4 min	
	4	<.2	Pump House 6 at 10 min	
	5	.3	Pump House 6 at 4 hr	
	6	<.2	"stream fall"	
	7	.2	Qtrs W-3 cw after 2 min	
	8	.2	Pump House 7 after 2 min	
	9	.7	Qtrs A cw after 2 min	
	10	1.4	Qtrs I cw after 2 min	
	11	<.2	Bldg 6 cw coffee mess after 2 min	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	12	.8	Pump House 6 after 4 hr	
9-14-78	1	<.2	Pump House 6 at 0 min	
	2	<.2	Pump House 6 at 1 min	
	3	.5	Pump House 6 at 2 min	
	4	<.2	Pump House 6 at 3 min	
	5	<.2	Pump House 6 at 4 min	
	6	<.2	Pump House 6 at 10 min	
	7	<.2	Pump House 6 at 1 hr	
	8	<.2	"stream fall"	
9-18-78	1	13.0	Pump House 6 at 0 min	
	2	.3	Pump House 6 at 1 min	
	3	<.2	Pump House 6 at 2 min	
	4	2.3	Pump House 6 at 3 min	
	5	<.2	Pump House 6 at 4 min	
	6	<.2	Pump House 6 at 10 min	
9-20-78	1	1.8	Pump House 6 Boiler drain at 0 min	
	2	2.9	Pump House 6 Boiler drain at 2 min	
	3	3.6	Pump House 6 Sample tap at 0 min	
	4	7.8	Pump House 6 Sample tape at 2 min	
	5	2.2	Pump House 6 Sample tap at 4 min	
	6	1.3	Pump House 6 Sample tap at 10 min	
9-21-78	1	1.8	Pump House 6 Sample tap at 0 min	
	2	1.6	Pump House 6 Sample tap at 2 min	
	3	<.2	Pump House 6 Sample tap at 10 min	
	4	<.2	Pump House 6 Sample tap at 20 min	
	5	<.2	Pump House 6 Sample tap at 2 hr	
9-22-78	1	.6	Qtrs W-3 cw at 2 min	
	2	1.0	Pump House 6 sample tap at 2 min	
	3	1.0	Qtrs A cw at 2 min	
	4	1.2	Qtrs I cw at 2 min	
	5	.8	Bldg 6 coffee mess cw at 2 min	
9-25-78	1	1.6	Qtrs A cw at 2 min	
	2	2.2	Qtrs I cw at 2 min	
	3	.45	Qtrs W-3 cw at 2 min	
	4	1.0	Bldg 6 coffee mess cw	
	5	2.2	Pump House 6 at 2 min	
	6	<.2	"Stream fallout" 100 feet from bay	
9-26-78	1	.65	Qtrs A cw at 2 min	
	2	1.8	Qtrs I cw at 2 min	
	3	.79	Qtrs W-3 cw at 2 min	
	4	.7	Bldg 6 coffee mess cw at 2 min	
	5	.36	Pump House 6 at 2 min	
	6	<.2	"Sample stream, 100 ft."	
9-27-78	1	3.8	Qtrs A cw at 2 min	
	2	1.3	Qtrs I cw at 2 min	
	3	.6	Qtrs W-3 cw at 2 min	

SAMPLE Date	No.	[Hg] (ppb)	SAMPLE LOCATION	COMMENTS
	4	3.2	Bldg 6 coffee mess cw at 2 min	
	5	.2	Pump House 6 at 2 min	
10-2-78	1	.4	Qtrs A cw at 2 min	
	2	1.3	Qtrs I cw at 2 min	
	3	.2	Qtrs W-3 at 2 min	
	4	1.0	Bldg 6 coffee mess cw at 2 min	
	5	.7	Pump House 6 at 2 min	
10-4-78	1	.4	Qtrs A cw at 2 min	
	2	1.2	Qtrs I cw at 2 min	
	3	.35	Qtrs W-3 cw at 2 min	
	4	.6	Bldg 6 coffee mess cw at 2 min	
	5	1.0	Pump House 6 at 2 min	
10-11-78	1	.5	Qtrs A cw at 2 min	
	2	1.0	Qtrs I cw at 2 min	
	3	.3	Qtrs W-3 cw at 2 min	
	4	.8	Bldg 6 coffee mess cw at 2 min	
	5	.7	Pump House 6 sample tap at 2 min	

NOTES:

Abreviations used:
- ppb = parts per billion (micrograms per liter of sample)
- ss = suspended solids only
- cw = cold water (in residences, from kitchen sink)
- hw = hot water (from drain on water heater)
- spec= specimen

Mercury analyses are reported as total mercury unless otherwise indicated. Analyses were done by standard cold vapor atomic absorption method as per EPA methods. Values in within { } were obtained by X-ray flourescence. Values are reported as total mercury content (inorganic, organic, soluble and insoluble) except as noted. In particular, values enclosed in parentheses () are for the supernatant liquid and does not include suspended solids.

Where possible under constraints of time and manpower and availability of reagents, at least three analyses were done on each sample. Although statistical data (confidence intervals, etc.) are not included in this tabulation, the approximate limits are indicated by the number of significant figures.

Bracketed values [ ] represent analyses of solid samples such as sand and sediment and are reported as mg of mercury (total) per g of solid.

REQUEST FOR AND RESULTS OF TESTS

PAGE NO.	NO. OF PAGES
1	1

SECTION A - REQUEST FOR TEST

1. TO:	2. FROM:
R.F. Green Medical Department Naval Research Lab Chesapeake Bay Division Chesapeake Beach, MD 20732	Laboratory Division Navy Environmental Health Center 3333 Vine St. Cincinnati, Ohio 45220

1978 APR -3 PM 1:32

3. PRIME CONTRACTOR AND ADDRESS	4. MANUFACTURING PLANT NAME AND ADDRESS
CONTRACT NUMBER	P. O. NUMBER

5. END ITEM AND/OR PROJECT	6. SAMPLE NUMBER	7. LOT NO.	8. REASON FOR SUBMITTAL	9. DATE SUBMITTED

10. MATERIAL TO BE TESTED	10a. QUANTITY SUBMITTED	11. QUANTITY REPRESENTED	12. SPEC. & AMEND. AND/OR DRAWING NO. & REV. FOR SAMPLE & DATE

13. PURCHASED FROM OR SOURCE	14. SHIPMENT METHOD	15. DATE SAMPLED AND SUBMITTED BY

16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS

17. SEND REPORT OF TEST TO

SECTION B - RESULTS OF TEST *(Continue on plain white paper if more space is required)*

1. DATE SAMPLE RECEIVED	2. DATE RESULTS REPORTED	3. LAB REPORT NUMBER
3/31/78	3/31/78	8090-13

4. TEST PERFORMED — RESULTS OF TEST — SAMPLE RESULT — REQUIREMENTS

Mercury analysis using Flameless AA

Sample	Hg,ppb
Pump House #6	28

DATE	TYPED NAME AND TITLE OF PERSON CONDUCTING TEST	SIGNATURE
3/31/78	Walter F. Vogl LCDR MSC USN	Walter F. Vogl

DD FORM 1 FEB 62 1222 — REPLACES DD FORM 1222, 1 JUL 58, WHICH IS OBSOLETE.

S/N 0102-LF-012-0600

FINDINGS

1. Water in well #7 OK
2. Other water (NRL here, Ches Bay community) OK
3. Bay OK
4. No Hg in old ice cubes
5. Lots of Hg in well #6, possible to remove by cycling procedure
6. Probably Hg in buried Tee connecting P.H. #6 to tower
7. Oxidation process of remaining Hg in system is slow
8. Value of flushing seems to be diminishing
9. Lots of Hg in some water heaters

SUGGEST:

1. Flush Water Heaters
2. Sample each tank-full during clean-up of well #6
3. Dig-up and clean buried main between P.H.#6 and tower
4. Drain tower and clean
5. Increase flushing intervals to weekly or longer
6. Sample bottom of well#6 if needed after clean-up
7. A <u>few</u> strategic samples of D.C. water supply

Appendix A.6
FOIA Records Searches Conducted with MDE and USEPA Region 3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2

August 29, 2011

Jeff Woodward
Environmental Services
CH2M Hill
15010 Conference Center Drive
Suite 200
Chantilly, Virginia 20151

Dear Mr. Woodward:

The following information and disposition are furnished concerning your request made under the Freedom of Information Act.

Date Request Received: 07/28/11

Request Identification Number: **3FOI-1045-11**

(Estimated) Cost: $.00

(X) Positive Determination (Material enclosed).

( ) Requested information is not known to exist or is not in EPA's possession. (See remarks on next page).

( ) Requestor reviewed files on / / .

( ) Your request of / / was modified as a result of a discussion with. (See remarks on next page).

( ) Holding material Pending Receipt of Payment (estimated cost over $250.00 or arrangement for payment).

(x) Fee waiver: Less than $14.00.

( ) Processing Request: Extension until / / needed due to.

( ) Please see attached bill. Make check payable to U.S. Environmental Protection Agency. Put Request Identification Number (RIN) on check and mail to EPA-Region 3, P.O. Box 360515, Pittsburgh, PA 15251.

This letter is in response to your Freedom of Information Act request dated July 27, 2011, which we received on July 28, 2011, requesting information with regards to the Naval Research Laboratory Superfund Site, located at 5813 Bayside Road, Chesapeake Beach, Maryland.

In accordance with your wishes we are enclosing a copy of the site file in connection with the site referenced above. Should you have any questions concerning this matter please direct them to the attention of the Site Assessment Manager (SAM) Joe Vitello at 215-814-3354.

You may appeal this response, to the National Freedom of Information Officer, U. S. EPA, Records, FOIA and Privacy Branch, 1200 Pennsylvania Avenue, NW (2822T), Washington, DC 20460, Fax (202) 566-2147, E-mail: hq.foia@epa.gov. Only items mailed through the United States Postal Service may be delivered to 1200 Pennsylvania Avenue, NW. If you are submitting your appeal via hand delivery, courier service or overnight delivery, you must address your correspondence to 1301 Constitution Avenue, NW, Room 64161, Washington, DC 20004. The appeal must be made in writing, and it must be submitted no later than 30 calender days form the date of this letter. The Agency will not consider appeals received after the 30 calender day limit. The appeal letter should include the RIN listed above. For quickest possible handling, the appeal letter should be marked "Freedom of Information Act Appeal".

Sincerely,

Helen DuTeau

Helen DuTeau, Chief
Community Involvement and
Outreach Branch

Enclosures
cc: Richard VanHolt (3CG00)

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard • Baltimore, Maryland 21230
410-537-3000 • 1-800-633-6101 • http://www.mde.state.md.us

September 1, 2011

Mr. Jeff Woodward
CH2M Hill
15010 Conference Center Drive
Suite 200
Chantilly VA 20151

RE: Tracking Number: 2011-48754
Request Received July 28, 2011

NAVAL RESEARCH LABORATORY - CHESAPEAKE BAY DETA(

Dear Mr. Woodward:

The Maryland Department of the Environment (MDE) received your recent request for information under the Public Information Act (PIA).

Files have been located in the following MDE Administration(s):

Administration, Contact, Phone Number

Air & Radiation Management Administration, Laramie Daniel, (410) 537-3220
Science Services Administration, Susan Douglas, (410) 537-3899
Water Management Administration, Wendy Donaldson, (410) 537-3507
Land Management Administration, Maria Stephens, (410) 537-3422

You may contact the personnel listed above to schedule an appointment for file review or to arrange for photocopies of all releasable materials. You will be invoiced for all applicable search, review, duplication and postage charges. It is requested that you make arrangements to review available files within 30 days of receipt of this letter. After 30 days your request will be closed and it will be necessary to file a new request.

The Land Management Administration had a file on this site, however, the file was destroyed in accordance with the Land Management Administration's record retention schedule. This program maintains archived files for 2 years prior to destruction. MDE is required to send you this notice pursuant to Code of Maryland Regulation 26.01.04.10.

When requesting information regarding this request, please cite the tracking number referenced above. If you have any questions, please call me at (410) 537-4120.

Sincerely,

Joane Mueller

Joane Mueller
PIA Coordinator
Other MDE Administrations

cc: Laramie Daniel, Air & Radiation Management Administration
Susan Douglas, Science Services Administration

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore, Maryland 21230
410-537-3000 • 1-800-633-6101 • http://www.mde.state.md.us

July 28, 2011

Mr. Jeff Woodward
CH2M Hill
15010 Conference Center Drive
Suite 200
Chantilly VA 20151

RE: Tracking Number: 2011-48754
Request Received July 28, 2011

NAVAL RESEARCH LABORATORY - CHESAPEAKE BAY DETA(

Dear Mr. Woodward:

The Maryland Department of the Environment (MDE) received your recent request for information under the Public Information Act (PIA).

Your request has been assigned the tracking number listed above. Please use this number in all communications referring to this request.Your request has been reviewed and distributed to all appropriate MDE programs. After all programs have completed the search, you will be notified by mail as to whether or not pertinent records exist. If files exist, the notification letter will contain instructions for reviewing the records. Only after you schedule an appointment to review files will the requested files be gathered in preparation for your review.

There may be fees associated with the search whether or not files are located. The PIA fees are limited to standard charges for direct document search, review, duplication, and postage. The first two hours of search are free of charge. If your request did not indicate a willingness to pay fees, you will be notified only if the fees are likely to exceed $25.

When requesting information regarding this request, please cite the tracking number referenced above. If you have any questions, please call me at (410) 537-4120.

Sincerely,

Joane Mueller
PIA Coordinator
Other MDE Administrations

Appendix A.7
List of Documents used to Develop the Facility and Site Backgrounds

Bibliography of Documents reviewed as part of Historical Records Search for identified IR Sites and Areas of Concern

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Appendix B
Laboratory Specific Information

TABLE B1-1
Reference Limits and Evaluation Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: VOCs

Analyte Name	CAS No.	PALs[1,2] (ug/kg)			Project QL Goal[2,3] (ug/kg)	Laboratory Limits (ug/kg)			Laboratory Control Sample (LCS) and MS/MSD Recovery and Relative Percent Difference (RPD) Limits[4] (%)		
		RSLs Residential Soil Adjusted	BTAG Soil Fauna	BTAG Soil Flora		LOQ	LOD	DL	LCL	UCL	RPD
Dichlorodifluoromethane (Freon-12)	75-71-8	9400	NC	NC	4700	2	0.5	0.301	35	135	30
Chloromethane	74-87-3	12000	NC	NC	6000	1	0.5	0.153	50	130	
Vinyl chloride	75-01-4	60	300	300	30	1	0.25	0.0758	60	125	
Bromomethane	74-83-9	730	NC	NC	365	4	0.5	0.175	30	160	
Chloroethane	75-00-3	1500000	NC	NC	750000	2	0.5	0.472	40	155	
Trichlorofluoromethane(Freon-11)	75-69-4	79000	NC	NC	39500	2	0.25	0.108	25	185	
1,1-Dichloroethene	75-35-4	24000	NC	NC	12000	2	0.5	0.162	65	135	
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	76-13-1	910000	NC	NC	455000	5	0.5	0.147	**70**	**130**	
Acetone	67-64-1	6100000	NC	NC	3050000	15	5	4.64	20	160	
Carbon disulfide	75-15-0	82000	NC	NC	41000	1	0.5	0.168	45	160	
Methyl acetate	79-20-9	7800000	NC	NC	3900000	5	0.5	0.23	**70**	**130**	
Methylene chloride	75-09-2	11000	300	300	150	15	0.5	0.287	55	140	
trans-1,2-Dichloroethene	156-60-5	15000	300	300	150	1	0.25	0.106	65	135	
Methyl-tert-butyl ether (MTBE)	1634-04-4	43000	NC	NC	21500	1	0.5	0.19	**63**	**127**	
1,1-Dichloroethane	75-34-3	3300	300	300	150	2	0.25	0.11	75	125	
cis-1,2-Dichloroethene	156-59-2	16000	300	300	150	1	0.25	0.11	65	125	
2-Butanone	78-93-3	2800000	NC	NC	1400000	10	0.5	0.3	30	160	
Bromochloromethane	74-97-5	16000	3000000	NC	8000	1	0.5	0.19	70	125	
Chloroform	67-66-3	290	300	300	145	1	0.25	0.107	70	125	
1,1,1-Trichloroethane	71-55-6	640000	300	300	150	2	0.5	0.136	70	135	
Cyclohexane	110-82-7	120000	NC	NC	60000	5	0.5	0.121	**70**	**130**	
Carbon tetrachloride	56-23-5	610	300	300	150	2	0.25	0.0897	65	135	
Benzene	71-43-2	1100	100	100	50	1	0.5	0.178	75	125	
1,2-Dichloroethane	107-06-2	430	870000	NC	215	1	0.5	0.161	70	135	
Trichloroethene	79-01-6	440	300	300	150	2	0.25	0.0905	75	125	
Methylcyclohexane	108-87-2	NC	NC	NC	Lab LOD	5	0.5	0.119	**70**	**130**	
1,2-Dichloropropane	78-87-5	940	300	300	150	3	0.5	0.219	70	120	
Bromodichloromethane	75-27-4	270	450000	NC	135	1	0.5	0.117	70	130	
cis-1,3-Dichloropropene	10061-01-5	1700	300	300	150	1	0.25	0.102	70	125	
4-Methyl-2-pentanone	108-10-1	530000	100000	NC	50000	10	0.5	0.16	45	145	
Toluene	108-88-3	500000	100	100	50	2	0.5	0.193	70	125	
trans-1,3-Dichloropropene	10061-02-6	1700	300	300	150	3	0.5	0.122	65	125	
1,1,2-Trichloroethane	79-00-5	160	300	300	80	2	0.5	0.274	60	125	

TABLE B1-1
Reference Limits and Evaluation Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: VOCs

Analyte Name	CAS No.	PALs[1,2] (ug/kg)			Project QL Goal[2,3] (ug/kg)	Laboratory Limits (ug/kg)			Laboratory Control Sample (LCS) and MS/MSD Recovery and Relative Percent Difference (RPD) Limits[4] (%)		
		RSLs Residential Soil Adjusted	BTAG Soil Fauna	BTAG Soil Flora		LOQ	LOD	DL	LCL	UCL	RPD
Tetrachloroethene	127-18-4	550	300	300	150	2	0.5	0.115	65	140	
2-Hexanone	591-78-6	21000	NC	NC	10500	10	0.5	0.163	45	145	
Dibromochloromethane	124-48-1	680	NC	NC	340	1	0.5	0.121	65	130	
1,2-Dibromoethane	106-93-4	34	NC	5000	17	3	0.5	0.14	70	125	
Chlorobenzene	108-90-7	29000	100	NC	50	1	0.25	0.082	75	125	
Ethylbenzene	100-41-4	5400	100	100	50	1	0.5	0.139	75	125	
o-Xylene	95-47-6	69000	NC	NC	34500	1	0.25	0.0625	75	125	
m- and p-Xylene	m&pXYLENE	59000	NC	NC	29500	2	0.5	0.158	80	125	
Styrene	100-42-5	630000	100	100	50	1	0.25	0.0748	75	125	
Bromoform	75-25-2	62000	1147000	NC	31000	2	0.25	0.0651	55	135	
Isopropylbenzene	98-82-8	210000	NC	NC	105000	1	0.25	0.0829	75	130	
1,1,2,2-Tetrachloroethane	79-34-5	560	300	300	150	2	0.5	0.257	55	130	
1,3-Dichlorobenzene	541-73-1	NC	NC	NC	Lab LOD	1	0.25	0.111	70	125	
1,4-Dichlorobenzene	106-46-7	2400	100	100	50	1	0.25	0.077	70	125	
1,2-Dichlorobenzene	95-50-1	190000	100	100	50	1	0.5	0.121	75	120	
1,2-Dibromo-3-chloropropane	96-12-8	5.4	NC	NC	2.7	5	0.5	0.298	40	135	
1,2,4-Trichlorobenzene	120-82-1	6200	100	100	50	2	0.5	0.132	65	130	
1,2,3-Trichlorobenzene	87-61-6	4900	NC	NC	2450	2	0.5	0.256	60	135	

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] Project QL Goals are equal to half of the minimum PAL.

[4] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

TABLE B1-2
Reference Limits and Evaluation Table
Matrix: Surface Soil, Subsurface Soil
Analytical Group: SVOCs

Analyte Name	CAS No.	range	PALs[1,2] (ug/kg)			Project QL Goal[2,3] (ug/kg)	Laboratory Limits (ug/kg)			LCS and MS/MSD Recovery and RPD Limits[4] (%)		
			RSLs Residential Soil Adjusted	BTAG Soil Fauna	BTAG Soil Flora		LOQ	LOD	DL	LCL	UCL	RPD
Benzaldehyde	100-52-7	Low	780000	NC	NC	390000	85	3.3	2.57	**50**	**150**	30
Phenol	108-95-2	Low	1800000	100	100	50	170	3.3	2.02	40	100	
bis(2-Chloroethyl)ether	111-44-4	Low	210	NC	NC	105	17	3.3	0.88	40	105	
2-Chlorophenol	95-57-8	Low	39000	100	100	50	17	3.3	1.08	45	105	
2-Methylphenol	95-48-7	Low	310000	100	100	50	17	17	6.54	40	105	
2,2'-Oxybis(1-chloropropane)	108-60-1	Low	4600	NC	NC	2300	17	3.3	2.25	20	115	
Acetophenone	98-86-2	Low	780000	NC	NC	390000	17	3.3	3.33	**50**	**150**	
4-Methylphenol	106-44-5	Low	31000	100	100	50	17	17	4.22	40	105	
n-Nitroso-di-n-propylamine	621-64-7	Low	69	NC	NC	34.5	17	3.3	1.53	40	115	
Hexachloroethane	67-72-1	Low	4300	NC	NC	2150	17	3.3	2.36	35	110	
Nitrobenzene	98-95-3	Low	4800	NC	NC	2400	17	17	10.3	40	115	
Isophorone	78-59-1	Low	510000	NC	NC	255000	17	3.3	1.46	45	110	
2-Nitrophenol	88-75-5	Low	39000	NC	NC	19500	17	3.3	2.98	40	110	
2,4-Dimethylphenol	105-67-9	Low	120000	100	100	50	170	170	59.3	30	105	
bis(2-Chloroethoxy)methane	111-91-1	Low	18000	NC	NC	9000	17	3.3	1	45	110	
2,4-Dichlorophenol	120-83-2	Low	18000	100	100	50	33	17	16.2	45	110	
Naphthalene	91-20-3	Low	3600	100	100	50	17	3.3	0.91	40	105	
4-Chloroaniline	106-47-8	Low	2400	NC	NC	1200	67	33	33.3	10	100	
Hexachlorobutadiene	87-68-3	Low	6100	NC	NC	3050	17	3.3	2.12	40	115	
Caprolactam	105-60-2	Low	3100000	NC	NC	1550000	85	33	13.1	**62**	**112**	
4-Chloro-3-methylphenol	59-50-7	Low	610000	NC	NC	305000	17	3.3	1.33	45	115	
2-Methylnaphthalene	91-57-6	Low	31000	NC	NC	15500	17	3.3	0.85	45	105	
Hexachlorocyclopentadiene	77-47-4	Low	37000	NC	NC	18500	17	3.3	1.43	**10**	**113**	
2,4,6-Trichlorophenol	88-06-2	Low	6100	100	100	50	17	3.3	2.18	45	110	
2,4,5-Trichlorophenol	95-95-4	Low	610000	100	100	50	17	3.3	2.42	50	110	
1,1-Biphenyl	92-52-4	Low	5100	NC	NC	2550	17	3.3	0.91	**60**	**131**	
2-Chloronaphthalene	91-58-7	Low	180000	NC	NC	90000	17	3.3	1.06	45	105	
2-Nitroaniline	88-74-4	Low	61000	NC	NC	30500	17	17	5.34	45	120	
Dimethyl phthalate	131-11-3	Low	NC	NC	NC	Lab LOD	17	3.3	1.52	50	110	
2,6-Dinitrotoluene	606-20-2	Low	6100	NC	NC	3050	17	17	8.12	50	110	
Acenaphthylene	208-96-8	Low	340000	100	100	50	17	3.3	3.33	45	105	
3-Nitroaniline	99-09-2	Low	NC	NC	NC	Lab LOD	33	33	13.4	25	110	
Acenaphthene	83-32-9	Low	340000	100	100	50	17	3.3	3.33	45	110	
2,4-Dinitrophenol	51-28-5	Low	12000	100	100	50	170	170	88.1	15	130	
4-Nitrophenol	100-02-7	Low	4800	100	100	50	670	170	59.7	15	140	
Dibenzofuran	132-64-9	Low	7800	NC	NC	3900	17	3.3	3.33	50	105	
2,4-Dinitrotoluene	121-14-2	Low	1600	NC	NC	800	33	33	19.8	50	115	
Diethylphthalate	84-66-2	Low	4900000	NC	NC	2450000	17	17	9.37	50	115	
Fluorene	86-73-7	Low	230000	100	100	50	33	3.3	1.99	50	110	
4-Chlorophenyl-phenylether	7005-72-3	Low	31000	NC	NC	15500	17	3.3	3.33	45	110	

TABLE B1-2

Reference Limits and Evaluation Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: SVOCs

Analyte Name	CAS No.	range	PALs[1,2] (ug/kg)			Project QL Goal[2,3] (ug/kg)	Laboratory Limits (ug/kg)			LCS and MS/MSD Recovery and RPD Limits[4] (%)		
			RSLs Residential Soil Adjusted	BTAG Soil Fauna	BTAG Soil Flora		LOQ	LOD	DL	LCL	UCL	RPD
4-Nitroaniline	100-01-6	Low	24000	NC	NC	12000	33	33	33.3	35	115	
4,6-Dinitro-2-methylphenol	534-52-1	Low	490	NC	NC	245	170	33	28.7	30	135	
n-Nitrosodiphenylamine	86-30-6	Low	99000	NC	NC	49500	17	17	5	50	115	
1,2,4,5-Tetrachlorobenzene	95-94-3	Low	1800	100	100	50	33.3	1.67	1.23	**30**	**150**	
4-Bromophenyl-phenylether	101-55-3	Low	NC	NC	NC	Lab LOD	17	3.3	1.54	45	115	
Hexachlorobenzene	118-74-1	Low	300	NC	NC	150	17	3.3	1.86	45	120	
Atrazine	1912-24-9	Low	2100	NC	NC	1050	17	3.3	2.66	**61**	**146**	
Pentachlorophenol	87-86-5	Low	890	100	100	50	170	33	27	25	120	
Phenanthrene	85-01-8	Low	1700000	100	100	50	17	3.3	3.33	50	110	
Anthracene	120-12-7	Low	1700000	100	100	50	17	3.3	1.05	55	105	
Carbazole	86-74-8	Low	NC	NC	NC	Lab LOD	170	17	5.75	45	115	
Di-n-butylphthalate	84-74-2	Low	610000	NC	NC	305000	67	33	33.3	55	110	
Fluoranthene	206-44-0	Low	230000	100	100	50	17	3.3	3.33	55	115	
Pyrene	129-00-0	Low	170000	100	100	50	17	3.3	1.11	45	125	
Butylbenzylphthalate	85-68-7	Low	260000	NC	NC	130000	33	3.3	1.91	50	125	
3,3'-Dichlorobenzidine	91-94-1	Low	1100	NC	NC	550	830	330	104	10	130	
Benzo(a)anthracene	56-55-3	Low	150	100	100	50	17	3.3	3.33	50	110	
Chrysene	218-01-9	Low	15000	100	100	50	17	3.3	1.22	55	110	
bis(2-Ethylhexyl)phthalate	117-81-7	Low	35000	NC	NC	17500	33	17	7.59	45	125	
Di-n-octylphthalate	117-84-0	Low	35000	NC	NC	17500	17	3.3	1.05	40	130	
Benzo(b)fluoranthene	205-99-2	Low	150	100	100	50	17	3.3	1.95	45	115	
Benzo(k)fluoranthene	207-08-9	Low	1500	100	100	50	17	3.3	1.78	45	125	
Benzo(a)pyrene	50-32-8	SIM	15	100	NC	7.5	1.7	1.7	0.366	50	110	
Indeno(1,2,3-cd)pyrene	193-39-5	Low	150	100	100	50	33	3.3	1.95	40	120	
Dibenz(a,h)anthracene	53-70-3	SIM	15	100	100	7.5	1.7	1.7	0.404	40	125	
Benzo(g,h,i)perylene	191-24-2	Low	170000	100	100	50	33	3.3	1.88	40	125	
2,3,4,6-Tetrachlorophenol	58-90-2	Low	180000	100	100	50	33.3	3.33	1.46	**30**	**150**	

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] Project QL Goals are equal to half of the minimum PAL.

[4] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

Shading indicates instances where the LOD is greater than the PAL. Refer to section 2.6.

TABLE B1-3
Reference Limits and Evaluation Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: PCBs

Analyte Name	CAS No.	PALs[1,2] (ug/kg)			Project QL Goal[2,3] (ug/kg)	Laboratory Limits (ug/kg)			LCS and MS/MSD Recovery and RPD Limits[4] (%)		
		RSLs Residential Soil Adjusted	BTAG Soil Fauna	BTAG Soil Flora		LOQ	LOD	DL	LCL	UCL	RPD
Aroclor-1016	12674-11-2	390	NC	100	50	17	17	12.3	40	140	30
Aroclor-1221	11104-28-2	140	NC	100	50	17	17	11.5	NA	NA	NA
Aroclor-1232	11141-16-5	140	NC	100	50	17	6.7	2.7	NA	NA	NA
Aroclor-1242	53469-21-9	220	NC	100	50	17	17	10.6	NA	NA	NA
Aroclor-1248	12672-29-6	220	NC	100	50	17	6.7	2.8	NA	NA	NA
Aroclor-1254	11097-69-1	110	NC	100	50	17	6.7	3.4	NA	NA	NA
Aroclor-1260	11096-82-5	220	NC	100	50	17	17	4.9	60	130	30
Aroclor-1262	37384-23-5	NC	NC	NC	Lab LOD	17	6.7	1.8	NA	NA	NA
Aroclor-1268	11100-14-4	NC	NC	NC	Lab LOD	17	6.7	2.9	NA	NA	NA

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] Project QL Goals are equal to half of the minimum PAL.

[4] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

TABLE B1-4
Reference Limits and Evaluation Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: METALs

Analyte Name	CAS No.	Analytical Method	PALs[1,2] (mg/kg)			Project QL Goal[2,3] (mg/kg)	Laboratory Limits (mg/kg)			LCS and MS/MSD Recovery and RPD Limits[4] (%)		
			RSLs Residential Soil Adjusted	BTAG Soil Fauna	BTAG Soil Flora		LOQ	LOD	DL	LCL	UCL	RPD
Aluminum	7429-90-5	6010C	7700	NC	1	0.5	10	5	1.36	80	120	20
Antimony	7440-36-0	6020A	3.1	NC	0.48	0.24	0.2	0.05	0.0243			
Arsenic	7440-38-2	6020A	0.39	NC	328	0.195	0.5	0.05	0.0163			
Barium	7440-39-3	6010C	1500	440	440	220	1	1	0.264			
Beryllium	7440-41-7	6020A	16	NC	0.02	0.01	0.1	0.05	0.0195			
Cadmium	7440-43-9	6020A	7	NC	2.5	1.25	0.05	0.05	0.0033			
Calcium	7440-70-2	6010C	NC	NC	NC		50	50	20.2			
Chromium	7440-47-3	6020A	0.29	0.0075	0.02	0.00375	0.2	0.05	0.0139			
Chromium (hexavalent)	18540-29-9	7199	0.29	NC	NC	0.145	0.4	0.2	0.4			
Cobalt	7440-48-4	6020A	2.3	200	100	1.15	0.1	0.02	0.0064			
Copper	7440-50-8	6020A	310	NC	15	7.5	0.2	0.1	0.0254			
Iron	7439-89-6	6010C	5500	12	3260	6	5	1	0.619			
Lead	7439-92-1	6020A	400	0.01	2	0.005	0.1	0.02	0.0066			
Magnesium	7439-95-4	6010C	NC	4400	4400	2200	50	25	7.1			
Manganese	7439-96-5	6010C	180	330	330	90	1	1	0.448			
Mercury	7439-97-6	7471A	2.3	0.058	0.058	0.029	0.05	0.017	0.0061			
Nickel	7440-02-0	6020A	150	NC	2	1	0.2	0.05	0.0161			
Potassium	7440-09-7	6010C	NC	NC	NC		50	10	7.13			
Selenium	7782-49-2	6020A	39	1.8	1.8	0.9	0.5	0.1	0.0327			
Silver	7440-22-4	6020A	39	NC	0.0000098	0.0000049	0.1	0.01	0.0039	75		
Sodium	7440-23-5	6010C	NC	NC	NC		50	25	6.03	80		
Thallium	7440-28-0	6020A	0.078	NC	0.001	0.0005	0.1	0.01	0.0026			
Vanadium	7440-62-2	6020A	39	58	0.5	0.25	0.1	0.04	0.0097			
Zinc	7440-66-6	6020A	2300	NC	10	5	2	1	0.28			
Cyanide	57-12-5	9014	160	0.005	NC	0.0025	0.1	0.05	0.0208			

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] Project QL Goals are equal to half of the minimum PAL.

[4] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

Shading indicates instances where the LOD is greater than the PAL. Refer to section 2.6.

TABLE B1-5
Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: WCHEM[1]

Analyte Name	CAS No.[2]	Project QL Goal[3]	Units	Laboratory Limits			LCS and MS/MSD Recovery and RPD Limits[4] (%)		
				LOQ	**LOD**	**DL**	**LCL**	**UCL**	**RPD**
pH	PH	NA	pH	N/A	N/A	N/A	NA	NA	NA
Total Organic Carbon (TOC)	TOC	NA	mg/kg	1000	1000	225	75	125	20

Notes

[1] Results for pH will be used to determine the bioavailability of certain metals. Results for TOC will be used to tailor ecological screening criteria for certain organics.

[2] Contractor-specific analyte codes are listed.

[3] There are no Project QL Goals for WCHEM analytes.

[4] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

TABLE B1-6

Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: GRAINSIZE[1, 2]

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

Notes

[1] Results for GRAINSIZE will be used to evaluate the ecological risk at the site.

[2] Laboratory limits and Project QL Goals are not applicable to GRAINSIZE data.

TABLE B1-7
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: VOCs

Analyte Name	CAS No.	RSLs Tapwater Adjusted[1](ug/L)	Project QL Goal[2] (ug/L)	Laboratory Limits (ug/L)			LCS and MS/MSD Recovery and RPD Limits[3] (%)		
				LOQ	LOD	DL	LCL	UCL	RPD
Dichlorodifluoromethane (Freon-12)	75-71-8	19	9.5	1	0.5	0.25	30	155	30
Chloromethane	74-87-3	19	9.5	1	0.5	0.179	40	125	
Vinyl chloride	75-01-4	0.015	0.0075	1	0.5	0.238	50	145	
Bromomethane	74-83-9	0.7	0.35	1	0.5	0.279	30	145	
Chloroethane	75-00-3	2100	1050	1	0.5	0.15	60	135	
Trichlorofluoromethane(Freon-11)	75-69-4	110	55	1	0.5	0.179	60	145	
1,1-Dichloroethene	75-35-4	26	13	1	0.5	0.173	70	130	
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	76-13-1	5300	2650	1	0.5	0.225	**50**	**150**	
Acetone	67-64-1	1200	600	10	1	0.655	40	140	
Carbon disulfide	75-15-0	72	36	5	0.5	0.187	35	160	
Methyl acetate	79-20-9	1600	800	5	0.5	0.273	**70**	**130**	
Methylene chloride	75-09-2	4.7	2.35	1	0.5	0.347	55	140	
trans-1,2-Dichloroethene	156-60-5	8.6	4.3	1	0.5	0.114	60	140	
Methyl-tert-butyl ether (MTBE)	1634-04-4	12	6	1	0.5	0.128	**65**	**125**	
1,1-Dichloroethane	75-34-3	2.4	1.2	1	0.5	0.194	70	135	
cis-1,2-Dichloroethene	156-59-2	2.8	1.4	1	0.5	0.171	70	125	
2-Butanone	78-93-3	490	245	5	0.5	0.281	30	150	
Bromochloromethane	74-97-5	8.3	4.15	1	0.5	0.157	75	120	
Chloroform	67-66-3	0.19	0.095	1	0.5	0.161	65	135	
1,1,1-Trichloroethane	71-55-6	750	375	1	0.5	0.143	65	130	
Cyclohexane	110-82-7	1300	650	5	0.5	0.288	**77**	**125**	
Carbon tetrachloride	56-23-5	0.39	0.195	1	0.5	0.144	65	140	
Benzene	71-43-2	0.39	0.195	1	0.5	0.116	80	120	
1,2-Dichloroethane	107-06-2	0.15	0.075	1	0.5	0.122	70	130	
Trichloroethene	79-01-6	0.26	0.13	1	0.5	0.183	70	125	
Methylcyclohexane	108-87-2	NC		5	0.5	0.234	**70**	**130**	
1,2-Dichloropropane	78-87-5	0.38	0.19	1	0.5	0.146	75	125	
Bromodichloromethane	75-27-4	0.12	0.06	1	0.5	0.134	75	120	
cis-1,3-Dichloropropene	10061-01-5	0.41	0.205	1	0.1	0.0504	70	130	
4-Methyl-2-pentanone	108-10-1	100	50	5	0.5	0.234	60	135	
Toluene	108-88-3	86	43	1	0.1	0.057	75	120	
trans-1,3-Dichloropropene	10061-02-6	0.41	0.205	1	0.25	0.109	55	140	
1,1,2-Trichloroethane	79-00-5	0.041	0.0205	1	0.5	0.152	75	125	
Tetrachloroethene	127-18-4	0.072	0.036	1	0.5	0.165	45	150	
2-Hexanone	591-78-6	3.4	1.7	5	0.5	0.239	55	130	
Dibromochloromethane	124-48-1	0.15	0.075	1	0.25	0.0943	60	135	

TABLE B1-7
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: VOCs

Analyte Name	CAS No.	RSLs Tapwater Adjusted[1](ug/L)	Project QL Goal[2] (ug/L)	Laboratory Limits (ug/L)			LCS and MS/MSD Recovery and RPD Limits[3] (%)		
				LOQ	LOD	DL	LCL	UCL	RPD
1,2-Dibromoethane	106-93-4	0.0065	0.00325	1	0.25	0.107	80	120	
Chlorobenzene	108-90-7	7.2	3.6	1	0.5	0.128	80	120	
Ethylbenzene	100-41-4	1.3	0.65	1	0.25	0.107	75	125	
o-Xylene	95-47-6	19	9.5	1	0.25	0.104	80	120	
m- and p-Xylene	m&pXYLENE	19	9.5	2	0.5	0.286	75	130	
Styrene	100-42-5	110	55	1	0.1	0.0557	65	135	
Bromoform	75-25-2	7.9	3.95	1	0.25	0.102	70	130	
Isopropylbenzene	98-82-8	39	19.5	1	0.5	0.169	75	125	
1,1,2,2-Tetrachloroethane	79-34-5	0.066	0.033	1	0.5	0.12	65	130	
1,3-Dichlorobenzene	541-73-1	NC		1	0.25	0.106	75	125	
1,4-Dichlorobenzene	106-46-7	0.42	0.21	1	0.5	0.156	75	125	
1,2-Dichlorobenzene	95-50-1	28	14	1	0.5	0.154	70	120	
1,2-Dibromo-3-chloropropane	96-12-8	0.00032	0.00016	2	0.5	0.251	50	130	
1,2,4-Trichlorobenzene	120-82-1	0.39	0.195	2	0.5	0.147	65	135	
1,2,3-Trichlorobenzene	87-61-6	0.52	0.26	2	0.5	0.138	75	130	

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

Shading indicates instances where the LOD is greater than the PAL. Refer to section 2.6.

TABLE B1-8
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: SVOCS

Analyte Name	CAS No.	range	RSLs Tapwater Adjusted[1](ug/L)	Project QL Goal[2] (ug/L)	Laboratory Limits (ug/L)			LCS and MS/MSD Recovery and RPD Limits[3] (%)		
					LOQ	LOD	DL	LCL	UCL	RPD
Benzaldehyde	100-52-7	Low	150	75	0.5	0.5	0.12	**25**	**141**	30
Phenol	108-95-2	Low	450	225	0.5	0.1	0.0504	0	115	
bis(2-Chloroethyl)ether	111-44-4	Low	0.012	0.006	0.5	0.1	0.038	35	110	
2-Chlorophenol	95-57-8	Low	7.1	3.55	0.5	0.1	0.0634	35	105	
2-Methylphenol	95-48-7	Low	72	36	0.5	0.1	0.0509	40	110	
2,2'-Oxybis(1-chloropropane)	108-60-1	Low	0.31	0.155	0.5	0.1	0.0836	25	130	
Acetophenone	98-86-2	Low	150	75	0.5	0.5	0.147	**54**	**113**	
4-Methylphenol	106-44-5	Low	7.2	3.6	0.5	0.5	0.166	30	110	
n-Nitroso-di-n-propylamine	621-64-7	Low	0.0093	0.00465	0.5	0.5	0.139	35	130	
Hexachloroethane	67-72-1	Low	0.51	0.255	0.5	0.25	0.121	30	100	
Nitrobenzene	98-95-3	Low	0.12	0.06	0.5	0.5	0.126	45	110	
Isophorone	78-59-1	Low	67	33.5	0.5	0.1	0.0598	50	110	
2-Nitrophenol	88-75-5	Low	7.1	3.55	0.5	0.5	0.147	40	115	
2,4-Dimethylphenol	105-67-9	Low	27	13.5	1	0.5	0.269	30	110	
bis(2-Chloroethoxy)methane	111-91-1	Low	4.7	2.35	0.5	0.1	0.046	45	105	
2,4-Dichlorophenol	120-83-2	Low	3.5	1.75	0.5	0.25	0.241	50	105	
Naphthalene	91-20-3	SIM	0.14	0.07	0.05	0.05	0.0098	40	100	
4-Chloroaniline	106-47-8	Low	0.32	0.16	1	0.25	0.166	15	110	
Hexachlorobutadiene	87-68-3	Low	0.26	0.13	0.5	0.1	0.0344	25	105	
Caprolactam	105-60-2	Low	770	385	1	0.5	0.155	**25**	**135**	
4-Chloro-3-methylphenol	59-50-7	Low	110	55	0.5	0.25	0.125	45	110	
2-Methylnaphthalene	91-57-6	Low	2.7	1.35	0.5	0.1	0.0361	45	105	
Hexachlorocyclopentadiene	77-47-4	Low	2.2	1.1	0.5	0.25	0.152	**30**	**141**	
2,4,6-Trichlorophenol	88-06-2	Low	0.9	0.45	0.5	0.5	0.169	50	115	
2,4,5-Trichlorophenol	95-95-4	Low	89	44.5	0.5	0.25	0.11	50	110	
1,1-Biphenyl	92-52-4	Low	0.083	0.0415	0.5	0.1	0.0502	**59**	**114**	
2-Chloronaphthalene	91-58-7	Low	55	27.5	0.5	0.05	0.0283	50	105	
2-Nitroaniline	88-74-4	Low	15	7.5	0.5	0.5	0.154	50	115	
Dimethyl phthalate	131-11-3	Low	NC		0.5	0.25	0.146	25	125	
2,6-Dinitrotoluene	606-20-2	Low	1.5	0.75	0.5	0.25	0.122	50	115	
Acenaphthylene	208-96-8	Low	40	20	0.5	0.1	0.036	50	105	
3-Nitroaniline	99-09-2	Low	NC		1	0.5	0.241	25	125	
Acenaphthene	83-32-9	Low	40	20	0.5	0.1	0.029	45	110	
2,4-Dinitrophenol	51-28-5	Low	3	1.5	5	1	0.525	15	140	
4-Nitrophenol	100-02-7	Low	0.12	0.06	5	2	1.08	0	125	
Dibenzofuran	132-64-9	Low	0.58	0.29	0.5	0.1	0.0379	55	105	
2,4-Dinitrotoluene	121-14-2	Low	0.2	0.1	0.5	0.1	0.0938	50	120	
Diethylphthalate	84-66-2	Low	1100	550	0.5	0.25	0.128	40	120	
Fluorene	86-73-7	Low	22	11	0.5	0.1	0.0439	50	110	
4-Chlorophenyl-phenylether	7005-72-3	Low	2.7	1.35	0.5	0.25	0.116	50	110	
4-Nitroaniline	100-01-6	Low	3.3	1.65	1	1	0.339	35	120	
4,6-Dinitro-2-methylphenol	534-52-1	Low	0.12	0.06	5	1	0.759	40	130	
n-Nitrosodiphenylamine	86-30-6	Low	10	5	0.5	0.05	0.0394	50	110	
1,2,4,5-Tetrachlorobenzene	95-94-3	Low	0.12	0.06	2	0.5	0.147	**40**	**140**	
4-Bromophenyl-phenylether	101-55-3	Low	NC		0.5	0.1	0.0586	50	115	
Hexachlorobenzene	118-74-1	Low	0.042	0.021	0.5	0.5	0.128	50	110	
Atrazine	1912-24-9	Low	0.26	0.13	0.5	0.1	0.0561	**61**	**139**	

TABLE B1-8
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: SVOCS

Analyte Name	CAS No.	range	RSLs Tapwater Adjusted[1](ug/L)	Project QL Goal[2] (ug/L)	Laboratory Limits (ug/L)			LCS and MS/MSD Recovery and RPD Limits[3] (%)		
					LOQ	LOD	DL	LCL	UCL	RPD
Pentachlorophenol	87-86-5	Low	0.17	0.085	0.5	0.25	0.113	40	115	
Phenanthrene	85-01-8	Low	130	65	0.5	0.1	0.0347	50	115	
Anthracene	120-12-7	Low	130	65	0.5	0.05	0.038	55	110	
Carbazole	86-74-8	Low	NC		0.5	0.1	0.027	50	115	
Di-n-butylphthalate	84-74-2	Low	67	33.5	1	0.5	0.217	55	115	
Fluoranthene	206-44-0	Low	63	31.5	0.5	0.1	0.0327	55	115	
Pyrene	129-00-0	Low	8.7	4.35	0.5	0.1	0.0376	50	130	
Butylbenzylphthalate	85-68-7	Low	14	7	1	0.5	0.15	45	115	
3,3'-Dichlorobenzidine	91-94-1	Low	0.11	0.055	10	1	0.237	20	110	
Benzo(a)anthracene	56-55-3	SIM	0.029	0.0145	0.05	0.05	0.0124	55	110	
Chrysene	218-01-9	Low	2.9	1.45	0.5	0.1	0.0356	55	110	
bis(2-Ethylhexyl)phthalate	117-81-7	Low	0.071	0.0355	0.5	0.5	0.187	40	125	
Di-n-octylphthalate	117-84-0	Low	0.071	0.0355	0.5	0.5	0.446	35	135	
Benzo(b)fluoranthene	205-99-2	SIM	0.029	0.0145	0.05	0.05	0.0153	45	120	
Benzo(k)fluoranthene	207-08-9	SIM	0.29	0.145	0.05	0.05	0.0167	45	125	
Benzo(a)pyrene	50-32-8	SIM	0.0029	0.00145	0.05	0.05	0.008	55	110	
Indeno(1,2,3-cd)pyrene	193-39-5	SIM	0.029	0.0145	0.05	0.05	0.0147	45	125	
Dibenz(a,h)anthracene	53-70-3	SIM	0.0029	0.00145	0.05	0.05	0.0158	40	125	
Benzo(g,h,i)perylene	191-24-2	Low	8.7	4.35	0.5	0.5	0.273	40	125	
2,3,4,6-Tetrachlorophenol	58-90-2	Low	17	8.5	5	0.5	0.363	**40**	**115**	

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

Shading indicates instances where the LOD is greater than the PAL. Refer to section 2.6.

TABLE B1-9
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: PCBs

Analyte Name	CAS No.	RSLs Tapwater Adjusted[1](ug/L)	Project QL Goal[2] (ug/L)	Laboratory Limits (ug/L)			LCS and MS/MSD Recovery and RPD Limits[3] (%)		
				LOQ	LOD	DL	LCL	UCL	RPD
Aroclor-1016	12674-11-2	0.11	0.055	0.2	0.08	0.0537	25	145	30
Aroclor-1221	11104-28-2	0.0043	0.00215	0.2	0.08	0.0454	NA	NA	NA
Aroclor-1232	11141-16-5	0.0043	0.00215	0.2	0.08	0.0409	NA	NA	NA
Aroclor-1242	53469-21-9	0.034	0.017	0.2	0.08	0.0619	NA	NA	NA
Aroclor-1248	12672-29-6	0.034	0.017	0.2	0.08	0.0544	NA	NA	NA
Aroclor-1254	11097-69-1	0.031	0.0155	0.2	0.08	0.0532	NA	NA	NA
Aroclor-1260	11096-82-5	0.034	0.017	0.2	0.08	0.0291	30	145	30
Aroclor-1262	37384-23-5	NC	Lab LOD	0.2	0.08	0.08	NA	NA	NA
Aroclor-1268	11100-14-4	NC	Lab LOD	0.2	0.08	0.0397	NA	NA	NA

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

NC indicates that there is no criterion for a particular analyte.

Shading indicates instances where the LOD is greater than the PAL. Refer to section 2.6.

TABLE B1-10
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: METALs, FMETALs

Analyte Name	CAS No.	Analytical Method	RSLs Tapwater Adjusted[1] (ug/L)	Project QL Goal[2] (ug/L)	Laboratory Limits (ug/L)			LCS and MS/MSD Recovery and RPD Limits[3] (%)		
					LOQ	LOD	DL	LCL	UCL	RPD
Aluminum	7429-90-5	6010C	1600	800	100	50	13.1	80	120	20
Antimony	7440-36-0	6020A	0.6	0.3	2	0.5	0.148			
Arsenic	7440-38-2	6020A	0.045	0.0225	5	0.5	0.177			
Barium	7440-39-3	6010C	290	145	10	10	2.71			
Beryllium	7440-41-7	6020A	1.6	0.8	1	0.4	0.111			
Cadmium	7440-43-9	6020A	0.69	0.345	0.2	0.1	0.0385			
Calcium	7440-70-2	6010C	NC		500	500	230			
Chromium	7440-47-3	6020A	0.031	0.0155	1	0.5	0.195			
Chromium (hexavalent)[4]	18540-29-9	7199	0.031	0.0155	10	10	10	LCS: 84 MS: 38	LCS: 117 MS: 148	
Cobalt	7440-48-4	6020A	0.47	0.235	1	0.2	0.0501	80	120	
Copper	7440-50-8	6020A	62	31	1	0.5	0.127			
Iron	7439-89-6	6010C	1100	550	20	10	6.53			
Lead	7439-92-1	6020A	15	7.5	1	0.5	0.152			
Magnesium	7439-95-4	6010C	NC		500	500	143			
Manganese	7439-96-5	6010C	32	16	10	10	2.78			
Mercury	7439-97-6	7470A	0.43	0.215	0.2	0.1	0.0551			
Nickel	7440-02-0	6020A	30	15	1	0.5	0.171			
Potassium	7440-09-7	6010C	NC		100	100	32.9			
Selenium	7782-49-2	6020A	7.8	3.9	5	1	0.31			
Silver	7440-22-4	6020A	7.1	3.55	0.5	0.1	0.0367			
Sodium	7440-23-5	6010C	NC		500	500	127			
Thallium	7440-28-0	6020A	0.016	0.008	0.2	0.1	0.0268			
Vanadium	7440-62-2	6010C	7.8	3.9	1	0.2	0.0657			
Zinc	7440-66-6	6010C	470	235	10	10	4.89			
Cyanide[5]	57-12-5	9014	31	15.5	10	5	2.9			

Notes

[1] Refer to **Section 2** for specific identification of PALs by matrix.

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

[3] DoD QSM v.4.2 is the basis for LCS and MS/MSD limits. Values are bolded to indicate instances where laboratory in-house limits are used.

[4] Chromium (hexavalent) will only be analyzed as an FMETAL. The analytical method requires filtering prior to analysis.

[5] Cyanide will only be analyzed as a METAL. Dissolved Cyanide will not be reported.

NC indicates that there is no criterion for a particular analyte.

Shading indicates instances where the LOD is greater than the PAL. Refer to section 2.6.

TABLE B2-1
Analytical SOP References Table

Laboratory Name and Address: TriMatrix Laboratories, 5560 Corporate Exchange Ct. SE, Grand Rapids, MI 49512

POC: Walt Roudebush

Phone Number: (616) 975-4561

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
GR-01-100	Inductively Coupled Plasma Atomic Emission Spectroscopy-Perkin Elmer OPTIMA-3300DV/5300DV; 09/20/11, rev 5.9	NA	Definitive	SS, SB, GW / METALs, FMETALs	Inductively-coupled Plasma (ICP)	None	N
GR-01-123	Mercury by semi-Automated Cold Vapor Atomic Absorption, 09/25/11; rev 5.8	NA	Definitive	SS, SB, GW / METALs, FMETALs	CVAA	None	N
GR-01-129	Inductively Coupled Plasma Mass Spectrometry Perkin Elmer ELAN-6000/6100; 09/25/11, rev 4.0	NA	Definitive	SS, SB, GW / METALs, FMETALs	ICP/MS	None	N
GR-01-137	Block Digestion of Solids for ICP and ICPMS; 09/20/11, rev 1.6	NA	Definitive	SS, SB / METALs	Block Digester	None	N
GR-01-139	Preparation Procedure for Mercury in Soils, Wastes, and Oils; 01/09/12, rev 0.2	NA	Definitive	SS, SB / METALs	Block Digester	None	N
GR-01-140	Preparation Procedure for Mercury in Water, Wastewater, and Liquid Waste; 01/09/12, rev 0.4	NA	Definitive	GW / METALs, FMETALs	Block Digester	None	N
GR-01-147	Block Digestion of Total Metals in Water for ICP; 01/09/12, rev 0.4	NA	Definitive	GW / METALs, FMETALs	Block Digester	None	N
GR-01-148	Block Digestion of Aqueous Samples and Extracts for Total/Dissolved Metals by ICPMS; 10/20/11, rev 0.4	NA	Definitive	SS, SB, GW / METALs, FMETALs	Block Digester	None	N
GR-03-128	PCBs by Gas Chromatography; 04/25/11, rev 2.6	NA	Definitive	SS, SB, GW / PCBs	Gas Chromatograph (GC)/ECD	None	N
GR-04-103	Base/Neutral/Acid Compounds by Gas Chromatography/Mass Spectrometry; 05/15/11, rev 5.7	NA	Definitive	SS, SB, GW / SVOCs	GC/MS	None	N
GR-04-104	VOCs by Purge and Trap Capillary Column GC/MS; 1/25/2012, rev 4.7	NA	Definitive	SS, SB, GW / VOCs	GC/MS	None	N
GR-04-105	Closed System Purge and Trap and Extraction for VOCs; 9/30/11, rev 1.3	NA	Definitive	SS, SB / VOCs	NA	None	N
GR-05-122	Total and Amenable Cyanide by Konelab UV Spectrophotometry; 10/06/10, rev 0.4	In review	Definitive	SS, SB, GW / METALs	Spectrophometer	None	N
GR-05-132	Leco Carbon Analyzer (Organic Carbon); 01/12/12, rev 0.0	NA	Screening	SS / WCHEM	TOC Analyzer	None	N
GR-07-113	pH Potentiometric Method Soils and Wastes (Non-Aqueous Liquids); 01/12/12, rev 0.4	NA	Screening	SS / WCHEM	pH meter	None	N
GR-09-101	Extraction of Base Neutrals and Acids from Water; 05/02/11, rev 3.4	NA	Definitive	GW / SVOCs	Separatory Funnel	None	N
GR-09-103	Extraction of BNA Semi-Volatiles from Soil; Sediment and Sludge, 10/31/11, rev 3.8	NA	Definitive	SS, SB / SVOCs	Sonication	None	N
GR-09-107	Extraction of Organochlorine Pesticides, PCBs, and Chlorinated Hydrocarbons from Water; 5/2/11, rev 5.4	NA	Definitive	GW / PCBs	Separatory Funnel	None	N
GR-09-108	Extraction of Organochlorine Pesticides and PCBs from Soil, Sludge and Wipe Samples; 5/2/11, rev 5.4	NA	Definitive	SS, SB / PCBs	Sonicator	None	N
GR-10-104	Internal Chain of Custody; 11/10/11, rev 2.3	NA	NA	NA	NA	None	N
GR-15-100	Sample Receiving/Sample Log-In; 01/12/12, rev 3.3	NA	NA	NA	NA	None	N
GR-15-102	Laboratory Waste Disposal Guidelines; 4/25/11, rev 2.3	NA	NA	NA	NA	None	N
GR-16-119	Particle Size Analysis of Soils; 8/1/10, rev 0.0		Screening	SS / GRAINSIZE	Sieve	None	N
GR-18-106	Total and Amenable Cyanide Extraction and/or Macro-Distillation; 05/30/11, rev 3.3	NA	Definitive	SS, SB, GW / METALs	glassware / equipment for distillation	None	N
GR-18-109	Midi-Distillation for Total and Amenable Cyanide; 05/30/11, rev 3.6	NA	Definitive	SS, SB, GW / METALs	glassware / equipment for distillation	None	N

Required Laboratory Accreditation: DoD ELAP

Expiration Date: 4/30/2013

TABLE B2-2
Analytical SOP References Table

Laboratory Name and Address: ALS - Columbia, 1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623

POC: Debbie Patton

Phone Number: (585) 672-7473

Lab SOP Number	Title, Revision Date, and Number	Date reviewed if not revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
GEN-7199	Hexavalent Chromium by Ion Chromatography, Revision 3, 1/6/11	NA	Definitive	SS, SB, GW / METALs or FMETALs	Ion Chromatography	N	N
GEN-3060A	Alkaline Digestion for Hexavalent Chromium in Soils, Revision 2, 1/6/11	NA	Prep	SS, SB / METALs	Prep	N	N

Required Laboratory Accreditation: DoD ELAP

Expiration Date: 4/7/2014

TABLE B3-1
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: VOCs

Analytical Method/SOP Reference: SW-846 8260B / GR-04-104

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 LOQ and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported, including surrogates		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-1**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD)		Same as MS, and refer to **Table B1-1** for RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.		Precision / Accuracy / Bias	
Surrogate spike	All field and QC samples.	1,2-Dichloroethane-d4 66-124 Dibromofluoromethane 78-121 Toluene-d8 85-115% 4-Bromofluorobenzene 85-120%	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy / Bias	

TABLE B3-2
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: SVOCs

Analytical Method/SOP Reference: SW-846 8270C and 8270-SIM / GR-05-122

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 LOQ and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported, including surrogates		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-1**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD)		Same as MS, and refer to **Table B1-1** for RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.		Precision / Accuracy / Bias	
Surrogate spike	All field and QC samples.	Nitrobenzene-d5 35-100; 2-Fluorobiphenyl 45-105; o-Terphenyl 30-125; Phenol-d6 40-100; 2-Fluorophenol 35-105; 2,4,6-Tribromophenol 35-125	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy / Bias	

TABLE B3-3
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: PCBs

Analytical Method/SOP Reference: SW-846 8082A / GR-03-128

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 LOQ and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing Aroclors 1016 and 1260		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-3**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD)		Same as MS, and refer to **Table B1-3** for RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Surrogate spike	All field and QC samples.	Decachlorobiphenyl within 60-125%R.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy / Bias	

TABLE B3-4
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: METALs (refer to **Table B1-4** for a specific list of analytes by this method)

Analytical Method/SOP Reference: SW-846 6010C / GR-01-100

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported		QC acceptance criteria specified in DoD QSM v4.1., refer to **Tables B1-4**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)		MSD: Same as LCS and RPD $\leq$ 20% (between MS and MSD or sample and sample duplicate).	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Serial Dilution (aka Dilution test)	One per preparatory batch for samples with concentration > 50 x LOQ.	Five-fold dilution must agree within ± 10% of the original measurement.	Perform Post Digestion Spike (PDS) addition.		Precision / Accuracy	
Post Digestion Spike (PDS)	When serial dilution fails or analyte concentration in all samples < 50 x LOD.	Recovery within 75-125%.	Run all associated sample in the preparatory batch by method of standard additions (MSA) or qualify results.		Precision / Accuracy	
Internal Standards (IS)	NA	IS intensity within 70-125% of intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards.		Accuracy / Bias	

TABLE B3-5
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: METALs (refer to **Table B1-4** for a specific list of analytes by this method)

Analytical Method/SOP Reference: SW-846 6020A / GR-01-129

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported		QC acceptance criteria specified in DoD QSM v4.1., refer to **Table B1-4**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)		MSD: Same as LCS and RPD $\leq$ 20% (between MS and MSD or sample and sample duplicate).	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Serial Dilution (aka Dilution test)	One per preparatory batch for samples with concentration > 50 x LOQ.	Five-fold dilution must agree within ± 10% of the original measurement.	Perform Post Digestion Spike (PDS) addition.		Precision / Accuracy	
Post Digestion Spike (PDS)	When serial dilution fails or analyte concentration in all samples < 50 x LOD.	Recovery within 75-125%.	Run all associated sample in the preparatory batch by method of standard additions (MSA) or qualify results.		Precision / Accuracy	
Internal Standards (IS)	NA.	IS intensity within 30-120% of intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards.		Accuracy / Bias	

TABLE B3-6
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: METALs (Mercury)

Analytical Method/SOP Reference: SW-846 7471A / GR-01-123

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method / SOP QC Acceptance Limits.
LCS containing analyte to be reported		QC acceptance criteria specified in DoD QSM v4.1., refer to **Table B1-4**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)		MSD: Same as LCS and RPD $\leq$ 20% (between MS and MSD or sample and sample duplicate).	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	

TABLE B3-7
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: METALs (Cyanide)

Analytical Method/SOP Reference: SW-846 9014 / GR-05-122

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS		QC acceptance criteria specified in DoD QSM v4.1., refer to **Table B1-4**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for the failed analyte, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Use in-house limits for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)		Use in-house recovery limits for LCS. RPD $\leq$ 20% (between MS and MSD or sample and sample duplicate).	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	

TABLE B3-8
Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: METALs (Hexavalent Chromium)

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

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per batch of 20 or fewer samples.	No target compounds should be >1/2 LOQ.	Reclean, reanalyze and/or qualify the data.	Analyst/Supervisor	Bias/Contamination	Same as QC Acceptance Limits.
LCS-insoluble		80-120% of the true value.	Redigest if possible. If samples are out of holding time, redigest and report both sets of data. If insufficient sample is available to redigest, flag. If the LCS recoveries are high and the sample results are <LOQ, narrate.		Accuracy/Bias	
MS-soluble		75-125% of the true value.	Redigest entire batch unless spike is diluted out (sample result > 4x spike concentration). If redigest fails, contact client about possible matrix investigations. If samples are out of holding time, redigest and report both sets of data. If insufficient sample is available to redigest, flag. Flag results associated with out of control matrix spike.		Accuracy/ Bias	
MS-insoluble						
LCS-insoluble		80-120% of the true value.	Redigest if possible. If samples are out of holding time, redigest and report both sets of data. If insufficient sample is available to redigest, flag. If the LCS recoveries are high and the sample results are <LOQ, narrate.		Accuracy/Bias	
DUP(or MSD)		If parent concentration is >4x the LOQ, RPD<20%; if the parent concentration is <4x the LOQ, duplicate is acceptable if the difference is not > +/- LOQ.	Reprep and reanalyze sample and duplicate unless obvious or historical interferences or lack of volume.		Precision	
Post Digestion Matrix Spike		85-115% of the true value.	If MS also failed, no action beyond CA for MS.		Bias	

TABLE B3-9
Laboratory QC Samples Table

Matrix: Composite Soil

Analytical Group: WCHEM (TOC)

Analytical Method/SOP Reference: Lloyd Kahn / GR-05-132

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	Analyte not detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Re-prepare and analyze all associated samples. Discuss with client/qualify if re-analysis not feasible.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.1., refer to **Table B1-5.**	Re-prepare and analyze all associated samples. Discuss with client/qualify if re-analysis not feasible.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	For matrix evaluation use QC acceptance criteria specified for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	
Matrix Spike Duplicate (MSD)	One per preparatory batch of up to 20 samples.	MSD: For matrix evaluation, use QC acceptance criteria specified for LCS. MSD: RPD $\leq$ 20% (between MS and MSD).	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	

TABLE B3-10
Laboratory QC Samples Table

Matrix: Composite Soil

Analytical Group: WCHEM (pH)

Analytical Method/SOP Reference: SW-846 9045C / GR-07-113

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Standard Reference Material (SRM)	Two per preparatory batch of up to 20 samples.	±0.05 pH units of certified value	Re-prepare and analyze all associated samples.	Analyst / Laboratory Area Supervisor	Accuracy	Same as Method/SOP QC Acceptance Limits.
Laboratory Duplicate (DUP)	One per preparatory batch of up to 20 samples.	RPD limit for pH is 20.	Re-prepare and analyze all associated samples.	Analyst / Laboratory Area Supervisor	Bias	

TABLE B3-11
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: VOCs

Analytical Method/SOP Reference: SW-846 8260B / GR-04-104

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 LOQ and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported, including surrogates		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-7**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD)		Same as MS, and refer to **Table B1-7** for RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.		Precision / Accuracy / Bias	
Surrogate spike	All field and QC samples.	1,2-dichloroethane-d_4 70-120, 4-Bromofluorobenzene 75-120, dibromofluoromethane 85-115 Toluene-d_8	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy / Bias	

TABLE B3-12
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: SVOCs

Analytical Method/SOP Reference: SW-846 8270C and 8270-SIM / GR-05-122

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 LOQ and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported, including surrogates		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-8**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD)		Same as MS, and refer to **Table B1-8** for RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention times for internal standards must be ± 30 seconds from retention time of the midpont standard in the ICAL and the responses within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and/or gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.		Precision / Accuracy / Bias	
Surrogate spike	All field and QC samples.	Nitrobenzene-d5 40-110; 2-Fluorobiphenyl 50-110; o-Terphenyl 50-135; Phenol-d6 10-115; 2-Fluorophenol 20-110; 2,4,6-Tribromophenol 40-125	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy / Bias	

TABLE B3-13
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: PCBs

Analytical Method/SOP Reference: SW-846 8270C and 8270-SIM / GR-05-122

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 LOQ and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing Aroclors 1016 and 1260		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-9**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD)		Same as MS, and refer to **Table B1-9** for RPD.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Surrogate spike	All field and QC samples.	Decachlorobiphenyl within 40-135 %R.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.		Accuracy / Bias	

TABLE B3-14
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: METALs, FMETALs (refer to **Table B1-4** for a specific list of analytes by this method)

Analytical Method/SOP Reference: SW-846 6010C / GR-01-100

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-10**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)		Same as MS, and refer to **Table B1-10** for RPD.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	
Serial Dilution (aka Dilution test)	One per preparatory batch for samples with concentration > 50 x LOQ.	Five-fold dilution must agree within ± 10% of the original measurement.	Perform Post Digestion Spike (PDS) addition.		Precision / Accuracy	
Post Digestion Spike (PDS)	When serial dilution fails or analyte concentration in all samples < 50 x LOD.	Recovery within 75-125%.	Run all associated sample in the preparatory batch by method of standard additions (MSA) or qualify results.		Precision / Accuracy	
Internal Standards (IS)	NA	IS intensity within 70-125% of intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards.		Accuracy / Bias	

TABLE B3-15
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: METALs, FMETALs (refer to **Table B1-4** for a specific list of analytes by this method)

Analytical Method/SOP Reference: SW-846 6020A / GR-01-129

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS containing all analytes to be reported	One per preparatory batch of up to 20 samples.	QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-10**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)	One per preparatory batch of up to 20 samples.	Same as MS, and refer to **Table B1-10** for RPD.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.	Analyst / Laboratory Area Supervisor	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
Serial Dilution (aka Dilution test)	One per preparatory batch for samples with concentration > 50 x LOQ.	Five-fold dilution must agree within ± 10% of the original measurement.	Perform Post Digestion Spike (PDS) addition.	Analyst / Laboratory Area Supervisor	Precision / Accuracy	Same as Method/SOP QC Acceptance Limits.
Post Digestion Spike (PDS)	When serial dilution fails or analyte concentration in all samples < 50 x LOD.	Recovery within 75-125%.	Run all associated sample in the preparatory batch by method of standard additions (MSA) or qualify results.	Analyst / Laboratory Area Supervisor	Precision / Accuracy	Same as Method/SOP QC Acceptance Limits.
Internal Standards (IS)	NA.	IS intensity within 30-120% of intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards.	Analyst / Laboratory Area Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

TABLE B3-16
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: METALs, FMETALs (mercury)

Analytical Method/SOP Reference: SW-846 7470A / GR-01-123

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method / SOP QC Acceptance Limits.
Laboratory Control Sample (LCS) containing analyte to be reported		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-10**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.		Accuracy / Bias	
Matrix Spike (MS)		Same as LCS.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
Matrix Spike Duplicate (MSD) or Sample Duplicate (DUP)		Same as MS, and refer to **Table B1-10** for RPD.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	

TABLE B3-17
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: METALs (Cyanide)

Analytical Method/SOP Reference: SW-846 9014 / GR-05-122

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch of up to 20 samples.	No analytes detected > 1/2 RL and greater than 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct the problem. If required, reprep and reanalyze the method blank and all samples processed with the contaminated blank.	Analyst / Laboratory Area Supervisor	Contamination / Bias	Same as Method/SOP QC Acceptance Limits.
LCS		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-10**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for the failed analyte, if sufficient sample material is available.		Accuracy / Bias	
MS		Use in-house limits for LCS.	Examine results of LCS. If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Accuracy / Bias	
MSD or DUP		Same as MS, and refer to **Table B1-10** for RPD.	Examine results of LCS. If both the LCS and MS/MSD or MS/DUP are unacceptable, re-prepare and analyze the associated samples and QC, otherwise report and narrate.		Precision / Accuracy / Bias	

TABLE B3-18
Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: FMETALs (hexavalent chromium)

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

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per batch of 20 or fewer samples.	No target compounds detected >1/2 LOQ.	Reclean, reanalyze and/or qualify the data.	Analyst/Supervisor	Bias/Contamination	Same as QC Acceptance Limits.
LCS		QC acceptance criteria specified in DoD QSM v4.2., refer to **Table B1-10**.	Evaluate, reanalyze batch if possible. If the LCS recoveries are high and the sample results are <QL narrate.		Accuracy/Bias	
MS		38-148% of the true value.	If LCS acceptable, may report with qualifier and note outliers in the case narrative.		Accuracy/ Bias	
Duplicate (or MSD)		Same as MS, and refer to **Table B1-10** for RPD.	Repeat sample and duplicate unless obvious or historical interferences or lack of volume.		Precision	

Appendix C
Laboratory DoD ELAP Accreditation Letters

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Columbia Analytical Services

1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14623

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the DoD Quality Systems Manual for Environmental Laboratories Version 4.1 4/22/2009 and is accredited is accordance with the:

United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Environmental Testing

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Initial Accreditation Date:	*Issue Date:*	*Accreditation No.:*	*Certificate No.:*
January 22, 2010	April 7, 2012	65817	L12-48

Tracy Szerszen
President/Operations Manager

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services

1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14609
Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	(CAS SOP) GEN-TICW	UV-VIS	Total inorganic carbon
Aqueous	EPA 1631	CVAFS	Mercury
Aqueous	EPA 1664A	Gravimetric	Oil and grease
Aqueous	EPA 1664A	Gravimetric	Total petroleum hydrocarbons
Aqueous	EPA 218.6	IC-UV	Chromium, Hexavalent
Aqueous	EPA 245.1	CVAA	Mercury
Aqueous	EPA 300.0	IC	Chloride
Aqueous	EPA 300.0	IC	Fluoride
Aqueous	EPA 300.0	IC	Nitrate
Aqueous	EPA 300.0	IC	Sulfate
Aqueous	EPA 351.2	UV-VIS	Nitrogen, total Kjeldahl
Aqueous	EPA 353.2	UV-VIS	Nitrite as N
Aqueous	EPA 410.4	UV-VIS	Chemical oxygen demand
Aqueous	EPA 7470A	CVAA	Mercury
Aqueous	EPA 8151A	GC-ECD	Dinoseb
Aqueous	EPA 8260C	GC-MS-SIM	1,1-Dichloroethene
Aqueous	EPA 8260C	GC-MS-SIM	1,2-Dichlorobenzene
Aqueous	EPA 8260C	GC-MS-SIM	1,2-Dichloroethane
Aqueous	EPA 8260C	GC-MS-SIM	1,4-Dioxane
Aqueous	EPA 8260C	GC-MS-SIM	Carbon tetrachloride
Aqueous	EPA 8260C	GC-MS-SIM	Dichloromethane
Aqueous	EPA 8260C	GC-MS-SIM	Ethylbenzene
Aqueous	EPA 8260C	GC-MS-SIM	m- + p-Xylene
Aqueous	EPA 8260C	GC-MS-SIM	o-Xylene
Aqueous	EPA 8260C	GC-MS-SIM	Tetrachloroethene
Aqueous	EPA 8260C	GC-MS-SIM	Trichloroethene
Aqueous	EPA 8260C	GC-MS-SIM	Vinyl chloride
Aqueous	EPA 8260C	GC-MS-SIM	Xylenes, total
Aqueous	EPA 8310	HPLC-UV/FLUOR	Acenaphthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Acenaphthylene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Anthracene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(a)antracene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(a)pyrene

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(b)fluoranthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(g,h,i)perylene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Benzo(k)fluoranthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Chrysene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Dibenzo(a,h)anthracene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Fluoranthene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Fluorene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Indeno(1,2,3-cd)pyrene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Naphthalene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Phenanthrene
Aqueous	EPA 8310	HPLC-UV/FLUOR	Pyrene
Aqueous	EPA 9040B, C	POT	pH
Aqueous	EPA 9060, A	UV-VIS	Total organic carbon
Aqueous	EPA 9066	UV-VIS	Phenolics, total
Aqueous	RSK-175	GC-FID	Ethane
Aqueous	RSK-175	GC-FID	Ethylene
Aqueous	RSK-175	GC-FID	Methane
Aqueous	RSK-175	GC-FID	Propane
Aqueous	RSK-175	GC-FID	Acetylene
Aqueous	SM 2320B	Titration	Alkalinity, total, carbonate, and bicarbonate
Aqueous	SM 2340C	Titration	Hardness, total
Solids	(CAS SOP) GEN-351.2	UV-VIS	Nitrogen, total Kjeldahl
Solids	(CAS SOP) GEN-420.4/9066	UV-VIS	Phenolics, total
Solids	EPA Lloyd Kahn	UV-VIS	Total organic carbon
Solids	EPA 300.0	IC	Chloride
Solids	EPA 300.0	IC	Fluoride
Solids	EPA 300.0	IC	Nitrate
Solids	EPA 300.0	IC	Sulfate
Solids	EPA 7471B	CVAA	Mercury
Solids	EPA 8330A	HPLC-UV	1,3,5-Trinitrobenzene
Solids	EPA 8330A	HPLC-UV	1,3-Dinitrobenzene
Solids	EPA 8330A	HPLC-UV	2,4,6-Trinitrotoluene
Solids	EPA 8330A	HPLC-UV	2,4-Dinitrotoluene

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Matrix	Standard/Method	Technology	Analyte
Solids	EPA 8330A	HPLC-UV	2,6-Dinitrotoluene
Solids	EPA 8330A	HPLC-UV	2-Amino-4,6-dinitrotoluene
Solids	EPA 8330A	HPLC-UV	2-Nitrotoluene
Solids	EPA 8330A	HPLC-UV	3-Nitrotoluene
Solids	EPA 8330A	HPLC-UV	4-Amino-2,6-dinitrotoluene
Solids	EPA 8330A	HPLC-UV	4-Nitrotoluene
Solids	EPA 8330A	HPLC-UV	HMX
Solids	EPA 8330A	HPLC-UV	Nitrobenzene
Solids	EPA 8330A	HPLC-UV	RDX
Solids	EPA 8330A	HPLC-UV	Tetryl
Solids	EPA 9045C, D	POT	pH
Solids	SM 5220B	Titration	Chemical oxygen demand
Aqueous/Solids	EPA 1010A	Pensky Martin	Ignitability
Aqueous/Solids	EPA 353.2	UV-VIS	Nitrate/nitrite as N
Aqueous/Solids	EPA 6010C	ICP-AES	Aluminum
Aqueous/Solids	EPA 6010C	ICP-AES	Antimony
Aqueous/Solids	EPA 6010C	ICP-AES	Arsenic
Aqueous/Solids	EPA 6010C	ICP-AES	Barium
Aqueous/Solids	EPA 6010C	ICP-AES	Beryllium
Aqueous/Solids	EPA 6010C	ICP-AES	Boron
Aqueous/Solids	EPA 6010C	ICP-AES	Cadmium
Aqueous/Solids	EPA 6010C	ICP-AES	Calcium
Aqueous/Solids	EPA 6010C	ICP-AES	Chromium
Aqueous/Solids	EPA 6010C	ICP-AES	Cobalt
Aqueous/Solids	EPA 6010C	ICP-AES	Copper
Aqueous/Solids	EPA 6010C	ICP-AES	Iron
Aqueous/Solids	EPA 6010C	ICP-AES	Lead
Aqueous/Solids	EPA 6010C	ICP-AES	Magnesium
Aqueous/Solids	EPA 6010C	ICP-AES	Manganese
Aqueous/Solids	EPA 6010C	ICP-AES	Nickel
Aqueous/Solids	EPA 6010C	ICP-AES	Potassium
Aqueous/Solids	EPA 6010C	ICP-AES	Selenium
Aqueous/Solids	EPA 6010C	ICP-AES	Silver

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 6010C	ICP-AES	Sodium
Aqueous/Solids	EPA 6010C	ICP-AES	Thallium
Aqueous/Solids	EPA 6010C	ICP-AES	Tin
Aqueous/Solids	EPA 6010C	ICP-AES	Vanadium
Aqueous/Solids	EPA 6010C	ICP-AES	Zinc
Aqueous/Solids	EPA 6020A	ICP-MS	Arsenic
Aqueous/Solids	EPA 6020A	ICP-MS	Antimony
Aqueous/Solids	EPA 6020A	ICP-MS	Barium
Aqueous/Solids	EPA 6020A	ICP-MS	Beryllium
Aqueous/Solids	EPA 6020A	ICP-MS	Cadmium
Aqueous/Solids	EPA 6020A	ICP-MS	Chromium
Aqueous/Solids	EPA 6020A	ICP-MS	Cobalt
Aqueous/Solids	EPA 6020A	ICP-MS	Copper
Aqueous/Solids	EPA 6020A	ICP-MS	Lead
Aqueous/Solids	EPA 6020A	ICP-MS	Manganese
Aqueous/Solids	EPA 6020A	ICP-MS	Nickel
Aqueous/Solids	EPA 6020A	ICP-MS	Selenium
Aqueous/Solids	EPA 6020A	ICP-MS	Silver
Aqueous/Solids	EPA 6020A	ICP-MS	Thallium
Aqueous/Solids	EPA 6020A	ICP-MS	Vanadium
Aqueous/Solids	EPA 6020A	ICP-MS	Zinc
Aqueous/Solids	EPA 680	GC-MS	Monochlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Dichlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Trichlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Tetrachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Pentachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Hexachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Heptachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Octachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Nonachlorobiphenyls, Total
Aqueous/Solids	EPA 680	GC-MS	Decachlorobiphenyls, Total
Aqueous/Solids	EPA 6850	HPLC-MS	Perchlorate

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Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 7196A	UV-VIS	Chromium, hexavalent
Aqueous/Solids	EPA 7199	IC-UV	Chromium, hexavalent
Aqueous/Solids	EPA 8015C	GC-FID	Gasoline range organics
Aqueous/Solids	EPA 8015C	GC-FID	Diesel range organics
Aqueous/Solids	EPA 8081B	GC-ECD	4,4'-DDD
Aqueous/Solids	EPA 8081B	GC-ECD	4,4'-DDE
Aqueous/Solids	EPA 8081B	GC-ECD	4,4'-DDT
Aqueous/Solids	EPA 8081B	GC-ECD	Aldrin
Aqueous/Solids	EPA 8081B	GC-ECD	α-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Alpha-chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	β-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Chlordane, technical
Aqueous/Solids	EPA 8081B	GC-ECD	δ-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Dieldrin
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan I
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan II
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan sulfate
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin aldehyde
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin ketone
Aqueous/Solids	EPA 8081B	GC-ECD	γ-BHC (Lindane)
Aqueous/Solids	EPA 8081B	GC-ECD	γ-Chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	Heptachlor
Aqueous/Solids	EPA 8081B	GC-ECD	Heptachlor epoxide
Aqueous/Solids	EPA 8081B	GC-ECD	Hexachlorobenzene
Aqueous/Solids	EPA 8081B	GC-ECD	Methoxychlor
Aqueous/Solids	EPA 8081B	GC-ECD	Toxaphene
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1016
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1221
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1232
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1242
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1248
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1254

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Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1260
Aqueous/Solids	EPA 8082A	GC-ECD	PCB 1268
Aqueous/Solids	EPA 8151A	GC-ECD	2,4-D
Aqueous/Solids	EPA 8151A	GC-ECD	Dicamba
Aqueous/Solids	EPA 8151A	GC-ECD	2,4,5-T
Aqueous/Solids	EPA 8151A	GC-ECD	2,4,5-TP
Aqueous/Solids	EPA 8151A	GC-ECD	Pentachlorophenol (PCP)
Aqueous/Solids	EPA 8260C	GC-MS	1,1,1,2-Tetrachloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1,1-Trichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
Aqueous/Solids	EPA 8260C	GC-MS	1,1,2-Trichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1-Dichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,1-Dichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	1,1-Dichloropropene
Aqueous/Solids	EPA 8260C	GC-MS	1,2,3-Trichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2,3-Trichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2,4-Trimethylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dibromo-3-chloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dibromoethane
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloro-1,1,2-trifluoroethane (Freon 123a)
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloroethane
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloroethene, total
Aqueous/Solids	EPA 8260C	GC-MS	1,2-Dichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,3,5-Trimethylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,3-Dichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,3-Dichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	1,4-Dichlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	1,4-Dioxane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services

1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14609

Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8260C	GC-MS	2,2-Dichloro-1,1,1-trifluoroethane (Freon 123)
Aqueous/Solids	EPA 8260C	GC-MS	2,2-Dichloropropane
Aqueous/Solids	EPA 8260C	GC-MS	2-Butanone (MEK)
Aqueous/Solids	EPA 8260C	GC-MS	2-Chloro-1,3-butadiene
Aqueous/Solids	EPA 8260C	GC-MS	2-Chloroethylvinyl ether
Aqueous/Solids	EPA 8260C	GC-MS	2-Chlorotoluene
Aqueous/Solids	EPA 8260C	GC-MS	2-Hexanone
Aqueous/Solids	EPA 8260C	GC-MS	2-Methyl-1-propanol (Isobutlyl alcohol)
Aqueous/Solids	EPA 8260C	GC-MS	2-Methyl-2-propanol (Tertbutyl alcohol)
Aqueous/Solids	EPA 8260C	GC-MS	2-Nitropropane
Aqueous/Solids	EPA 8260C	GC-MS	2-Propanol
Aqueous/Solids	EPA 8260C	GC-MS	3-Chloro-1-propene (Allyl chloride)
Aqueous/Solids	EPA 8260C	GC-MS	4-Chlorotoluene
Aqueous/Solids	EPA 8260C	GC-MS	4-Ethyltoluene
Aqueous/Solids	EPA 8260C	GC-MS	4-Isopropyltoluene
Aqueous/Solids	EPA 8260C	GC-MS	4-Methyl-2-pentanone (MIBK)
Aqueous/Solids	EPA 8260C	GC-MS	Acetone
Aqueous/Solids	EPA 8260C	GC-MS	Acetonitrile
Aqueous/Solids	EPA 8260C	GC-MS	Acrolein
Aqueous/Solids	EPA 8260C	GC-MS	Acrylonitrile
Aqueous/Solids	EPA 8260C	GC-MS	Benzene
Aqueous/Solids	EPA 8260C	GC-MS	Benzyl chloride
Aqueous/Solids	EPA 8260C	GC-MS	Bromobenzene
Aqueous/Solids	EPA 8260C	GC-MS	Bromochloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Bromodichloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Bromoform
Aqueous/Solids	EPA 8260C	GC-MS	Bromomethane
Aqueous/Solids	EPA 8260C	GC-MS	Carbon disulfide
Aqueous/Solids	EPA 8260C	GC-MS	Carbon tetrachloride
Aqueous/Solids	EPA 8260C	GC-MS	Chlorobenzene
Aqueous/Solids	EPA 8260C	GC-MS	Chloroethane
Aqueous/Solids	EPA 8260C	GC-MS	Chloroform
Aqueous/Solids	EPA 8260C	GC-MS	Chloromethane

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Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8260C	GC-MS	cis-1,2-Dichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	cis-1,3-Dichloropropene
Aqueous/Solids	EPA 8260C	GC-MS	Cyclohexane
Aqueous/Solids	EPA 8260C	GC-MS	Cyclohexanone
Aqueous/Solids	EPA 8260C	GC-MS	Dibromochloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Dibromomethane
Aqueous/Solids	EPA 8260C	GC-MS	Dichlorodifluoromethane (Freon 12)
Aqueous/Solids	EPA 8260C	GC-MS	Dichlorofluoromethane (Freon 21)
Aqueous/Solids	EPA 8260C	GC-MS	Dichloromethane
Aqueous/Solids	EPA 8260C	GC-MS	Diethyl ether
Aqueous/Solids	EPA 8260C	GC-MS	Diisopropyl ether
Aqueous/Solids	EPA 8260C	GC-MS	Ethyl methacrylate
Aqueous/Solids	EPA 8260C	GC-MS	Ethyl tert-butyl ether
Aqueous/Solids	EPA 8260C	GC-MS	Ethylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8260C	GC-MS	Iodomethane
Aqueous/Solids	EPA 8260C	GC-MS	Isopropylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	m- + p-Xylene
Aqueous/Solids	EPA 8260C	GC-MS	Methacrylonitrile
Aqueous/Solids	EPA 8260C	GC-MS	Methyl acetate
Aqueous/Solids	EPA 8260C	GC-MS	Methyl methacrylate
Aqueous/Solids	EPA 8260C	GC-MS	Methylcyclohexane
Aqueous/Solids	EPA 8260C	GC-MS	Methyl-tert-butyl ether (MTBE)
Aqueous/Solids	EPA 8260C	GC-MS	Napthalene
Aqueous/Solids	EPA 8260C	GC-MS	N-butylacetate
Aqueous/Solids	EPA 8260C	GC-MS	N-butylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	N-heptane
Aqueous/Solids	EPA 8260C	GC-MS	N-propylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	o-Xylene
Aqueous/Solids	EPA 8260C	GC-MS	Propionitrile
Aqueous/Solids	EPA 8260C	GC-MS	sec-butylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	Styrene
Aqueous/Solids	EPA 8260C	GC-MS	tert-amyl methyl ether

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8260C	GC-MS	tert-butylbenzene
Aqueous/Solids	EPA 8260C	GC-MS	Tetra hydrofuran
Aqueous/Solids	EPA 8260C	GC-MS	Tetrachloroethene
Aqueous/Solids	EPA 8260C	GC-MS	Toluene
Aqueous/Solids	EPA 8260C	GC-MS	trans-1,2-Dichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	trans-1,3-Dichloropropene
Aqueous/Solids	EPA 8260C	GC-MS	trans-1,4-Dichloro-2-butene
Aqueous/Solids	EPA 8260C	GC-MS	Trichloroethene
Aqueous/Solids	EPA 8260C	GC-MS	Trichlorofluoromethane (Freon 11)
Aqueous/Solids	EPA 8260C	GC-MS	Vinyl acetate
Aqueous/Solids	EPA 8260C	GC-MS	Vinyl chloride
Aqueous/Solids	EPA 8260C	GC-MS	Xylenes, total
Aqueous/Solids	EPA 8270D	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2-Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2-Diphenylhydrazine
Aqueous/Solids	EPA 8270D	GC-MS	1,3,5-Trinitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,3-Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,3-Dinitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,4-Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,4-Dioxane
Aqueous/Solids	EPA 8270D	GC-MS	1,4-Naphthoquinone
Aqueous/Solids	EPA 8270D	GC-MS	1-Methyl-2-pyrrolidinone
Aqueous/Solids	EPA 8270D	GC-MS	1-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	1-Naphthylamine
Aqueous/Solids	EPA 8270D	GC-MS	2,3,4,6-Tetrachlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4,5-Trichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4,6-Trichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dimethylphenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dinitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dinitrotoluene
Aqueous/Solids	EPA 8270D	GC-MS	2,6-Dichlorophenol

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Columbia Analytical Services

1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14609

Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	2,6-Dinitrotoluene
Aqueous/Solids	EPA 8270D	GC-MS	2-Acetylaminofluorene
Aqueous/Solids	EPA 8270D	GC-MS	2-Chloronaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2-Chlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Methyl-5-nitroaniline (5-Nitro-o-toluidine)
Aqueous/Solids	EPA 8270D	GC-MS	2-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2-Methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Naphthylamine
Aqueous/Solids	EPA 8270D	GC-MS	2-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	2-Nitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Picoline
Aqueous/Solids	EPA 8270D	GC-MS	3,3'-Dichlorobenzidine
Aqueous/Solids	EPA 8270D	GC-MS	3,3'-Dimethylbenzidine
Aqueous/Solids	EPA 8270D	GC-MS	3+4-Methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	3-Methylcholanthrene
Aqueous/Solids	EPA 8270D	GC-MS	3-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4,6-Dinitro-2-methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Aminobiphenyl
Aqueous/Solids	EPA 8270D	GC-MS	4-Bromophenyl-phenylether
Aqueous/Solids	EPA 8270D	GC-MS	4-Chloro-3-methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Chloroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Chlorophenyl-phenylether
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitroquinoline-1-oxide
Aqueous/Solids	EPA 8270D	GC-MS	7,12-Dimethylbenz(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	α,α-Dimethylphenethylamine
Aqueous/Solids	EPA 8270D	GC-MS	Acenaphthene
Aqueous/Solids	EPA 8270D	GC-MS	Acenaphthylene
Aqueous/Solids	EPA 8270D	GC-MS	Acetophenone
Aqueous/Solids	EPA 8270D	GC-MS	Aniline
Aqueous/Solids	EPA 8270D	GC-MS	Anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Aramite

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Columbia Analytical Services

1565 Jefferson Road, Building 300, Suite 360, Rochester, NY 14609
Lisa Reyes Phone: 585-288-5380

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Atrazine
Aqueous/Solids	EPA 8270D	GC-MS	Benzaldehyde
Aqueous/Solids	EPA 8270D	GC-MS	Benzidine
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(a)pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Benzoic acid
Aqueous/Solids	EPA 8270D	GC-MS	Benzyl alcohol
Aqueous/Solids	EPA 8270D	GC-MS	Biphenyl
Aqueous/Solids	EPA 8270D	GC-MS	Bis(1-chloroisopropyl)ether
Aqueous/Solids	EPA 8270D	GC-MS	Bis(-2-chloroethoxy)methane
Aqueous/Solids	EPA 8270D	GC-MS	Bis(2-chloroethyl)ether
Aqueous/Solids	EPA 8270D	GC-MS	Bis(2-ethylhexyl)phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Caprolactam
Aqueous/Solids	EPA 8270D	GC-MS	Carbazole
Aqueous/Solids	EPA 8270D	GC-MS	Chlorobenzilate
Aqueous/Solids	EPA 8270D	GC-MS	Chrysene
Aqueous/Solids	EPA 8270D	GC-MS	Cyclohexane, isothiocyanato-
Aqueous/Solids	EPA 8270D	GC-MS	Diallate
Aqueous/Solids	EPA 8270D	GC-MS	Dibenzo(a,h)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Dibenzofuran
Aqueous/Solids	EPA 8270D	GC-MS	Diethylphthalate
Aqueous/Solids	EPA 8270D	GC-MS	Dimethoate
Aqueous/Solids	EPA 8270D	GC-MS	Dimethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Di-n-butylphthalate
Aqueous/Solids	EPA 8270D	GC-MS	Di-n-octyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Dinoseb
Aqueous/Solids	EPA 8270D	GC-MS	Diphenylamine
Aqueous/Solids	EPA 8270D	GC-MS	Disulfoton
Aqueous/Solids	EPA 8270D	GC-MS	Ethyl methanesulfonate

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Fluorene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorocyclopentadiene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachloroethane
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorophene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachloropropene
Aqueous/Solids	EPA 8270D	GC-MS	Indeno(1,2,3-cd)pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Isodrin
Aqueous/Solids	EPA 8270D	GC-MS	Isophorone
Aqueous/Solids	EPA 8270D	GC-MS	Isosafrole
Aqueous/Solids	EPA 8270D	GC-MS	Methapyrilene
Aqueous/Solids	EPA 8270D	GC-MS	Methyl methanesulfonate
Aqueous/Solids	EPA 8270D	GC-MS	Methyl parathion
Aqueous/Solids	EPA 8270D	GC-MS	Naphthalene
Aqueous/Solids	EPA 8270D	GC-MS	Nitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodiethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodimethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodi-n-butylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitroso-di-n-propylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosodiphenylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosomethylethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosomorpholine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosopiperidine
Aqueous/Solids	EPA 8270D	GC-MS	N-nitrosopyrolidine
Aqueous/Solids	EPA 8270D	GC-MS	Octachlorostyrene
Aqueous/Solids	EPA 8270D	GC-MS	o,o,o-triethyl phosphorothioate
Aqueous/Solids	EPA 8270D	GC-MS	o-toluidine
Aqueous/Solids	EPA 8270D	GC-MS	Parathion (ethyl)
Aqueous/Solids	EPA 8270D	GC-MS	p-dimethylaminoazobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachloroethane

Certificate of Accreditation: Supplement

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Pentachloronitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	Phenacetin
Aqueous/Solids	EPA 8270D	GC-MS	Phenanthrene
Aqueous/Solids	EPA 8270D	GC-MS	Phenol
Aqueous/Solids	EPA 8270D	GC-MS	Phorate
Aqueous/Solids	EPA 8270D	GC-MS	Phthalimide
Aqueous/Solids	EPA 8270D	GC-MS	Pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Pyridine
Aqueous/Solids	EPA 8270D	GC-MS	Safrole
Aqueous/Solids	EPA 8270D	GC-MS	Sulfotepp
Aqueous/Solids	EPA 8270D	GC-MS	Thionazin
Aqueous/Solids	EPA 8270D	GC-MS-LL	1,4-Dioxane
Aqueous/Solids	EPA 8270D	GC-MS-LL	1-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS-LL	2-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Acenaphthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Acenaphthylene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Anthracene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(a)pyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Bis(2-ethylhexyl)phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Carbazole
Aqueous/Solids	EPA 8270D	GC-MS-LL	Chrysene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Dibenzo(a,h)anthracene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Dibenzofuran
Aqueous/Solids	EPA 8270D	GC-MS-LL	Diethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Dimethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Di-n-butyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS-LL	Di-n-octyl phthalate

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS-LL	Fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Fluorene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Hexachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Indeno(1,2,3-cd)pyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Naphthalene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Nitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Octachlorostyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Phenanthrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Pyrene
Aqueous/Solids	EPA 8270D	GC-MS-LL	Pyridine
Aqueous/Solids	EPA 9012A, B	UV-VIS	Cyanide, total
Aqueous/Solids	EPA 9034	Titration	Sulfide, acid soluble
Aqueous/Solids	EPA 9056A	IC	Bromide
Aqueous/Solids	EPA 9056A	IC	Chloride
Aqueous/Solids	EPA 9056A	IC	Fluoride
Aqueous/Solids	EPA 9056A	IC	Nitrate as Nitrogen
Aqueous/Solids	EPA 9056A	IC	Nitrite as Nitrogen
Aqueous/Solids	EPA 9056A	IC	Sulfate
Aqueous/Solids	GEN-AVS	Titrimetric	Acid Volatile Sulfide
Aqueous/Solids	EPA 8330B	HPLC	1,3,5-Trinitrobenzene
Aqueous/Solids	EPA 8330B	HPLC	1,3-Dinitrobenzene
Aqueous/Solids	EPA 8330B	HPLC	2,4,6-Trinitrotoluene (TNT)
Aqueous/Solids	EPA 8330B	HPLC	2,4-Dinitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	2,6-Dinitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	2-Amino 4,6-Dinitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	2-Nitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	3,5-Dinitroaniline
Aqueous/Solids	EPA 8330B	HPLC	3-Nitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	4-Amino 2,6-Dinitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	4-Nitrotoluene
Aqueous/Solids	EPA 8330B	HPLC	Hexahydro 1,3,5-Trinitro 1,3,5-Triazine
Aqueous/Solids	EPA 8330B	HPLC	Methyl 2,4,6 Trinitrophenylnitramine
Aqueous/Solids	EPA 8330B	HPLC	Nitrobenzene
Aqueous/Solids	EPA 8330B	HPLC	Nitroglycerin

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8330B	HPLC	Octahydro 1.3.5.7 Tetranitro 1,3,5,7 Tetraz
Aqueous/Solids	EPA 8330B	HPLC	Pentaerythritol Tetranitrate (PETN)
Aqueous/Solids	HPLC-METACID	HPLC	Acetic Acid
Aqueous/Solids	HPLC-METACID	HPLC	Butanoic Acid (Butyric Acid)
Aqueous/Solids	HPLC-METACID	HPLC	Lactic Acid
Aqueous/Solids	HPLC-METACID	HPLC	Propionic Acid
Aqueous/Solids	HPLC-METACID	HPLC	Pyruvic Acid

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 3010A	Acid Digestion	Metals prep
Aqueous	EPA 3510C	SF Extraction	Semivolatiles, pesticides, PCBs, DRO
Aqueous	EPA 5030B	P&T	Volatiles
Solids	EPA 3050B	Acid Digestion	Metals prep
Solids	EPA 3060A	Digestion	Hexavalent chromium digestion
Solids	EPA 3541	SOX Extraction	Semivolatiles, pesticides, PCBs, DRO
Solids	EPA 5035	P&T closed	Volatiles
Aqueous/Solids	EPA 1311	TCLP	Physical Extraction
Aqueous/Solids	EPA 1312	SPLP	Physical Extraction
Aqueous/Solids	EPA 3620B	Florisil Cleanup	Semivolatiles, pesticides, PCBs
Aqueous/Solids	EPA 3660B	Sulfur Cleanup	Semivolatiles, pesticides, PCBs
Aqueous/Solids	EPA 3665A	Sulfuric Acid Cleanup	PCBs
Aqueous/Solids	EPA 9012A, B	Distillation	Cyanide
Aqueous/Solids	EPA 9030B	Distillation	Sulfide, acid soluble

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/ACLASS

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TriMatrix Laboratories, Inc.
5560 Corporate Exchange Court, SE
Grand Rapids, MI 49512

has been assessed by ACLASS
and meets the requirements of

ISO/IEC 17025:2005 and DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE-1542

Certificate Number

ACLASS Approval

Certificate Valid: 4/30/2011-04/30/2013
Version No. 002 Issued: 12/23/2011

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated January 2009*).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & DoD-ELAP

TriMatrix Laboratories, Inc

5560 Corporate Exchange Court, SE, Grand Rapids, MI 49512
Rick Wilburn Phone: 616-975-4500

TESTING

Valid to: April 30, 2013 Certificate Number: ADE - 1542

I. Environmental

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water/Solid	TKN	351.2	Spectrophotometric
Water/Solid	Nitroaromatics and Nitramines	8330A	HPLC-UV
Solid	Ignitability	1020A	Closed-Cup
Water	HEM Oil and Grease/SGT-HEM Non-Polar Material	1664A/9070A	Gravimetric
Solid	HEM Oil and Grease/SGT-HEM Non-Polar Material	9071B	Gravimetric
Water	Metals	200.7/6010C	ICP
Solid	Metals	6010C	ICP
Water	Metals	200.8/6020A	ICP MS
Solid	Metals	6020A	ICP MS
Water	Calcium Hardness As $CaCO_3$	SM2340B	ICP
Water	Total Hardness As $CaCO_3$	SM2340B	ICP
Water	Mercury	245.1/7470A	CVAA

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Solid	Mercury	7471A	CVAA
Water	Volatiles Organics	601/602/8021B	GC-PID; HECD
Solid	Volatile Organics	8021B	GC-PID; HECD
Water	Volatile Organics	524.2/624/8260B	GCMS
Solid	Volatile Organics	8260B	GCMS
Water	Organochlorine Pesticides	608/8081B	GC-ECD
Solid	Organochlorine Pesticides	8081B	GC-ECD
Water	Semivolatile Organic Compounds	625/8270C	GCMS
Solid	Semivolatile Organic Compounds	8270C	GCMS
Water	PCBs	608/8082A	GC
Solid	PCBs	8082A	GC
Water/Solid	Chlorinated Herbicides	8151A	GC-ECD
Solid	Paint Filter Test	9095B	Filtration
Water	Sulfate	ASTM D516-02(90); 9038	Turbidimetric
Water	Dissolved Gas Analysis	RSK-175	GC-FID
Water	Color	SM 2120B	Platinum-Cobalt Color
Water	Turbidity	SM2130B	Nephelometric
Water	Acidity	SM2310B	Titrimetric

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Total Alkalinity (as $CaCO_3$)	SM2320B	Titrimetric
Water	Conductivity	SM2510B/9050A	Specific Conductance
Water	Total Residue/Solids (TS)	SM2540B	Gravimetric
Water	Filterable Residue (TDS)	SM2540C	Gravimetric
Water	Non-Filterable Residue (TSS)	SM 2540 D	Gravimetric
Solid	Chromium (VI) Cr^{+6}	3060A	Digestion
Water	Chromium (VI) Cr^{+6}	SM3500-Cr B/7196A	Spectrophotometric
Solid	Chromium (VI) Cr^{+6}	7196A	Spectrophotometric
Water	Ferrous Iron	SM 3500-Fe B	Spectrophotometric
Water	Chloride	SM 4500-Cl E/9251	Spectrophotometric
Water/Solid	Fluoride	SM 4500-F C	ISE
Water	pH and Corrosivity	SM 4500-H^+ B/9040C	Potentiometric
Solid	pH and Corrosivity	9045D	Potentiometric
Water/Solid	Ammonia-N	SM 4500-NH_3 B	Distillation
Water/Solid	Ammonia-N	SM 4500-NH_3 G	Spectrophotometric
Water	Nitrite-N	SM 4500-NO_2 B/NO_3 F	Spectrophotometric
Water/Solid	Nitrate-N	SM 4500-NO_3 F	Spectrophotometric
Water	Nitrate+Nitrite-N	SM 4500-NO_3 F	Spectrophotometric

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MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Sulfide	SM 4500-S_2 D	Spectrophotometric
Water	Sulfide	SM 4500-S_2 F	Titrimetric
Water/Solid	Sulfide	9034	Titrimetric
Water	Sulfite	SM 4500-SO_3^{2-} B	Titrimetric
Water	o-Phosphate	SM 4500-P E	Spectrophotometric
Water/Solid	Phosphorus Total	SM 4500-P E	Spectrophotometric
Water	Silica as SiO_2	SM 4500-SiO_2 D	Spectrophotometric
Water	COD	SM 5220 D	Spectrophotometric
Water	Total Organic Carbon (TOC)	SM 5310 C/9060A	Oxidation/CO_2 Det
Water	Surfactants (MBAS)	SM 5540 C	Spectrophotometric
Water	Heterotrophic Bacteria (Std Plate)	SM 9215 B	Microbiological
Water	Fecal Coliform	SM 9222 D	Microbiological
Water	Total Coliform, E. Coli	SM 9223 B	Microbiological
Solid	Total Residue/Solids (TS)	SM 2540B	Gravimetric
Water/Solid	Diesel Range Organics (DRO)	Wisconsin DRO/8015C	GC-FID
Water/Solid	Gasoline Range Organics (GRO)	Wisconsin GRO/8015C	GC-FID
Water/Solid	Oil Range Organics	8015C	GC-FID
Water/Solid	TCLP	1311	Acetic Acid Leaching

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MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water/Solid	SPLP	1312	Acetic Acid Leaching
Solid	Semivolatiles Extraction	3550C	Ultrasonic Extraction
Water	Metals Digestion	200.2	Block Digestion
Solid	Semivolatiles Extraction	3545A	Pressurized Fluid Ext
Solid	Volatiles Extraction	5035A	Purge & Trap
Solid	Cyanide Extraction	9013A	Extraction
Water	Metals Digestion	3010A	Block Digestion
Water	Metals Digestion	3020A	Block Digestion
Solid	Metals Digestion	3050B	Block Digestion
Water	Semivolatiles Extraction	3510C	Separatory Funnel Ext
Water	Volatiles Extraction	5030B	Purge & Trap/Water
Water	Volatile Residue (VS)	160.4	Gravimetric
Water	Methoxychlor	608	GC-ECD
Water	1,2-Dibromo-3-Chloropropane & 1,2-Dibromoethane	8011	GC-ECD
Water/Solid	Nitroglycerine and PETN	8332	HPLC-UV
Water	Mercury, Low-Level	1631E	CVAF
Water	Anions	300.0/9056A	Ion Chromatographic
Solid	Anions	9056A	Ion Chromatographic

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MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Total Phenolics	420.4/9065	Spectrophotometric
Solid	Total Phenolics	9065	Spectrophotometric
Water	Nonhalogenated Organics	8015C	GC-FID
Water/Solid	Semivolatile Organic Compounds	8270C SIM	GCMS
Water/Solid	Carbonyl Compounds	8315A	HPLC-UV
Water	Total Organic Halides (TOX)	9020B	Coulometric Titration
Water/Solid	Sulfide	9030B	Distillation
Solid	Acid Volatile Sulfide and Selected Simultaneously Extractable Metals	EPA Method 821-R-91-100	Distillation/ Spectrophotometric
Solid	Total Organic Carbon (TOC)	Lloyd Kahn	Infrared
Water/Solid	Cyanide Available	OIA-1677	Amperometry
Water	Calcium Hardness As $CaCO_3$	SM 2340 C	Titrimetric
Water	Total Hardness As $CaCO_3$	SM 2340 C	Titrimetric
Water	Cyanide	SM 4500-CN C/9010C	Distillation
Solid	Cyanide	9010C	Distillation
Water	Cyanide Total	SM 4500-CN E/9014	Spectrophotometric
Solid	Cyanide Total	9014	Spectrophotometric
Water	Cyanide Amenable	SM 4500-CN G/9014	Spectrophotometric
Solid	Cyanide Amenable	9014	Spectrophotometric

MATRIX	SPECIFIC TEST or ANALYTE GROUP**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	BOD and CBOD	SM 5210 B	Luminescence
Solid	Total Organic Carbon (TOC)	WALKLEY BLACK	Titrimetric
Water	Bromide	ASTM D1246-88	ISE

Notes:

1. ** = As Applicable*
2. *** = Refer to Accredited Analyte Listing for specific analytes in which the laboratory is accredited.*
3. *This scope is part of and must be included with the Certificate of Accreditation No. ADE-1542*

Vice President

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Accredited Analytes/Methods (by matrix)
TriMatrix Laboratoires, Inc.
Grand Rapids, MI

NELAC Code	Analyte	Matrix									
		Aqueous						Solid			
	Trace Metals										
1000	Aluminum	200.7	200.8	6010C	6020A			6010C			
1005	Antimony		200.8		6020A				6020A		
1010	Arsenic	200.7	200.8	6010C	6020A			6010C	6020A		
1015	Barium	200.7	200.8	6010C	6020A			6010C	6020A		
1020	Beryllium	200.7	200.8	6010C	6020A			6010C	6020A		
1025	Boron	200.7	200.8	6010C	6020A			6010C	6020A		
1030	Cadmium	200.7	200.8	6010C	6020A			6010C	6020A		
1035	Calcium	200.7		6010C				6010C			
1040	Chromium, total	200.7	200.8	6010C	6020A			6010C	6020A		
1045	Chromium VI	SM3500Cr B				7196A				7196A	
1050	Cobalt	200.7	200.8	6010C	6020A			6010C	6020A		
1055	Copper	200.7	200.8	6010C	6020A			6010C	6020A		
1070	Iron	200.7		6010C				6010C			
1075	Lead	200.7	200.8	6010C	6020A			6010C	6020A		
1085	Magnesium	200.7		6010C				6010C			
1090	Manganese	200.7	200.8	6010C	6020A			6010C	6020A		
1095	Mercury	245.1				7470A				7471A	
1095	Mercury (Low Level)					1631E					
1100	Molybdenum	200.7	200.8	6010C	6020A			6010C	6020A		
1105	Nickel	200.7	200.8	6010C	6020A			6010C	6020A		
1125	Potassium	200.7		6010C				6010C			
1140	Selenium	200.7	200.8	6010C	6020A			6010C	6020A		
1150	Silver	200.7	200.8	6010C	6020A			6010C	6020A		
1155	Sodium	200.7		6010C				6010C			
1160	Strontium	200.7	200.8	6010C	6020A			6010C			
1165	Thallium	200.7	200.8	6010C	6020A			6010C	6020A		
1175	Tin	200.7	200.8	6010C	6020A			6010C	6020A		
1180	Titanium	200.7		6010C				6010C			
1185	Vanadium	200.7	200.8	6010C	6020A			6010C	6020A		
1190	Zinc	200.7	200.8	6010C	6020A			6010C	6020A		
	Demands										
2040	TOC	SM5310C	9060A					Walkley Black	Lloyd Kahn		
1565	COD			SM5220D							
	Misc Analytes										
1505	Total Alkalinity (as $CaCO_3$)	SM2320B									
	BOD and CBOD	SM5210B									
	Calcium Hardness as $CaCO_3$	SM2340B	SM2340C								
1550	Total Hardness as $CaCO_3$	SM2340B	SM2340C								
1960	Total Residue/Solids (TS)	SM2540B						3550C			
1705	Filterable Residue (TDS)		SM2540C								
1780	Ignitability							1020A			
1955	Non-Filterable Residue (TSS)	SM2540D									
	Volitile Residue (VS)		160.4								
	pH			9040C	SM4500H+B			9045D			
2005	Sulfide	SM4500S2- D	SM4500S2- F	9034				9034			
1645	Total Cyanide	SM4500CN E	9014					9014			
1510	Cyanide, Amenable	SM4500-CN G	9014					9014			
1515	Ammonia	SM4500NH3-G						SM4500NH3-G			
1610	Conductivity	SM2510B	9050A								
1795	Nitrogen, Total Kjeldahl (TKN)	351.2						351.2			
1905	Total Phenolics	420.4	9065					9065			
2045	Total Organic Halides (TOX)	9020B									
1540	Bromide	ASTM D1246-88			9056A			9056A			
1575	Chloride	SM4500Cl-E	9251	300.0	9056A			9056A			
1730	Fluoride	SM4500F-C		300.0	9056A			9056A	SM4500F-C		
1810	Nitrate as N	SM4500NO3-F		300.0	9056A			9056A	SM4500NO3-F		
1840	Nitrite as N	SM4500NO2-B	SM4500NO3-F	300.0	9056A			9056A			
1820	Nitrate + Nitrite as N	SM4500NO3-F		300.0	9056A			9056A			
1870	ortho-phosphorus	SM4500P-E									
1910	Total Phosphorus	SM4500P-E						SM4500P-E			
1990	Silica as SiO2	SM4500-Si D									
2000	Sulfate	ASTM D516-02	9038	300.0	9056A			9056A			
2025	Surfactants - MBAS	SM5540C									
	Fecal Coliform	SM9222D									
	Heterotrophic Bacteria (Std Plate)	SM9215B									
	Total Coliform, E. Coli	SM9223B									
2055	Turbidity		SM2130B								
	Petroleum Hydrocarbons										
1935	SGT-HEM; Non-Polar Material	1664A	9070A					9071B			
1860	HEM; Oil and Grease	1664A	9070A					9071B			
9408	Gasoline Range Organics (GRO)	8015C	Wisconsin GRO					8015C	Wisconsin GRO		
9369	Diesel Range Organics (DRO)	8015C	Wisconsin DRO					8015C	Wisconsin DRO		
	Oil Range Organics (ORO)	8015C						8015C			
	VOCs										
4315	Acetone		624	8260B					8260B		
4320	Acetonitrile		624	8260B					8260B		
4325	Acrolein		624	8260B					8260B		
4340	Acrylonitrile		624	8260B					8260B		
4375	Benzene	524.2	624	8260B		602	8021B	8021B	8260B		
4385	Bromobenzene	524.2		8260B	601		8021B	8021B	8260B		
4390	Bromochloromethane	524.2		8260B					8260B		
4395	Bromodichloromethane	524.2	624	8260B	601		8021B	8021B	8260B		
4400	Bromoform	524.2	624	8260B	601		8021B	8021B	8260B		
4950	Bromomethane	524.2	624	8260B	601		8021B	8021B	8260B		
4410	2-Butanone (MEK)		624	8260B					8260B		
4435	n-Butylbenzene	524.2		8260B					8260B		
4440	sec-Butylbenzene	524.2		8260B					8260B		
4445	tert-Butylbenzene	524.2		8260B					8260B		
4450	Carbon disulfide		624	8260B					8260B		
4455	Carbon Tetrachloride	524.2	624	8260B	601		8021B	8021B	8260B		

Accredited Analytes/Methods (by matrix)
TriMatrix Laboratoires, Inc.
Grand Rapids, MI

NELAC Code	Analyte	Matrix									
		Aqueous						Solid			
4475	Chlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B		
4575	Chlorodibromomethane	524.2	624	8260B	601		8021B	8021B	8260B		
4485	Chloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
4500	2-Chloroethylvinylether		624	8260B	601		8021B	8021B	8260B		
4505	Chloroform	524.2	624	8260B	601		8021B	8021B	8260B		
4960	Chloromethane	524.2	624	8260B	601		8021B	8021B	8260B		
4535	2-Chlorotoluene	524.2		8260B					8260B		
4540	4-Chlorotoluene	524.2		8260B					8260B		
4570	1,2-Dibromo-3-chloropropane (DBCP)		624	8260B	601		8021B	8021B	8260B		
4585	1,2-Dibromoethane (EDB)		624	8260B	601		8021B	8021B	8260B		
4595	Dibromomethane	524.2	624	8260B	601		8021B	8021B	8260B		
4610	1,2-Dichlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B		
4615	1,3-Dichlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B		
4620	1,4-Dichlorobenzene	524.2	624	8260B	601	602	8021B	8021B	8260B		
4625	Dichlorodifluoromethane	524.2	624	8260B	601		8021B	8021B	8260B		
4630	1,1-Dichloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
4635	1,2-Dichloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
4640	1,1-Dichloroethene	524.2	624	8260B	601		8021B	8021B	8260B		
4645	*cis* -1,2-Dichloroethene	524.2	624	8260B	601		8021B	8021B	8260B		
4700	trans-1,2-Dichloroethene	524.2	624	8260B	601		8021B	8021B	8260B		
4975	Dichloromethane (Methylene Chloride)	524.2	624	8260B	601		8021B	8021B	8260B		
4655	1,2-Dichloropropane	524.2	624	8260B	601		8021B	8021B	8260B		
4660	1,3-Dichloropropane	524.2		8260B					8260B		
4665	2,2-Dichloropropane	524.2		8260B					8260B		
4670	1,1-Dichloropropene	524.2		8260B					8260B		
4680	cis-1,3-Dichloropropene	524.2	624	8260B	601		8021B	8021B	8260B		
4685	*trans* -1,3-Dichloropropene	524.2	624	8260B	601		8021B	8021B	8260B		
9375	Di-isopropylether (DIPE)			8260B					8260B		
4765	Ethylbenzene	524.2	624	8260B		602	8021B	8021B	8260B		
3815	1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)			8260B					8260B		
4835	Hexachlorobutadiene	524.2	624	8260B					8260B		
4860	2-Hexanone		624	8260B					8260B		
4900	Isopropylbenzene	524.2	624	8260B	601		8021B	8021B	8260B		
4910	4-Isopropyltoluene	524.2		8260B					8260B		
4995	4-Methyl-2-pentanone (MIBK)		624	8260B					8260B		
5000	Methyl-tert-butylether (MTBE)	524.2	624	8260B		602	8021B	8021B	8260B		
5005	Naphthalene	524.2	624	8260B	601		8021B	8021B	8260B		
5090	n-Propylbenzene	524.2		8260B					8260B		
5100	Styrene	524.2	624	8260B	601		8021B	8021B	8260B		
4370	tert-amylmethylether (TAME)			8260B					8260B		
5105	1,1,1,2-Tetrachloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
5110	1,1,2,2-Tetrachloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
5115	Tetrachloroethene	524.2	624	8260B	601		8021B	8021B	8260B		
5140	Toluene	524.2	624	8260B		602	8021B	8021B	8260B		
5150	1,2,3-Trichlorobenzene	524.2		8260B					8260B		
5155	1,2,4-Trichlorobenzene	524.2	624	8260B	601		8021B	8021B	8260B		
5160	1,1,1-Trichloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
5165	1,1,2-Trichloroethane	524.2	624	8260B	601		8021B	8021B	8260B		
5170	Trichloroethene	524.2	624	8260B	601		8021B	8021B	8260B		
5175	Trichlorofluoromethane (Freon 11)	524.2	624	8260B	601		8021B	8021B	8260B		
5180	1,2,3-Trichloropropane	524.2	624	8260B	601		8021B	8021B	8260B		
5210	1,2,4-Trimethylbenzene	524.2		8260B					8260B		
5215	1,3,5-Trimethylbenzene	524.2		8260B					8260B		
5225	Vinyl acetate		624	8260B	601		8021B	8021B	8260B		
5235	Vinyl chloride	524.2	624	8260B	601		8021B	8021B	8260B		
5250	o-Xylene		624	8260B		602			8260B		
5240	m+p-Xylene		624	8260B		602			8260B		
5260	Xylenes, total	524.2	624	8260B		602	8021B	8021B	8260B		
	SVOCs - Base/Neutrals/Acids										
5500	Acenaphthene	8270C SIM	625	8270C				8270C	8270C SIM		
5505	Acenaphthylene	8270C SiM	625	8270C				8270C	8270C SIM		
5545	Aniline		625	8270C				8270C			
5555	Anthracene	8270C SIM	625	8270C				8270C	8270C SIM		
5575	Benzo(a)anthracene	8270C SIM	625	8270C				8270C	8270C SIM		
5585	Benzo(b)fluoranthene	8270C SIM	625	8270C				8270C	8270C SIM		
5600	Benzo(k)fluoranthene	8270C SIM	625	8270C				8270C	8270C SIM		
5590	Benzo(g,h,i)perylene	8270C SIM	625	8270C				8270C	8270C SIM		
5580	Benzo(a)pyrene	8270C SIM	625	8270C				8270C	8270C SIM		
5595	Benzidine		625	8270C				8270C			
5610	Benzoic acid		625	8270C				8270C			
5630	Benzyl alcohol		625	8270C				8270C			
5660	4-Bromophenyl-phenylether		625	8270C				8270C			
5670	Butyl benzyl phthalate		625	8270C				8270C			
5680	Carbazole							8270C			
5745	4-Chloroaniline		625	8270C				8270C			
5760	bis(2-Chloroethoxy)methane		625	8270C				8270C			
5765	bis(2-Chloroethyl)ether		625	8270C				8270C			
5780	bis(2-Chloroiospropyl) ether		625	8270C				8270C			
5700	4-Chloro-3-methylphenol		625	8270C				8270C			
5795	2-Chloronaphthalene		625	8270C				8270C			
5825	4-Chlorophenyl-phenylether		625	8270C				8270C			
5800	2-Chlorophenol		625	8270C				8270C			
5855	Chrysene	8270C SIM	625	8270C				8270C	8270C SIM		
5895	Dibenzo(a,h)anthracene	8270C SIM	625	8270C				8270C	8270C SIM		
5905	Dibenzofuran		625	8270C				8270C			
5925	Di-n-butylphthalate		625	8270C				8270C			
4610	1,2-Dichlorobenzene		625	8270C				8270C			
4615	1,3-Dichlorobenzene		625	8270C				8270C			
4620	1,4-Dichlorobenzene		625	8270C				8270C			
5945	3,3'-Dichlorobenzidine		625	8270C				8270C			
6000	2,4-Dichlorophenol		625	8270C				8270C			
6005	2,6-Dichlorophenol		625	8270C				8270C			
6070	Diethyl phthalate		625	8270C				8270C			
6130	2,4-Dimethylphenol		625	8270C				8270C			

Accredited Analytes/Methods (by matrix)
TriMatrix Laboratoires, Inc.
Grand Rapids, MI

NELAC Code	Analyte	Matrix									
		Aqueous						Solid			
6135	Dimethylphthalate		625	8270C				8270C			
6175	2,4-Dinitrophenol		625	8270C				8270C			
6185	2,4-Dinitrotoluene		625	8270C				8270C			
6190	2,6-Dinitrotoluene		625	8270C				8270C			
6200	Di-n-octylphthalate		625	8270C				8270C			
4740	p-Dioxane			8270C				8270C			
6065	bis(2-ethylhexyl) phthalate		625	8270C				8270C			
6265	Fluoranthene	8270C SIM	625	8270C				8270C	8270C SIM		
6270	Fluorene	8270C SIM	625	8270C				8270C	8270C SIM		
6275	Hexachlorobenzene		625	8270C				8270C			
4835	Hexachlorobutadiene		625	8270C				8270C			
6285	Hexachlorocyclopentadiene		625	8270C				8270C			
4840	Hexachloroethane		625	8270C				8270C			
6315	Indeno(1,2,3, cd)pyrene	8270C SIM	625	8270C				8270C	8270C SIM		
6320	Isophorone		625	8270C				8270C			
6360	2-Methyl-4,6-Dinitrophenol		625	8270C				8270C			
6400	2-Methylphenol		625	8270C				8270C			
6410	4-Methylphenol (and/or 3-Methylphenol)		625	8270C				8270C			
6385	2-Methylnaphthalene	8270C SIM	625	8270C				8270C	8270C SIM		
5005	Naphthalene	8270C SIM		8270C				8270C	8270C SIM		
6460	2-Nitroaniline		625	8270C				8270C			
6465	3-Nitroaniline		625	8270C				8270C			
6470	4-Nitroaniline		625	8270C				8270C			
5015	Nitrobenzene		625	8270C				8270C			
6490	2-Nitrophenol		625	8270C				8270C			
6500	4-Nitrophenol		625	8270C				8270C			
6525	N-Nitrosodiethylamine		625	8270C				8270C			
6530	N-Nitrosodimethylamine		625	8270C				8270C			
6535	N-Nitrosodiphenylamine		625	8270C				8270C			
6545	N-Nitroso-di-n-propylamine		625	8270C				8270C			
6590	Pentachlorobenzene		625	8270C				8270C			
6605	Pentachlorophenol		625	8270C				8270C			
6615	Phenanthrene	8270C SIM	625	8270C				8270C	8270C SIM		
6625	Phenol		625	8270C				8270C			
6665	Pyrene	8270C SIM	625	8270C				8270C	8270C SIM		
5095	Pyridine		625	8270C				8270C			
6715	1,2,4,5-Tetrachlorobenzene		625	8270C				8270C			
6735	2,3,4,6-Tetrachlorophenol		625	8270C				8270C			
5145	o-Toluidine		625	8270C				8270C			
5155	1,2,4-Trichlorobenzene		625	8270C				8270C			
6835	2,4,5-Trichlorophenol		625	8270C				8270C			
6840	2,4,6-Trichlorophenol		625	8270C				8270C			
	Nitroaromatic and Nitramines										
9306	4-Amino-2,6-dinitrotoluene	8330A						8330A			
9303	2-Amino-4,6-dinitrotoluene	8330A						8330A			
6160	1,3-Dinitrobenzene	8330A						8330A			
6185	2,4-Dinitrotoluene	8330A						8330A			
6190	2,6-Dinitrotoluene	8330A						8330A			
9522	HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	8330A						8330A			
5015	Nitrobenzene	8330A						8330A			
6485	Nitroglycerin	8332						8332			
9507	2-Nitrotoluene	8330A						8330A			
9510	3-Nitrotoluene	8330A						8330A			
9513	4-Nitrotoluene	8330A						8330A			
9558	Pentaerythritoltetranitrate	8332						8332			
9432	RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	8330A						8330A			
6415	Tetryl (methyl-2,4,6-trinitrophenylnitramine)	8330A						8330A			
6885	1,3,5-Trinitrobenzene	8330A						8330A			
9651	2,4,6-Trinitrotoluene	8330A						8330A			
	Pesticides										
7025	Aldrin	608	8081B					8081B			
7110	alpha-BHC	608	8081B					8081B			
7115	beta-BHC	608	8081B					8081B			
7105	delta-BHC	608	8081B					8081B			
7120	gamma-BHC (Lindane)	608	8081B					8081B			
7240	alpha-Chlordane	608	8081B					8081B			
7245	gamma-Chlordane	608	8081B					8081B			
7250	Chlordane (technical)	608	8081B					8081B			
7355	DDD (4,4)	608	8081B					8081B			
7360	DDE (4,4)	608	8081B					8081B			
7365	DDT (4,4)	608	8081B					8081B			
7470	Dieldrin	608	8081B					8081B			
7510	Endosulfan I	608	8081B					8081B			
7515	Endosulfan II	608	8081B								
7520	Endosulfan sulfate	608	8081B								
7540	Endrin	608	8081B					8081B			
7530	Endrin aldehyde	608	8081B					8081B			
7535	Endrin ketone	608	8081B					8081B			
7685	Heptachlor	608	8081B					8081B			
7690	Heptachlor Epoxide (beta)	608	8081B					8081B			
7810	Methoxychlor	608.2	8081B					8081B			
8250	Toxaphene (total)	608	8081B					8081B			
	Organophoshorus Pesticides										
7475	Dimethoate		8270C					8270C			
8610	Dichlorvos		8270C					8270C			
8625	Disulfoton		8270C					8270C			
7955	Parathion, ethyl		8270C					8270C			
7825	Parathion, methyl		8270C					8270C			
7985	Phorate		8270C					8270C			
8155	Sulfotepp		8270C					8270C			
	Herbicides										

Accredited Analytes/Methods (by matrix)											
TriMatrix Laboratoires, Inc.											
Grand Rapids, MI											
NELAC Code	Analyte	Matrix									
		Aqueous						Solid			
8655	2,4,5-T	8151A						8151A			
8650	2,4,5-TP (Silvex)	8151A						8151A			
8545	2,4-D	8151A						8151A			
8560	2,4-DB	8151A						8151A			
8555	Dalapon	8151A						8151A			
8595	Dicamba	8151A						8151A			
8605	Dichloroprop	8151A						8151A			
8620	Dinoseb	8151A						8151A			
7775	MCPA	8151A						8151A			
7780	MCPP	8151A						8151A			
6605	Pentachlorophenol							8151A			
8645	Picloram							8151A			
	PCBs										
8880	Aroclor 1016	608	8082A					8082A			
8885	Aroclor 1221	608	8082A					8082A			
8890	Aroclor 1232	608	8082A					8082A			
8895	Aroclor 1242	608	8082A					8082A			
8900	Aroclor 1248	608	8082A					8082A			
8905	Aroclor 1254	608	8082A					8082A			
8910	Aroclor 1260	608	8082A					8082A			
	Misc. Analytes -Additional										
	Iron, Ferrous	SM 3500-Fe B									
	Cyanide, Available	OIA-1677						OIA-1677			
	Acidity	SM 2310 B									
	Sulfite	SM 4500-SO^{3} B									
	Paint Filter Liquids Test							9095B			
	Color	SM 2120 B									
	Acid Volatile Sulfides (AVS/SEM)							EPA-821-R-91-100			
	PCBs - Additional Aroclors										
	Aroclor 1262	608	8082A					8082A			
	Aroclor 1268	608	8082A					8082A			
	Misc. Organics										
	Ethane	RSK-175									
	Ethylene	RSK-175									
	Methane	RSK-175									
	Additional Compounds										
	Volatiles										
	1,2-dibromo-3-chloropropane	8011									
	1,2-dibromoethane	8011									
	1,2,3-Trimethylbenzene			8260B					8260B		
	1,2,3-trichlorobenzene			8260B					8260B		
	1,2,3-trichloropropane			8260B					8260B		
	1,4-dichlorobenzene			8260B					8260B		
	1,4-dioxane			8260B					8260B		
	1-chlorohexane			8260B					8260B		
	sec-butanol		8015C	8260B				8015C	8260B		
	2-chloro-1,3-butadiene			8260B					8260B		
	2-methylnaphthalene			8260B					8260B		
	2-nitropropane			8260B					8260B		
	allyl chloride			8260B					8260B		
	cyclohexane			8260B					8260B		
	ETBE			8260B					8260B		
	ethyl acetate			8260B					8260B		
	ethyl ether			8260B					8260B		
	ethyl methacrylate			8260B					8260B		
	hexachloroethane			8260B					8260B		
	hexane			8260B					8260B		
	iodomethane			8260B					8260B		
	isobutanol		8015C	8260B				8015C	8260B		
	isopropanol		8015C	8260B				8015C	8260B		
	isopropyl ether			8260B					8260B		
	methacrylonitrile			8260B					8260B		
	methyl acetate			8260B					8260B		
	methyl methacrylate			8260B					8260B		
	methylcyclohexane			8260B					8260B		
	n-butanol		8015C	8260B				8015C	8260B		
	n-butyl acetate			8260B					8260B		
	n-propanol		8015C	8260B				8015C	8260B		
	propionitrile			8260B					8260B		
	t-butanol		8015C	8260B				8015C	8260B		
	tetrahydrofuran			8260B					8260B		
	trans-1,4,dichloro-2-butene			8260B					8260B		
	trichlorotrifluoromethane			8260B					8260B		
	SVOCs - Base/Neutrals/Acids			8270C				8270C			
	1,1'-Biphenyl			8270C				8270C			
	1,2-Bis(2-chloroethoxy)ethane			8270C				8270C			
	1,2-Diphenylhydrazine			8270C				8270C			
	1,3 Dinitrobenzene			8270C				8270C			
	1,4-Naphthoquinone			8270C				8270C			
	1,4-Phenylenediamine			8270C				8270C			
	1-Methylnaphthalene			8270C				8270C			
	1-Naphthylamine			8270C				8270C			
	1-Nitrosopyrrolidine			8270C				8270C			
	2-Acetylaminofluorene			8270C				8270C			
	2-Chloroaniline			8270C				8270C			
	2-Naphthylamine			8270C				8270C			
	2-Picoline			8270C				8270C			
	3,3'-Dimethylbenzidine			8270C				8270C			

Accredited Analytes/Methods (by matrix)

TriMatrix Laboratoires, Inc.

Grand Rapids, MI

NELAC Code	Analyte	Matrix									
		Aqueous						Solid			
	3-Methylchloanthrene			8270C				8270C			
	4,6-Dinitro-2-methylphenol			8270C				8270C			
	4-Aminobiphenyl			8270C				8270C			
	5-Nitro-o-toluidine			8270C				8270C			
	7,12-Dimethylbenz(a)anthracene			8270C				8270C			
	a,a-Dimethylphenethylamine			8270C				8270C			
	Acetophenone			8270C				8270C			
	Aramite			8270C				8270C			
	Atrazine			8270C				8270C			
	Benzaldehyde			8270C				8270C			
	Benzo(b)fluoroanthene			8270C				8270C			
	Bis(2-ethylhexyl) adipate			8270C				8270C			
	Caprolactam			8270C				8270C			
	Chlorobenzilate			8270C				8270C			
	Diallate			8270C				8270C			
	Dicyclohexyl Phthalate			8270C				8270C			
	Dimethoate			8270C				8270C			
	Disulfoton			8270C				8270C			
	Ethyl Methacrylate			8270C				8270C			
	Ethyl Methansulfonate			8270C				8270C			
	Famphur			8270C				8270C			
	Hexachloropropene			8270C				8270C			
	Isodrin			8270C				8270C			
	Isosafrole			8270C				8270C			
	Kepone			8270C				8270C			
	Methapyrilene			8270C				8270C			
	Methyl Methacrylate			8270C				8270C			
	Methyl Methanesulfonate			8270C				8270C			
	Methylparathion			8270C				8270C			
	N-Nitroso-di-n-butylamine			8270C				8270C			
	N-Nitrosomethylethylamine			8270C				8270C			
	N-Nitrosomorpholine			8270C				8270C			
	N-Nitrosopiperidine			8270C				8270C			
	o,o,o-Triethylphosphorothioate			8270C				8270C			
	Parathion			8270C				8270C			
	p-Dimethylaminoazobenzene			8270C				8270C			
	Penacetin			8270C				8270C			
	Pentachloroethane			8270C				8270C			
	Pentachloronitrobenzene			8270C				8270C			
	Phorate			8270C				8270C			
	Pronamide			8270C				8270C			
	Safrole			8270C				8270C			
	Sulfotepp			8270C				8270C			
	Thionazin			8270C				8270C			
	1,3,5-Trinitrobenzene			8270C				8270C			
	Carbonyls										
	Formaldehyde	8315A						8315A			
	Acetaldehyde	8315A						8315A			
	Propanal	8315A						8315A			
	Crotonaldehyde	8315A						8315A			
	Butanal	8315A						8315A			
	Pentanal	8315A						8315A			
	Cyclohexanone	8315A						8315A			
	m-Tolualdehyde	8315A						8315A			
	Hexanal	8315A						8315A			
	Heptanal	8315A						8315A			
	Octanal	8315A						8315A			
	Nonanal	8315A						8315A			
	Decanal	8315A						8315A			

Appendix D
Health and Safety Plan

Health and Safety Plan

Base-Wide Site Inspection

Naval Research Lab- Chesapeake Bay Detachment
Chesapeake Beach, Maryland

Prepared for

Department of the Navy
Naval Facilities Engineering Command

September 2012

CH2MHILL

15010 Conference Center Drive Suite 200
Chantilly, VA 20151

Contents

ATTACHMENTS

Approval

This site-specific Health and Safety Plan (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 and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

By approving this HSP, the Responsible Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

Original Plan

RHSM Approval: Carl Woods for Mark Orman **Date**: 8/18/12

Project Manager or
Field Operations Manager Approval: **Date:**

Revisions

Revisions Made By: **Date:**

Description of Revisions to Plan:

Revisions Approved By: **Date:**

1.0 Introduction

HSE
TargetZero

Health, Safety, and Environment Policy Commitment

Protection of people and the environment is a CH2M HILL core value. It is our vision to create a culture that empowers employees to drive this value into all global operations and achieve excellence in health, safety, and environment (HSE) performance.
CH2M HILL deploys an integrated, enterprise-wide behavior based HSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for their fellow employees to prevent injuries, illnesses, and adverse environmental impacts, and create a safe, healthy, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSE processes to customer needs and requiring CH2M HILL employees and subcontractors to deliver projects that identify HSE requirements and commit to compliance with applicable HSE laws and regulations, company standards, and external requirements.
- We are committed to pollution prevention in conjunction with our Sustainability Policy and by offering our clients sustainable solutions.
- We aspire to continually improve our performance and influence others to redefine world-class HSE excellence.
- We evaluate our design engineering and physical work environment to verify safe work conditions and practices are established, followed, and corrected as needed.
- We assess and continually improve our HSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely evaluating our program.
- We expect all employees to embrace our Target Zero culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and "walk the talk" on and off the job.

The undersigned pledge our leadership, commitment, and accountability for making this Policy a reality at CH2M HILL.

Dated the 5th day of April, 2012

Lee McIntire
Chief Executive Officer

John Madia
Chief Human Resources Officer

Mike Lucki
Chief Financial Officer

Margaret McLean
Chief Legal Officer

Mike McKelvy
President, Government, Environment, and Infrastructure Division

Bob Card
President, Energy, Water and Facilities Division

Jacqueline Rast
President, International Division

Fred Brune
Chief Administrative Officer

Gene Lupia
President, Delivery Excellence

Brad Barber
Director, Health, Safety, and Environment

CH2M HILL Policy and Commitment

1.1.1 Safe Work Policy

It is the policy of CH2M HILL to perform work in the safest manner possible. Safety must never be compromised. To fulfill the requirements of this policy, an organized and effective safety program must be carried out at each location where work is performed.

CH2M HILL believes that all injuries are preventable, and we are dedicated to the goal of a safe work environment. To achieve this goal, every employee on the project must assume responsibility for safety.

Every employee is empowered to:

- Conduct their work in a safe manner;
- Stop work immediately to correct any unsafe condition that is encountered; and
- Take corrective actions so that work may proceed in a safe manner.

Safety, occupational health, and environmental protection will not be sacrificed for production. These elements are integrated into quality control, cost reduction, and job performance, and are crucial to our success.

1.1.2 Health and Safety Commitment

CH2M HILL has embraced a philosophy for health and safety excellence. The primary driving force behind this commitment to health and safety is simple: employees are CH2M HILL's most significant asset and CH2M HILL management values their safety, health, and welfare. Also, top management believes that all injuries are preventable. CH2M HILL's safety culture empowers employees at all levels to accept ownership for safety and take whatever actions are necessary to eliminate injury. Our company is committed to world-class performance in health and safety and also understands that world-class performance in health and safety is a critical element in overall business success.

CH2M HILL is committed to the prevention of personal injuries, occupational illnesses, and damage to equipment and property in all of its operations; to the protection of the general public whenever it comes in contact with the Company's work; and to the prevention of pollution and environmental degradation.

Company management, field supervisors, and employees plan safety into each work task in order to prevent occupational injuries and illnesses. The ultimate success of CH2M HILL's safety program depends on the full cooperation and participation of each employee.

CH2M HILL management extends its full commitment to health and safety excellence.

1.1.3 Project-Specific Health, Safety, and the Environment Goals

All management and employees are to strive to meet the project-specific Health, Safety, and the Environment (HSE) goals outlined below. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

The Project has established eleven specific goals and objectives:

- Create an injury-free environment;
- Have zero injuries or incidents;
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example;
- Ensure effective implementation of the HSP through education, delegation, and team work;
- Ensure 100 percent participation in HSE compliance;
- Continuously improve our safety performance;
- Maintain free and open lines of communication;
- Make a personal commitment to safety as a value;

- Focus safety improvements on high-risk groups;
- Continue strong employee involvement initiatives; and
- Achieve health and safety excellence.

2.0 Applicability

This HSP applies to:

- All CH2M HILL staff, including subcontractors and tiered subcontractors of CH2M HILL working on the site; and
- All visitors to the construction site in the custody of CH2M HILL (including visitors from the Client, the Government, the public, and other staff of any CH2M HILL company).

This HSP does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of CH2M HILL.

This HSP defines the procedures and requirements for the health and safety of CH2M HILL staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This HSP will be kept onsite during field activities and will be reviewed as necessary. The HSP will be amended or revised as project activities or conditions change or when supplemental information becomes available. The HSP adopts, by reference, the Enterprise-wide Core Standards and Standard Operating Procedures (SOPs), as appropriate. In addition, the HSP may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this HSP and any governing regulation, the more stringent and protective requirement shall apply.

All CH2M HILL staff and subcontractors must sign the employee sign-off form included in this document as Attachment 1 to acknowledge review of this document. Copies of the signature page will be maintained onsite by the Safety Coordinator (SC).

3.0 General Project Information

Project Information and Background

Project Number: 423675

Client: Department of Navy, Northeastern Region

Project/Site Name: Naval Research Lab-Chesapeake Bay Detachment

Site Address: 5813 Bayside Rd., Chesapeake Beach, MD 20732

CH2M HILL Project Manager: Jeff Woodard

CH2M HILL Office: WDC

DATE HSP Prepared: 8/18/2012

Date(s) of Site Work: September – December 2012

Site Background and Setting

NRL-CBD is located at 5813 Bayside Road in Calvert County, Maryland south of the town of Chesapeake Beach, Maryland. NRL-CBD is located approximately 40 miles southeast of Washington, DC and occupies approximately 160 acres along the western shoreline of the Chesapeake Bay. The facility is bounded by the Chesapeake Bay to the east and residential housing areas to the north, south, and west. The facility is separated into an eastern and western portion, separated by Bayside Road.

The mission of NRL-CBD is to provide and maintain facilities for use by the research divisions of the Naval Research Laboratory in Washington, D.C. for the testing, development, and evaluation of radar, radio, optical and fire control equipment, along with other research projects requiring a maritime environment or open skies, but with land-based support facilities (NEESA, 1984).

The original acquisition of land for NRL-CBD was made in 1941 and construction progressed rapidly during the war years. Major expansion occurred in 1953-54 with construction of a large laboratory building, shop facilities, and complete utility systems (NEESA, 1984).

3.1.1.1 Site 2

From the 1950s until the 1960s, Site 2 was used as an area for chemical burial and/or burning. Based on the history of the site, the likely potential sources of site-related constituents would be the burial and/or burning pits.

3.1.1.2 Site 3

From 1942 until 1950, Site 3 was used as a landfill for municipal, shop and laboratory wastes and after the landfill closed the site was used for storage. Based on the history of the site, the likely potential sources of site-related constituents are the disposal pits and undocumented releases during the time the site was used as a storage area.

3.1.1.3 Site 4

From 1950 until 1958, Site 4 was used as a landfill for municipal, shop and laboratory wastes. Based on the history of the site, the likely potential sources of site-related constituents are the disposal pits.

3.1.1.4 Site 5

From 1958 until 1968, Site 5 was used as a landfill for municipal, shop and laboratory wastes and after the landfill was closed the site was used for storage. Based on the history of the site, the likely potential sources of site-related constituents are the disposal and burn pits. In addition, undocumented releases from the time when the site was used as open storage may serve as a source.

3.1.1.5 Site 7

From 1940 until 1952, Site 7 consisted of unpaved roads located on the portion of NRL-CBD located west of Bayside Road. The unpaved roads were treated with waste oils for dust control. Based on the history of the site, the likely sources of site-related constituents are the former oiled roadways, which are documented to have potentially contained PCB contaminated oil.

3.1.1.6 Site 9

From the late 1950s until 1975, Site 9 contained a photo-processing lab. Based on the history of the site, the likely source of site-related constituents is the former drain pipe through which the photo processing wastes were reportedly disposed. The building and drain pipes have been since demolished and removed from the site.

3.1.1.7 AOC C

During the 1960s, AOC C may have been used as an area of chemical burial and/or burning. The likely potential sources of site-related constituents are the former burial and/or burning pits.

3.1.1.8 AOC D

AOC D, known as the water tower, is located on the western portion of NRL-CBD adjacent to Site 8. The date of construction for the water tower is not available; however, the water tower is first shown in aerial photographs beginning in 1955. Although there are no documented releases from this area; it is assumed that the water tower likely was painted and re-coated with lead based paint several times during the time period when lead based paint was readily available.

Description of Tasks

All CH2M HILL and Subcontractor employees engaging in hazardous waste operations (HAZWOPER) or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65 (or if required by Subcontract). Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities. See the following tasks that fall under HAZWOPER requirements.

3.1.2 HAZWOPER-Regulated Tasks

- Sampling (Soil & Groundwater)
- Test Pitting
- Geophysics Survey
- Drilling (DPT)
- Utility locates, Surveying
- Investigation-derived waste handling & management

3.1.3 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. The following tasks do not involve exposure to safety or health hazards associated with the hazardous waste operations. Hazwoper training or medical requirements do not apply for the tasks listed below.

TASKS

- All tasks described in this HSP require hazwoper training (minimum 24-hour initial hazwoper training for surveyors/utility locators). Contact RHSM for any other additional tasks to determine hazwoper applicability

CONTROLS

- Brief on hazards, limits of access, and emergency procedures.
- Post areas of contamination as appropriate.
- Perform air sampling/monitoring as specified in this HSP.

Site Map

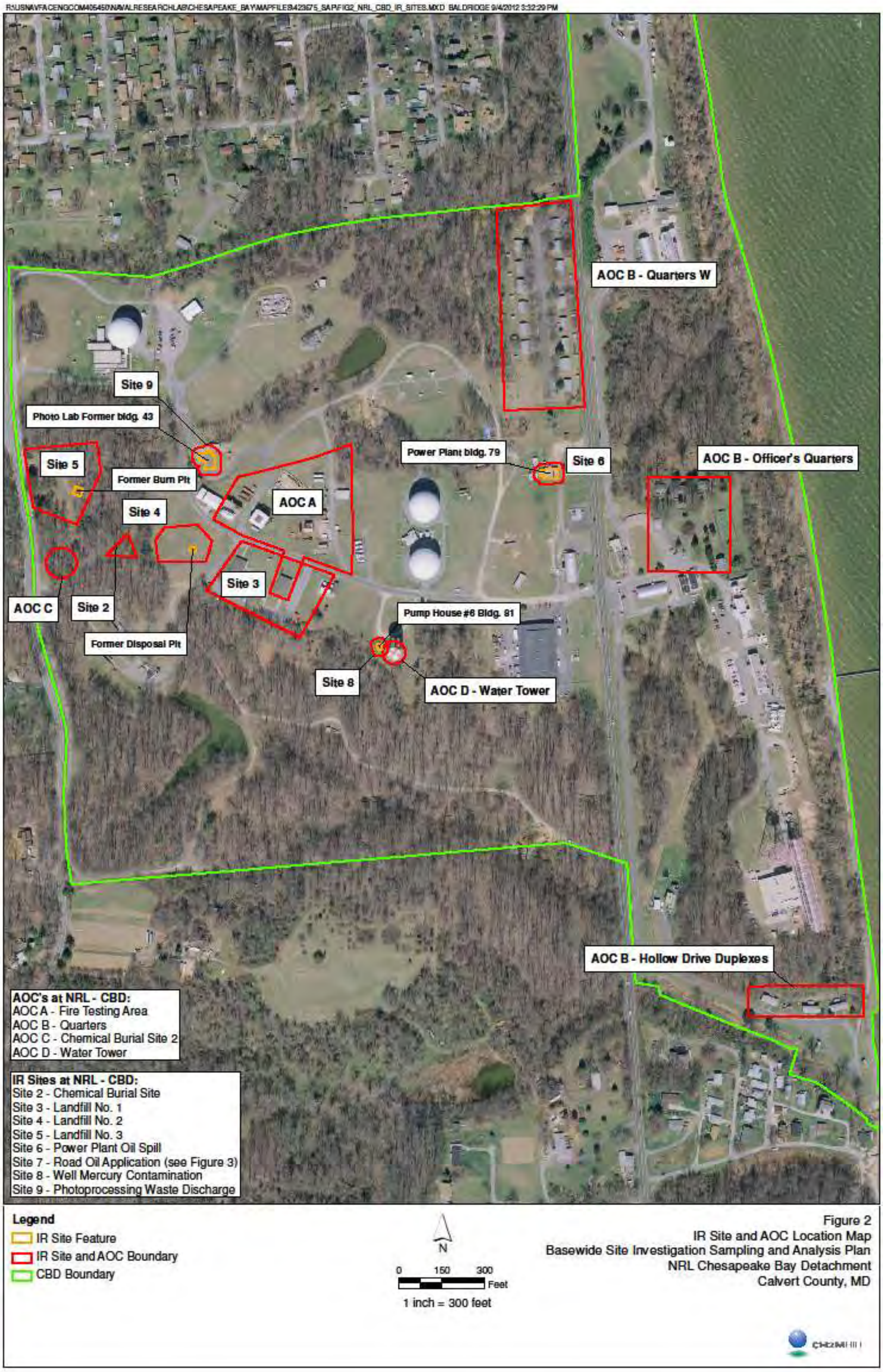


Figure 2
IR Site and AOC Location Map
Basewide Site Investigation Sampling and Analysis Plan
NRL Chesapeake Bay Detachment
Calvert County, MD

4.0 Project Organization and Responsibilities

Client

Contact Name: Nate Delong
Phone: 202-685-3297
Facility Contact Name: Harold Rolfs
Phone: 410-257-4002

CH2M HILL

4.1.1 Project Manager

PM Name: Jeff Woodward
CH2M HILL Office: WDC
Telephone Number: 703-376-5293
Cellular Number: 571-217-6582

The project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE 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 document:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Select safe and competent subcontractors by:
  - Choosing potential subcontractors based on technical ability and HSE performance;
  - Implementing the subcontractor prequalification process;
  - Ensuring that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award; and
  - Ensuring HSE submittals, subcontract agreements, and appropriate site-specific safety procedures are in place and accepted prior field mobilization.
- Ensure copies of training and medical monitoring records, and site-specific safety procedures are being maintained in the project file accessible to site personnel.
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and procedures.
- Manage the site and interfacing with 3rd parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care.
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented.
- Provide visible support and motivation for HSE programs, rules, procedures, processes, and training, leading by example and encouraging CH2M HILL employees to take ownership of HSE issues.
- Intervene or stop work when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered.
- Make available to and require CH2M HILL employees to complete required HSE training within established timelines and provide project numbers for such training.
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites.

- Promptly report all work-related HSE incidents or near misses.
- Wear any required personal protective equipment.
- Ensure CH2M HILL employees complete required HSE training within established timelines.
- Conduct, cooperate, or assist with HSE incident investigations.
- Consult with the Human Resources Delivery Partner before taking any disciplinary action (other than verbal counseling) associated with CH2M HILL Policy 203 and/or HSE programs rules, procedures, processes and training.

4.1.2 CH2M HILL Responsible Health and Safety Manager

RHSM Name: Mark Orman CH2M HILL Office: MKE Telephone Number: 414-847-0597 Cellular Number: 414-712-4138

The RHSM is responsible for the following:

- Review and evaluate subcontractor HSE performance using the pre-qualification process;
- Approve HSP and its revisions as well as Activity Hazard Analyses (AHA);
- Review and evaluate subcontractor site-specific safety procedures for adequacy prior to start of subcontractor's field operations;
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices;
- Permit upgrades and downgrades in respiratory protection after reviewing analytical data;
- Conduct audits as determined by project schedule and coordination with PM; and
- Participate in incident investigations, lessons learned, loss and near loss reporting.

4.1.3 CH2M HILL Project Environmental Manager

EM Name: Nancy Ballantyne CH2M HILL Office: DEN Telephone Number: 720-286-5561 Cellular Number: 303-885-9954

The Project EM is responsible for the following:

- Provide environmental program support in areas such as training, auditing, planning, permit tracking, and subcontractor oversight as needed or as specified in the project environmental plan;
- Review and evaluate qualifications for subcontractors with a history of environmental non-compliance and for waste transportation and disposal subcontractors;
- Evaluate any spills, releases, or environmental permit incidents for appropriate follow-up actions, notifications, and recordkeeping requirements; and
- Provide environmental compliance and environmental management expertise and advice to the project team as needed during the course of the project.

4.1.4 CH2M HILL Safety Coordinator

SC Name: Andrew Bogdanski CH2M HILL Office: WDC Telephone Number: 703-376-5038 Cellular Number: 703-431-5820

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 the Employee Sign-Off Form, prior to commencing field activities;
- Verify CH2M HILL site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in this HSP;
- Verify that project files include copies of subcontractor training and medical monitoring records, and accepted site-specific safety procedures prior to start of subcontractor's field operations;
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the HSP;
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the HSP;
- Post the Occupational Safety and Health Administration (OSHA) job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. If you work in a state with an OSHA State Plan, make sure the State Plan poster is posted, if required;
- Hold and/or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change);
- Verify that project health and safety forms and permits are being used as outlined this HSP;
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined this HSP;
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3rd party interfaces;
- Verify appropriate personal protective equipment (PPE) use, availability, and training;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented;
- Conduct accident investigations including root cause analysis;
- Calibrate and conduct air monitoring in accordance with the HSP; maintain all air monitoring records in project file;
- Maintain HSE records and documentation;
- Facilitate OSHA or other government agency inspections including accompanying inspector and providing all necessary documentation and follow-up;
- Deliver field HSE training as needed based on project-specific hazards and activities;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
- Wear any required personal protective equipment;

- Conduct, cooperate, or assist with HSE incident investigations;
- Contact the PM and RHSM when standards of conduct or CH2M HILL Policy 203 has been violated by a CH2M HILL employee;
- Contact the RHSM and PM in the event of an incident;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and RHSM as appropriate; and
- Document all verbal health and safety-related communications in project field logbook, daily reports, or other records.

CH2M HILL Subcontractors

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

Subcontractor: TriMatrix Laboratories, Inc.
Subcontractor Contact Name: Walt Roudebush
Telephone: (616)-975-4561

Subcontractor: TBD (Drilling-DPT)
Subcontractor Contact Name: TBD
Telephone: TBD

Subcontractor: TBD (IDW - transportation and disposal of waste)
Subcontractor Contact Name: TBD
Telephone: TBD

Subcontractor: TBD (Utility Locating/Surveying)
Subcontractor Contact Name: TBD
Telephone: TBD

Subcontractor: TBD (Excavation-Test Pitting)
Subcontractor Contact Name: TBD
Telephone: TBD

Subcontractor: TBD (Geophysics)
Subcontractor Contact Name: TBD
Telephone: TBD

Subcontractors must comply with the following activities, and are responsible to:

- Comply with all local, state, and federal safety standards;
- Comply with project and owner safety requirements;
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings;
- Provide a qualified safety representative to interface with CH2M HILL;
- Maintain safety equipment and PPE for their employees;
- Maintain and replace safety protection systems damaged or removed by the subcontractor’s operations;

- Notify the SC of any accident, injury, or incident (including spills or releases) immediately and submit reports to CH2M HILL within 24 hours;
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers);
- Conduct and document weekly safety inspections of project-specific tasks and associated work areas;
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the CH2M HILL HSP, subcontractor HSPs, and subcontractor AHAs and sign appropriate sign-off forms; and
- Determine and implement necessary controls and corrective actions to correct unsafe conditions.

The subcontractors listed above may be required to submit their own site-specific HSP and other plans such as lead or asbestos abatement compliance plans. Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit their plans to CH2M HILL for review and acceptance before the start of field work.

Subcontractors are also required to prepare AHAs before beginning each activity posing hazards to their personnel. The AHA shall identify the principle steps of the activity, potential health and safety hazards for each step and recommended control measures for each identified hazard. 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.

Employee Responsibilities

All personnel are assigned responsibility for safe and healthy operations. This concept is the foundation for involving all employees in identifying hazards and providing solutions. For any operation, individuals have full authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions or practices. This right represents a significant facet of worker empowerment and program ownership. Through shared values and a belief that all accidents are preventable, our employees accept personal responsibility for working safely.

Each employee is responsible for the following performance objectives:

- Understanding and abiding by CH2M HILL and client HSE programs, rules, procedures, processes, and training, including any that are project-specific;
- Completing all required HSE training made available and accessible within established timelines;
- Always wearing any required personal protective equipment;
- Intervening or stopping work for you or other CH2M HILL employees when an unsafe condition or behavior is encountered or observed, and/or when an environmentally compromising condition exists;
- Promptly notifying a supervisor, PM, SC, or RHSM when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition exists;
- Promptly reporting a supervisor, PM, SC, or RHSM all work-related health, safety , and environmental incidents or near misses;
- Attending required project HSE pre-task briefings and meeting prior to performing work; and
- Cooperating or assisting with HSE incident investigations.

4.1.5 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work and during employee orientation, each employee will be informed of their authority to do so.

Client Contractors

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

This HSP does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues). In addition to these instructions, CH2M HILL team members should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Self-assessment checklists are to be used by the SC and CH2M HILL team members to review the contractor's performance only as it pertains to evaluating CH2M HILL exposure and safety. The RHSM is the only person who is authorized to comment on or approve contractor safety procedures.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL team members on the precautions related to the contractor's work;
- When an apparent contractor non-compliance or unsafe condition or practice poses a risk to CH2M HILL team members:
  - Notify the contractor safety representative;
  - Request that the contractor determine and implement corrective actions;
  - If necessary, stop affected CH2M HILL work until contractor corrects the condition or practice; and
  - Notify the client, PM, and RHSM as appropriate.

If apparent contractor non-compliance or unsafe conditions or practices are observed, inform the contractor safety representative (CH2M HILL's obligation is limited strictly to informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative (CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

All verbal health and safety-related communications will be documented in project field logbook, daily reports, or other records.

5.0 Standards of Conduct

All individuals associated with this project must work injury-free and drug-free and must comply with the following standards of conduct, the HSP, and the safety requirements of CH2M HILL. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

Standards of Conduct Violations

All individuals associated with this project are expected to behave in a professional manner. Violations of the standards of conduct would include, but not be limited to:

- Failure to perform work;
- Inefficient performance, incompetence, or neglect of work;
- Willful refusal to perform work as directed (insubordination);
- Negligence in observing safety regulations, poor housekeeping, or failure to report on-the-job injuries or unsafe conditions;
- Unexcused or excessive absence or tardiness;
- Unwillingness or inability to work in harmony with others;
- Discourtesy, irritation, friction, or other conduct that creates disharmony;
- Harassment or discrimination against another individual;
- Failure to be prepared for work by wearing the appropriate construction clothing or bringing the necessary tools; or
- Violation of any other commonly accepted reasonable rule of responsible personal conduct.

Disciplinary Actions

The Environmental Services (ES) business group employees, employees working on ES business group projects, and subcontractor employees are subject to disciplinary action for not following HSE rules and requirements. Potential disciplinary action is equally applicable to all employees including management and supervision. Disciplinary action may include denial of access to the worksite, warnings, reprimands, and other actions up to and including termination depending on the specific circumstances.

Subcontractor Safety Performance

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

5.1.1 Observed Hazard Form

When apparent non-compliance or unsafe conditions or practices are observed, notify the subcontractor's supervisor or safety representative verbally, and document using the Observed Hazard Form, included as an attachment to this HSP, and require corrective action.

If necessary, stop subcontractor's work using the Stop Work Order Form until corrective actions is implemented for observed serious hazards or conditions. Update the Observed Hazard Form to document corrective actions have been taken. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

5.1.2 Stop Work Order

CH2M HILL has the authority, as specified in the contract, and the responsibility to stop work in the event any CH2M HILL employee observes unsafe conditions or failure of the subcontractor to adhere to its safe-work practices, or observes a condition or practice that may result in a release or violation of an environmental requirement. This authority and action does not in any way relieve the subcontractor of its responsibilities for the means and methods of the work or, therefore, of any corrective actions. Failure to comply with safe work practices can be the basis for restriction or removal of the subcontractor staff from the job site, termination of the subcontract, restriction from future work, or all three.

When an apparent imminent danger is observed, immediately stop work and alert all affected individuals. Remove all affected CH2M HILL employees and subcontractor staff from the danger, notify the subcontractor's supervisor or safety representative, and do not allow work to resume until adequate corrective measures are implemented. Notify the PM, Contract Administrator (KA) and RHSM.

When repeated non-compliance or unsafe conditions are observed, notify the subcontractor's supervisor or safety representative and stop affected work by completing and delivering the Stop Work Order Form (attached to this HSP) until adequate corrective measures are implemented. Consult the KA to determine what the contract dictates for actions to pursue in event of subcontractor non-compliance including work stoppage, back charges, progress payments, removal of subcontractor manager, monetary penalties, or termination of subcontractor for cause.

Incentive Program

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

Reporting Unsafe Conditions/Practices

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Accident prevention requires a pro-active policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition which might jeopardize the safety of our projects. All unsafe conditions or unsafe practices will be corrected immediately. CH2M HILL has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition;
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SC needs to be notified at once by the responsible employee;
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SC;
- The SC will act promptly to correct the unsafe condition or practice; and
- Details of the incident or situation will be recorded by the SC in the field logbook or use the Observed Hazard Form if subcontractor was involved.

6.0 Safety Planning and Change Management

Daily Safety Meetings and Pre-Task Safety Plans

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs that apply for each day's project activities. The Pre-Task Safety Plans (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 as an attachment to this HSP, 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 HSE procedures, as identified in the HSP and AHA. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day.

Change Management

This HSP addresses all known activities and associated hazards. As work progresses, if significant changes are identified which could affect health and safety at the site, coordinate with the RHSM to determine whether a HSP update is necessary.

The following are examples of changes that may require a revision to the plan:

- Change in CH2M HILL staff;
- New subcontractor to perform work;
- New chemicals brought to site for use;
- Change in scope or addition of new tasks;
- Change in contaminants of concern (COCs) or change in concentrations of COCs; and
- New hazards or hazards not previously identified that are not addressed in this HSP.

Agency Inspection Guidance

(Reference CH2M HILL SOP HSE-201, *Agency Inspections and Communications*)

Agency inspections (e.g., OSHA, EPA, other regulatory agencies) are on the rise. CH2M HILL implements safety and environmental programs in order to ensure safety to workers, the public, and the environment. This plan addresses things like labeling containers, completing the hazard communication training using the attachments to this HSP, listing training requirements and PPE requirements, and addressing project-specific hazards. Field personnel need to contact the RHSM to update this plan if hazards are encountered that are not addressed.

SOP HSE-201 addresses agency inspections in detail, and the attached **Target Zero Bulletin on Agency Inspections** provides a good summary of the inspection process and what to do if an agency such as OSHA or EPA shows up at the site. It is critical to make immediate notification to the RHSM if an inspector arrives (and EM if it is environmental-related); they can help facilitate and make additional notifications.

Review the Target Zero Bulletin and keep it with your Health and Safety Plan/Environmental Plan. Make it a topic at a safety meeting and keep it readily available in the event of an inspection.

7.0 Project Hazard Analysis

A health and safety risk analysis (Table 1) has been performed for each task. In the order listed below, the RHSM considers the various methods for mitigating the hazards. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects:

- Elimination of the hazards (use remote sampling methodology to avoid going into a confined space);
- Substitution (reduce exposure to vapors by using of a geoprobe instead of test pitting);
- Engineering controls (ventilate a confined space to improve air quality);
- Warnings (establish exclusion zones to keep untrained people away from hazardous waste work);
- Administrative controls (implement a work-rest schedule to reduce chance of heat stress); or
- Use of PPE (use of respirators when action levels are exceeded).

The hazard controls and safe work practices are summarized in the following sections of this HSP:

- General hazards and controls;
- Project-specific hazards and controls;
- Physical hazards and controls;
- Biological hazards and controls; and
- Contaminants of concern.

Activity Hazard Analysis

An AHA must be developed for each CH2M HILL job activity. The AHA shall define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements to be performed and training requirements for the safe operation of the equipment listed must be identified. Workers are briefed on the AHA before performing 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. The AHA shall identify the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard.

The following hazard controls and applicable CH2M HILL core standards and SOPs should be used as a basis for preparing AHAs.

AHAs prepared for CH2M HILL activities are included as an attachment to this HSP.

Subcontractor Activity Hazard Analysis

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 scope of work, along with their project-specific safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

Table 1 – General Activity Hazard Analysis

Potential Hazard	Mob/Demob	Sampling (Soil & Groundwater)	Oversight of surveying & utility locating	Drilling & Well installation	IDW Mgmt.
Arsenic		X		X	X
Benzene		X		X	X
Biological Hazards	X	X	X	X	X
Cadmium		X		X	X
Chemical Hazard		X		X	X
Compressed Gas Cylinders (calibration gas)		X			X
Confined Space Entry	Not anticipated for this scope				
Drilling				X	
Drum Handling		X		X	X
Drum Sampling				X	X
Electrical Safety	X	X		X	
Excavation (Test Pitting)		X			X
Field Vehicles	X	X	X	X	X
Fire Prevention	X	X	X	X	X
Forklifts				X	X
Groundwater Sampling		X		X	
Hand & Power Tools	X	X	X	X	X
Heavy Metals (Hex Chrom & Lead)		X		X	X
Knife Use	X	X			
Manual Lifting	X	X	X	X	X
Methylene Chloride		X		X	X
Noise				X	
Portable Generators	X	X		X	
Pressure Washing Equipment/ Decontamination				X	
Rigging				X	
Slip, Trip, Fall	X	X	X	X	X
Temperature Extremes	X	X	X	X	X
Traffic Control					
Ultraviolet Light exposure (sunburn)	X	X	X	X	X
Utilities (underground/overhead)				X	
Vinyl Chloride		X		X	X
Working around Material Handling Equipment	X			X	X

8.0 General Hazards and Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. It is a summarized list of requirements. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented.

Bloodborne Pathogens

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

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (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 pathogens computer-based training module annually. When performing first-aid/CPR the following shall apply:

- 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;
- 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; and
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. 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.

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); and
- Administering post-exposure prophylaxis.

Chemical Storage

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;
- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

8.1.1 Storage of Flammable/Combustible Liquids

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.
- Approved safety cans shall be used for the handling and use of flammable liquids in quantities of 5 gallons (19 liters) or less. Do not use plastic gas cans.

- For quantities of 1 gallon (3.78 liters) or less, the original container may be used for storage and use of flammable liquids.
- Flammable or combustible liquids shall not be stored in areas used for stairways or normally used for the passage of people.

Driving Safety

(Reference CH2M HILL HSE Policy 205, Distracted Driving – Wireless Devices, Vehicle Safety Core Standard)

All CH2M HILL employees are prohibited from using Wireless Devices while operating a Motor Vehicle when conducting company business regardless of the location or vehicle ownership and whether or not during regular working hours.

All CH2M HILL contractors and subcontractors are prohibited from using Wireless Devices while operating a CH2M HILL- or CH2M HILL client-owned, leased, or rented Motor Vehicle, or while operating any other Motor Vehicle on the project site.

- Prohibited use includes the following:
    - Dialing or speed dialing
    - Using a hands-free or voice recognition (blue tooth) device to dial or speed dial
    - Engaging in conversation or listening to a conversation using a Wireless Device
    - Checking emails or surfing the internet using a Wireless Device
    - Texting or e-mailing (reading, sending, or screening) with a Wireless Device
    - Programming or entering coordinates into a global positioning system (GPS) device (following directions by a GPS is permitted)
    - Using a Wireless Device for voice recording or dictation
- Employees, contractors, and subcontractors who need to use a wireless device must pull off the road to a safe location, with the vehicle securely stopped and emergency flashers on, or wait until they reach their destination.
- Avoid distractions from mobile phones, smartphones, voice recognition systems, PDAs, notebook, tablets (or similar devices), or laptops, by turning off or silencing the wireless devices before operating a motor vehicle.

Follow the guidelines below when operating a vehicle:

- Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you;
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving; and
- Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

Electrical Safety

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

Below are the hazard controls and safe work practices to follow when using electrical tools, extension cords, and/or other electrical-powered equipment or when exposed to electrical hazards. Ensure the requirements of the referenced SOP are followed:

- Only qualified personnel are permitted to work on unprotected energized electrical systems;
- Only authorized personnel are permitted to enter high-voltage areas;
- CH2M HILL employees who might from time to time work in an environment influenced by the presence of electrical energy must complete Awareness Level Electrical Safety Training located on the CH2M HILL Virtual Office;
- 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 cannot be utilized;
  - Client requires such a program to be implemented; or
  - 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 and Underwriters Laboratory (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 (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) 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; and
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first aid kit, bloodborne pathogen kit, and fire extinguisher in the field vehicle at all times.

- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
  - Vision Fields and Blind Spots
  - Vehicle Size
  - Mirror adjustments
  - Seat adjustments
  - Cruise control features, if offered
  - Pre-program radio stations and Global Positioning System (GPS), if equipped
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van or pick-up truck.
- 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.
- Ensure back-up alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.
- See the Vehicle Accident Guidance attached to this HSP, if a vehicle incident is experienced in a rental or fleet vehicle.

Fire Prevention

(Reference CH2M HILL SOP HSE-403, *Hazardous Material Handling*)

Follow the fire prevention and control procedures listed below.

8.1.2 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). 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 (3 meters) from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.

8.1.3 Dispensing of Flammable/Combustible Liquids

- Areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) (shall be separated from other operations by at least 25 feet (7.6 meters).
- Drainage away from storm drains or surface waters or other means of containment shall be provided to control spills.
- Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispensing of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).
- Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks is prohibited.
- Dispensing devices and nozzles for flammable liquids shall be of an approved type.

General Practices and Housekeeping

The following are general requirements applicable to all portions of the work:

- 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, 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 emergencies, occupational illnesses, injuries, vehicle accidents, and near misses immediately;
- 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; and
- Check the work area to determine what problems or hazards may exist.

Hazard Communication

(Reference CH2M HILL SOPs HSE-107, *Hazard Communication* and HSE-403, *Hazardous Material Handling*)

The hazard communication coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using the chemical inventory form included as an attachment to this HSP;
- 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 and include on the chemical inventory sheet (attached to this HSP) and add the MSDS to the MSDS attachment section of this HSP;
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly;
- Give employees required chemical-specific HAZCOM training using the chemical-specific training form included as an attachment to this HSP; and
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

Knife Use

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leatherman™) are prohibited at worksites except where the following three conditions are met:

- The open-bladed knife is determined to be the best tool for the job;
- An approved Activity Hazard Analysis (AHA) or written procedure is in place that covers the necessary safety precautions (work practices, PPE, and training); and
- Knife users have been trained and follow the AHA.

Lighting

Lighting shall be evaluated when conducting work inside buildings, confined spaces, or other areas/instances where supplemental light may be needed (e.g., work before sunrise or after sunset). A light meter can be used to evaluate the adequacy of lighting. The following are common requirements for lighting and the conditions/type of work being performed:

- 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.

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. Use the following to mitigate the hazards associated with lifting:

- When possible, the task should be modified to minimize manual lifting hazards;
- Lifting of loads weighing more than 40 pounds (18 kilograms) shall 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; and
- All CH2M HILL workers must have training in proper manual lifting training either through the New Employee Orientation or through Manual Lifting module located on the VO.

Personal Hygiene

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Implement the following:

- Keep hands away from nose, mouth, and eyes during work;
- Keep areas of broken skin (chapped, burned, etc.) covered; and
- Wash hands with soap and water prior to eating, smoking, or applying cosmetics.

Personal Security

Follow the guidelines below for personal security measures. The RHSM and Firm-Wide Security Office can be contacted if additional, specific measures are needed (e.g., such as evaluating the needs for security service).

General Safety and Security Guidelines

CH2M Hill Corporate Security Department recommends the following guidelines for workers in the United States:

- Stay alert and be aware of your surroundings. Avoid pre-occupations with mobile devices, while in an unfamiliar area.
- Whenever possible use the buddy system with another employee or client or subcontractor employee.
- Trust your intuition; if a situation appears strange or wrong, it probably is.
- Be confident in your walk or stride; do not give the appearance you are new in town.
- Avoid carrying and displaying large sums of cash.
- If you sense or see dangerous situations along your route, change your route and depart the area quickly. If you feel that you are being followed, go to the nearest police station or safe location and file a complaint with the police. Provide a description of the person, their vehicle, license plate number and any other useful information.
- Only walk short distances that are safe and secure while visiting an unfamiliar city or location.
- Take host approved transportation for long distances.
- "Fight or Flight?" Leaving the possible or dangerous area is always better than staying to fight.
- Always report suspicious activity to the nearest local law enforcement agency.
- Locate emergency exits in your hotel or where you are staying to ensure you know where to go in case of a fire or a natural or man-made disaster.
- Secure your electronic devices when left in your room or take them with you if you are not able to secure them properly.
- If you feel your life is in danger, call 911. Be sure to speak clearly, concisely and give the dispatcher a good description of where you are physically located.

Operating or Riding in Vehicles

- When waiting for public transportation or a taxi, remain in a store or restaurant as long as possible before catching your ride and never wait by yourself in an isolated area.
- Approach your vehicle with keys firmly in your hand and ready to unlock the car.
- Quickly check your car before entering it to determine damage or presence of an intruder.
- Vulnerable times can be stopping to find your keys to enter your vehicle or stepping out of your vehicle in an isolated area. Be aware of your surroundings before you perform these activities.
- Always keep your doors locked during transit and when the vehicle is parked.
- Never leave your vehicle unlocked, even when to performing a quick task such as checking in a hotel, getting gas or going picking up food.
- If confronted by an individual inside a vehicle pointing a weapon at you, run the opposite way from where the vehicle is facing and scream as loud as you can. This evasive action will probably cause the individual to drive away.
- If an individual in a passing car points at your tires or engine to indicate a malfunction, only pull over in a well-lit and populated gas or rest stop. Never pull over in an isolated or dimly lit area. You may have a malfunction or the passing motorist may be attempting to rob you.
- Always park your vehicle is a well-lit and secure area. If your vehicle is parked in a dimly lit or isolated area in a parking garage; ask an attendant or friend to accompany you to your vehicle.

- Secure your valuables in the trunk, or place them out of sight or cover them with a blanket or coat if there is no secure storage area in the vehicle. The would-be-perpetrator likes to see what to steal and not knowing what you have concealed will normally prevent a break in.

Riding in a Taxi

- Have your host or a designated travel agent suggest or reserve a reputable taxi service for you during your stay.
- Only use a taxi service that was vetted for safety and reliability.
- If possible, place luggage, laptop and personal belongings inside the taxi.
- When you first enter the taxi, check the driver photo identification card, normally located on the driver's visor with the driver to ensure they match.

Walking

- If you experience automotive trouble, remain inside the locked vehicle and call for assistance.
- If you can't reach assistance via a mobile phone, only walk for help in a safe area facing the traffic.
- If while walking, you are shadowed or followed by a vehicle, run back in the direction of your vehicle and enter the vehicle if possible. File a police report on the incident as soon as practicable.
- Be aware of your surroundings and those around you while walking and do not be distracted by using electronic devices.
- Regularly change your route if you are walking to and from meetings or conferences and choose only well-lit areas to walk in at night.
- If walking long distances, identify a "safe house, shop, store or restaurant" to duck into if confronted by a perpetrator.

Jogging or Running

- Always jog or run in an area that is safe, secure, and used for exercising.
- Avoid running along busy roads or highways.
- If you chose to venture out on a jog or run, check the route by vehicle prior to beginning to exercise.
- Let the host or a friend know when you leave, when you plan to return, and the route you will take during exercising.
- Take a photo identification and mobile phone with you for emergencies.
- Avoid physically over-extending yourself since reflexes and decision-making ability can be impaired.

Clothing and Jewelry

- Dress to blend in with locals, maintain a low profile and avoid drawing attention to yourself.
- Travel with inexpensive clothing and jewelry.
- Avoid wearing CH2M HILL distinctive clothing or using CH2M HILL logos on luggage or laptops.

Emergency Numbers and Information

- Leave your itinerary and emergency contact numbers where you can be reached with family members and only those that have a need to know.
- Pre-program emergency numbers in the mobile device you are traveling with.
- Carry a list of current medications and specific doses in your purse or wallet.
- Record medical emergency information on a document that can be readily available if you are unable to speak or unconscious.
- Have a photo copy of your driver's license, passport, and credit card information separately in case your wallet or purse is stolen.

Shipping and Transportation of Hazardous Materials

(Reference CH2M HILL SOP HSE-417, *Hazardous Materials Transportation*)

The U.S. Department of Transportation (DOT) has specific regulations governing shipping of hazardous materials (also called dangerous goods). Chemicals brought to the site might be defined as hazardous materials by the U.S DOT. Hazardous wastes that may be shipped offsite are also defined as hazardous materials by U.S. DOT. Other wastes may also be U.S. DOT hazardous materials. To confirm whether a material or a waste is a U.S. DOT hazardous material, check with the ESBG Waste Coordinator (Lisa Schwan/ATL), the project EM, or the CH2M HILL Dangerous Goods Shipping Coordinators (John Blasco/BAO or Rob Strehlow/MKW).

All staff who affect shipment of hazardous materials, including receiving hazardous materials, preparing profiles or manifests, packaging hazardous wastes, labeling, or transporting hazardous materials by road, are called HazMat employees (note CH2M HILL cannot transport hazardous wastes by public road). HazMat employees must receive CH2M HILL online training in shipping dangerous goods. CH2M HILL's online Dangerous Goods Shipping course can be found on the CH2M HILL HSSE website.

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. If the material is a product that is being shipped (e.g., calibration gas), use the HazMat ShipRight tool on the CH2M HILL virtual office (under Company Resources – Online Shipping). Contact the Dangerous Goods Shipping coordinators, the ESBG Waste Coordinator or the project EM for additional information.

49 CFR 172 requires that all hazmat employees be aware of potential transportation security concerns. Hazardous materials security is addressed in CH2M HILL's Hazardous Materials SOP (HSE-403). The following points are provided as an overview of security measures to increase awareness of this important matter:

- It is essential that each employee understand the security risks involved with transporting hazardous materials;
- All transporters of hazardous materials must be prequalified by a Contracts Administrator who evaluate the carrier's safety rating, security measures, and employee screening procedures;
- When shipping hazardous materials, check driver credentials and ask about shipping details;
- When receiving a hazardous materials shipment, inspect packages for signs of tampering or damage to the contents. Verify the drivers and company information on the form with the driver; and
- If there is suspicious or unusual behavior (e.g., driver without credentials, evasive answers) or any discrepancies identified, do not offer or accept the shipment, and immediately notify the project manager or the RHSM.

Employees responsible for shipping hazard materials must also review the CH2M HILL Transportation Security Plan (HSE-417 Appendix A).

Substance Abuse

(Reference CH2M HILL SOP HSE-105, *Drug-Free Workplace)*

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

Prohibitions onsite include:

- 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; and
- Arrival at work under the influence of legal or illegal drugs or alcohol.

Drug and/or alcohol testing is applicable under CH2M HILL Constructors, Inc. and munitions response projects performed in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. When required, this testing is performed in accordance with SOP HSE-105, Drug-Free Workplace. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the CH2M HILL Virtual Office (VO).

9.0 Project-Specific 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 work or the particular hazard. Each person onsite is required to abide by the hazard controls. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented. 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.

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.

Benzene

(Reference CH2M HILL SOP HSE-503, *Benzene*)

Benzene is considered a "Confirmed Human Carcinogen." CH2M HILL is required to control employee workplace exposure to benzene when personal exposures is at or above 0.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the OSHA Benzene standard, 29 CFR 1910.1028. The elements of the CH2M HILL benzene program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;

- Training on hazards of benzene and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Benzene);* and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. 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;
- 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.

Cadmium

(Reference CH2M HILL SOP HSE-504, *Cadmium*)

Cadmium is considered a "Suspected Human Carcinogen." CH2M HILL is required to control employee workplace exposure to cadmium when personal exposure is at or above 2.5 micrograms per cubic meter ($\mu g/m^3$) by implementing a program that meets the requirements of the OSHA Cadmium standard, 29 *Code of Federal Regulations* (CFR) 1926.1127. The elements of the CH2M HILL cadmium program include the following:

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

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. 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;
- 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.

Compressed Gas Cylinders

(Reference CH2M HILL SOP HSE-403, *Hazardous Materials Handling*)

Below are the hazard controls and safe work practices to follow when working around or using compressed gas cylinders. Ensure the requirements in the referenced SOP are followed.

- Cylinders and pressure-controlling apparatus shall be inspected for defects and leakage prior to use. Damaged or defective items shall not be used. If a cylinder is found to be defective, the gas distributor shall be notified and subsequent instructions followed. If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.
- Cylinders shall be labeled with the identity of the contents. Cylinders not labeled shall be sent back to the cylinder distributor. The color of the cylinder shall not be used exclusively to identify cylinder contents.
- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinders must be secured in an upright position at all times.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.
- Eye protection (safety glasses or goggles) shall be worn when using cylinders.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders inside buildings shall be stored in dry, well-ventilated locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high, having a fire resistance rating of at least 0.5 hour.
- Signs indicating no smoking shall be provided for storage areas containing flammable gas cylinders.
- Complete the self-assessment checklist for compressed gas cylinders are being used.

Drilling Safety

(Reference CH2M HILL SOP HSE-204, *Drilling*)

Below are the hazard controls and safe work practices to follow when working around or performing drilling. Ensure the requirements in the referenced SOP are followed.

- The drill rig is not to be operated in inclement weather.
- The driller is to verify that the rig is properly leveled and stabilized before raising the mast.
- Personnel should be cleared from the sides and rear of the rig before the mast is raised.
- The driller is not to drive the rig with the mast in the raised position.
- The driller must check for overhead power lines before raising the mast. Maintain a minimum distance of 10 feet (3 meters) between mast and overhead lines (<50 kV) and an additional 0.4 inches for every 1 kV over 50kV. Verify the voltage of nearby overhead power lines to determine the minimum distance.

- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include unexploded ordnance (UXO), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with UXO. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Personnel should stand clear before rig startup.
- The driller is to verify that the rig is in neutral when the operator is not at the controls.
- Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.).
- Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts.
- Do not smoke or permit other spark-producing equipment around the drill rig.
- The drill rig must be equipped with a kill wire or switch, and personnel are to be informed of its location.
- Be aware and stand clear of heavy objects that are hoisted overhead.
- The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program.
- The driller is to verify that all machine guards are in place while the rig is in operation.
- The driller is responsible for housekeeping (maintaining a clean work area).
- The drill rig should be equipped with at least one fire extinguisher.
- If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately.
- Use the drilling self-assessment checklist attached to this HSP to evaluate drilling operations.

Drum and Portable Tank Handling

Below are the hazard controls and safe work practices to follow when overseeing the movement of drums or when handling drums:

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries;
- Ensure drum or tank bungs and lids are secured and are labeled prior to moving;
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Covers and/or lids will be properly secured at the end of each workday;
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling;
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface;
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials;

- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency;
- Supply operators with appropriate respiratory protective equipment when needed;
- Ensure that drums are secure and are not in the operator's view of the roadway;
- Prior to handling, all personnel should be warned about hazards of handling;
- Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (e.g. small containers may have to be removed first to permit heavy equipment to enter and move the drums;
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur;
- Use containers or overpacks that are compatible with the waste or materials;
- Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance;
- Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.; and
- Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, and waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums;
- Sample only labeled drums or drums from a known waste stream;
- Do not sample bulging or swollen drums. Contact the RHSM;
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open;
- Use the proper tools to open and seal drums;
- Reseal bung holes or plugs whenever possible;
- Avoid mixing incompatible drum contents;
- Sample drums without leaning over the drum opening;
- Transfer/sample the content of drums using a method that minimizes contact with material;
- Use the PPE and perform air monitoring as specified in the PPE and Site Monitoring sections of this HSP;
- Take precautions to prevent contaminated media from contacting the floor or ground, such as having plastic under the sampling area, having a spill kit accessible during sampling activities; and
- If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

Earthmoving Equipment

(Reference CH2M HILL, SOP HSE-306, *Earthmoving Equipment*)

Below are the hazard controls and safe work practices to follow when working around or operating heavy equipment. Ensure the requirements in the referenced SOP are followed.

- CH2M HILL authorizes only those employees qualified by training or previous experience to operate material handling equipment.
- CH2M HILL employees must be evaluated prior to operating earthmoving equipment by a CH2M HILL earthmoving equipment operator evaluation designated person. This evaluation will be documented according to SOP HSE-306, Earthmoving Equipment.
- Heavy equipment operators are prohibited from using any wireless device while operating equipment. Equipment must be stopped before using devices such as two way radios or cell phones.
- Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include: service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts and operating controls. All defects shall be corrected before the equipment is placed in service. Documentation of this inspection must be maintained onsite at all times (use the Earthmoving Equipment Inspection form if operated by CH2M HILL).
- Equipment must be on a stable foundation such as solid ground or cribbing; outriggers are to be fully extended.
- Equipment must not be used to lift personnel; loads must not be lifted over the heads of personnel.
- Equipment, or parts thereof, which are suspended must be substantially blocked or cribbed to prevent shifting before personnel are permitted to work under or between them. All controls shall be in a neutral position, with the motors stopped and brakes set.
- Equipment which is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operators view is obstructed.
- When equipment is used near energized power lines, the closest part of the equipment must be at least 10 feet (3 meters) from the power lines less than 50 kilovolts (kV). Provide an additional 4 feet (1.2 meters) for every 10 kV over 50 kV. A person must be designated to observe clearances and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. All overhead power lines must be considered to be an energized until the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Underground utility lines must be located before excavation begins; refer to the Utilities (underground) section.
- Operators loading and unloading from vehicles are responsible for seeing that vehicle drivers are in the vehicle cab or in a safe area.
- The parking brake shall be set whenever equipment is parked; wheels must be chocked when parked on inclines.
- When not in operation, the blade or bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab. When equipment is unattended, power must be shut off, brakes set, blades or buckets landed and shift lever in neutral.

Excavation Activities

(Reference CH2M HILL SOP HSE-307, *Excavation and Trenching Safety*)

The requirements in this section shall be followed whenever excavation is being performed. Refer to the Earthmoving Equipment section and SOP for additional requirements applicable to operating/oversight of earthmoving equipment. Below are the hazard controls and safe work practices to follow when working around or performing excavation. Ensure the requirements in the referenced SOP are followed.

- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include unexploded ordnance (UXO), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with UXO. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Do not enter the excavations unless completely necessary, and only after the excavation competent person has completed their daily inspection and has authorized entry. An inspection shall be conducted by the competent person prior to the start of work, as needed throughout the shift, after every rainstorm, and after any hazard increasing occurrence. Documentation of the inspection must be maintained onsite at all times.
- Follow all excavation entry requirements established by the excavation competent person and any excavation permit being used.
- Sloping, benching, shoring, shielding, or other protective systems are required to protect personnel from cave-ins except when the excavation is made entirely in stable rock or is less than 5 feet deep (1.5 meters) and there is no indication of possible cave-in, as determined by the excavation competent person. Protective systems for excavations deeper than 20 feet (6.1 meters) must be designed or approved by a registered professional engineer.
- Trenches greater than 4 feet (1.2 meters) deep shall be provided with a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet (7.6 meters).
- The atmosphere of excavations greater than 4 feet (1.2 meters) deep shall be tested prior to entry when a hazardous atmosphere exists or could reasonably be expected to exist, such as excavating landfills, hazardous waste dumps; or areas containing sewer or gas utility systems, petroleum distillates, or areas where hazardous substances are stored nearby.
- Spoil piles, material, and equipment must be kept at least 2 feet (61 centimeters) from the edge of the excavation, or a retaining device must be used to prevent the material from falling into the excavation.
- Excavations shall not be entered when:
  - Protective systems are damaged or unstable;
  - Objects or structures above the work location may become unstable and fall into the excavation;
  - The potential for a hazardous atmosphere exists, unless the air has been tested and found to be at safe levels; or
  - Accumulated water exists in the excavation, unless precautions have been taken to prevent excavation cave-in.
- The excavation self-assessment checklist shall be used to evaluate excavations prior to entry.

Forklift Operations

(Reference CH2M HILL, SOP HSE-309, *Forklifts*)

Below are the hazard controls and safe work practices to follow when working around or operating forklifts. Ensure the requirements in the referenced SOP are followed.

- Forklift operators are prohibited from using any wireless device while operating forklifts.
- A rated lifting capacity must be posted in a location readily visible to the operator.
- A forklift truck must not be used to elevate employees unless a platform with guardrails, a back guard, and a kill switch is provided on the vehicle. When guardrails are not possible, fall arrest protection is required.
- The subcontractor operating the forklift must post and enforce a set of operating rules for forklift trucks.
- Only certified forklift operators shall operate forklifts.
- Stunt driving and horseplay are prohibited.
- Employees must not ride on the forks.
- Employees must never be permitted under the forks (unless forks are blocked).
- The driver must inspect the forklift once a shift and document this inspection.
- The operator must look in the direction of travel and must not move the vehicle until all persons are clear of the vehicle.
- Forks must be carried as low as possible.
- The operator must lower the forks, shut off the engine, and set the brakes (or block the wheels) before leaving the forklift operator's position unless maintenance or safety inspections require the forklift to be running.
- Trucks must be blocked and have brakes set when forklifts are driven onto their beds.
- Extreme care must be taken when tilting elevated loads.
- Every forklift must have operable brakes capable of safely stopping it when fully loaded.
- Forklifts must have parking brakes and an operable horn.
- When the operator is exposed to possible falling objects, industrial trucks must be equipped with overhead protection (canopy).
- If using certified CH2M HILL forklift operators—forklifts must be inspected and documented daily using the forklift inspection form.

Groundwater Sampling/Water Level Measurements

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are performing groundwater 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.

Hand and Power Tools

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

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed:

- 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;
- 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.); and
- 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.

Heavy Metals

Heavy metals such as chromium and lead are contaminants that are being sampled for during this investigation. Dust suppression must be implemented during drilling or other intrusive activities. Follow the site monitoring section of this HSP for dust monitoring. Wear the PPE specified in the PPE section of this HSP. Also, follow appropriate decontamination and PPE doffing procedures as outlined in this plan and ensure you wash hands/face prior to eating, smoking or applying cosmetics. Keep soil/sediment samples moist to prevent causing airborne dust.

Hexavalent Chromium (Cr VI) Exposure

(Reference the CH2M HILL SOP HSE-513, *Hexavalent Chromium - Chromium VI*)

The OSHA permissible exposure limit (PEL) and ACGIH Threshold Limit Value (TLV) for Chromium VI is 5 ug/m^3 (insoluble) and 1 ug/m^3 (soluble) with an action level (AL) of 2.5 ug/m3 for insoluble and 0.5 ug/ m^3 for soluble. Hexavalent Chromium is considered a Human Carcinogen.

The precautions listed below shall be followed when exposed to Cr VI:

- Exposure assessments must be performed for workers who may be exposed to Cr VI above the AL.
- Avoid exposure by inhalation, skin and eye contact with fume, liquid and/or particulate Cr VI.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- 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.
- Review the fact sheet included as an attachment to this HSP.

Lead

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

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 elements of the CH2M HILL lead program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of lead and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Lead Exposure Training);* and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. 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;
- 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.

Portable Generator Hazards

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

- 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.
- Ensure the generator is grounded in accordance with the manufacturer's operation manual.
- 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.

Pressure Washing Operations

Below are the hazard controls and safe work practices to follow when working around or performing pressure washing.

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer's safety and operating instructions.
- Inspect pressure washer before use and confirm deadman trigger is fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches (1.1 meter) from the trigger to the tip and utilize greater than 10 degree tips.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

Slips, Trips and Falls

General

- Institute and maintain good housekeeping practices.
- Designate foot traffic paths in and out of sites, when necessary, to ensure paths are kept free from slip, trip, and fall hazards or to deter personnel from taking "shortcuts" where slip, trip, hazards may be.
- Mitigate icy conditions by keeping foot traffic paths clear of ice and snow.
- Watch footing as you walk to avoid trip hazards, animal holes, or other obstacles, especially in tall grassy areas.

Muddy Conditions

- Muddy conditions present a slipping hazard. Use mats or other similar surface to work from if footing cannot be stabilized.
- Take shortened steps across muddy areas.
- Use a walking staff or other similar means to assist with balance.

Steep Slopes/Uneven Ground/Rock and Vertical Slopes

- Be aware that escarpments can slough. Avoid these areas.
- Exercise caution in relying on rocks and trees/tree stumps to support yourself – many times they are loose.
- Whenever possible, switchback your way up/down steep areas, and maintain a slow pace with firm footing.
- Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls which can result in twisted or sprained ankles, knees, and backs.
- Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed.
- If steep terrain must be negotiated coordinate with RHSM to evaluate the need for ladders or ropes to provide stability.

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 sub contractor. Ensure the requirements in the referenced SOP are followed.

- 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 (12.2 meters) 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 (12.2 meters) away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.
- Traffic control training module on the VO shall be completed when CH2M HILL workers who work in and around roadways and who exposed to public vehicular traffic.

Utilities (underground)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted <u>before any intrusive subsurface activity</u> and must include at least the following elements:

1. A background and records assessment of known utilities or other subsurface obstructions.
2. Contacting and using the designated local utility locating service.
3. Conducting an independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions. *Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service above.*
4. A visual survey of the area to validate the chosen location.

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, then non-aggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator or other aggressive method is used.

Aggressive methods are never allowed within 2 feet of an identified high risk utility (see paragraph below).

Any deviation from these requirements must be approved by the Responsible HS Manager and the Project Manager.

Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities. For military installations, contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams and/or as-built drawings for the facility.

Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate.

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

Designated Local Utility Locating Service

Contact your designated local utility locating service (e.g., Dig-Safe, Blue Stake, One Call) to identify and mark the location of utilities. Call 811 in the US or go to www.call811.com to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions.

Independent Field Survey (Utility Locate)

The organization conducting the intrusive work (CH2M HILL or subcontractor) shall arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility locating service.

The independent field survey provider shall determine the most appropriate instrumentation/technique or combinations of instrumentation/techniques to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A CH2M HILL or subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to re-survey the area. Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, CH2M HILL or the subcontractor shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations:
- Having qualified staff available and instrumentation to conduct the locate;
- Agreeing to document the survey and clearances in writing.
- Should any of the above criteria not be met, CH2M HILL or subcontractor must arrange for an alternate independent utility locate service to perform the survey.
- The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SC, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

Visual Assessment before and during Intrusive Activities

Perform a “360 degree” assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

The visual survey shall include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by non-aggressive means such as air or water knifing, hand digging, or human powered hand augering. Non-conductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by non-aggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

Intrusive Activities within 2 feet of an Underground Utility

Use non-aggressive methods (hand digging, vacuum excavation, etc.) to perform intrusive activities within 2 feet of a high risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair/replace). Hazardous utilities shall be de-energized whenever possible.

Spotter

A spotter shall be used to monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, refusal of auger or excavating equipment). If any suspicious conditions are encountered stop work immediately and contact the PM or RHSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (e.g., air horn, hand signals).

Utilities (overhead)

Proximity to Power Lines

It must be determined whether equipment operations including, positioning, and traveling will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.

Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10 (3.0)
50-200	15 (4.6)
201-350	20 (6.1)
351-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)
Over 1000	Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

Vinyl Chloride

(Reference CH2M HILL, SOP HSE-512, *Vinyl Chloride*)

Vinyl Chloride is considered a "Confirmed Human Carcinogen." Vinyl Chloride has a mild, sweet, chloroform-like odor.

CH2M HILL is required to control employee workplace exposure to vinyl chloride when personal exposures are at or above 1.0 ppm as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the Occupational Safety and Health Administration (OSHA) Vinyl Chloride standard, 29 CFR 1910.1017. The elements of the CH2M HILL vinyl chloride program include the following:

- Exposure monitoring
- Methods of control, including personal protective equipment (PPE) and respirators
- Medical surveillance
- Training on hazards of vinyl chloride and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Vinyl Chloride)*
- Record keeping requirements

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. 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.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Review the fact sheet included as an attachment to this HSP.

Working Around Material Handling Equipment

When CH2M HILL personnel are exposed to material handling equipment, the following safe work practices/hazard controls shall be implemented:

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers and equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.
- Wear a high visibility safety vest or high visibility clothing

10.0 Physical Hazards and Controls

Physical hazards include exposure to temperature extremes, sun, noise, and radiation. If you encounter a physical hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made.

Noise

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

CH2M HILL is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 85 dBA or a noise dose of 50% must participate in the Hearing Conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online Noise Training Module located on CH2M HILL's virtual office.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner and a copy of the OSHA standard 29 CFR 1910.95 shall be posted in the workplace.

Ultraviolet Radiation (sun exposure)

Health effects regarding ultraviolet (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. Implement the following controls to avoid sunburn.

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.
- No sunscreen provides 100 percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

Temperature Extremes

(Reference CH2M HILL SOP HSE-211, *Heat and Cold Stress*)

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress;
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes (see following sections); and
- Communicating any concerns regarding heat and cold stress to their supervisor or SC.

10.1.1 Heat

Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least two continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in three to four weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level; such as during a heat wave.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

SYMPTOMS AND TREATMENT OF HEAT STRESS

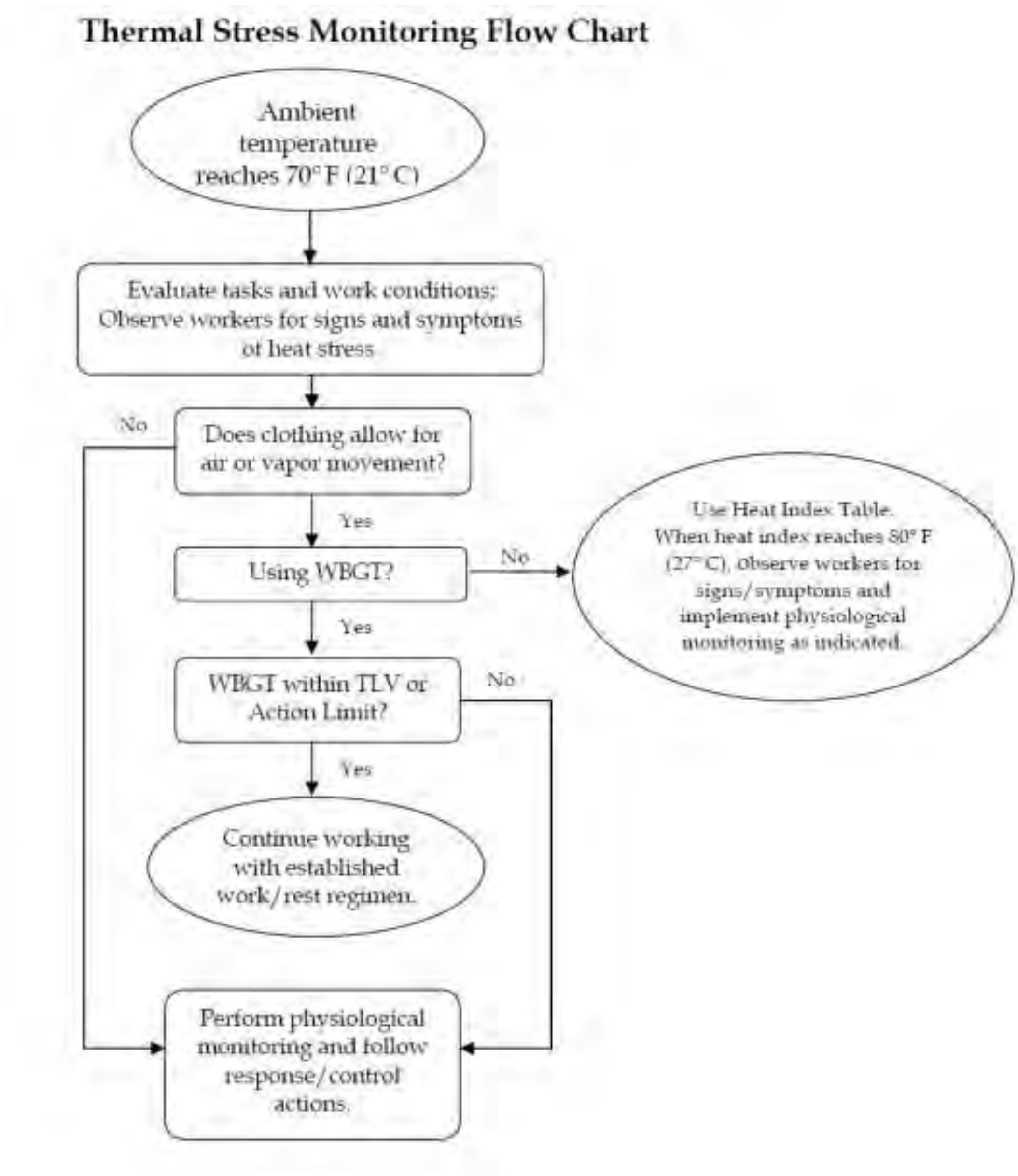
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during 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!

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- 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 to site work conditions by slowly increasing workloads; for example, do not begin site work with extremely demanding activities. Closely monitor employees during their first 14 days of work in the field.
- Supervisors and SCs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their co-workers.
- Effective communication must be maintained with employees throughout the work shift either by voice, observation, or electronic device.
- 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 shade to protect personnel against radiant heat (sun, flames, hot metal).
- Use portable fans for convection cooling or in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
- Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms, of heat-relatedness illnesses, precautions to measures and emergency procedures to follow as described in this plan.
- Observe one another for signs of heat stress. PREVENTION and communication is key.

Thermal Stress Monitoring



Thermal Stress Monitoring – Permeable or Impermeable Clothing

When **permeable work clothes** are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80° F (27° C) [see Heat Index Table below], or sooner if workers exhibit symptoms of heat stress indicated in the table above. These heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (e.g., clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted when the ambient temperature reaches 70° F (21° C) or sooner when climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing, or workers exhibit symptoms of heat stress

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.

Source: National Weather Service

Physiological Monitoring and Associated Actions

For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in the Heat Index Table.

For employees wearing impermeable clothing, physiological monitoring should begin initially at a 15 minute interval, then if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol below.

The following physiological monitoring protocol below, using either radial pulse or aural temperature, will occur when the heat index is 80 degrees F or greater (or when personnel exhibit signs of heat stress), the following will be performed:

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (e.g. 180 – 35 year old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.
- The heart rate after one minute rest period should not exceed 120 beats per minute (bpm).
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, 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 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 120 bpm after the FIRST minute into the rest period.

Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.

- If the oral or aural temperature exceeds 99.6° F (37.6 ° F) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6 ° F (37.6° C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field, however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.
- Use the form attached to this HSP to track workers' measurements and actions taken.

Procedures for when Heat Illness Symptoms are Experienced

- **Always** contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a CH2M HILL worker, contact the occupational physician at 1-866-893-2514 and immediate supervisor.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow precautions under the emergency medical treatment of this HSP.
- Follow the Incident Notification, Reporting, and Investigation section of this HSP.

10.1.2 Cold

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

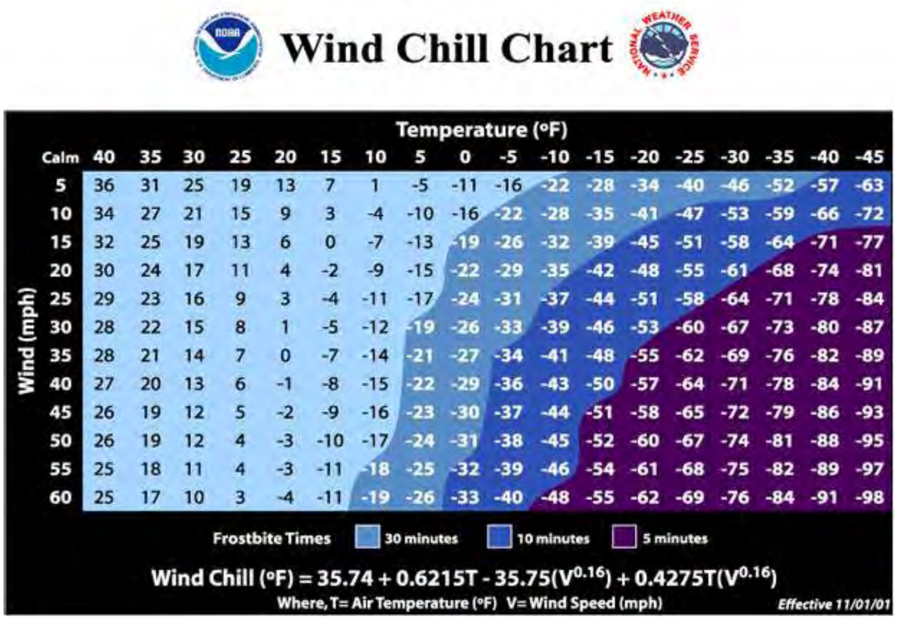
Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- 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 wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.


Wind Chill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

(Calm column header)

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Radiological Hazards

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

Hazards	Controls
None Known	None Required

11.0 Biological Hazards and Controls

Biological hazards are everywhere and change with the region and season. During project planning stages, ask the site Point of Contact if there are insect or other biological hazards have been noted in any of the work sites.

Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the occupational nurse at 1-866-893-2514.

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.

Precautions include:

- Watching for and avoiding 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 a buddy. When working at a remote location, ensure that first-aid kits contain over-the-counter allergy and itch medication (e.g., Benadryl, Claritin, etc) as well as other over-the-counter medications that may not be available to aid in symptom treatment.
- If bees or other stinging insects are known to be present, determine whether additional protective clothing should be donned before entering/working in brushy areas.
- Before entering a heavily vegetated or brushy area, observe the area for several minutes to see if bees or other stinging insects may be present. If nests or individual insects are observed, retreat and inquire whether a specialist or a client service can be contacted to clear the area before work proceeds.
- Consider if heavy-weight clothing or tyvek, or head netting would provide additional protection in areas where wasps/bees are known or suspected. Be aware of heat stress conditions additional clothing may cause.
- Use insect repellent on clothing. Wear light-colored clothing and remove bright reflective safety-colored clothing if not working near a roadway as these may attract the wasps.
- Wear fragrance-free or lightly-scented sunscreen, and body lotions. Bees are attracted to sweet scents. Avoid using floral scented soaps, shampoos, or conditioners.
- Move slowly and calmly through vegetated areas and try to avoid major disturbance of vegetation as wasps/bees often react to aggressive movement.
- If you encounter a wasp, back away slowly and calmly, do not run or swat at the insect. Wait for it to leave, or gently move or brush it off gently with a piece of paper or other light object. Do not use your hand.

If you are stung, contact the occupational nurse at 1-866-893-2514, no matter how minor it may seem. If a stinger is present, remove it as soon as possible using something with a thin, hard edge (e.g., credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol or soap and water. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

Bird Droppings

Large amounts of bird droppings may present a disease risk. The best way to prevent exposure to fungus spores in bird droppings is to avoid disturbing it. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease.

If disturbing the droppings or if removal is necessary to perform work, follow these controls:

- Use dust control measures (wetting with water or HEPA vacuuming) for all activities that may generate dust from 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.

Fire Ants

There are several types of fire ants in the United States that can cause painful bites and allergic reactions. Fire ants aggressively defend their nests by stinging several times after climbing on their victims. Large ant mounds are easily visible, but there can be smaller mounds or nests with little "worked" soil that can be stepped on inadvertently. They can also be under rocks, wood or other debris. Implement the following when fire ants are observed:

- Be aware of fire ants and take care not to stand on ant nests;
- Use insect repellents on clothing and footwear to temporarily discourage ants from climbing; and
- Tuck pants into socks.

If stung, get away from the area you are standing on, briskly brush off ants—wash affected area with soap. Call the occupational nurse.

Giant Hogweed

Giant hogweed is a noxious weed that has become established in New York, Pennsylvania, Ohio, Maryland, Oregon, Washington, Michigan, Virginia, Vermont, New Hampshire Maine, and adjacent areas of Canada, but can be spread to surrounding areas.

Its sap, in combination with moisture and sunlight, can cause phytophotodermatitis—a serious skin inflammation and severe eye irritation leading to blindness. Contact between the skin and the sap of this plant occurs either through brushing against the bristles on the stem or breaking the stem or leaves. Eye exposure to the sap can occur during the breaking of the stems (during clearing/grubbing). Heat, sunlight, and moisture worsen the skin reaction.

Giant hogweed is a biennial or perennial which can grow up to 12 feet (approximately 3.5 meters) or more. Its hollow, ridged stems grow 2-4 inches (5-10 cm) in diameter and have dark reddish-purple blotches. Its large compound leaves can grow up to five feet (1.5 meters) wide. Its white flower heads can grow up to 2.5 feet (approximately 1 meter) in diameter.

Symptoms of exposure include initial itching and redness, then painful blisters form within 48 hours with the area becoming dark and pigmented. Long-term effects include scarring, sensitivity of the affected area to sunlight, temporary or permanent blindness if it gets into the eyes.

As with all hazardous plants, recognition and avoidance is key. Do not touch any portion of the plant. Become familiar with the identity of these plants (see below). 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 cold water immediately.   Keep exposed area away from sunlight for 48 hours. Contact the occupational nurse immediately.


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 N,N-diethyl-meta-toluamide (DEET) since mosquitoes may bite through thin clothing;
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET. Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands; and
- 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.

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 to 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.

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. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but plants lose its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). 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, seek medical attention.

Poison Ivy

Poison Sumac

Poison Oak

Contamination with poison ivy, sumac or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed).
- Contact with clothing that has been contaminated with the oil.
- Contact from removing shoes that have been contaminated (shoes are coated with urishol oil).
- Sitting in a vehicle that has become contaminated.
- Contact with any objects or tools that have become contaminated.
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing.

If you must work on a site with poison ivy, sumac or oak the following precautions are necessary:

- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.
- All tools used in the poison ivy, sumac or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.
- Personal protective equipment, including Tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.

- As soon as possible following the work, shower to remove any potential contamination. Any body part with suspected or actual exposure should be washed with Zanfel, Tecnu or other product designed for removing urishiol. If you do not have Zanfel or Tecnu wash with cold water. Do not take a bath, as the oils can form and invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy and sumac contamination. Check with the closest CH2M HILL warehouse to see if these products are available. Follow all directions for application.

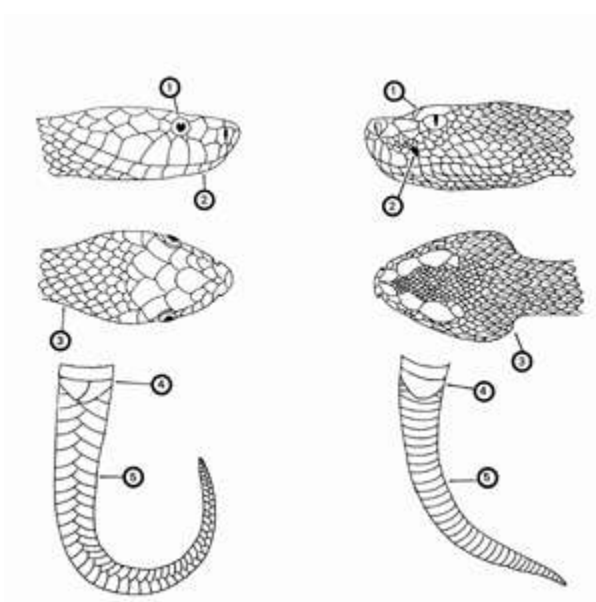
If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor and the occupational nurse 1-866-893-2514.

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 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. Below is a guide to identifying poisonous snakes from non-poisonous snakes.

Identification of Poisonous Snakes

Major Identification Features Non-venomous Snake	Major Identification Features Venomous Snake
1. Round pupils	1. Elliptical pupils
2. No sensing pit	2. Sensing pit between eye and nostril
3. Head slightly wider than neck	3. Head much wider than neck
4. Divided anal plate	4. Single anal plate
5. Double row of scales on the underside of the tail	5. Single scales on the underside of the tail



Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in the United States. It varies in size in shape, but the distinguishing mark is the violin shape on its body. They are typically non-aggressive. Keep an eye out for irregular, pattern-less webs that sometimes appear almost tubular built in a protected area such as in a crevice or between two rocks. The spider will retreat to this area of the web when threatened.

The Black Widow, Red Widow and the Brown Widow are all poisonous. Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale 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.

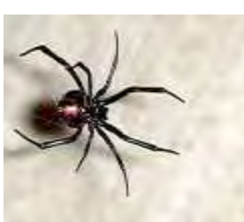
Hazard Controls

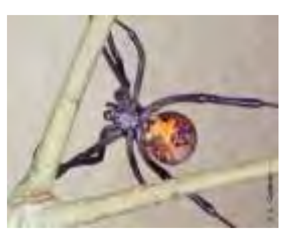
- Inspect or shake out any clothing, shoes, towels, or equipment before use.
- Wear protective clothing such as a long-sleeved shirt and long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials.
- Minimize the empty spaces between stacked materials.
- Remove and reduce debris and rubble from around the outdoor work areas.
- Trim or eliminate tall grasses from around outdoor work areas.
- Store apparel and outdoor equipment in tightly closed plastic bags.
- Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores.

If you think you have been bit by a poisonous spider, immediately call the occupational nurse at 1-866-893-2514 and follow the guidance below:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood;
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite;
- Elevate the bitten area, if possible;
- Do not apply a tourniquet, do not try to remove venom; and
- Try to positively identify the spider to confirm its type. If the spider has been killed, collect it in a plastic bag or jar for identification purposes. Do not try to capture a live spider—especially if you think it is a poisonous spider.

Black Widow Red Widow Brown Widow Brown Recluse






Stinging Caterpillars

If you find a fuzzy or spiny caterpillar which inflicts a painful sting upon contact, you probably have found a stinging caterpillar. The intensity of the irritation, whether it is caused by “venomous” or “irritating” hairs or barbed hooks and/or sharp, hollow spines, will be dependent on the species of caterpillar and the individual’s sensitivity. Reaction ranges from mild, with local reddening, swelling and itching, to rather severe depending on the susceptibility of the individual, the tenderness of the skin and the place of contact, and may even require hospital care for unusually sensitive persons. Hypersensitive persons may experience symptoms and/or allergic reactions, e.g., severe swelling, nausea, difficulty in breathing and generalized systemic reaction.

Saddleback caterpillars are an example of a stinging caterpillar. These are prevalent along the east coast from Florida to Massachusetts. They are most active within August and September. Contact with this caterpillar may produce a rash and a high fever.

Stings usually occur when people brush against a caterpillar or attempt to remove it from their body or their clothing. Only a few of the many thousand caterpillars can sting.

Avoid handling any hairy caterpillars or material with which they have been in contact. Suitable protective clothing, including safety glasses and gloves should always be worn if handling these insects are necessary. Remember, dead caterpillars can still cause painful stings. Most caterpillar infestations are usually short lived and should be left undisturbed, unless they are causing a problem. All the moth larvae are leaf feeders, which is where they can be found. Infested shrubs and trees may be vacuumed or sprayed or dusted to reduce or eliminate the caterpillars. Contact the RHSM if caterpillars are abundant and cannot be avoided to determine if spraying foliage or removal of caterpillars is be necessary.

If you are stung, call the occupational nurse at 1-866-893-2514. Applying tape, such as adhesive or duct or cellophane transparent and pulling it off may be helpful in removing broken spines. Washing the affected skin area thoroughly with soap and water may also help to remove insect hairs/spines and/or irritating venom. Prompt application of an ice pack and a baking soda poultice may help to reduce pain and prevent swelling.

Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. 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 (6.4 mm) in size.

In some geographic areas exposure is not easily avoided. 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.

Where site conditions (vegetation above knee height, tick endemic area) or when tasks (having to sit or kneel in vegetation) diminish the effectiveness of the other controls mentioned above, bug-out suits (check with your local or regional warehouse) or Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Avoid habitats where possible, reduce the abundance through habitat disruption or application of acracide. If these controls aren’t feasible, contact your local or regional warehouse for preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See Tick Fact Sheet attached to this HSP for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet, and call the occupational nurse at 1-866-893-2514.

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

Be sure to complete an Incident Report (either use the Hours and Incident Tracking System [HITS] system on the VO) if you do come in contact with a tick.

12.0 Contaminants of Concern

The table below summarizes the potential contaminants of concern (COC) and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). These concentrations were used to determine engineering and administrative controls described in the "Project-Specific Hazard Controls" section of this HSP, as well as PPE and site monitoring requirements.

Contaminants of Concern					
Contaminant	**Location and Maximum[a] Concentration (ppm)**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
Arsenic	GW: SB: SS:	0.01 mg/m^3	5 mg/ m^3 as As Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Benzene	GW: SB: SS:	0.5 ppm	500 Ca	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression	9.24
Cadmium	GW: SB: SS:	0.005 mg/m^3	9 mg/ m^3 as Cd Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Chromium (as Cr(II) & Cr(III))	GW: SB: SS:	0.5 mg/m^3	25 mg/m^3	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Hexavalent Chromium	GW: SB: SS:	5 ug/m^3 (insoluble) 1 ug/m^3 (soluble)	15 mg/m^3 as Cr (VI)	Acute: Coughing, sneezing, chest pain, breathing difficulty, itching and burning sensation to skin and lungs. Long term (Chronic): Allergic (asthma like symptoms) respiratory reaction, skin and eye irritation, nosebleeds, contact dermatitis, allergic like skin reaction, ulceration and perforation of the nasal septum.	NA
Lead	GW: SB: SS:	0.05 mg/m^3	100 mg/m^3 as Pb	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
Methylene Chloride	GW: SB: SS:	25 ppm	2300 Ca	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]	11.32
PCBs (Limits as Aroclor 1254)	GW: SB: SS:	0.5 mg/m^3	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK
PNAs (Limits as Coal Tar Pitch)	GW: SB: SS:	0.2 mg/m^3	80 Ca	Dermatitis and bronchitis	UK
1,1,2,2-Tetrachloroethane (Tetrachlorethane)	GW: SB: SS:	1 ppm	100 Ca	Nausea, vomiting, abdominal pain, finger tremors, jaundice, hepatitis, liver tenderness, monocytosis, kidney damage, dermatitis	11.10
Tetrachloroethylene (PCE)	GW: SB: SS:	25 ppm	150 Ca	Eye, nose, and throat irritation; nausea; flushed face and neck; vertigo; dizziness; sleepiness; skin redness; headache; liver damage	9.32
1,1,2-Trichloroethane	GW: SB: SS:	10 ppm	100 Ca	Eye and nose irritation, CNS depression, liver damage, dermatitis	11.00
Trichloroethylene (TCE)	GW: SB: SS:	10 ppm	1,000 Ca	Headache, vertigo, visual disturbance, eye and skin irritation, fatigue, giddiness, tremors, sleepiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury	9.45

Contaminants of Concern					
Contaminant	**Location and Maximum[a] Concentration (ppm)**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
Vinyl Chloride	GW: SB: SS:	1 ppm	NL Ca	Weakness, abdominal pain, gastrointestinal bleeding, enlarged liver, pallor or cyanosis of extremities	9.99
Vinylidene Chloride (1,1-dichloroethylene)	GW: SB: SS:	5 ppm	NL Ca	Eye, skin, and throat irritation; dizziness; headache; nausea; difficult breathing; liver and kidney dysfunction; pneumonitis	9.65

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (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.

eV = electron volt
mg/kg = milligram per kilogram
mg/m^3 = milligrams per cubic meter
ug/m^3 = micrograms per cubic meter

Potential Routes of Exposure		
Dermal: Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of PPE.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.	**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).

13.0 Site Monitoring

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

When performing site monitoring, record all the information, such as in a field logbook. Note date and time, describe monitoring location (for example, in breathing zone, at source and site location), and what the reading is. If any action levels are reached, note it in the field logbook and note the action taken.

Exposure records (air sampling) must be preserved for the duration of employment plus thirty years. Ensure that copies of the field log book are maintained in the project file.

Copies of all project exposure records (e.g., copies of field logbook pages where air monitoring readings are recorded and associated calibration) shall be sent to the regional SPA for retention and maintained in the project files.

Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels[a]	Action to be Taken when Action Level reached	Frequency [b]	Calibration
Toxic Gas Monitor: MultiRAE Plus with 10.6 eV lamp (VOCs, O_2, LEL, CO,, H_2S)	All Intrusive and Sampling Activities	<1 ppm	Level D	Continuous	Daily
		≥1 ppm, sustained	Monitor with vinyl chloride (VC) and benzene detector/colorimetric tubes, if negative for VC and Bezene, see next PID action level below. If positive for VC or Bezne, see detector tube action levels below for upgrade in respiratory protection.		
		1-5 ppm	Level C		
		≥5 ppm sustained (no benzene or vinyl chloride present)	Contact RHSM to determine whether source can be identified as to the specific chemical and determine whether upgrade in respiratory protection is necessary.		
			Level B, Not Authorized		
CGI: MultiRAE	All Intrusive Activities, groundwater sampling	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Initially and periodically during tasks	Daily
O2: MultiRAE	All Intrusive Activities, groundwater sampling	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	Initially and periodically during tasks	Daily
Dust Monitor: DataRAM or equivalent	Intrusive Work	<1.0 mg/m^3	Continue work	Continuously during intrusive operations	Zero Daily
		≥ 1.0 mg/m^3	Suspend work and implement dust suppression. If dust cannot be controlled to under this action level, contact RHSM for upgrade in respiratory protection.		
Detector Tube: Benzene specific 0.5/c (0.5 to 10 ppm range) with pre-tube, or equivalent	When PID is ≥1 ppm at sites listed above	<0.5 ppm 0.5-25 ppm >25 ppm	Level D Level C Level B	Initially and periodically when PID/FIB >1 ppm	Not applicable

Instrument	Tasks	Action Levels[a]	Action to be Taken when Action Level reached	Frequency [b]	Calibration
Colormetric Tube: Vinyl chloride specific (0.5 to 30 ppm range) with pre-tube, or equivalent	When PID is ≥1 ppm at sites listed above	<0.5 ppm 0.5-10 ppm >10 ppm	Level D Level C (verify cartridge availability/compatibility) Level B	Initially and periodically when PID/FID >1 ppm	Not applicable
Noise-Level Monitor [d]	Heavy Equipment Operations (Drilling, Excavator, Generator)	<85 dB(A) 85-120 dB(A) 120 dB(A)	No action required Hearing protection required Stop; re-evaluate	Initially and periodically during task	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; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.
[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry.
[d] Noise monitoring and audiometric testing also required.

Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: MultiRAE, 11.7	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
Dust Monitor: DataRAM	Dust-free air	Not applicable	0.00 mg/m^3 in "Measure" mode	Dust-free area OR Z-bag with HEPA filter
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL $\pm$ 5% LEL	1.5 lpm reg direct tubing
Sound Level Meter	Refer to Instrument Manual on site,			

Calibrate air monitoring equipment daily (or prior to use) in accordance with the instrument's instructions. Document the calibration in the field logbook (or equivalent) and include the following information:

- Instrument name
- Serial Number
- Owner of instrument (for example, CH2M HILL, HAZCO)
- Calibration gas (including type and lot number)
- Type of regulator (for example, 1.5 lpm)
- Type of tubing (for example, direct or T-tubing)
- Ambient weather condition (for example, temperature and wind direction)
- Calibration/instrument readings
- Operator's name and signature
- Date and time

Integrated Personal 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 RHSM immediately if these contaminants are encountered.

14.0 Personal Protective Equipment

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

Required 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 that approved this plan. Below are items that need to be followed when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE;
- Employees must be trained in the limitations of 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; and
- 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 Personal Protective Equipment Requirements[a]

Task	Level	Body	Head	Respirator [b]
-General Site Entry -Surveying/Utility Locating -Oversight of subcontractors (if outside the exclusion zone)	D	Work clothes; safety toed leather work boots and gloves Tyvek or Bug-Out Suits when needed to protect against biological hazards (see memo as an attachment to this HSP for specific PPE specifications) **Special**: If walking in knee-high or higher vegetation, snake chaps are required.	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
IDW Management Groundwater Sampling Drilling (DPT) Test Pitting	Modified D	Work Clothes or Coveralls. SC to determine body protection based on potential contact with site contaminants. If outer layer of personal clothing cannot be kept clean, then outer cotton coveralls or uncoated Tyvek coveralls shall be worn. (Polycoated Tyvek when there is potential to contact contaminated groundwater or free liquids from drums.)	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required

Project-Specific Personal Protective Equipment Requirements[a]

Task	Level	Body	Head	Respirator [b]
Soil Sampling	Modified D	**Coveralls:** Uncoated 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] 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 107-2010 high-visibility safety vests.	Work near vehicular traffic ways or earth moving equipment.	
Equipment decontamination if using pressure washer	Modified D with splash protection	**Coveralls:** Polycoated Tyvek® **Boots:** 16-inch-high steel-toed rubber boots **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] over safety glasses with side shields or splash goggles Ear protection [d]	None required.
Tasks requiring upgrade based on air monitoring–contact RHSM prior to any 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 Advantage, Ultratwin or equivalent; [organic vapor, GME or equivalent] [e].
Tasks requiring upgrade	B	**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	Positive-pressure demand self-contained breathing apparatus (SCBA); MSA Ultralite, or equivalent.

Reasons for Upgrading or Downgrading Level of Protection (with approval of the RHSM)

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 in the "Site Monitoring" section 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 (1 meter) or less without shouting.
[e] See cartridge change-out schedule.
[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.

15.0 Worker Training and Qualification

CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, *Training*)

15.1.1 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

15.1.1.1 Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal (TSD) operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with 29 CFR 1910.120.

15.1.1.2 Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received three days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

15.1.1.3 Refresher Training

General site workers and TSD workers shall receive 8-hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

15.1.1.4 Eight-Hour Supervisory Training

On site management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing such operations. Employees designated as Safety Coordinator – Hazardous Waste are considered 8-hour HAZWOPER Site Safety Supervisor trained.

15.1.2 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the American Red Cross Association or National Safety Council shall be administered by a certified trainer. A minimum of two personnel per active field operation will have first aid and CPR training. Bloodborne pathogen training located on CH2M HILL's Virtual Office is also required for those designated as first aid/CPR trained.

15.1.3 Safety Coordinator Training

SCs are trained to implement the HSE program on CH2M HILL field projects. A qualified SC is required to be identified in the site-specific HSP for CH2M HILL field projects. SCs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SCs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection, excavation).

15.1.4 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed site-specific training that will address the contents of applicable HSPs, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. This training allows field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

15.1.5 Project-Specific Training Requirements

Project-specific training for this project includes:

- Training on this HSP and AHAs
- Training Subcontractor AHAs
- Qualified Excavator (backhoe) operator (Subcontractor)
- Qualified drill rig operator (Subcontractor)
- If respirators are necessary, personnel must be current with and have documentation of respirator training within the past 12 months and current fit test for make and model of respirator to be worn. Level B qualified/trained personnel if Level B upgrade is required

The training listed below is required computer-based training located on CH2M HILL's Virtual Office (VO).

- Arsenic, Benzene, Cadmium, Hexavlaent Chromium, Lead and Methylene Chloride Training
- Electrical safety
- Lifting training (part of new employee orientation training)
- Noise
- Vinyl chloride

16.0 Medical Surveillance and Qualification

(Reference CH2M HILL SOP HSE-113, *Medical Surveillance*

All site workers participating in hazardous waste operations or emergency response (HAZWOPER) will maintain an adequate medical surveillance program in accordance with 29 CFR 1910.120 or 29 CFR 1926.65 and other applicable OSHA standards. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

Hazardous Waste Operations and Emergency Response

CH2M HILL personnel expected to participate in on site HAZWOPER tasks are required to have a current medical qualification for performing this work. Medical qualification shall consist of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site, including any recommended limitations on the employee's assigned work. The physician's written opinion shall state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

Job or Site-Specific Medical Surveillance

Due to the nature of hazards for a particular job or work site, specialized medical surveillance may be necessary. This surveillance could include biological monitoring for specific compounds, or specialized medical examinations.

No site-specific medical surveillance is required at this time.

Respirator User Qualification

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification shall consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134.

Hearing Conservation

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 and exposed to noise levels in excess of the 85dBA time-weighted average shall be included in a hearing conservation program that includes annual audiometric testing.

17.0 Site-Control Plan

Site-Control Procedures

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

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SC will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, 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; and
  - Two-way radio or cellular telephone if available.
- Establish offsite communication.
- Establish and maintain the "buddy system."

Remediation Work Area Zones

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

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

17.1.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

17.1.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

17.1.3 Exclusion Zone

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed.

17.1.4 Other Controlled Areas

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape or rope) as necessary and posted with appropriate signage.

18.0 Decontamination

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

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. 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.

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.

Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination;
- Do not directly handle or touch contaminated materials;
- Make sure there are no cuts or tears in PPE;
- Fasten all closures in suits and cover them with duct tape, if appropriate;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contamination, where possible;
- Do not eat or drink in contaminated work areas;
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas;
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work;
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated;
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary; and
- Minimize the amount of tools and equipment necessary in contaminated areas.

Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned/decontaminated when it is brought out of the EZ.

Decontamination During Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

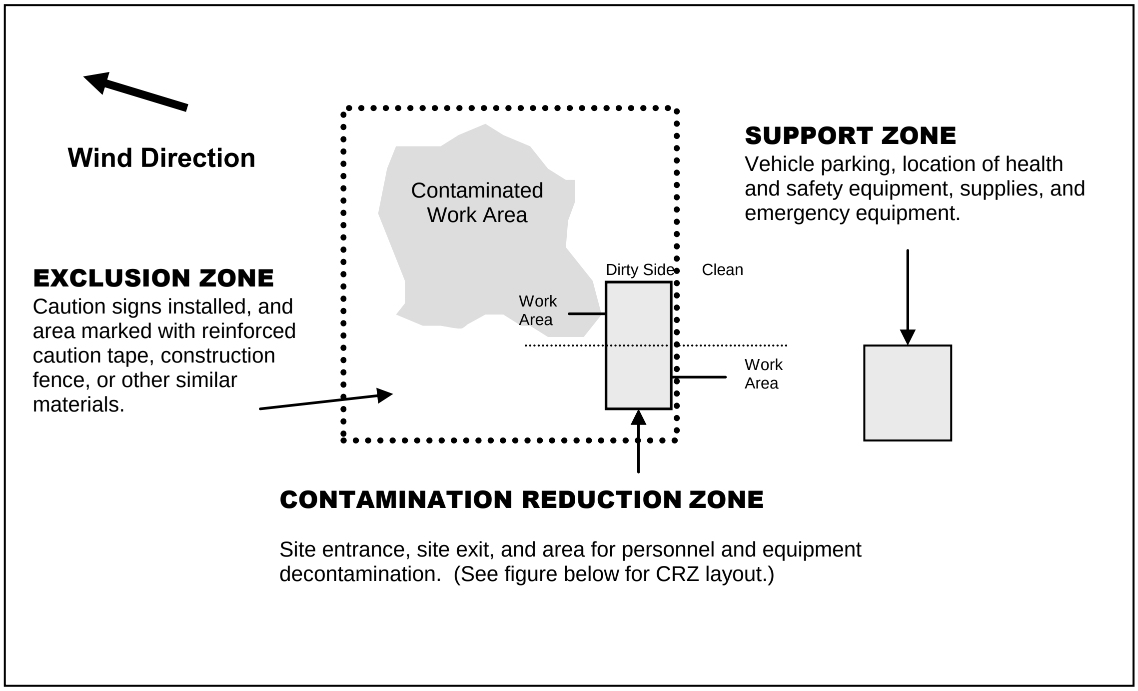
Waste Collection and Disposal

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the project plans.

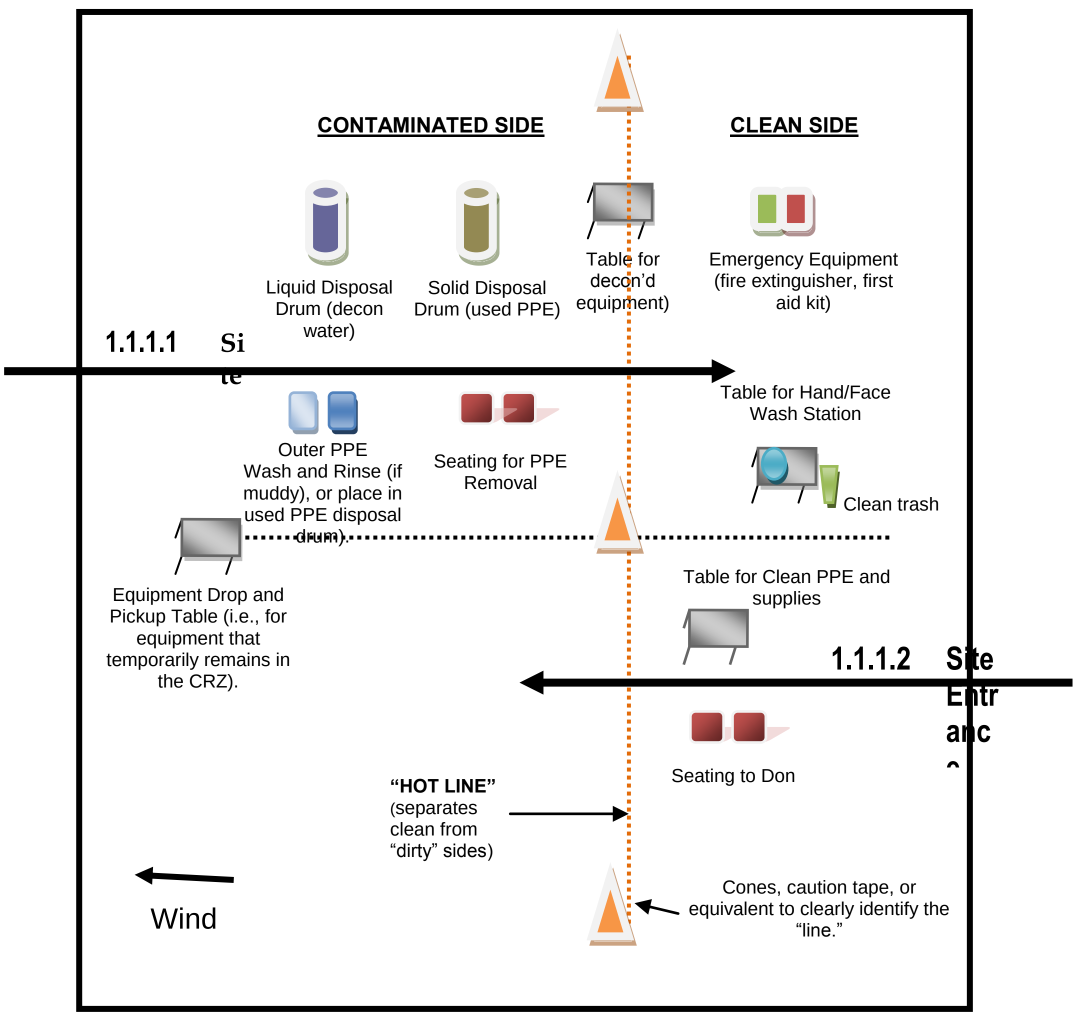
Diagram of Personnel-Decontamination Line

The following figure 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.

Work Area - Set up appropriately based on wind direction



Typical Contamination Reduction Zone



19.0 Emergency Response Plan

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

Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SC or designee, 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. Pre-Emergency Planning activities performed by the ERC include:

- Review the facility emergency and contingency plans where applicable;
- Determine what onsite communication equipment is available (two-way radio, air horn);
- Determine what offsite communication equipment is needed (nearest telephone, cell phone);
- Confirm and post the "Emergency Contacts" page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated;
- 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;
- 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. This may include a "tabletop" exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year;
- Brief new workers on the emergency response plan; and
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

Emergency Equipment and Supplies

The ERC shall ensure the following emergency equipment is on the site. Verify and update the locations of this equipment as needed. The equipment will be inspected in accordance with manufacturer's recommendations. The inspection shall be documented in a field logbook or similar means to be kept in the project files.

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	Drill rig/Excavator/Support zone
First aid kit	Field vehicle/support zone
Eye wash	Field vehicle/support zone
Potable water	Field vehicle/support zone
Bloodborne-pathogen kit	Field vehicle/support zone
Additional equipment (specify):	Cell phone/On person

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; and
- 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 the “Incident Notification, Reporting, and Investigation” section of this HSP.

Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or 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 the “Emergency Contacts” page located in this section.
- 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 using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to this HSP.
- 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 the "Incident Notification, Reporting and Investigation" section of this HSP.

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.

Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop--seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

19.1.1 Tornado Safety

Recognizing imminent tornado signs include seeing an unusually dark sky, possibly with some green or yellow clouds. You may hear a roaring or rumbling sound like a train, or a whistling sound like a jet. Large hail may also be falling. You may be able to see funnels, or they may be hidden by rain or hail.

Listen to your radio for tornado warnings during bad thunderstorms. If a tornado warning is issued, don't panic. Instead, listen and look. Quickly but calmly follow directions for getting to shelter.

Take cover. Indoors you should go down into the basement and crouch down under the stairs, away from windows. Do not take an elevator. If you can't get to a basement, go into a closet or bathroom and pull a mattress over you or sit underneath a sturdy piece of furniture on the ground floor near the center of the building. Pull your knees up under you and protect your head with your hands.

A bad place to be in a tornado is in a building with a large freestanding roof such as a gymnasium, arena, auditorium, church or shopping mall. If you are caught in such a building, take cover under something sturdy.

More than half of tornado deaths occur in mobile homes. If a tornado threatens, get out and go to a building with a good foundation, or lay down in a ditch away from vehicles and other objects.

If you are driving, get to a shelter, lie down in a ditch or seek cover up under the girders of an overpass or bridge. Stay as close to the ground as you can. Protect your head and duck flying debris.

Stay away from metal and electrical equipment because lightning accompanies tornadoes.

If you have time before the tornado strikes, secure objects such as garbage cans and lawn furniture which can injure people. While most tornado damage is a result of the violent winds, most injuries and deaths actually result from flying debris.

Emergency Contacts

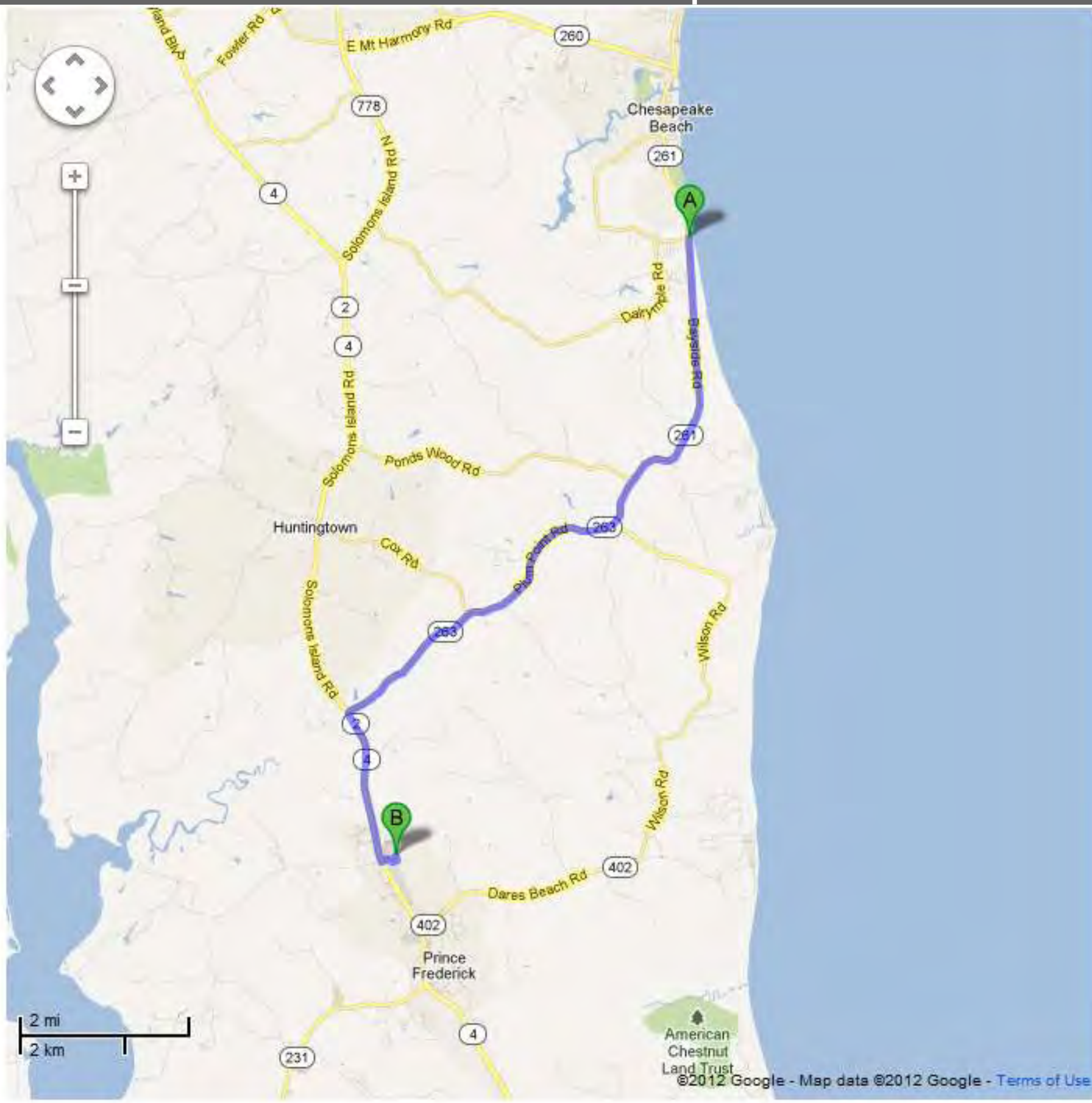
24-hour CH2M HILL Injury Reporting– 1-866-893-2514

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

Medical Emergency – 911 **Facility Medical Response #:** **Local Ambulance #:**	**CH2M HILL- Medical Consultant** WorkCare Dr. Peter Greaney M.D. 300 S. Harbor Blvd, Suite 600 Anaheim , CA 92805 800-455-6155/866-893-2514 714-978-7488
Fire/Spill Emergency – 911 **Facility Fire Response #:** **Local Fire Dept #:**	**CH2M HILL Director – Health, Safety, Security & Environment** Andy Strickland/DEN (720) 480-0685 (cell) or (720) 286-2393 (office)
Security & Police – 911 **Facility Security #:** **Local Police #:**	**CH2M HILL Responsible Health and Safety Manager (RHSM)** Name: Mark Orman Phone: 414-847-0597
Utilities Emergency Phone Numbers Water: 1-800-257-7777 Gas: 1-800-257-7777 Electric: 1-800-257-7777	**CH2M HILL Human Resources Department** Phone: Employee Connect toll-free number 1-877-586-4411 (U.S. and Canada)
CH2M HILL Project Manager Name: Jeff Woodward Phone: 703-376-5293	**CH2M HILL Worker's Compensation:** Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: (720)891-5382
CH2M HILL Safety Coordinator (SC) Name: Andy Bogdanski Phone: 703-376-5038	**Media Inquiries Corporate Strategic Communications** Name: John Corsi Phone: (720) 286-2087
CH2M HILL Project Environmental Manager Name: Nancy Ballantyne Phone: 720-286-5561	**Automobile Accidents** Rental: Jennifer Rindahl/DEN: 720-286-2449 CH2M HILL owned vehicle: Linda George/DEN: 720-286-2057
Federal Express Dangerous Goods Shipping Phone: 800/238-5355	**CHEMTEL (hazardous material spills)** **Phone: 800/255-3924**
Facility Alarms: TBD	Evacuation Assembly Area(s): TBD daily by SC

Facility/Site Evacuation Route(s): TBD daily by SC

Directions to Local Hospital



A 5813 Bayside Rd, Chesapeake Beach, MD 20732

261	1. Head **south** on **MD-261/Bayside Rd** toward **Summer City Blvd** About 6 mins	go 3.9 mi total 3.9 mi
263	2. Continue straight onto **MD-263 W/Plum Point Rd** About 6 mins	go 4.1 mi total 8.0 mi
2	3. Turn left onto **MD-2 S/MD-4 S/Solomons Island Rd** About 3 mins	go 1.9 mi total 9.9 mi
	4. Turn left onto **Hospital Rd** About 1 min	go 397 ft total 10.0 mi
	5. Take the 2nd right to stay on **Hospital Rd** Destination will be on the right	go 0.2 mi total 10.1 mi

B 106 Hospital Rd, Prince Frederick, MD 20678

20.0 Spill Containment Procedures

CH2M HILL and subcontractor personnel working at the project site shall be knowledgeable of the potential health, safety and environmental concerns associated with petroleum and other substances that could potentially be released at the project site.

The following is a list of criteria that must be addressed in CH2M HILL's or the subcontractor's plans in the event of a spill or release. In the event of a large quantity spill notify emergency services. Personnel discovering a spill shall (only if safe to do so):

- Stop or contain the spill immediately (if possible) or note source. Shut off the source (e.g., pump, treatment system) if possible. If unsafe conditions exist, then leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. The SC shall be notified immediately;
- Extinguish sources of ignition (flames, sparks, hot surfaces, cigarettes);
- Clear personnel from the spill location and barricade the area;
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread;
- Use sorbent materials to control the spill at the source;
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks or other suitable materials to help contain the spill;
- Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- Assess possible hazards to human health or the environment as a result of the release, fire or explosion; and
- Follow incident notification, reporting, and investigation section of this plan.

21.0 Inspections

Management Health, Safety, Security, and Environment Inspections

The Management Inspection Checklist (attached to this plan) is intended to facilitate PM leadership, provide an opportunity for PM's to mentor field staff on HSE and identify any big picture actions that need to be addressed. Observations that would improve global HSE program should also be included on the form. This Checklist does NOT take the place of a formal HSE audit. The PM shall:

- Complete one checklist per month during field work when visiting the site. The PM may delegate completion to the task lead, field team leader, or construction manager if the project is short duration and a visit is not planned for.
- Complete applicable sections of the checklist (can by typed or hand-written). Address issues with the field team, taking the opportunity to mentor staff by identifying the "root cause" of observation (e.g., why are SBOs not being completed, had this hazard been noted by any other team members?).
- Send completed form to Project Delivery Manager, Sector HSE Lead, and RHSM for tracking and review. Original should be kept in the project files.

Project Activity Self-Assessment Checklists

In addition to the hazard controls specified in this document, Project Activity Self-Assessment Checklists are contained as an attachment to this HSP. The Project-Activity Self–Assessment Checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

The self-assessment checklists will also be used by the SC in evaluating the subcontractors and any client contractors' compliance on site.

The self-assessment checklists for the following tasks and exposures are required when the task or exposure is initiated and weekly thereafter while the task or exposure is taking place. The checklists shall be completed by the SC or other CH2M HILL representative and maintained in project files.

- Drilling
- Hand and Power Tools
- Excavation
- Traffic Control
- Hazardous Materials Handling
- Lifting
- PPE

Safe Behavior Observations

Safe Behavior Observations (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 any field work performed by subcontractors or when there are at least two CH2M HILL personnel performing field work.

The SC or designee shall complete the SBO form (attached to this HSP) for the task/operation being observed and submit them weekly.

For Federal projects, SBOs may be submitted electronically by e-mailing them to the address, "CH2M HILL ES FED Safe Behavior Observations" when connected to the network or at CH2MHILLESFEDSafeBehaviorObservation@ch2m.com.

22.0 Incident Notification, Reporting, and Investigation

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

General Information

This section applies to the following:

- All injuries involving employees, third parties, or members of the public;
- Damage to property or equipment;
- Interruptions to work or public service (hitting a utility);
- Incidents which attract negative media coverage;
- Near misses;
- Spills, leaks, or regulatory violations; and
- Motor vehicle accidents.

Documentation, including incident reports, investigation, analysis and corrective measure taken, shall be kept by the SC and maintained onsite for the duration of the project.

Section Definitions

Incident: An incident is an event that causes or could have caused undesired consequences. An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with CH2M HILL operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness to a CH2M HILL employee or subcontractor employee, or member of the public;
- Property damage;
- Spill or release;
- Environmental requirement or permit violation;
- A "near-miss"; or
- Other (e.g., fire, explosion, bomb threat, workplace violence, threats)**Accident**: an incident involving actual loss through injury, damage to assets, or environmental harm.

Near Miss: A near-miss occurs when an intervening factor prevented an injury or illness, property damage, spill or release, permit violation or other event from occurring. Examples of near-miss situations include: a hard hat or other personal protective equipment (PPE) prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an incident.

Serious Incident:

A Serious Incident must be immediately reported to senior management includes:

- Work related death, or life threatening injury or illness of a CH2M HILL employee;
- subcontractor, or member of the public;
- Kidnap/missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or

- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident (including "near misses," as defined in the section above) in which they are involved or witness to their supervisor.

The CH2M HILL or Subcontractor supervisor, upon receiving an incident report, shall inform his immediate superior and the CH2M HILL SC.

The SC shall immediately report the following information to the RHSM and PM by phone and e-mail:

- Project Name and Site Manager;
- Date and time of incident;
- Description of incident;
- Extent of known injuries or damage;
- Level of medical attention; and
- Preliminary root cause/corrective actions

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and whether agency reporting is required;

The CH2M HILL team shall comply with all applicable statutory incident reporting requirements such as those to OSHA, the police, or state or Federal environmental agency.

Be aware that many OSHA-designated states require reporting to the area OSHA office if one person is admitted to the hospital (e.g., California and Washington); whereas Federal OSHA requires it if three or more are admitted.

HITS System and Incident Report Form

CH2M HILL maintains a HITS entry and/or Incident Report Form (IRF) for all work-related injuries and illnesses sustained by its employees in accordance with recordkeeping and insurance requirements. A HITS entry and/or IRF will also be maintained for other incidents (property damage, fire or explosion, spill, release, potential violation, and near misses) as part of our loss prevention and risk reduction initiative.

The SC shall complete an entry into the Hours and Incident Tracking System (HITS) database system located on CH2M HILL's Virtual Office (or if VO not available, use the hard copy Incident Report Form and Root Cause Analysis Form and forward it to the RHSM) within 24 hours and finalize those forms within 3 calendar days.

Injury Management/Return-to-Work (for US/Puerto Rico based CH2M HILL Staff Only)

(Reference CH2M HILL, SOP HSSE-124, Injury Management/Return-to-Work)

22.1.1 Background

The Injury Management Program has been established to provide orderly, effective and timely medical treatment and return-to-work transition for an employee who sustains a work-related injury or illness. It also provides guidance and assistance with obtaining appropriate treatment to aid recovery, keep supervisors informed of employee status, and to quickly report and investigate work-related injury/illnesses to prevent recurrence.

To implement the Injury Management/Return-to-Work Program successfully, supervisors and/or SC should:

- Ensure employees are informed of the Injury Management/Return-to-Work Program;
- Become familiar with the Notification Process (detailed below); and
- Post the Injury Management/Return-to-Work Notification Poster.

22.1.2 The Injury Management/Return-to-Work Notification Process:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-866-893-2514 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week.
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.
- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead, and assists with any necessary follow up treatment). The supervisor or SC accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- Supervisor or SC completes the HITS entry or Incident Report Form immediately (within 24 hours) and forwards it to the Project Manager and RHSM.
- Nurse notifies appropriate CH2M HILL staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor ensures medical limitations prescribed (if any) by physician are followed until the worker is released to full duty.

Serious Incident Reporting Requirements

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

The serious incident reporting requirements ensures timely notification and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates Health, Safety, Security and Environment and Firm Wide Security Operations requirements for the consistent reporting of and managing of serious events throughout our operations.

22.1.3 Serious Incident Determination

The following are general criteria for determining whether an incident on CH2M HILL owned or managed facilities or program sites is considered serious and must be immediately reported up to Group President level through the reporting/notification process:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public;
- Kidnap or missing person;
- Acts or threats of terrorism;

- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

22.1.4 Serious Incident Reporting

If an incident meets the "Serious Incident" criteria, the Project Manager is to immediately contact the Crisis Manager at 720-286-4911, then follow the standard incident reporting procedure.

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team.

ESBG US Operations
Incident Reporting Flow Diagram

Direct Reporting Responsibility

Informational Reporting

Incident:

- Injury or illness
- Hazardous substance exposure
- Damage to property
- Fire or explosion
- Spill, release, potential violation, or permit exceedance
- A "near-miss"

If incident is an **injury** to US or Puerto Rico based CH2M HILL personnel contact the Occupational Health Nurse at 866/893-2514. Outside the US, the supervisor must notify the HR

The Ops Leader is responsible for completing the Incident Report Form (IRF) in **HITS** when there is an injury to a CH2M HILL employee. The PM, CM or SC is responsible for completing the IRF for all other incidents. ***The IRF/HITS must be completed within 24 hours of the incident and does not replace the required immediate PM and RHSM notifications.***

Incident

Ensure that Emergency Responders have been notified as necessary

Employee or Subcontractor

Provide immediate notification.

Supervisor – Construction Manager - Safety Coordinator

Provide immediate notification by phone and email to PM and RHSM. In addition, for spills, NOVs, and permit issues you may also call the EM.

CRISIS MANAGER:

If the incident meets the "**Serious Incident**" criteria, contact the Crisis Manager

(720.286.4911)

Third Party – Incidents outside of our contractual obligations do not need to be communicated, unless they are serious and/or may affect CH2M HILL. The RHSM will determine the level of communication necessary for third party incidents.

Serious Incident:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public
- Kidnap/missing person
- Acts or threats of terrorism
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 US in damage.
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

Responsible HSM (RHSM)

Immediately notify the Sector OR Client Program HSE Manager, immediately notify the Responsible Environmental Manager (EM) for spills, NOVs, and permit issues, and direct the incident investigation.

Client Program HSE Manager

Notify Sector HSM, and coordinate communication and incident investigations.

Immediate notification to the Sector HSM is not required for some minor incidents. Follow the program or sector protocol.

Sector HSE Manager

Coordinate communication, direct significant incident investigations, notify Sector EM for spills, NOVs, & permit issues.

HSSE Director

Provide decision-making assistance or direction for incident resolution.

Project Manager

Provide notification to the Sector OR Program Project Delivery (PD) or Operations (Ops) Manager or designee. Notification is based on program or sector specific criteria.

Immediate notification to the PD/Ops Manager is not required for some minor incidents. Follow the program or sector protocol.

Sector or Program PD/Ops Manager

Notify Client Program Manager OR Sector Director, provide guidance and follow the incident through to resolution.

Client Program Manager

Notify Sector Director; provide decision-making assistance or direction for incident resolution.

Keep unnecessary communication of serious incidents to a minimum.

Sector Director

Provide decision-making assistance or direction for incident resolution.

ES US Operations Director/ Executive Leadership Team

Provide decision-making assistance, direction for incident resolution, and make higher level notifications as necessary

Post-emergency incident communications regarding serious incidents at a CH2M HILL office or project (regardless of the party involved) shall be considered sensitive in nature and must be controlled in a confidential manner.

Incident Root Cause Analysis

The accident analysis is essential if all causes of the incident are to be identified for the correct remedial actions to be taken to prevent the same and similar type of incident from recurring. Root Cause Analysis (RCA) shall be completed for all recordable injuries, property damage incidents in excess of $5000.00 (US), environmental permit violations, spills and releases which are required to be reported to regulatory agencies, and any other incident, including near misses where they RHSM or PM determines an RCA is appropriate. The RHSM/REM is responsible for ensuring it is completed and results entered in the incident report form in HITS. RCA's must be completed using a Team that includes, at least the RHSM or designee, the involved party(ies), a responsible operations representative (e.g. PM, construction manager, crew supervisor, etc.) and an independent management representative not associated with the incident.

The Root Cause Analysis Form must be completed for all Loss Incidents and Near Loss Incidents. This form must be submitted to the investigation team for review.

For minor losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, determine the root cause, and develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must follow the Root Cause Analysis Flow Chart (see Attachment 4 of the SOP) to assist in identifying the root cause(s) of a loss. Any loss may have one or more root causes and contributing factors. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the person involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors." Causes that pertain to the system within which the loss or injury occurred should be referred to as "job factors."

Personal factors include:

- Lack of skill or knowledge;
- Correct way takes more time and/or requires more effort;
- Short-cutting standard procedures is positively reinforced or tolerated; or
- Person thinks there is no personal benefit to always doing the job according to standards.

Job Factors include:

- Lack of or inadequate operational procedures or work standards;
- Inadequate communication of expectations regarding procedures or standards; or
- Inadequate tools or equipment.

The root cause(s) could be any one or a combination of these seven possibilities or some other uncontrollable factor. In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.

22.1.5 Corrective Actions

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a timeframe for completion. Be sure the corrective actions address the causes.

Once the investigation report has been completed, the PM shall hold a review meeting to discuss the incident and provide recommendations. The responsible supervisors shall be assigned to carry out the recommendations, and shall inform the SC upon successful implementation of all recommended actions.

- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, EM, or FWSO.
- Incident investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.

23.0 Records and Reports

An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other CH2M HILL employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during OSHA investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an accident, illness or other emergency; and
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with CH2M HILL's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SC are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), MSDSs, exposure modeling results;
- Physical hazard exposure records include noise, ionizing radiation, non-ionizing radiation, vibration, and lasers exposure assessments and measurements;
- Respiratory fit test records;
- Training records;
- Incident reports, investigations and associated back-up information such as agency notifications, calculations, and corrective actions taken;
- Federal or state agency inspection records;
- Other Records:
  - Ergonomic evaluations;
  - HSE audits and assessments;
  - Project-specific HSE plans;
  - Confined space entry permits;
  - Equipment inspections;
  - Equipment maintenance;
  - Emergency equipment inspection records;
  - SBOs;
  - Self-assessment checklists
- The RHSM shall coordinate with the PM or designee to ensure that final project-specific HSE records described in this section, including negative exposure determinations, are maintained with the project files in accordance with the CH2M HILL records retention schedule, or forwarded to the Medical Surveillance Program Administrator, as appropriate. Records retention requirements are detailed in the Recordkeeping and Access to Records SOP, HSE-119.

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**

Chemical Inventory/Register Form

CH2MHILL

CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP 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 SOP 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

Drilling
Hand and Power Tools
Hazardous Materials Handling
Manual Lifting
Personal Protective Equipment
Heat Stress Physiological Monitoring Form
Biological Prevention Measures

HS&E Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project"s written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling 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.

Project Name: ______________________________ Project No.: ______________

Location: ______________________________ PM: ______________

Auditor: ____________________ Title: ____________________ Date: __________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
☐ Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
☐ Evaluate a CH2M HILL subcontractor"s compliance with drilling safety requirements (complete entire checklist).
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 drilling 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 SOP HSE-35.

SECTION 1 - SAFE WORK PRACTICES (4.1)

	Yes	No	N/A	N/O
1. Personnel cleared during rig startup	☐	☐	☐	☐
2. Personnel clear of rotating parts	☐	☐	☐	☐
3. Personnel not positioned under hoisted loads	☐	☐	☐	☐
4. Loose clothing and jewelry removed	☐	☐	☐	☐
5. Smoking is prohibited around drilling operation	☐	☐	☐	☐
6. Personnel wearing appropriate personal protective equipment (PPE), per written plan	☐	☐	☐	☐
7. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐

SECTION 2 - SUPPORT FUNCTIONS (4.2)

FORMS/PERMITS (4.2.1)

	Yes	No	N/A	N/O
8. Driller license/certification obtained	☐	☐	☐	☐
9. Well development/abandonment notifications and logs submitted and in project files	☐	☐	☐	☐
10. Water withdrawal permit obtained, where required	☐	☐	☐	☐
11. Dig permit obtained, where required	☐	☐	☐	☐

UTILITY LOCATING (4.2.2)

	Yes	No	N/A	N/O
12. Location of underground utilities and structures identified	☐	☐	☐	☐

SECTION 2 (Continued)	Yes	No	N/A	N/O
WASTE MANAGEMENT (4.2.3)				
13. Drill cuttings and purge water managed and disposed properly	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project‟s written safety plan	☐	☐	☐	☐
15. Appropriate decontamination procedures being followed, per project‟s written safety plan	☐	☐	☐	☐
DRILLING AT ORDNANCE EXPLOSIVES (OE)/UNEXPLODED ORDNANCE (UXO) SITES (4.2.5)				
16. OE plan prepared and approved	☐	☐	☐	☐
17. OE/UXO avoidance provided, routes and boundaries cleared and marked	☐	☐	☐	☐
18. Initial pilot hole established by UXO technician with hand auger	☐	☐	☐	☐
19. Personnel remain inside cleared areas	☐	☐	☐	☐
SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)				
GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	☐	☐	☐	☐
21. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
22. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	☐	☐	☐	☐
24. Safe clearance distance maintained from overhead power lines	☐	☐	☐	☐
25. Drilling pad established, when necessary	☐	☐	☐	☐
26. Drill rig leveled and stabilized	☐	☐	☐	☐
27. Additional precautions taken when drilling in confined areas	☐	☐	☐	☐
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
29. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
30. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
31. Safe clearance distance maintained while traveling under overhead power lines	☐	☐	☐	☐
32. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	☐	☐	☐	☐
34. All machine guards are in place	☐	☐	☐	☐
35. Rig ropes not wrapped around body parts	☐	☐	☐	☐
36. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
37. Drill operation stopped during inclement weather	☐	☐	☐	☐
38. Air monitoring conducted per written safety plan for hazardous atmospheres	☐	☐	☐	☐
39. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	☐	☐	☐	☐
41. Equipment and tools properly stored	☐	☐	☐	☐
42. All vehicles locked and keys removed	☐	☐	☐	☐
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	☐	☐	☐	☐
29. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
30. Cathead in clean, sound condition	☐	☐	☐	☐
31. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	☐	☐	☐	☐
33. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
34. Good housekeeping maintained on and around rig	☐	☐	☐	☐

SECTION 4

Complete this section for all items checked "No" in previous sections. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ______________________________ Project Manager:___________________________

CH2MHILL

H&S Self-Assessment Checklist – HAND AND POWER TOOLS

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 hand and power tool hazards and/or 2) CH2M HILL provides oversight of subcontractor personnel who are exposed to hand and power tool hazards.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of hand and power tool use 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 hand and power tool hazards.
☐ Evaluate a CH2M HILL subcontractor‟s compliance with hand and power tool 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 the Hand and Power Tools SOP.

SECTION 1

SAFE WORK PRACTICES (3.1)

	Yes	No	N/A	N/O
1. All tools operated according to manufacturer‟s instructions and design limitations.	☐	☐	☐	☐
2. All hand and power tools maintained in a safe condition and inspected and tested before use.	☐	☐	☐	☐
3. Defective tools are tagged and removed from service until repaired.	☐	☐	☐	☐
4. PPE is selected and used according to tool-specific hazards anticipated.	☐	☐	☐	☐
5. Power tools are not carried or lowered by their cord or hose.	☐	☐	☐	☐
6. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.	☐	☐	☐	☐
7. Safety guards remain installed or are promptly replaced after repair.	☐	☐	☐	☐
8. Tools are stored properly.	☐	☐	☐	☐
9. Cordless tools and recharging units both conform to electrical standards and specifications.	☐	☐	☐	☐
10. Tools used in explosive environments are rated for such use.	☐	☐	☐	☐
11. Knife or blade hand tools are used with the proper precautions.	☐	☐	☐	☐
12. Consider controls to avoid muscular skeletal, repetitive motion, and cumulative trauma stressors.	☐	☐	☐	☐

CH2MHILL

H&S Self-Assessment Checklist – HAND AND POWER TOOLS

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
13. PPE is selected and used according to tool-specific hazards anticipated.	☐	☐	☐	☐
14. Tools are tested daily to assure safety devices are operating properly.	☐	☐	☐	☐
15. Damaged tools are removed from service until repaired.	☐	☐	☐	☐
16. Power operated tools designed to accommodate guards have guards installed.	☐	☐	☐	☐
17. Rotating or moving parts on tools are properly guarded.	☐	☐	☐	☐
18. Machines designed for fixed locations are secured or anchored.	☐	☐	☐	☐
19. Floor and bench-mounted grinders are provided with properly positioned work rests.	☐	☐	☐	☐
20. Guards are provided at point of operation, nip points, rotating parts, etc.	☐	☐	☐	☐
21. Fluid used in hydraulic-powered tools is approved fire-resistant fluid.	☐	☐	☐	☐
ELECTRIC-POWERED TOOLS (3.2.2)				
22. Electric tools are approved double insulated or grounded and used according to SOP HS-23.	☐	☐	☐	☐
23. Electric cords are not used for hoisting or lowering tools.	☐	☐	☐	☐
24. Electric tools are used in damp/ wet locations are approved for such locations or GFCI installed.	☐	☐	☐	☐
25. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.	☐	☐	☐	☐
26. Portable, power-driven circular saws are equipped with proper guards.	☐	☐	☐	☐
ABRASIVE WHEEL TOOLS (3.2.3)				
27. All employees using abrasive wheel tools are wearing eye protection.	☐	☐	☐	☐
28. All grinding machines are supplied with sufficient power to maintain spindle speed.	☐	☐	☐	☐
29. Abrasive wheels are closely inspected and ring-tested before use.	☐	☐	☐	☐
30. Grinding wheels are properly installed.	☐	☐	☐	☐
31. Cup-type wheels for external grinding are protected by the proper guard or flanges.	☐	☐	☐	☐
32. Portable abrasive wheels used for internal grinding are protected by safety flanges.	☐	☐	☐	☐
33. Safety flanges are used only with wheels designed to fit the flanges.	☐	☐	☐	☐
34. Safety guards on abrasive wheel tools are mounted properly and of sufficient strength.	☐	☐	☐	☐
PNEUMATIC-POWERED TOOLS (3.2.4)				
35. Tools are secured to hoses or whip by positive means to prevent disconnection.	☐	☐	☐	☐
36. Safety clips or retainers are installed to prevent attachments being expelled.	☐	☐	☐	☐
37. Safety devices are installed on automatic fastener feed tools as required.	☐	☐	☐	☐
38. Compressed air is not used for cleaning unless reduced to < 30 psi, with PPE, and guarded.	☐	☐	☐	☐
39. Manufacturer‟s safe operating pressure for hoses, pipes, valves, etc. are not exceeded.	☐	☐	☐	☐
40. Hoses are not used for hoisting or lowering tools.	☐	☐	☐	☐
41. All hoses >1/2-inch diameter have safety device at source to reduce pressure upon hose failure.	☐	☐	☐	☐
42. Airless spray guns have required safety devices installed.	☐	☐	☐	☐
43. Blast cleaning nozzles are equipped with operating valves, which are held open manually.	☐	☐	☐	☐
44. Supports are provided for mounting nozzles when not in use.	☐	☐	☐	☐
45. Air receiver drains, handholes, and manholes are easily accessible.	☐	☐	☐	☐
46. Air receivers are equipped with drainpipes and valves for removal of accumulated oil and water.	☐	☐	☐	☐
47. Air receivers are completely drained at required intervals.	☐	☐	☐	☐
48. Air receivers are equipped with indicating pressure gauges.	☐	☐	☐	☐
49. Safety, indicating, and controlling devices are installed as required.	☐	☐	☐	☐
50. Safety valves are tested frequently and at regular intervals to assure good operating condition.	☐	☐	☐	☐

	Yes	No	N/A	N/O
LIQUID FUEL-POWERED TOOLS (3.2.5)				
51. Liquid fuel-powered tools are stopped when refueling, servicing, or maintaining.	☐	☐	☐	☐
52. Liquid fuels are stored, handled, and transported in accordance with SOP HS-21	☐	☐	☐	☐
53. Liquid fuel-powered tools are used in confined spaces in accordance with SOP HS-17.	☐	☐	☐	☐
54. Safe operating pressures of hoses, valves, pipes, filters, and other fittings are not exceeded.	☐	☐	☐	☐

SECTION 2 (continued)

POWDER-ACTUATED TOOLS (3.2.6)

55. Only trained employee operates powder-actuated tools. ☐ ☐ ☐ ☐
56. Powder-actuated tools are not loaded until just prior to intended firing time. ☐ ☐ ☐ ☐
57. Tools are not pointed at any employee at any time. ☐ ☐ ☐ ☐
58. Hands are kept clear of open barrel end. ☐ ☐ ☐ ☐
59. Loaded tools are not left unattended. ☐ ☐ ☐ ☐
60. Fasteners are not driven into very hard or brittle materials. ☐ ☐ ☐ ☐
61. Fasteners are not driven into easily penetrated materials unless suitable backing is provided. ☐ ☐ ☐ ☐
62. Fasteners are not driven into spalled areas. ☐ ☐ ☐ ☐
63. Powder-actuated tools are not used in an explosive or flammable atmosphere. ☐ ☐ ☐ ☐
64. All tools are used with correct shields, guards, or attachments recommended by manufacturer. ☐ ☐ ☐ ☐

JACKING TOOLS (3.2.7)

65. Rated capacities are legibly marked on jacks and not exceeded. ☐ ☐ ☐ ☐
66. Jacks have a positive stop to prevent over-travel. ☐ ☐ ☐ ☐
67. The base of jacks are blocked or cribbed to provide a firm foundation, when required. ☐ ☐ ☐ ☐
68. Wood blocks are place between the cap and load to prevent slippage, when required. ☐ ☐ ☐ ☐
69. After load is raised, it is cribbed, blocked, or otherwise secured immediately. ☐ ☐ ☐ ☐
70. Antifreeze is used when hydraulic jacks are exposed to freezing temperatures. ☐ ☐ ☐ ☐
71. All jacks are properly lubricated. ☐ ☐ ☐ ☐
72. Jacks are inspected as required. ☐ ☐ ☐ ☐
73. Repair or replacement parts are examined for possible defects. ☐ ☐ ☐ ☐
74. Jacks not working properly are removed from service and repaired or replaced. ☐ ☐ ☐ ☐

HAND TOOLS (3.2.8)

75. Wrenches are not used when jaws are sprung to the point of slippage. ☐ ☐ ☐ ☐
76. Impact tools are kept free of mushroomed heads. ☐ ☐ ☐ ☐
77. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool. ☐ ☐ ☐ ☐

CH2MHILL

H&S Self-Assessment Checklist – HAND AND POWER TOOLS

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: __________________________________

CH2MHILL

HS&E Self-Assessment Checklist: HAZARDOUS MATERIALS

This checklist is provided as a method of verifying compliance with regulations pertaining to the handling of hazardous materials. It shall be used at locations where CH2M HILL employees handle hazardous materials, or are required to perform oversight of subcontractor personnel handling hazardous materials, or both.

CH2M HILL staff shall not direct the means and methods of subcontractor operations nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies, and CH2M HILL staff must carefully rely on the subcontractor's expertise. Items considered imminently dangerous (possibility of serious injury or death) must be corrected immediately, or all exposed personnel must be removed from the hazard until it is corrected.

Completed checklists must be sent to the appropriate regional health and safety program manager for review.

Project Name: ____________________ Project No.: ____________
Location: ____________________ PM: ____________
Auditor: ____________ Title: ____________ Date: ________

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate CH2M HILL compliance with hazardous material handling requirements (SOP HSE-403)
☐ Evaluate a CH2M HILL subcontractor‟s compliance with hazardous material requirements
Subcontractor‟s Name: ____________________

- Check “Yes” if an assessment item is complete or correct.
- Check “No” if an item is incomplete or deficient. Section 2 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 HSE-403.

SECTION 1	Yes	No	N/A	N/O

23.1.1.1 PROCEDURES FOR HAZARDOUS MATERIAL HANDLING (6.0)

23.1.1.2 GENERAL GUIDELINES (6.1)

	Yes	No	N/A	N/O
1. Acids are stored away from bases.	☐	☐	☐	☐
2. Oxidizers and organics are stored away from inorganic reducing agents.	☐	☐	☐	☐
3. Flammables and corrosives are stored in appropriate storage cabinets.	☐	☐	☐	☐
4. Paper and other combustibles are not stored near flammables.	☐	☐	☐	☐
5. Secondary containment and lipped shelving are in place in storage areas.	☐	☐	☐	☐
6. A fire suppression system is available.	☐	☐	☐	☐

23.1.1.3 SPILL CONTROL/CLEANUP (6.2)

	Yes	No	N/A	N/O
7. Spill control materials are located on the project site.	☐	☐	☐	☐

23.1.1.4 HAZARDOUS CHEMICAL INVENTORY REPORTING (6.3)

	Yes	No	N/A	N/O
8. Reporting is required if the project site handles and stores 10,000 lb or more of a hazardous chemical.	☐	☐	☐	☐
9. Or 500 lb or the threshold planning quantity (TPQ) of an extremely hazardous substance.	☐	☐	☐	☐
10. Regional ECC has been consulted for hazardous chemical inventory reporting.	☐	☐	☐	☐

23.1.1.5 TOXIC CHEMICAL RELEASE REPORTING

	Yes	No	N/A	N/O
11. Reporting requirements for toxic chemical release reporting have been followed.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O

23.1.1.6 FLAMMABLE AND COMBUSTIBLE LIQUIDS (6.5)

23.1.1.7 GENERAL STORAGE (6.5.1)

	Yes	No	N/A	N/O
12. Only approved containers/portable tanks used to store flammable and combustible liquids.	☐	☐	☐	☐
13. Approved safety cans used for handling flammable liquids in quantities 1-5 gallons.	☐	☐	☐	☐
14. For quantities of one gallon or less, the original container must be used for storage.	☐	☐	☐	☐
15. Flammable or combustible liquids are not stored in stairways or personnel passageways.	☐	☐	☐	☐
INDOOR STORAGE (6.5.2)				
16. Quantities of flammable or combustible liquids > 25 gallons stored in approved storage cabinet.	☐	☐	☐	☐
17. No more than 25 gallons of flamm. or comb. liquids can be stored outside an approved cabinet.	☐	☐	☐	☐
18. Cabinets are labeled with "„FLAMMABLE: KEEP FIRE AWAY."	☐	☐	☐	☐
19 No more than 60 gallons of flamm. or 120 gallons of comb. liquids stored in one storage cabinet.	☐	☐	☐	☐
20. Not more than three cabinets located in a single storage area.	☐	☐	☐	☐
OUTSIDE STORAGE (6.5.3)				
21. Storage of containers (not more than 60 gallons each) do not exceed 1,100 gallons in any area.	☐	☐	☐	☐
22. Storage areas are not within 20 feet of any building.	☐	☐	☐	☐
23. Storage areas graded to divert spills away from buildings and surrounded by an earth dike.	☐	☐	☐	☐
24. Storage areas are free from weeds, debris, and other combustible materials.	☐	☐	☐	☐
25. Outdoor portable tanks are provided with emergency vent devices.	☐	☐	☐	☐
26. Outdoor portable tanks are no closer than 20 feet from any building.	☐	☐	☐	☐
27. Signs indicating no smoking are posted around the storage area.	☐	☐	☐	☐
DISPENSING (6.5.4)				
28. Areas where liquids are dispensed in >5-gal quantities are separated from other operations by 25".	☐	☐	☐	☐
29. Drainage or other means provided to control spills.	☐	☐	☐	☐
30. Adequate natural or mechanical ventilation provided to maintain concentration of flammable vapor < 10% of the lower flammable limit.	☐	☐	☐	☐
31. Dispensing of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded).	☐	☐	☐	☐
32. Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks prohibited.	☐	☐	☐	☐
33. Dispensing devices and nozzles for flammable liquids are of an approved type.	☐	☐	☐	☐
USE (6.5.5)				
34. Flammable liquids are kept in closed containers when not in actual use.	☐	☐	☐	☐
35. Leakage or spillage of flammable or combustible liquids is disposed of promptly and safely.	☐	☐	☐	☐
36. Sources of ignition are kept at least 50 feet from flammable liquids.	☐	☐	☐	☐
LIQUID PETROLEUM GAS (6.6)				
37. LPG containers meet DOT requirements.	☐	☐	☐	☐
38. Each container or system has a safety relief device or valve in good working order.	☐	☐	☐	☐
39. Portable heaters using LPG have an automatic shutoff device in the event of flame failure.	☐	☐	☐	☐
40. Storage of LPG within buildings is prohibited.	☐	☐	☐	☐
41. LPG storage location has at least one portable fire extinguisher rated not less than 20-B:C.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O

23.1.1.8 COMPRESSED GAS CYLINDERS (6.7)

GENERAL (6.7.1)	Yes	No	N/A	N/O
42. Cylinders and apparatus inspected for defects and leakage prior to use. Damaged items not used.	☐	☐	☐	☐
43. Gas distributor notified and subsequent instructions followed for defective cylinders.	☐	☐	☐	☐
44. Leaking cylinders removed from the work area.	☐	☐	☐	☐
45. Cylinder users do not modify, tamper, or attempt repair on cylinders or apparatus.	☐	☐	☐	☐
46. Only cylinder owners or authorized agent refill cylinders or attempt to mix gases in a cylinder.	☐	☐	☐	☐
47. Cylinders labeled with the identity of the contents.	☐	☐	☐	☐
TRANSPORTING (6.7.2)				
48. Cylinders not rolled in the horizontal position or dragged; suitable material-handling device used.	☐	☐	☐	☐
49. Cylinders being transported have valve protection caps installed.	☐	☐	☐	☐
50. Cylinders in vertical position when transported by motor vehicle, hoisted, or carried.	☐	☐	☐	☐
51. Cylinders hoisted by a cradle or pallet designed for such use, and not by magnets, slings, or their valve protection caps.	☐	☐	☐	☐
STORAGE (6.7.3)				
52. Cylinders are stored in the vertical position with valve protection caps installed.	☐	☐	☐	☐
53. Cylinders are secured from being knocked over by a chain or other stabilizing device.	☐	☐	☐	☐
54. Cylinders are stored away from readily ignitable substances.	☐	☐	☐	☐
55. Cylinders are protected from exposure to temperature extremes.	☐	☐	☐	☐
56. Oxygen cylinders in storage are separated from fuel gas cylinders or combustible materials > 20″	☐	☐	☐	☐
or by a ½-hour fire-resistant barrier at least 5″ high.	☐	☐	☐	☐
57. Cylinders inside buildings are stored in dry, well-ventilated locations > 20″ from comb. materials.	☐	☐	☐	☐
58. Cylinders are stored in definitely assigned places away from elevators, stairs, or gangways.	☐	☐	☐	☐
59. Signs indicating no smoking are provided for storage areas containing flammable gas cylinders.	☐	☐	☐	☐
PLACEMENT FOR USAGE (6.7.4)				
60. Cylinders are located where they will not be knocked over or damaged.	☐	☐	☐	☐
61. Cylinders are secured in the vertical position.	☐	☐	☐	☐
62. Cylinders are not placed where they can become part of an electrical circuit.	☐	☐	☐	☐
63. Cylinders are kept far enough away from welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields are provided.	☐	☐	☐	☐
64. Cylinders are not taken into confined spaces.	☐	☐	☐	☐
CYLINDER CONNECTIONS (6.7.5)				
65. Pressure-controlling apparatus is compatible with the particular gas used.	☐	☐	☐	☐
66. Cylinders and pressure-controlling apparatus are kept free of oil and grease.	☐	☐	☐	☐
67. Pressure-controlling apparatus is kept gastight to prevent leakage.	☐	☐	☐	☐
68. Cylinders not attached to process where backflow could occur unless check valves or traps used.	☐	☐	☐	☐
69. Manifolds designed for product used at the appropriate temperatures, pressures, and flow rates.	☐	☐	☐	☐
70. Manifolds are labeled and placed in well-ventilated and accessible locations.	☐	☐	☐	☐
71. Cylinders are not cross-connected with plant air lines.	☐	☐	☐	☐
72. Flash arrestors or reverse flow check valves are installed on all flammable gas cylinders.	☐	☐	☐	☐
USAGE (6.7.6)				
73. Eye protection (safety glasses or goggles) is worn when using cylinders.	☐	☐	☐	☐
74. Cylinder valve and regulator are inspected for foreign material before connecting.	☐	☐	☐	☐
75. If cylinders are frozen, warm (not boiling) water is used to thaw cylinders.	☐	☐	☐	☐
76. Cylinder valve remains closed except when the cylinder is in use.	☐	☐	☐	☐
77. Fuel gas cylinder valves are not opened more than 1½ turns, for quick closing.	☐	☐	☐	☐
78. If a special wrench is used to open a cylinder valve, it is left in position on the valve.	☐	☐	☐	☐

SECTION 1 (continued)	Yes	No	N/A	N/O
USAGE (continued) (6.7.6)				
79. Acetylene cylinders are used in the vertical position.	☐	☐	☐	☐
80. Acetylene cylinders are not used > 15 psig or > 30 psia.	☐	☐	☐	☐
81. Copper pipe or fittings are not used with acetylene systems.	☐	☐	☐	☐
82. Compressed gas is not used to dust off clothing.	☐	☐	☐	☐
83. Cylinder valve closed and regulator relieved of internal pressure before regulators are removed.	☐	☐	☐	☐
EXPLOSIVES (6.8)				
84. Written authorization provided by Munitions Market Segment Leader designating individuals who can store or use high explosives under the authority of the CH2M HILL BATF Type 33 User of High Explosives License/permit.	☐	☐	☐	☐
85. Written authorization provided by Munitions Market Segment Leader designating individuals who can manufacture high explosives under the authority of the CH2M HILL BATF Type 20 Manufacturer of High Explosives License/permit.	☐	☐	☐	☐
86. Approved Explosive Siting Plan (ESP).	☐	☐	☐	☐
87. Approved Explosive Management Plan (EMP).	☐	☐	☐	☐
88. Sources of ignition are not brought in or near storage magazines, or within 50‟ of an area where explosives are being handled, transported, or used.	☐	☐	☐	☐
89. Radio transmitting or receiving equipment is not brought within 1,000‟ of blasting activities.	☐	☐	☐	☐
90. Transportation and storage of explosives comply with local, state, and federal regulations.	☐	☐	☐	☐
91. Vehicles transporting explosives are placarded and displayed according to DOT regulations.	☐	☐	☐	☐
92. Detonators or blasting caps are not stored with explosive charges.	☐	☐	☐	☐
93. Explosives are stored in storage magazines as required by local, state, and federal regulations.	☐	☐	☐	☐
94. Contact the Munitions Response market Segment Leader for additional instructions	☐	☐	☐	☐

23.1.1.9 PROCEDURES FOR HAZARDOUS MATERIALS SHIPPING (7.0)

1. Only dangerous goods shippers are permitted to ship dangerous goods (CH2M HILL only).	☐	☐	☐	☐
2. Dangerous goods are shipped or transported in accordance with CH2M HILL‟s procedures.	☐	☐	☐	☐
3. All personnel shipping dangerous goods have completed the computer-based training (CH2M HILL only)	☐	☐	☐	☐
4. Dangerous goods are stored only in the equipment warehouse prior to shipping.	☐	☐	☐	☐
5. Written authorization provided by Munitions Market Segment Leader designating individuals who can "offer explosives for shipment" under the authority of the CH2M HILL Department of Transportation Hazardous Materials Certificate of Registration				

23.1.1.10 SHIPPING BY AIR (7.1)

5. Shipments for Federal Express meet IATA requirements for dangerous goods.	☐	☐	☐	☐
6. Before shipping, packages are clearly identified, packed, marked, labeled, and documented.	☐	☐	☐	☐
7. The quantity does not exceed IATA regulations.	☐	☐	☐	☐
8. Packaging meets IATA requirements and withstand transport by air.	☐	☐	☐	☐
9. Shipper classifies each item into one of the 9 hazard classes.	☐	☐	☐	☐
10. Inner packages are packed to prevent breaking or leaking during shipping.	☐	☐	☐	☐
11. Absorbent or cushioning material does not react with the contents of the inner package.	☐	☐	☐	☐
12. Outer packages in fiberboard, a plastic case, or other sturdy container.	☐	☐	☐	☐
13. Package is capable of withstanding 4‟ drop test with no damage.	☐	☐	☐	☐
14. Package is marked with: proper shipping name of contents, technical name, UN number, total net. quantity, and the name and address of the shipper and recipient.	☐	☐	☐	☐
15. Irrelevant labels have been removed from package.				
16. Hazard label and handling label are secured in correct locations.	☐	☐	☐	☐
17. Dangerous goods airbill has been completed.	☐	☐	☐	☐
18. Dangerous goods are not shipped via UPS.	☐	☐	☐	☐

23.1.1.11 SECTION 1 (continued)

23.1.1.12 SHIPPING BY HIGHWAY (7.2)

	Yes	No	N/A	N/O
19. Use Federal Express packaging and paperwork requirements that comply with DOT regs for ground transportation of dangerous goods.	☐	☐	☐	☐
20. Consult with local state highway police if route includes vehicular tunnels.	☐	☐	☐	☐
21. Inner packaging prevents breakage or leakage under normal conditions of transport.	☐	☐	☐	☐
22. Absorbent/cushioning material does not react with contents of the package.	☐	☐	☐	☐
23. Labels for highway transportation are the same as those for air transportation.	☐	☐	☐	☐
24. Engine turned off, brake set during loading and unloading.	☐	☐	☐	☐

23.1.1.13 EMERGENCY RESPONSE (7.3)

25. Appropriate emergency response information available not on the package, within reach of driver.	☐	☐	☐	☐
26. Information includes copy of pages from *Emergency Response Guidebook* for each item.	☐	☐	☐	☐
27. An MSDS for each item must also be included.	☐	☐	☐	☐
28. Emergency response information must also include the information found on the shipping papers.	☐	☐	☐	☐
29. CH2M HILL"s 24-hour EMERGENCY RESPONSE TELEPHONE NUMBER, (800) 255-3954, is included, as required.	☐	☐	☐	☐
30. In the event of an accident, keep other individuals, except response workers, from the vicinity.	☐	☐	☐	☐
31. In case of breakage, spillage, or leakage, use means to prevent spreading and contain the spill.	☐	☐	☐	☐
32. Care taken during the handling of cargo to minimize hazards.	☐	☐	☐	☐
33. MSDS is consulted for safe handling procedures.	☐	☐	☐	☐
34. Wash the area of the vehicle where the dangerous goods may have spilled.	☐	☐	☐	☐
35. Consult your supervisor in the event of a spill.	☐	☐	☐	☐
36. Ask your supervisor to call CHEM-TEL of the local HAZMAT unit if the spill poses a danger.	☐	☐	☐	☐

SECTION 2

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

Item #	Corrective Action Planned or Taken	Date Corrected

Auditor: ___________________________________ Project Manager: _____________________________________

CH2MHILL

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 supplies without reaching or twisting.	o	o	o	o

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

		Yes	No	N/A	N/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: ______________________________

CH2MHILL

HS&E Self-Assessment Checklist: PERSONAL PROTECTIVE EQUIPMENT

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 CH2M HILL employees are required to wear PPE or are required to perform oversight of a subcontractor using PPE or both.

CH2M HILL staff shall not direct the means and methods of subcontractor use of PPE nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: ____ Project No.: ______________________

Location: ____ PM: __________________________________

Auditor: ____________________________________ Title: _________________________________ Date: _____________

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate CH2M HILL compliance with its PPE program (SOP HSE-117)
☐ Evaluate a CH2M HILL subcontractor"s compliance with its PPE program
Subcontractor"s Name: ____

Check the appropriate box, as follows:

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 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 the PPE SOP.

SECTION 1	Yes	No	N/A	N/O
GENERAL				
1. Required PPE listed in HSP FSI or AHA.	☐	☐	☐	☐
2. PPE available for use by employees.	☐	☐	☐	☐
3. PPE cleaning supplies available for use.	☐	☐	☐	☐
4. PPE stored appropriately to prevent deformation or distortion.	☐	☐	☐	☐
5. PPE written certification has been completed.	☐	☐	☐	☐
EYEWEAR (Glasses/Goggles/Face Shields)				
6 Eyewear cleaning supplies available.	☐	☐	☐	☐
7 Safety glasses in good condition and lenses free of scratches.	☐	☐	☐	☐
8 Goggles adjustment strap not cracked or frayed, not deformed, or lenses not scratched.	☐	☐	☐	☐
9. Face shields in good condition, including adjustment band, and free of scratches or chips.	☐	☐	☐	☐

SECTION 1 (Continued)	**Yes**	**No**	**N/A**	**N/O**
HEAD PROTECTION				
10. Hard hat bill and suspension attached as allowed by manufacturer.	☐	☐	☐	☐
11. Shell is pliable, free of dents, cracks, nicks, or any damage due to impact.	☐	☐	☐	☐
12. Suspension maintained at 1.25 inches from inside of shell.	☐	☐	☐	☐
13. Suspension free of cuts or fraying, torn headband, adjustment strap workable.	☐	☐	☐	☐
14. Electrical hard hat matched to hazard classification.	☐	☐	☐	☐
15. Dated to determine whether within manufacturer"s allowable 5-year use time period.	☐	☐	☐	☐
HAND PROTECTION				
16. Available in sizes matched to employee.	☐	☐	☐	☐
17. Gloves free of rips tears, abrasions, or holes.	☐	☐	☐	☐
18. Matched to manufacturer"s specification for chemicals used onsite.	☐	☐	☐	☐
19. Electrical gloves matched to hazard and periodically inspected for insulating rating. ☐	☐		☐	☐
20. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	☐	☐	☐	☐
BODY PROTECTION				
21. Available in sizes matched to employee.	☐	☐	☐	☐
22. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	☐	☐	☐	☐
23. Vapor-tight fully encapsulated suits tested at required periodic intervals.	☐	☐	☐	☐
24. Flame-resistant clothing matched to electrical hazard and arc flash rating.	☐	☐	☐	☐
25 Welding gear matched to degree of hazard and free of cuts, tears or burn holes.	☐	☐	☐	☐
26 Flotation gear available for work near or on water and in good condition.	☐	☐	☐	☐
HOT AND COLD BODY PROTECTION				
27 Cooling gear available based on degree of heat stress hazard.	☐	☐	☐	☐
28 Cooling gear in operable, clean, and sanitary condition.	☐	☐	☐	☐
29 Cold-weather gear provided based on needs assessment.	☐	☐	☐	☐
30. Cold-weather gear available in sizes to match employees.	☐	☐	☐	☐
31 Cold-weather gear is in free of tears, rips, or holes and in maintained in a clean condition.	☐	☐	☐	☐
TRAINING				
32 Initial PPE training completed by employees.	☐	☐	☐	☐
33 Training conducted when new types or styles of PPE are issued.	☐	☐	☐	☐
34 PPE selection, use, and maintenance reviewed at daily safety briefings.	☐	☐	☐	☐

SECTION 2

Complete this section for all items checked "No" in Section 1. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned or Taken	Date Corrected

Auditor: ________________________________ Project Manager: ___________________________________

CH2MHILL

HEAT STRESS PHYSIOLOGICAL MONITORING FORM

Project:

Date: | Company:

1. Take and record measurement of temperature or pulse at the frequency indicated in the safety plan.
2. Follow the Physiological Monitoring Protocol in the safety plan.
3. Never continue work if your body temperature is more than 100.4° F/38° C, or if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness.

Employee:

Describe action taken below if measurements are exceeded:

Time								
Temp								
Pulse								

Employee:

Describe action taken below if measurements are exceeded:

Time								
Temp								
Pulse								

Employee:

Describe action taken below if measurements are exceeded:

Time								
Temp								
Pulse								

Employee:

Describe action taken below if measurements are exceeded:

Time								
Temp								
Pulse								

Employee:

Describe action taken below if measurements are exceeded:

Time								
Temp								
Pulse								

HS&E Self-Assessment Checklist—Biological Prevention Measures

HS&E Self-Assessment Checklist

This checklist shall be used by Navy CLEAN personnel and shall be completed by each crew entering the work area at the frequency of one per day or otherwise specified in the project‟s Health and Safety Plan/Field Safety Instruction (HSP/FSI). The checklist should be completed prior to entry and at the end of the day to document that appropriate checks have been completed.

This checklist is to be used at locations where the possibility exists that contact with biological hazards is possible.

Site Safety Coordinator (SSC) will request any CH2M HILL subcontractor to take necessary precautions in eliminating the exposure to biological hazards, but shall not direct the means and methods.

Project Name: ____ Project No.: ____________________
Location: ____ PM: _______________________________
Auditor: ___________________________ Title: _________________________ Date: ____________

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 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.

SECTION 1 – PRE-ENTRY	Yes	No	N/A	N/O
SITE HAZARD EVALUATION				
1. Inform field members of hazards (types, symptoms)	☐	☐	☐	☐
2. Can work be completed without entering the work zone	☐	☐	☐	☐
3. Have controls been implemented where possible (clearing vegetation, spraying)	☐	☐	☐	☐
4. Has an inspection been made to identify nests, hives or areas where insects may concentrate	☐	☐	☐	☐
5. Will working at different time will reduce exposure	☐	☐	☐	☐
SENSITIVITIES				
6. Does any staff have existing reactions to stings or bites	☐	☐	☐	☐
7. If yes to #6, is special required and medication available on site (epi-pen)	☐	☐	☐	☐
8. Has anyone with an existing condition briefed other team members about symptoms and first aid which may be required	☐	☐	☐	☐
EMERGENCY RESPONSE				
9. Are first aid kits, along with tick removal kits, readily available to all staff	☐	☐	☐	☐
10. Does each member of the field staff have ability to communicate (phone, radios, and visual)	☐	☐	☐	☐
11. Are emergency contacts available (base emergency, local police, or local EMT	☐	☐	☐	☐
12. If working in remote areas, is transport readily available (less than 5 minutes)	☐	☐	☐	☐
13. Have you planned an emergency exit from the site in the event of a swarm	☐	☐	☐	☐

CH2MHILL

SECTION 2 - PPE	Yes	No	N/A	N/O
SELECTION OF PPE				
14. Will weather (heat, rain, ice) impact the safety of workers wearing protective suits	☐	☐	☐	☐
15. Will visibility be limited to unacceptable levels if a hood is worn	☐	☐	☐	☐
16. Will the use of equipment be difficult if a suit is worn	☐	☐	☐	☐
17. Will heavy vegetation be encountered that could rip or damage a suit	☐	☐	☐	☐
18. Will a Bug-Out suit or Tyvek suit be used by staff (if not, please give additional rationale in writing in Section 4)	☐	☐	☐	☐
TYPE OF PPE USED OTHER THAN BUG-OUT OR TYVEK SUIT				
19. Is staff wearing light-colored clothes	☐	☐	☐	☐
20. Is staff wearing long sleeve shirts	☐	☐	☐	☐
21. Are pant legs tucked into socks	☐	☐	☐	☐
22. Are shirts tucked into pants	☐	☐	☐	☐
23. Has tape been placed around sock/pant leg line and around waist	☐	☐	☐	☐
24. Have hand and wrist areas been sealed	☐	☐	☐	☐
25. Are hats being worn	☐	☐	☐	☐
26. Have clothes been pre treated with Permethrin	☐	☐	☐	☐
27. Has team member inspected coworker‟s suits or clothing to ensure no spaces exist for insects to penetrate	☐	☐	☐	☐

SECTION 3 – CHECKS AND DECONTAMINATION	Yes	No	N/A	N/O
DAILY CHECKS (TO BE COMPLETED DURING AND AT END OF DAY)				
28. Were tick/insect checks performed during the day (if not, please provide reason in Section 4)	☐	☐	☐	☐
29. Was one unclothed tick check completed	☐	☐	☐	☐
30. Were ticks found on the outerwear (if yes, please note the number in Section 4)	☐	☐	☐	☐
31. Were ticks found inside the Bug-Out, Tyvek, or personal clothing	☐	☐	☐	☐
32. Were suits turned inside out and inspected prior to putting away	☐	☐	☐	☐
33. Were showers taken by field staff immediately upon arrive from the field	☐	☐	☐	☐
34. Were clothing placed in a garbage bag and sealed to prevent any insects from spreading	☐	☐	☐	☐
35. If ticks were found embedding in skin, were they properly removed and saved	☐	☐	☐	☐
36. Have vehicles been inspected for ticks on a daily basis and before the vehicle is turned in	☐	☐	☐	☐
REPORTING				
37. If a tick was found on your skin, could you tell where it entered so that it could be addressed	☐	☐	☐	☐
38. If a tick was found embedded, did you contact the PM, complete a HITS form and contact the Occupational Physician at 1-866-893-2514	☐	☐	☐	☐
39. Did you contact field staff on the project to provide potential corrective measures	☐	☐	☐	☐
40. Did you follow the IM/RTW procedure to ensure you received the proper medical attention (if not, provide an explanation in Section 4)	☐	☐	☐	☐

SECTION 4

Complete this section for all items where further information was requested in the previous sections.

Item #	Rationale	Corrected (either next day or intended on future projects)

Auditor: ________________________________ Project Manager: _____________________________

CH2M HILL Health and Safety Plan

Attachment 5

Key Target Zero Program Elements

(blank forms for field use)

Activity Hazard Analysis

Pre-Task Safety Plans

Safe Behavior Observation

Incident Report and Investigation

(use electronic form when possible)

HITS

Lessons Learned Template

ACTIVITY HAZARD ANALYSIS

Activity:	**Date**:
	Project Name:
Description of the work:	**Site Supervisor**:
	Site Safety Officer:
	Review for latest use: Before the job is performed

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)

ACTIVITY HAZARD ANALYSIS

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)

Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements** (List inspection requirements for the work activity)	**Training Requirements** (List training requirements including hazard communication)

ACTIVITY HAZARD ANALYSIS

	PRINT NAME	SIGNATURE	
Supervisor Name:	______________________	______________________	Date/Time:____________________
Safety Officer Name:	______________________	______________________	Date/Time:____________________
Employee Name(s):	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________
	______________________	______________________	Date/Time:____________________

CH2MHILL

Pre-Task Safety Plan (PTSP) and Safety Meeting Sign-in Sheet

Project:____________________________ Location: ________________ Date:________________

Supervisor: __________________________________ Job Activity:____

____

Attendees: Print Name Sign Name

____

____

____

____

____

____

____

List Tasks and verify that applicable AHAs have been reviewed:

____

____

____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

____

____

____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition
__Underground Utilities	__ Security	__ Poor communications

Other Potential Hazards (Describe):

____

____

____

Hazard Control Measures (Check All That Apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device __ Hard Hat __ Safety-Toed Boots	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections __ Entry Permits/notification	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected __ Overhead line clearance __ Underground utils ID'd
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ No visible dust __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Drill rigs/geoprobe rigs __ Cranes and rigging __ Utilities marked	Training: __ Hazwaste (current) __ Construction __ Competent person __ Task-specific __ FA/CPR __ Confined Space __ Hazcom
Underground Utilities __Dig alert called __3rd Party locater __As-builts reviewed __Interview site staff __Client review __soft locate necessary?	Incident Communications __Work stops until cleared by TM/CM __Immediate calls to TM/CM __Client notification __24 hour notification setup __Clear communications	AHA' s __reviewed and approved by HSM __on site and current __applicable for this day's work __Communication and incident processes included?	
Field Notes (including observations from prior day, etc.): ____ ____ ____			

Name (Print): ________________________________

Signature:________________________________ Date:________________

CH2MHILL

Safe Behavior Observation Form

☐ Federal ☐ Commercial (check one)
☐ International

☐ Construction or ☐ Consulting (check one)

Project Number (required):	Client/Program:
Project Name:	Observer: / Date:
Position/Title of worker observed:	Background Information/ comments:
Task/Observation Observed:	

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

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

For ES Federal Sector projects please email completed forms to: CH2M HILL ES FED Safe Behavior Observation
For ES Commercial Sector projects please email completed forms to: CH2M HILL ES COM Safe Behavior Observation
For CNR ES staff please email completed forms to: cnressafe@ch2m.com
For International ES projects please e-mail completed forms to: ESINTLSafeBehaviorObservation@ch2m.com

HITS Incident Report Hardcopy (Phase 1 – Initial Entry)

Phase 1 – Initial Entry

Type of Incident (May select more than one)

☐ Injury/Illness ☐ Spill/Release ☐ Near Miss
☐ Property Damage ☐ Environment/Permit ☐ Other

General Information Section

Preparer's Name: ______________________ **Preparer's Phone Number:** ______________________

Date of Incident: ______________ **Time of Incident**: __________ AM / PM

What Business Group is accountable for this incident: ______________________

What Business Group SubGroup is accountable for this incident: ______________________

What CH2M HILL Company is accountable for this incident: ______________________

Where did the Incident occur?

☐ United States, Geographic Region: ______________________
☐ Canada, Province/Territory: ______________________
☐ International, County: ______________________

Location of Incident?

☐ Company Premises, CH2M HILL Office (use 3 letter office code if available): ______________________
☐ Project, Project name: ______________________
☐ In Transit
Traveling from: ______________________
Traveling to: ______________________
☐ At Home
☐ Other, Specify: ______________________

Describe the incident: ______________________

____

____

Describe how this event could have been prevented: ______________________

____

Provide Witness Information:

Name: ______________________ Phone: ______________________
Name: ______________________ Phone: ______________________
Name: ______________________ Phone: ______________________

Personnel Notified of Incident (Provide name, date and time):

CH2M HILL Personnel:

____

Client Personnel:

____

Additional Comments:

____

____

Injury/Illness Section **[Complete only if Injury/Illness Incident type selected]**

Who was injured?

☐ CH2M HILL Employee or CH2M HILL Temp Employee
☐ Subcontractor to CH2M HILL (Non-LLC Joint Venture Project)
☐ LLC Joint Venture Partner Employee
☐ LLC Joint Venture Project Subcontractor/Contractor
☐ Other

Name of Injured: ______________________ **Job Title:** ______________________

Employer Name: ______________________ **Supervisor of Employee:** ______________________

Complete for CH2M HILL Employee Injuries

Business Group of Injured Employee: ______________________

Has the employee called the Injury Management Administrator (1-866-893-2514)?

☐ Yes ☐ No ☐ Not Sure

Has the injured employee's supervisor been notified of this incident?

☐ Yes ☐ No ☐ Not Sure

Complete for Non-CH2M HILL Employee Injuries

Has the project safety coordinator been notified of this incident?

☐ Yes ☐ No ☐ Not Sure

Project Safety Coordinator: ______________________________

Body Part Affected: ______________________________

Injury/Illness (Result): ______________________________

Describe treatment provided (if medication provided, identify whether over-the-counter or prescription): ______________________________

____

Describe any work restriction prescribed (include dates and number of days): ______________________________

____

Physician/Health Care Provider Information

Name: ______________________________ Phone: ______________________________

Was treatment provided away from the worksite?

☐ No

☐ Yes

Facility Name: ______________________________

Address: ______________________________

City: ______________________________ Phone Number: ______________________________

Was injured treated in an emergency room?

☐ No ☐ Yes

Was injured hospitalized overnight as an in-patient?

☐ No ☐ Yes

General Information Environmental Section **[Complete only if Environment/Permit or Spill/Release Incident type selected]**

Who had control of the area during the incident?

☐ CH2M HILL, Company: ______________________________

☐ Subcontractor, Company: ______________________________

☐ Joint Venture Partner/Contractor/Subcontractor, Company: ______________________________

☐ Other, Company: ______________________________

Relationship to CH2M HILL: ______________________________

Property Damage Section **[Complete only if Property Damage Incident type selected]**

Property Damaged: ______________________________

Property Owner: ______________________________

Damage Description: ______________________________

Estimated US Dollar Amount: ______________________________

Spill or Release Section **[Complete only if Spill/Release Incident type selected]**

Substance: ______________________________

Estimated Quantity: ______________________________

Did the spill/release move off the property?: ______________________________

Spill/Release From: ______________________________

Spill/Release To: ______________________________

Environment/Permit Section **[Complete only if Environment/Permit Incident type selected]**

Describe Environmental or Permit Issue: ______________________________

Permit Type: ______________________________

Permitted Level or Criteria (e.g., discharge limit): ______________________________

Permit Name and Number (e.g., NPDES No. ST1234): ______________________________

Substance and Estimated Quantity: ______________________________

Duration of Permit Exceedence: ______________________________

HSSE Lessons Learned

[Date] ESBG LL-11-xx

Subject	**[Insert Descriptive Name of Lessons Learned]**
CH2M HILL Project?	[Yes or No]
Situation	[Describe incident or situation that occurred in general terms. Try to be brief and avoid unnecessary details such as names of people or projects, business groups, divisions, dates, location, etc.]
Lessons Learned ***(Recommendations and Comments)***	• Bullet out any lessons learned, recommendations or other important "take away" information that would benefit others. Tie the recommendations to the incident or event, and avoid including information that is not directly tied to the event.
Submitted By	[Name/Office Location/Phone]
Additional Information Contact	[Name/Office Location/Phone]
Keywords/Categories	[Insert any keywords or incident categories that would aid in a search for this lessons learned]

CH2M HILL Health and Safety Plan

Attachment 6

Fact Sheets

Tick Fact Sheet

Vehicle Accident Guidance

Working Alone

NAVFAC Biological Hazards Memo

Eastern Venomous Snake Fact Sheet

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 °F) for arsenic trioxide
Boiling Point:	Sublimes at 613°C (1135°F); 465°C (869 °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 μg/m³
PEL	10 μg/m³
STEL	None
TLV	10 μg/m³

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.

CH2MHILL

Benzene Fact Sheet

Uses and Occurrences: Found in gasoline and other fuels, and used in the manufacture of plastics, detergents, pesticides, and other chemicals.

Physical Characteristics:

Appearance:	Clear, colorless liquid
Odor:	Sweet, aromatic odor
Flammable:	Class IB; NFPA Rating: 3
Flash Point:	11°C (52°F)
Flammable Range:	1.3% to 7.5%
Specific gravity:	0.879; (water = 1.0)
Stability:	Stable
Incompatibilities:	Heat and Oxidizing Agents
Melting Point:	5.5°C (42°F)
Boiling Point:	80.1°C (176 °F)

Signs and Symptoms of Exposure:

Inhalation:	Short term: headaches, nausea, dizziness, respiratory irritation, convulsions, and respiratory paralysis. Long term: fatigue, nervousness, irritability, blurred vision, and bone marrow depression (leukemia)
Skin and Eye:	Short term: dermatitis, irritation. Long term: redness, blistering, and dry, scaly dermatitis
Ingestion:	Gastrointestinal irritation

Modes of Exposure:

Inhalation:	Vapors
Absorption:	Liquid
Ingestion:	Liquid

Exposure Limits:

Action level (AL):	0.5 ppm
PEL:	1 ppm
STEL:	5 ppm
PEL-C:	None
TLV:	0.5 ppm
TLV-STEL	2.5 ppm

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 Benzene standard and Training
EL > PEL	Implement all portions of the OSHA Benzene 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 clothing and gloves

Respiratory: Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation: Move to fresh air; contact a physician

Skin: Quick drenching of body; wash with soap and water

Eyes: Flush with water for 15 minutes, lifting lower and upper lids occasionally; seek medical attention immediately

Ingestion: DO NOT INDUCE VOMITING; seek medical attention immediately

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Cadmium Standard of Practice HSE-504

Cadmium Fact Sheet

Uses and Occurrences

The manufacture and transportation of cadmium compounds; coatings on metals; nickel-cadmium storage batteries; nickel plating, power transmission wire; pigments in ceramic glazes, enamels, and fungicides; corrosion-resistant coatings on marine, aircraft, and motor vehicles; manufacture of nuclear reactor rods; and welding electrodes and solder.

Physical Characteristics

Appearance:	Soft, blue-white, malleable, lustrous metal or grayish-white powder; some compounds may appear as a brown, yellow, or red powdery substance
Odor:	Odorless
Flammable:	Severe fire hazard, such as dust
Flash Point:	Not Applicable
Flammable Range:	Not Applicable
Specific Gravity:	8.64 (metal dust)
Stability:	Very stable
Incompatibilities:	Nitric acid, boiling concentrated hydrochloric and sulfuric acids; contact of cadmium metal dust with strong oxidizers or with elemental sulfur, selenium, and tellurium may cause fires and explosion.
Melting Point:	321°C (610°F)
Boiling Point:	765°C (1,409°F)

Signs and Symptoms of Exposure

Short-Term (Acute):	Dust and Fume: Irritation of nose and throat; inhalation may cause a delayed onset of cough, chest pain, sweating, chills, shortness of breath, and weakness. Death may occur. Dust: Ingestion may cause nausea, vomiting, diarrhea, and abdominal cramps.
Long-Term (Chronic):	Dust and Fume: Repeated or prolonged exposure may cause loss of sense of smell, ulceration of the nose, shortness of breath (emphysema), kidney damage, and mild anemia. Exposure to cadmium has been reported to cause an increase incidence of lung cancer.

Modes of Exposure

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

Exposure Limits

Action level (AL)	2.5 μg/m³
PEL	5 μg/m³
STEL	None
TLV	10 μg/m³, 2μg/m³ (respirable)

Exposure Level versus 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 Cadmium standard and Training
EL > PEL	Implement all portions of the OSHA Cadmium Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Splash-proof or dust-resistant goggles; face shield
Skin:	Protective coveralls, gloves, and footwear
Respiratory:	Air-purifying respirators and supplied air respirators, depending on the exposure

First Aid

Inhalation:	Move to fresh air; seek medical attention immediately.
Skin:	Remove clothing and shoes; wash with large amounts of water.
Eyes:	Flush with water immediately, lifting the upper and lower eyelids; seek medical attention immediately.
Ingestion:	DO NOT INDUCE VOMITING; seek medical attention immediately.

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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^{o}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

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Methylene Chloride Fact Sheet

Uses and Occurrences: Used in paint stripping, polyurethane foam manufacturing as a blowing agent, cleaning and degreasing, and chemical sample extraction. Solvent good for fats, oils, waxes, resins, and rubber. Used in propellant mixtures for aerosol cans. An extraction agent in the pharmaceutical industry.

Physical Characteristics:

Appearance:	Colorless liquid
Odor:	Chloroform-like odor; poor warning property
Flammable:	Combustible Liquid
Flash Point:	N/A
Flammable Range:	13% to 23%
Specific Gravity:	1.33; (water = 1.0)
Stability:	Stable under ordinary conditions of use and storage
Vapor Pressure:	350 mm Hg at 20 ^{o}C (68^{o}F)
Incompatibilities:	Strong oxidizers; caustics; chemically active metals such as aluminum, magnesium powders, potassium and sodium; concentrated nitric acid
Melting Point:	-97 ^{o}C (-143^{o}F)
Boiling Point:	39.8 ^{o}C (104^{o}F)

Signs and Symptoms of Exposure:

Inhalation: <u>Short Term</u>: Causes irrigation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting, and headache. Causes formation of carbon monoxide in blood, which affects cardiovascular system and central nervous system. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. Exposure may make the symptoms of angina (chest pains) worse.

<u>Long Term</u>: Can cause headache, mental confusion, depression, liver effects, kidney effects, bronchitis, loss of appetite, nausea, lack of balance, and visual disturbances.

Skin Contact: <u>Short Term</u>: Causes irritation, redness, and pain. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
<u>Long Term</u>: Dermatitis

Eye Contact: Vapors can cause eye irritation. Contact can produce pain, inflammation, and temporal eye damage.

Ingestion:	May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through gastrointestinal tract may produce symptoms of central nervous system depression ranging from light-headedness to unconsciousness.

Modes of Exposure:

Inhalation:	Vapor
Absorption:	Solution
Ingestion:	Ingestion of solution
Skin and Eye Contact:	Solution

Exposure Limits:

Action Level:	12.5 ppm
PEL:	25 ppm
STEL:	125 ppm
PEL-C:	None
TLV:	50 ppm

Exposure Level versus Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL< AL	Maintain exposure as low as reasonably achievable. Maintain records of initial determination, and provide training.
EL >AL, EL < PEL/STEL	Ongoing monitoring, as required. Medical surveillance.
EL > PEL/STEL	All remaining requirements apply.

PPE:

Eye:	Splash goggles; face shield.
Skin:	Inner glove of polyethylene/ethylene vinyl alcohol, outer glove nitrile or neoprene, Tyvek or other full-body clothing.
Respiratory:	Supplied air respirators are required.

First Aid:

Inhalation:	Move to fresh air; seek medical attention immediately. If breathing has stopped, perform artificial respiration.
Skin:	Promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention immediately.
Eyes:	Immediately irrigate the eyes with large amount of water, occasionally lifting the lower and upper lids. Get medical attention immediately.
Ingestion:	Seek medical attention immediately.

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Enterprise Standard Operating Procedure HSE-512

Vinyl Chloride Fact Sheet

Uses and Occurrences—Polyvinyl chloride and copolymers, organic synthesis, adhesives for plastics, and as a precursor in the production of the common plastic polyvinyl chloride (PVC). It is often a degradation product of a number of chlorinated compounds, including tetra-chloroethylene and trichloroethylene, at hazardous waste sites in soils and groundwater. It can also be a breakdown product of the combustion of PVC or other chlorinated compounds.

Physical Characteristics

Appearance:	Colorless gas
Odor:	Sweet; Odor threshold: 3,000 ppm
Flammable:	Class IA Flammable Liquid Gas; NFPA Rating: 4
Flash Point:	-78 °C (-108°F)
Flammable Limits:	3.6% - 33.0% (% by volume in air)
Specific gravity:	0.91; (water = 1.0)
Stability:	Stable under ordinary conditions of use and storage
Vapor Pressure:	2300 mm Hg (at 20 °C)
Incompatibilities:	Atmospheric oxygen and strong oxidizers may react to produce peroxide, which can initiate a violent polymerization reaction
Melting Point:	-155.7 °C (-248°F)
Boiling Point:	-14 °C (7°F)

Signs and Symptoms of Exposure

Inhalation:	Short Term: Dizziness, light-headedness, nausea, dullness of visual and auditory responses, drowsiness, and unconsciousness Long Term: Thickening of skin, contact and allergic dermatitis, fatigue, coughing and sneezing, abdominal pain, gastrointestinal bleeding, nausea, vomiting, indigestion, diarrhea, jaundice, weight loss, anorexia, and cold and tingling sensations of the hands and feet, carcinogen.
Skin contact:	Short Term: Skin contact with liquid can cause frostbite. Long Term: Dermatitis
Eye contact:	Vapors can cause eye irritation. Contact can produce pain, inflammation and temporal eye damage.

Modes of Exposure

Inhalation:	Vapor
Absorption:	Liquid causes frostbite
Ingestion:	Ingestion of contaminated water

Exposure Limits

Action level	0.5 ppm
PEL	1 ppm
STEL	None
PEL-C	5 ppm
TLV	1 ppm

Exposure Level vs. Regulatory Requirements

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

PPE

Eye: Safety glasses, chemical goggles, face shield

Skin: Tychem SL or other full-body clothing, depending on the exposure. Nitrile, Viton or laminated film gloves.

Respiratory: Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation: Move to fresh air, begin rescue breathing if breathing has stopped and CPR if heart action has stopped, transfer promptly to a medical facility.

Skin: Immerse affected part in warm water. Seek medical attention.

Eyes Flush with large amounts of water for at least 15 minutes. Seek medical attention immediately.

Ingestion: Contact a physician.

Cr VI Fact Sheet

Uses and Occurrences

Chromium is a naturally occurring element in rocks, animals, plants, soil, and volcanic gases. Chromium occurs in the environment predominantly in one of two valence states:

- Trivalent (Cr III), which occurs naturally and is an essential nutrient, and
- Hexavalent chromium (Cr VI), which, along with the less common metallic chromium (Cr 0), is most commonly produced in plating processes

The major industrial sources of Cr VI compounds are chromate pigments in dyes, paints, inks, and plastics; chromates added as anti-corrosive agents to paints, primer, and other surface coatings; chrome plating by depositing chromium metal onto an item's surface using a solution of chromic acid; particles released during smelting of ferro-chromium ore; fumes from welding stainless steel or nonferrous chromium alloys; and as an impurity in Portland cement.

Physical Characteristics

Appearance:	Dark red flakes or powder
Odor:	None
Flammable:	Non-combustible solid, but will accelerate the burning of combustible materials
Flash Point:	None
Flammable Range:	None
Specific gravity:	2.7 for Cr VI
Stability:	Stable
Incompatibilities:	Reducing and oxidizing agents, acetic acid
Melting Point:	1907°C or 3465°F for Cr
Boiling Point:	2671°C or 4840°F for Cr

Signs and Symptoms of Exposure

Short term (Acute):	Coughing,, sneezing, chest pain, breathing difficulty, itching and burning sensation to skin and lungs.
Long term (Chronic):	Allergic (asthma like symptoms) respiratory reaction, skin and eye irritation, nosebleeds, contact dermatitis, allergic like skin reaction, ulceration and perforation of the nasal septum

Modes of Exposure

Inhalation:	Dusts and fumes
Skin Absorption:	Liquid
Ingestion:	Dusts and liquid

Exposure Limits

Action level	2.5 micrograms per cubic meter (μg/m^3)
PEL	5 μg/m^3
STEL	None
TLV	5 μg/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 Cr VI standard and Training
EL > PEL	Implement all portions of the OSHA Cr VI Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Safety glasses;
Skin:	Chemical protective gloves and body protection
Respiratory:	Air-purifying respirators and supplied-air respirators, depending on the exposure, and a PAPR if requested by the worker

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

Tick-Borne Pathogens — A Fact Sheet

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are actually six notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity—even in places that are predominantly paved with bordering vegetation.

Hazard Recognition

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

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These 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. For this region, 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.

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. For Lyme disease, the bite area will sometimes resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.

Deer Tick

Distribution of Deer Tick (dark green)

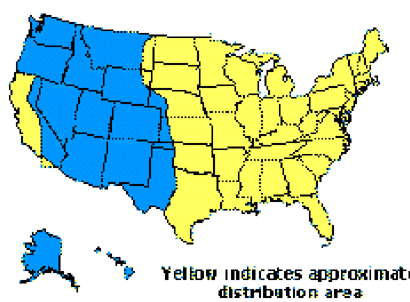
From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)

Distribution of Pacific Deer Tick (dark green)

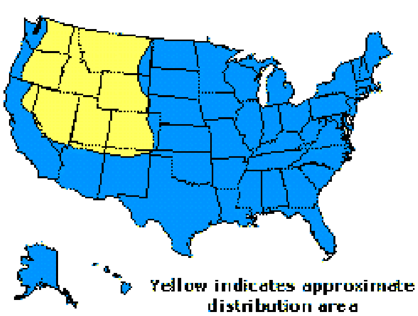
Lone Star Tick

Distribution of Lone Star Tick (Green)

Dog Tick



Rocky Mountain Wood Tick



Hazard Control

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

- 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—tick-borne 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 by between 72 and 100 percent 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 to a 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 to control exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be easily seen, 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 any time 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 situations such as hand-to-face contact, eating, drinking, and smoking 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.

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.

Tick Removal

1. Use the tick removal kit obtained through the CH2M HILL Milwaukee warehouse, or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.
Error! Objects cannot be created from editing field codes.
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. Avoid squeezing, crushing or puncturing 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. Should you wish to save the tick for identification, place it in a plastic bag, with the date of the tick bite, and place in your freezer. It may be used at a later date to assist a physician with making an accurate diagnosis (if you become ill).

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. Individuals previously infected with Lyme disease does not confer immunity—re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

The employee should contact the Injury Management/Return To Work provider (IMRTW), WorkCare using the toll-free number 866-893-2514 to report the tick bite. WorkCare will follow-up with each CH2M Hill employee who reports a tick bite and is at risk of developing Lyme disease by monitoring for symptoms up to 45 days, and will refer the employee to a medical provider for evaluation and treatment as necessary.

2011 Vehicle Accident Guidance—ESBG

Remember that if you a **renting** a non-CH2M HILL owned vehicle (short-term rental) in the U.S., you should carry the insurance card from the state where your driver's license is issued.

If you operate a **fleet vehicle**, carry the insurance card where the vehicle is registered.

For ALL Vehicles if you are in an accident:

1. If you are injured, call 911 for emergency medical treatment or 1-866-893-2514 to contact the CH2M HILL Occupational Nurse/Physician for minor injuries. If you feel you have not been injured, contact the RHSM for guidance on whether calling the CH2M HILL Occupation Nurse/Physician is applicable.

2. **Call the Police--**For any vehicle accident/damage, it is recommended that the local police (or site security/emergency services if working on a client site that provides such services) be called to determine if a report needs to be filed. In some instances, a report may not be required (during accident alerts, or in public parking lots). Document that the authorities were called and follow up with any guidance they give you. State requirements vary. If a report is filed, obtain a copy.

3. Notify Supervisor, (and PM/RHSM if working on a project site)

4. Complete a HITS report on the VO.

Additional Steps

To report an auto accident, and before a claim can be taken by telephonic reporting, have available your name (the company name alone is no longer accepted, a driver's name must be provided even for fender benders), location of accident and your office address if different than the accident location, business group and project number. A claim cannot be taken without your name, address, business group and your project number. By location the state where the accident occurred, and which office you are aligned to, i.e., accident occurs in Idaho, but you are out of the Denver office. Advise the claim recorder the accident occurred in ID, but that your office location is Denver. This will assist the claim intake person in identifying location coding for the claims.

Auto accidents involve two different sections of an Auto policy:

1) Liability to others due to Bodily Injury and Property Damage
2) Physical Damage - Comprehensive and Collision - damage to the vehicle CH employee is driving

CH2M Hill has Liability coverage for any auto - our policy will respond on either a primary or excess basis.

Refer to the table below for additional notifications to make based on the type of accident experienced and type of vehicle being used.

CH2MHILL

HSSE Target Zero World-Class Performance

Liability - Bodily Injury or Property Damage to Others

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill - Primary	Contact Broadspire (1-800-753-6737); Jennifer Rindahl/DEN (720-286-2449); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill - Primary	Contact Jennifer Rindahl/DEN (720-286-2449)
Client vehicle driven by CH2M Hill employee	Client's auto policy unless client has made CH2M Hill responsible for vehicle	Contact Broadspire (1-800-753-6737); Contact Jennifer Rindahl/DEN (720-286-2449); contact client;
Short term lease (30 days or less)	Rental car company if rented through Enterprise, Budget or Hertz; CH2M Hill excess	Contact Broadspire (1-800-753-6737); Contact local branch of rental car company where vehicle leased (ERAC includes 24 hour roadside assistance) and Jennifer Rindahl/DEN (720-286-2449)
Short term lease (30 days or less)	CH2M Hill - Primary if rented through company other than our national agreements; $100,000 deductible	Contact Broadspire (1-800-753-6737); Contact rental car company and Jennifer Rindahl/DEN (720-286-2449)
Personal vehicle used on business	Employee's personal auto policy; CH2M Hill on an excess basis	Contact personal auto insurance company; contact Jennifer Rindahl/DEN (720-286-2449)

Physical Damage - damage to vehicle CH employee was driving

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill ONLY if vehicle is scheduled on policy - $5,000 deductible	Contact Broadspire (1-800-753-6737); Jennifer Rindahl/DEN (720-286-2449); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill Equipment Schedule if scheduled on policy	Contact Jennifer Rindahl/DEN (720-286-2449)
CH2M Hill fleet, pool or project vehicle - long term lease	ARI if physical damage coverage purchased - $500 deductible	Contact Jennifer Rindahl/DEN 720.286.2449; call ARI at 1-800-221-1645 give them Client Code and ARI fleet vehicle number; and notify Linda George/DEN - Fleet Coordinator - 720-286-2057
Client vehicle CH2M Hill Employee is driving	Client's auto policy unless client has made CH2M Hill contractually responsible for vehicle	Contact Jennifer Rindahl/DEN (720-286-2449); contact client; contact Broadspire (1-800-753-6737)
Short term lease (30 days or less) using corporate VISA	VISA if corporate credit card used and vehicle is not a pickup, truck, cargo van or used off-road	Contact VISA - 1-800-847-2911 or http://www.visa.com/eclaim
Short term lease (30 days or less) through Enterprise (ERAC) and vehicle is used off-road and physical damage coverage included when vehicle leased	ERAC up to $3,000 in damage; CH2M Hill's coverage is excess	Notify Rental Car Company; contact Jennifer Rindahl/DEN (720-286-2449) if damage over $5,000
Short term lease (30 days or less) did **not** use corporate VISA	CH2M Hill - $5,000 deductible (project responsibility)	Contact Broadspire (1-800-753-6737); Contact Jennifer Rindhal/DEN 720-286-2449; contact VISA - 1-800-847-2911 or http://www.visa.com/eclaim
Personal vehicle used on business	CH will reimburse the amount of the deductible carried on the employee's policy up to $500 whichever is less	Contact Jennifer Rindahl/DEN (720-286-2449); contact client; contact Broadspire (1-800-753-6737)

Details for reporting a claim on the CH2M Hill VO are accessed by going to the VO home page and clicking:

GLOBAL ENTERPRISE SERVICES/INSURANCE & BONDING/CLAIMS REPORTING

HOW DO I REPORT A CLAIM TAB or access the following URL:

https://www.int.ch2m.com/intrnl/voffice/corp/insurance/claims/report.asp?Menu=menu3h

For Personally Owned Vehicles (POVs):

CH2M HILL does not provide auto insurance for POVs, it is responsibility of the owner. If you are in a vehicle accident conducting company business, contact the police as above, supervisor, and 911 or CH2M HILL's occupational nurse/physician as stated above. Complete a HITS report. Contact Jennifer Rindahl/DEN for assistance for meeting personal insurance deductibles (up to $500) with proof of insurance and deductible.

If using your POV for extended project use, notify the PM to make sure a rental car is not needed. Check your insurance policy for guidance on using the POV for business use.

Additional Resources:

[Claims Resource Manual]

WORKING ALONE PROTOCOL
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:____

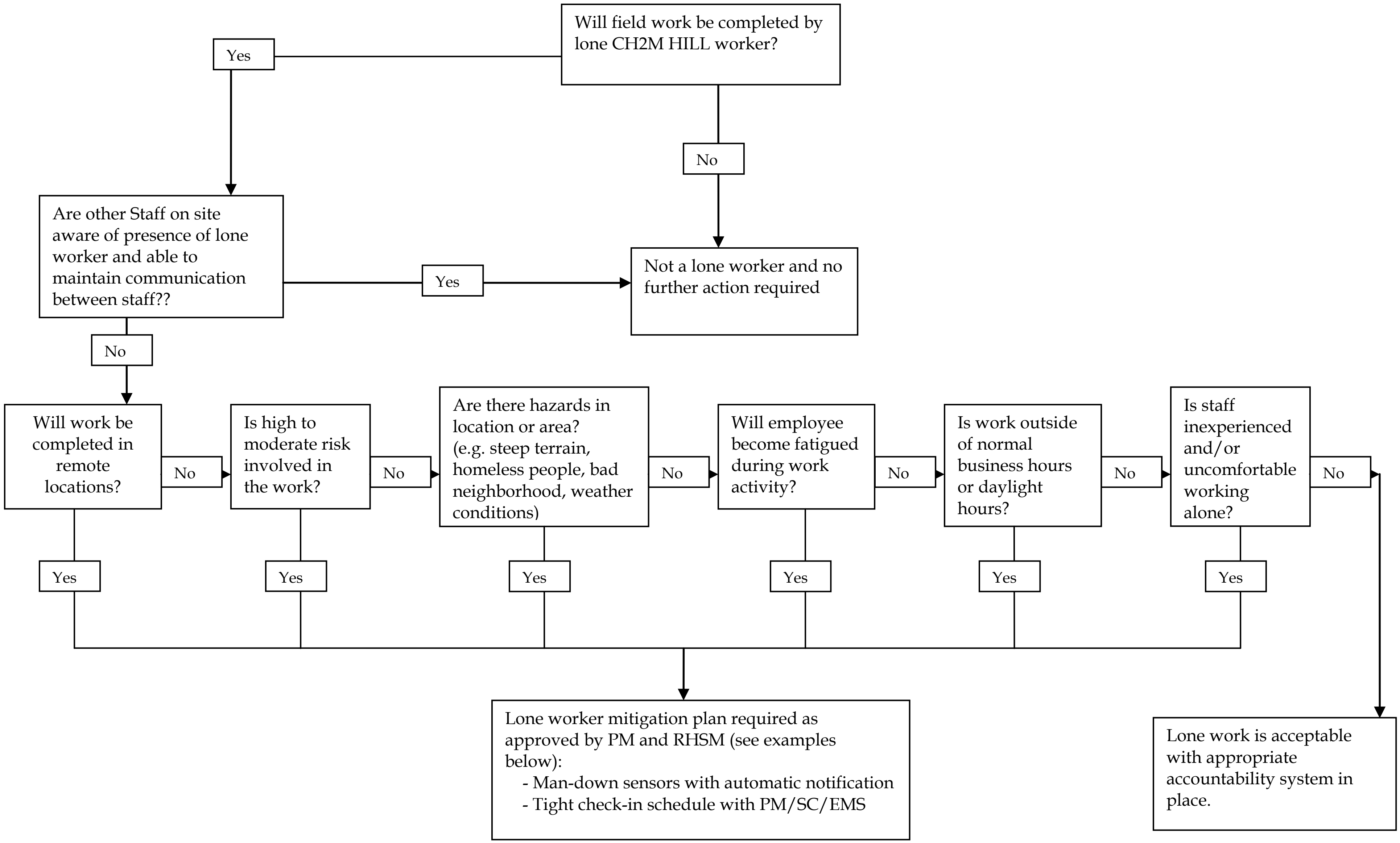
Specified Frequency and time for call in:____

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 Responsible Health and Safety Manager.

Lone Worker Protocol



Personal Protection Measures in the Prevention of Biological Incidents

TO: NAVFACLANT CLEAN Members

COPIES: Mark Orman/MKE
Mike Goldman/ATL

FROM: Ray Tyler/VBO, NAVFACLANT Program Manager

DATE: March 4, 2010
1 Attachment

NAVFACLANT CLEAN members, you are to be commended in reducing the number of biological incidents over the past years, particularly those related to tick bites. Our goal is to have zero biological and other safety incidents on the CLEAN program. To achieve Target Zero and to make sure that no one is injured on the job or at home, this memo outlines the procedures in selecting the appropriate clothing, treatment options, and inspection procedures which must be followed on CLEAN projects to prevent biological incidents.

Clothing & Insect Repellant Requirements

The selection of which clothing to utilize will depend on several factors including weather conditions, site vegetation and tasks to be completed. The table below provides the type of protection to be applied for each staff member conducting field work (including site inspections) on Navy CLEAN projects. Any deviations from the below table should be discussed with the PM and the Program H&S Manager, Mark Orman/MKE.

Body Part	Protective Measure
Head	Light colored hat with wide all-around brim (required) Treat neck with DEET (required)
Upper Body	Light colored long sleeve shirt (required) Treat exposed skin with DEET (required) One of the following must be worn: 1) Pre-treated or self-applied Permethrin clothing 2) Tyvek® coverall 3) Bug Suit
Lower Body	Light colored long pants tucked into socks and taped to prevent any entry points (required) One of the following must be followed: 1) Pre-treated or self-applied Permethrin clothing treatment 2) Tyvek® coverall 3) Bug suit
Feet	White socks (recommended) Taped pant cuffs to boots (required) Pants tucked into socks (required) Permethrin gaiters (optional)

A checklist has been developed for staff to remind us of the procedures that should be followed each day staff are working in an environment where contact with biological is expected (Attachment 1). This checklist should be filled out daily for each team and will become part of the project file and will be asked for if a biological incident occurs.

As with personal clothing as well as suits, it is critical that the user remove the clothing as soon as possible and properly handle the used clothing. Shortening the time the clothing is worn reduces the chances from ticks to make their way from your clothes to your skin.

Self Applied Permethrin Clothing Treatment

Permethrin based repellents (i.e., Permanone) have proven to be highly effective in preventing tick bites. Permethrin is actually an insecticide, rather than a traditional repellant, and works primarily by killing ticks on contact with the clothes (although it also has some repellant properties). Repellants containing Permethrin are for use on clothing only, and **are not intended for skin application**. These products are formulated as aerosol sprays or pumps, and will typically provide up to 2 weeks of protection from a single treatment (lasting through several washings). Typically, these products are applied in a well ventilated area, and allowed to dry for 2-4 hours (more time is required for higher humidity environments). Costs for these repellents generally run from $7 to $20.

While skin reactions are not common, it is recommended to avoid contact with face eyes or skin when treating clothing. If a reaction is noticed, remove the clothing and shower as quickly as is possible. All chemical treatments, either for clothing or for skin, should follow the manufacturer's instructions. Additional information on the application of repellents can be found on the Center for Disease Control (CDC) website:
http://www.cdc.gov/ncidod/dvbid/westnile/repellentupdates.htm

Pretreated Permethrin Clothing

There are some manufacturers which produce clothing that has already been treated with repellents, such as Permethrin. Typically, the fibers are impregnated with the repellant, reportedly making them able to withstand up to 70 wash cycles. While there is likely some variability in how long these clothing remain effective, they could also be retreated to prolong their effectiveness. Purchasing pre-treated clothing is one alternative to applying a Permethrin based repellant to your clothing. However, the costs of these clothes can range from $20 to $50. Staff should discuss the need for such clothing with their PMs.

Bug Suits

Bug Suits (aka Bug-Out-Suits), are garments which are assembled with a mesh foundation woven throughout the pants and jacket, along with a mesh/fabric hood. These provide a physical barrier to small insects. Typically, these garments are not treated with repellants and still are susceptible to infiltration through seams.

Bug Suits add an additional layer of clothing to the wearer when used properly. Drawbacks to the use of the suits may include an increase of tripping hazards if not properly sized, impaired vision, and an in increase risk of heat related illnesses. The suits should not be used around heavy equipment or moving parts that could catch the material and pull an individual into the equipment. Frequent inspections of the suit is required to ensure that no tears have developed or separations of seams. Additional rest breaks and increased personal monitoring is necessary during their use. Bug Suits should be ordered and charged to the projects they are being used on.

Tyvek®

Tyvek® suits provide a continuous physical barrier for the legs and torso, which makes it very difficult for ticks to infiltrate. The light color also makes it easier to see ticks that have transferred onto the body. The disposable nature of the suits also reduces the hazard associated with ticks which go undetected in clothing at the end of the day. Tyvek® clothing does present an additional heat stress hazard for employees. Additional rest breaks and increased personal monitoring is necessary during their use.

Skin Treatment

The use of skin applied repellants is required when working in areas where the presence of ticks is anticipated. While other repellants may provide some level of protection, DEET (*N*,*N*-Diethyl-*meta*-toluamide) based repellants are required for use on CH2M HILL projects.

These repellants must be reapplied periodically in accordance with manufacturer's recommendations. The effectiveness of DEET on the skin is influenced by the concentration of DEET, absorption through the skin, evaporation, sweating, air temperature, wind and abrasion of the treated surface by rubbing or washing. Studies have shown that 100% DEET may offer up to 12 hours of protection, while lower concentrations of DEET (20%-34%) may provide between 3 to 6 hours of protection. The Centers for Disease Control and Prevention (CDC) recommends repellents with between 20%-30% DEET content. Some non-DEET repellent products also provide some level of protection, but those products have been found to offer a lesser degree of protection than DEET based products. It should be noted that while DEET will repel ticks and decrease the chance of a tick bite, it may not deter a tick from walking across the skin to unexposed and untreated areas.

Tick Checks and Response to Tick Bites

The use of protective clothing and application of repellents is only part of preventing a biological incident. No one should be under the false impression that by using the appropriate clothing and applying adequate repellent that they are immune to tick bites. By conducting routine tick checks, reducing the time which ticks have to find a pathway to your skin, we can further reduce the risk.

Tick Checks

By checking ourselves and others for ticks, we are able to find ticks before they have a chance to attach or transfer diseases. Field staff will conduct personal checks as often as possible, but no less than once at lunch and at the end of the day. The inspection at the end of the day should include an unclothed tick check. Personal checks should be conducted using a mirror to look over areas that are not able to be seen by just one person. Clothing should be turned inside-out and thoroughly inspected.

It is also recommended that if facilities are available, that a second set of clothes be brought to change into. The clothing worn during the day should be placed in a plastic trash bag and taped closed. The bag should be transported separate from the passenger area of the vehicle (i.e. in trunk, back of pick-up truck).

Personal Hygiene

In addition to removing clothing as soon as is practical, it is also important to practice good and immediate hygiene following field work. By washing shortly after tasks are complete, not only are you washing away any site dirt, you are also removing the applied repellent. Showering is the recommended method for removing residual repellent and provides an additional opportunity for personal check. If showering is not readily available, the minimum requirement is to wash the hands and face prior to eating or drinking.

Tick Bite and Removal

If bitten by a tick, act promptly. Remove the tick immediately using tweezers pulling gently at the point of attachment (head). Rick removal kits may also be ordered through the equipment warehouse. It is essential to remove the tick as soon as possible (best if found and removed within 24 hours of attachment).

The tick should be placed in a Ziploc bag for testing at a later date, if deemed necessary by the Occ. Nurse. As with any incident, contact the PM, HSM and the WorkCare Occupational Health Nurse at **1-866-893-2514** as soon as possible, and provide as much information as possible regarding the date, time and location of the bite. Follow the nurse's advice regarding monitoring symptoms and follow-up contact.
Complete HITS (incident report) or designate a person to complete the form as soon as possible, but no more than 24-hours after identifying the bite. ***Remember, time is your enemy. The longer you wait to inspect for a tick, the longer it takes for you to communicate a tick bite, the more likely it is that a tick can transfer a blood borne illness.***

Final Words

I am asking all of you to follow the steps described in this memo and really try to modify your behavior and continuously strive for our "Target Zero" goal of no incidents or accidents. This isn't easy, I know. Pleasing the client, meeting deadlines, and staying within budget compete with our time to embrace the H&S culture, but each of us must work harder to push past simply complying with H&S. You need to make an individual commitment to incorporate H&S into every activity you involve yourself with, at work and at home. Thank you all for what you do every day. Be safe.

Identifying Eastern Venomous Snakes

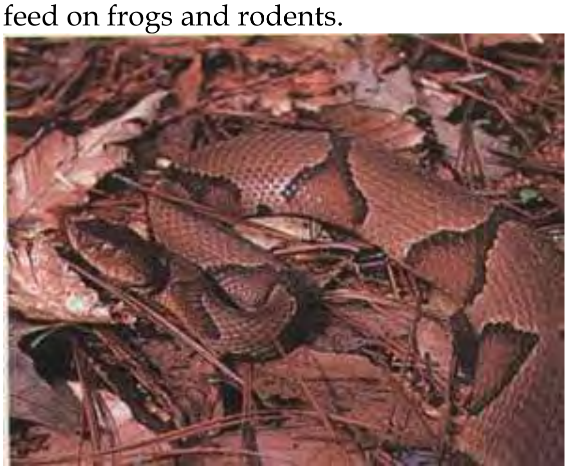
Canebrake Rattlesnake, *Crotalus*

Other common names: timber rattlesnake, banded rattlesnake.
Identification: 25-70 inches. Light tan or beige above with dark brown crossbands and a reddish stripe down the middle of the back; brown band from eye to angle of mouth; tail dark gray or black; scales keeled.
Habits: Canebrake rattlers inhabit wooded and forested areas, preferring hardwoods. They tend to lie motionless in a resting coil, usually near logs, tree bases, or in thickets. They feed on rodents, preferring wood rats and squirrels. Canebrake rattlers move from hibernation sites to summer foraging grounds in mid-spring, and return to winter quarters in late summer and early fall. They are most often observed during these periods of travel.

Copperhead, *Agkistrodon contortr*

Other common names: Highland moccasin, lemontail, yellowtail.

Identification: 14-45 inches. Beige or pale gray, often with a pink or orange tint above, with broad, darker brown, hourglass shaped crossbands; underside lighter than back, with dark brown blotches; scales keeled. The top of the head is patternless, often with a faint orange tint. Young copperheads have a bright yellow tail. **Habits:** Copperheads frequent forested and wooded areas. They are unaggressive, but create a potential hazard by lying motionless and camouflaged. They feed on frogs and rodents.



Coral Snake, *Micrurus fulvius*

Other common name: harlequin snake.
Identification: 15-42 inches. Series of wide black and red rings, separated by narrow yellow rings, encircling the body; snout black; scales smooth.

Habits: Coral snakes are secretive and rarely encountered. They forage in leaf litter during the day or night, and remain concealed most of the time. They inhabit dry, wooded areas, especially pine lands. Coral snakes don't strike, but if carelessly handled they may bite unexpectedly and should not be held under any circumstances. They feed on lizards and other snakes.

Cottonmouth, *Agkistrodon piscivo*

Other common names: water moccasin, stump-tailed moccasin.

Identification: 15-55 inches. Dark tan, brown or nearly black, with vague black or dark brown crossbands; a black and white line runs from the eye to the angle of the mouth; underside dark with large blackish blotches; juveniles have a bold crossbanded pattern of brown and pink or orange, with yellow tail; scales keeled.

Habits: Cottonmouths frequent swamplands and pond, lake and stream borders, especially those with dense canopies. They frequently remain coiled near water, or on logs and stumps in water. Upon provocation, cottonmouths will coil, open their mouths to expose the white lining, and shake their tails. They are highly defensive and not inclined to get out of one's way. They feed on fish, frogs and small mammals.

Distribution: Throughout Louisiana.

Eastern Diamondback Rattlesnake

Identification: 25-90 inches. Brown above with dark brown, pale-edged, diamond-shaped markings; dark band bordered by light stripes through eyes; tail with dark rings; scales keeled.

Habits: Diamondbacks occur in open pinelands. Adults feed on small rabbits.

Distribution: Upland portions of Tangipahoa, Washington and St. Tammany Parishes.

Pygmy Rattlesnake, *Sistrurus mil*

Other common name: ground rattler.

Identification: 12-25 inches. Pale gray or tan above, with a row of dark spots down the back and one row on each side; black band through eyes; underside gray or tan with brown blotches; scales keeled.

Habits: Pygmy rattlesnakes occur in wooded areas, but tend to avoid swamps. They favor areas with a grass understory such as pinelands and dry coastlands.

Distribution: Through most of Louisiana except the Mississippi River Valley and coastal marshes and prairie west of the Atchafalaya Basin.

Source: Obtained from the Louisiana Department of Wildlife and Fisheries

Snakebites

Snakes bite either to capture prey or as a defense. In venomous species, the discharge of venom is voluntary. Venom is stored in glands on either side of the head behind the eyes, and is expelled through muscular action. The venom passes through two ducts leading to hollow fangs located in the forward portion of the upper jaw (maxilla). Each fang possesses a small opening near the tip through which the venom is injected into the site of the bite (Fig. 1). This action is similar to forcing drops of fluid through a hypodermic syringe and needle.

Because injection of venom is voluntary, venomous snakes may occasionally deliver a "dry" bite in which no venom is injected. This can occur when snakes produce a superficial bite or are panicked. About one in five bites to humans from venomous snakes are in this category. At other times only a specific amount of venom is injected. Due to the spongy nature of the glands it is nearly impossible for a snake to expel all of its venom. When most of the venom is expelled from the glands, between 15 and 20 days are required for the secretory tissue to refill the glands. However, secretion appears to be rapid during the first few days, so that venomous snakes may possess dangerous quantities of venom within a day or two of its expulsion.

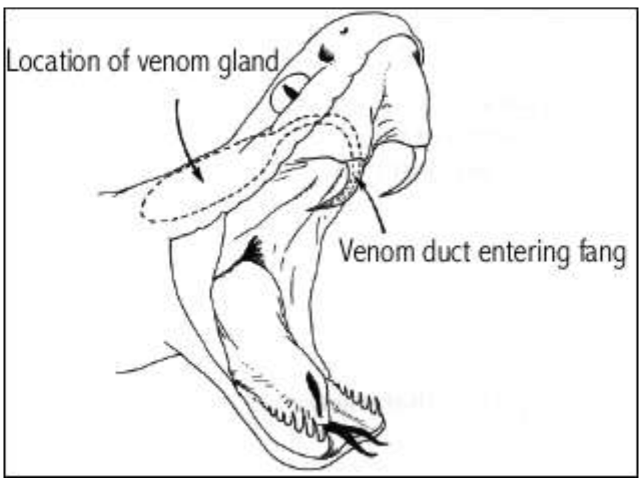


Fig. 1. Venom apparatus of a rattlesnake

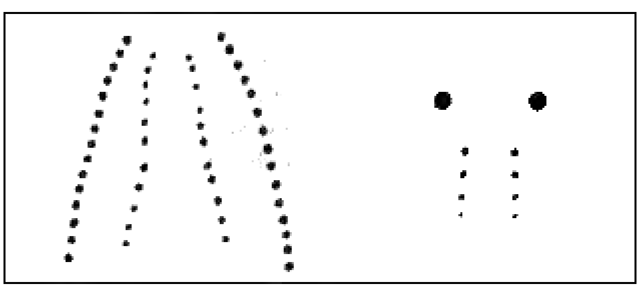


Fig. 2. Tooth mark pattern from the

Bites from venomous snakes exhibit a distinctive pattern (Fig. 2). Typically only one or two fang punctures are evident on the skin, although smaller scratches or punctures may be evident from small teeth within the snake's mouth. Bites from non-venomous snakes display markings from small teeth only, typically seen in rows. Sharp, throbbing pain usually results immediately when venom is injected from the pit vipers, and will immediately indicate envenomation. However, pain is not always a symptom, even from potentially lethal bites. Bites from coral snakes may be nearly painless, or exhibit limited pain near the bite. Bites from nonvenomous snakes produce superficial pain, if any at all.

Bites from pit vipers are hemorrhagic, that is, they break down vascular tissue by enzymatic action. Upon entering the body, the venom travels through lymphatic vessels and sometimes the bloodstream, binding with the victim's tissues as it goes. This results in severe pain and swelling, and can produce secondary results such as dizziness, nausea, headache and shock. Short-term results from bites may include discoloration and eventual tissue loss. In fatal bites, death usually results from loss of blood pressure and volume through destruction of vascular tissue.

Coral snake venom is neurotoxic and effects the central nervous system. Thus, there may be little pain or swelling from the bite. However, effects on the nervous system can cause the arrest of involuntary muscle activity that normally controls breathing and heartbeat. Envenomation may cause symptoms of drowsiness or anxiety. It is important to note that subtle symptoms from coral snake bite may not be apparent for several hours.

Individuals may react differently to venomous snakebites, just as some people are more susceptible to bee stings than others. Successive bites may initiate some immunity that can reduce the negative impact of bites. However, successive bites often increase sensitivity to venom, producing the opposite effect -- people who have experienced two or three previous bites may go into shock if subsequently bitten.

Snakebite is a rare occurrence, even among people who spend a great deal of time outdoors. In Louisiana, approximately one in 10,000 people are bitten by venomous snakes each year. The people at greatest risk of being bitten are those who handle snakes. This includes individuals who keep venomous snakes as pets, or are in the habit of killing or skinning snakes. Another high-risk category is children playing outdoors. Fatality from snakebites has become a rare occurrence: about one in 600 reported bites are fatal following medical treatment.

Treatment. The first step in snakebite treatment is to avoid panic. The low death rate from snakebites should be reassuring.

What to do:
1) Remain calm; snakebite is rarely fatal.

2) Seek immediate medical attention. Call the Occupational Nurse 1-866-893-2514.

Prevention. Snakebite can be avoided in a number of ways:
1) Be cautious about where hands and feet are placed. Do not put hands in holes or under objects (i.e., lumber, scrap metal, overturned boats) without first being sure that a snake is not located underneath.

2) Do not lay your head down or sit down in vegetation or other situations where there may be any doubt about the presence of venomous snakes.

3) Wear proper foot gear such as hightop leather boots and snake chaps when walking through dense vegetation.

4) Don't attempt to capture, tease or handle venomous snakes. Involuntary nervous activity may allow snakes to bite for up to an hour after they have been "killed."

5)Be vigilant for snakes while walking and working

Source: Obtained from the Louisiana Department of Wildlife and Fisheries

Observed Hazard Form

CH2MHILL

OBSERVED HAZARD FORM

Name/Company of Observer (*optional*):

Date reported:____________________

Time reported:______________________

Contractor/s performing unsafe act or creating unsafe condition:

1. ____

2. ____

3. ____

Unsafe Act or Condition:

____
____
____
____
____
____
____
____
____

Location of Unsafe Act or Condition:

____

Name of CH2M HILL Representative:

____

Corrective Actions Taken: Date: ____________

____
____
____
____
____

Project Safety Committee Evaluation: Date: ____________

____
____
____
____
____

Stop Work Order Form

CH2MHILL

Stop Work Order

REPORT PREPARED BY:

Name:	**Title:**	**Signature:**	**Date:**

ISSUE OF NONPERFORMANCE:

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	**Title:**	**Signature:**	**Date:**

** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,*

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	**Title:**	**Signature:**	**Date:**

CH2M HILL HEALTH AND SAFETY PLAN
Attachment 9

Agency Inspection Target Zero Bulletin

Environmental Services Business Group

Bulletin

Subject: HSSE Agency Inspections (OSHA, EPA, DOT, State Health Department)

Do you know what YOU would do if an agency inspector arrived at your site unannounced?

Recently, a State Occupational Safety and Health Administration (OSHA) inspector made an unannounced visit to one of our Federal project sites. OSHA, U.S. Environmental Protection Agency (EPA), and authorized state or local agencies have authority to inspect any facility that is subject to health, safety, and environmental legislation. Inspections may be announced or unannounced. This particular inspector indicated that the project was targeted for an inspection because the work was funded by the American Recovery and Reinvestment Act (ARRA).

Enterprise Standard Operating Procedure (SOP) HSE-201, *Agency Inspections and Communications,* describes the responsibilities, procedures, and requirements associated with inspections conducted by external regulatory agencies, as well as the methods for communicating information to key individuals. This Target Zero Bulletin is a brief summary of what to do in the event of an agency inspection at your site. Refer to the SOP for more specific guidance.

Notification of Inspections

- If the inspection is an announced regulatory agency inspection, the Project Manager (PM) should notify the Responsible Health and Safety Manager (RHSM) and Responsible Environmental Manager (REM) well in advance of the inspection.
- If an unannounced agency inspector visits one of our projects, Field personnel must immediately notify the project Emergency Response Coordinator (ERC). Typically the ERC is the Safety Coordinator (SC).
- The ERC must immediately notify the RHSM/REM, as appropriate, of unannounced inspections, or designate someone to call the RHSM/REM. The RHSM/REMs can provide guidance to the field staff and PM.

Inspector Credential Verification

- Upon arrival, the ERC must request the inspector to provide official credentials. Record the inspector's name and office phone number or obtain the inspector's business card.
- The inspector shall sign the visitors log and be given a site-specific health, safety, and environmental protection briefing.
- The inspector shall meet any site access requirements associated with security clearances, specialized training, and medical monitoring. The CH2M HILL representative shall verify that the inspector possesses these requirements; access will only be granted to those areas where appropriate access requirements are met. Some inspectors have the authority to gain access to any work area at any time, such as an inspector with a search warrant. In these cases, we can stop work operations as necessary to protect the safety of the inspector(s).

Opening Conference

- The CH2M HILL Project Manager, ERC, RHSM, or REM, and the inspector shall determine attendees for the opening conference. The RHSM (for OSHA and other worker health and safety inspections) or REM (for environmental inspections) shall join the opening conference via conference call.
- The inspector shall inform CH2M HILL of the purpose of the inspection and provide a copy of the complaint, if applicable.
- The inspector shall outline the scope of the inspection, including employee interviews conducted in private, physical inspection of the workplace and records, possible referrals, discrimination complaints, and the closing conference(s).

Requests for OSHA Logs

- An OSHA inspector may request to review the project OSHA Injury/Illness log, better known as the OSHA 300 Log. Contact your RHSM for assistance in obtaining the OSHA 300 Log.
- Field projects with a continuous duration of one year or longer are considered to be separate establishments and are required to maintain an OSHA 300 log specific to the project. The project OSHA 300 log should be maintained onsite and kept current.
- Recordable injuries and illnesses sustained on field projects less than one year in duration are maintained on the CH2M HILL office log where the injured employee is based.

The Inspection

- The scope of the inspection shall be limited to that indicated by the inspector in the opening conference. The inspector shall be escorted to relevant areas only. The ERC or other designated by the RHSM or REM must accompany the inspector during the inspection.
- Ensure that the inspection is limited to the scope that the inspector disclosed during the opening conference. The ERC should always take notes which identify: areas inspected, machinery or equipment and materials examined, employees or other persons interviewed, and photographs taken by the inspector.
- The inspector will observe safety, health, and environmental conditions and practices and document the inspection process. The inspector may also take photos and instrument readings, examine records, collect air samples, measure noise levels, survey existing engineering controls, and monitor employee exposure to toxic vapors, gases, and dusts.
- CH2M HILL should gather duplicate information (photographs, readings, samples) in the same manner and condition as the inspector. If the equipment needed to take duplicate samples is not onsite, ask the inspector if the sampling can wait until the equipment is available. If samples are taken, request a description of the tests that the agency intends to perform on the samples and request results as soon as they are available.
- Employees may be questioned during the inspection tour. The employee can refuse to speak to an inspector, can speak to the inspector with a company representative (including management) present, or can speak to the inspector privately. It is CH2M HILL policy that employees who wish to speak to the inspector are not discriminated against, intimidated, or otherwise mistreated for exercising their rights during compliance inspections.
- Copies of documents should not be provided to the inspector without the approval of the RHSM or REM or Legal Insurance Department (LID). **DO NOT** voluntarily release documents. Respond only to inspection team requests.
- During the course of the inspection, the inspector may point out violations. For each violation, the CH2M HILL representative should ask the inspector to discuss possible corrective action. Where possible, violations detected by the inspector should be corrected immediately and noted by the inspector as corrected.
- For those items which cannot be corrected immediately, an action plan shall be formulated for timely correction. In any instance, employees exposed to hazards shall be removed from the area.

Closing Conference

After the inspection, a closing conference is normally held as follows:

- The CH2M HILL PM, ERC, RHSM or REM shall be involved via conference call in the closing conference, at a minimum;
- The inspector shall describe the apparent violations found during the inspection and other pertinent issues as deemed necessary by the inspector. CH2M HILL shall be advised of their rights to participate in any subsequent conferences, meetings or discussions. Any unusual circumstances noted during the closing conference shall be documented by the ERC;
- The inspector shall discuss violations observed during the inspection and indicate for which violations a citation and a proposed penalty may be issued or recommended;
- The ERC shall request receipts for all samples and approved documents photocopied by the inspector, request a photocopy of the inspector's photograph log, and request a copy of the final inspection report; and
- Any documentation from an agency inspection must be transmitted immediately to the RHSM or REM, and LID.

Unannounced regulatory agency inspections may happen at any time on our projects -

Get your RHSM/REM and PM involved immediately if an Inspector arrives.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 10

Completed CH2M HILL AHAs

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 11

Material Safety Data Sheets