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FINAL SITE-SPECIFIC WORK PLAN ADDENDUM FOR EXPANDED SITE INSPECTION AT
SITE UXO-17 FORMER FIRING POSITION 2 (ASR #2.212) MCB CAMP LEJEUNE NC
10/1/2010
CH2M HILL

FINAL

**Site-Specific Work Plan Addendum for
Expanded Site Inspection at
Site UXO-17 – Former Firing Position 2
(ASR #2.212)**

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

Task Order 141

October 2010

Prepared for

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

Under the

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

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Acronyms and Abbreviations

bgs	below ground surface
CAMA	Coastal Area Management Act
CamLej	Camp Lejeune
COC	chain-of-custody
CWM	chemical warfare materiel
DDESB	Department of Defense Explosives Safety Board
DFOW	definable feature of work
DGM	digital geophysical mapping
DoD	Department of Defense
DPT	direct-push technology
DU	decision unit
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Investigation
ESQD	Explosives Safety Quantity Distance
ESS	Explosives Safety Submission
EZ	exclusion zone
GIS	Geographical Information System
GPS	global positioning system
GSV	Geophysical Systems Verification
HSP	Health and Safety Plan
IDW	investigation-derived waste
m	meter
MARCORSYSCOM	Marine Corps System Command
MC	munitions constituents
MCB	Marine Corps Base
MD	munitions debris
MEC	munitions and explosives of concern
MGFD	Munition with Greatest Fragmentation Distance
mm	millimeter
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRP	Munitions Response Program

NAVFAC	Naval Facilities Engineering Command
NC SSL	North Carolina Soil Screening Level
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards
NEW	Net Explosive Weight
PA/SI	Preliminary Assessment/Site Inspection
PETN	pentaerythritol tetranitrate
PM	Project Manager
QA	quality assurance
QC	quality control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
SOP	standard operating procedure
UFP-SAP	Uniform Federal Policy Sampling and Analysis Plan
UXO	unexploded ordnance
WP	Work Plan
WQP	water quality parameter

Introduction

1.1 Background and Project Objectives

Marine Corps Base Camp Lejeune (MCB CamLej) is planning an Expanded Site Inspection (ESI) at Site Unexploded Ordnance (UXO) 17, Former Firing Position 2, an area defined as Archive Search Report [ASR] #2.212 in the *Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune, Onslow, North Carolina* (U.S. Army Corps of Engineers [USACE], 2001). The ESI will cover a 12-acre area that may be used to expand the existing Base landfill, which is located immediately south of the site. Based on the historical activities at Site UXO-17, the potential presence of munitions and explosives of concern (MEC) and their impact on soil, sediment, surface water, and groundwater will be assessed under the Munitions Response Program (MRP) before expansion of the landfill facility takes place. The ESI is being conducted to accomplish the following objectives:

- Estimate the number and density of geophysical anomalies that represent potential subsurface MEC.
- Evaluate the presence and nature of munitions constituents (MC) contamination that may exist at Site UXO-17
- Evaluate ecological and human health risks using analytical data collected at Site UXO-17

1.2 Work Plan Scope and Organization

The following activities will be performed in accordance with methods and procedures detailed in the MCB CamLej MRP Master Project Plans (CH2M HILL, 2008c) (referred to hereinafter as the MRP Master Project Plans) to accomplish the objectives described in Section 1.1:

- Perform DGM over 10 percent of Site UXO-17
- Conduct a field investigation for MC contamination by sampling and analyzing groundwater, soil, surface water, and sediment
- Prepare an ESI report

This Work Plan (WP) is divided into sections that provide information on the detailed investigation approach, including procedures to be employed during the execution of the project. Appendices to this WP provide supporting documentation that detail specific procedures for the execution of the project:

- **Section 1, Introduction**, provides general information about this WP, describes Site UXO-17, summarizes the history of the site, and presents the project scope and objectives.

- **Section 2, Technical Management Plan**, identifies the technical approach, methods, and operational procedures that will be used to execute the ESI.
- **Section 3, Field Investigation Plan**, identifies the technical approach, methods, and operational procedures that will be used to execute the field investigation activities, including mobilization and demobilization, land surveying, vegetation clearing, well installation, sampling of environmental media, and DGM.
- **Section 4, MEC Contingency Plan**, identifies the technical approach, methods, and operational procedures that will be used to execute blow-in-place demolition of MEC and/or material potentially presenting an explosive hazard (MPPEH) (if required).
- **Section 5, Explosives Management Plan**, provides details about managing explosives in accordance with applicable regulations.
- **Section 6, Explosives Siting Plan**, placeholder only; not applicable.
- **Section 7, Quality Control Plan**, provides details of the approach, methods, and operational procedures to be employed for quality control (QC) of the ESI activities at Site UXO-17.
- **Section 8, Environmental Protection Plan**, describes the approach, methods, and operational procedures to be employed to protect the natural environment during the performance of all tasks at Site UXO-17.
- **Section 9, References**, lists the references cited in the preceding sections.
- **Appendix A, Health and Safety Plan**, provides an interface with CH2M HILL's overall health and safety program. The Health and Safety Plan (HSP) also includes the MEC avoidance procedures that will be used to ensure that onsite personnel are protected from MEC that may be present at the site.
- **Appendix B, MEC Disposal Standard Operating Procedures**, provides the standard operating procedures (SOPs) for MEC removal.

An Explosives Safety Submission (ESS) Amendment (No. 2) will be submitted to Marine Corps System Command (MARCORSYSCOM) under separate cover for review and approval. The original Site UXO-17 ESS, *Explosives Safety Submission for Munitions Response Activities, Former Firing Position 2, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*, August 2008 (CH2M HILL, 2008b), and *Amendment 1, Explosives Safety Submission for Munitions Response Activities, Former Firing Position 2, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*, December 2008 (CH2M HILL, 2008a) did not include the entire site, only a 4 -acre portion of Site UXO-17. ESS Amendment No. 2 will cover all 16 acres of Site UXO-17, including all MR investigations to be performed at the project site and intrusive investigations of DGM anomalies that will be conducted under separate contract task orders. It will be reviewed and approved by MARCORSYSCOM and Department of Defense Explosives Safety Board (DDESB) for conformance with all applicable Marine Corps, Department of the Navy, and Department of Defense (DoD) requirements for the safe handling of MEC and explosives prior to the start of any intrusive activities.

Until ESS Amendment No. 2 has been approved and approved by MARCOSYSCOM and DDESB, the MARCOMSYSCOM ESS Determination, dated 30 September 2010 will be followed. The 30 September 2010 ESS Determination permits investigation while conducting anomaly avoidance procedures (i.e. no contact with MEC/MPPEH is permitted). In the event MEC/MPPEH is found, CamLej EOD will be notified.

1.3 Site Location and Description

Site UXO-17 encompasses 16 acres and consists of former Firing Position 2 (ASR #2.212). The site lies east of Piney Green Road and north of the current Base landfill (**Figure 1-1**). Access to the site is unrestricted for any Base personnel or visitors.

The focus of this ESI will be on a 12-acre portion of the site, as shown in **Figure 1-1**. The remaining 4 acres of the site were previously investigated in a focused Preliminary Assessment/Site investigation (PA/SI) (CH2M HILL, 2010a).

The surface topography within the area of investigation consists of relatively level terrain at an average elevation of 25 feet above mean sea level. Vegetative cover consists of coniferous woodland and grassland. One known cultural feature exists onsite, Old Bear Creek Road, which crosses the southern portion of the investigation area.

Surface water runoff at Site UXO-17 flows into localized drainage ditches and a small onsite pond which in turn drain to Wallace Creek north of the site.

1.4 Site History

In July 2008, CH2M HILL completed a detailed archival records search report that documented information relating to historical activities at Site UXO-17, including interviews with current and former Base personnel (CH2M HILL, 2010a).

Site UXO-17 was reportedly used as a firing position from the 1950s through at least 1985 (CH2M HILL, 2010a). The current MCB CamLej Range Safety Officer stated that 105 millimeter (mm) and 155 mm howitzers were used at this site to fire practice rounds into the K-2 and G-10 Impact Areas (CH2M HILL, 2010a). In addition, the MCB CamLej Range Control Officer stated that 4.2-inch mortars, 175 mm guns, 8-inch howitzers, and 120 mm mortars also may have been used, with unused projectile propellant being burnt on the ground. No chemical warfare materiel (CWM) was reported to have been used at this site.

Previous Site Investigations

No investigation of the 12-acre portion of the site has been completed to date.

From September through October 2008, CH2M HILL conducted a Focused PA/SI within a 4-acre portion of Site UXO-17 to support the planned expansion of the Base landfill. The boundary of the 4-acre area is shown on **Figure 1-1**. The objective of the Focused PA/SI was to evaluate the presence of MEC and to characterize potential impacts to soil and groundwater related to historical activities in the 4-acre portion of Site UXO-17. Field activities, including land surveying, vegetation clearing, buried utility location, soil and groundwater sampling, and DGM were conducted in accordance with the *Site Specific Work Plan Addendum for Focused Preliminary Assessment/Site Inspection for Former Landfill Firing*

Position 2 (CH2M HILL, 2008d). The results of these investigation activities are summarized below and reported in the draft Focused PA/SI report (CH2M HILL, 2010a).

The DGM survey resulted in the selection of 1,310 anomalies and 21 saturated response areas for intrusive investigation. During the geophysical survey, partially buried and mounded construction debris, such as concrete, rebar, and concertina wire, was observed throughout Site UXO-17. An intrusive investigation to address the anomalies observed during the DGM survey is planned for November 2010. No MEC has been identified at Site UXO-17; however, during vegetation clearance for the PA/SI on August 28, 2008, four M20 practice anti-tank land mines, all classified as munitions debris (MD), were found on the ground surface.

Nine composite surface soil samples were collected from three decision units (DUs; **Figure 1-2**). The samples were analyzed for explosives residues, perchlorate, and Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Analytical results were compared to the U.S. Environmental Protection Agency (EPA) Adjusted Soil Regional Screening Level (RSLs), North Carolina Soil Screening Levels (NC SSLs), and twice the mean Base background concentrations. Explosives residues and perchlorate were not detected in any of the surface soil samples. None of the metals detected in surface soil exceeded screening criteria.

Four subsurface soil samples were collected during the Focused PA/SI and analyzed for explosives residues, perchlorate, and RCRA metals. Analytical results were compared to the EPA Adjusted Soil RSLs, NC SSLs, and twice the mean Base background concentrations. Explosives residues and perchlorate were not detected in any of the subsurface soil samples. No metals were detected in subsurface soil samples at concentrations that exceeded screening criteria.

Four groundwater samples were collected from temporary monitoring wells installed during the Focused PA/SI and analyzed for explosives residues, perchlorate, and total RCRA metals. Analytical results were compared to the EPA Adjusted Tap Water RSLs, North Carolina Groundwater Quality Standards (NCGWQS), and twice the mean Base background concentrations. Explosives residues were not detected in any of the groundwater samples. Perchlorate was only detected in one groundwater sample, although at a concentration less than the corresponding screening criteria. Three metals (chromium, lead and selenium) were detected at concentrations exceeding Base background screening criteria, but did not exceed the Tap Water RSLs or NCGWQS.

Human health and ecological risk screenings were performed to assess the potential for risks associated with exposure to soil and groundwater. Results from these screenings indicated there were no unacceptable risks to human health or the environment owing to exposure to soil or groundwater within the 4-acre portion of Site UXO-17.

1.5 Climate

The climate in the MCB CamLej area is discussed in Section 1.4 of the MRP Master Project Plans (CH2M HILL, 2008c).

1.6 Geology and Hydrogeology

The regional geology and hydrogeology at MCB CamLej is discussed in **Section 1.6 and 1.7** of the MRP Master Project Plans (CH2M HILL, 2008c).

The shallow soils at Site UXO-17 consist of fine-grained sands and silty sands with interbedded clay lenses (CH2M HILL, 2010a). The thickness of the surficial aquifer is at least 16 feet, but the total thickness is undetermined. The depth to water in the surficial aquifer of the 4-acre portion of Site UXO-17, which was subject of the focused PA/SI, ranges from approximately 2 to 10 feet below ground surface (bgs).



Legend

-  Drainage Pond
-  4-acre Focused PA/SI
-  Site UXO-17 Boundary
-  ESI Investigation Area
-  Base Boundary



1 inch = 400 feet

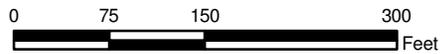
Figure 1-1
Site Location Map
Site UXO-17
MCB CamLej
North Carolina





Legend

-  Subsurface Soil Sample and Temporary Well Location
-  Decision Units
-  Focused MILCON PA/SI Investigation
-  Site UXO-17 Boundary



1 inch = 150 feet

Figure 1-2
Focused MILCON PA/SI Sample Locations
Site UXO-17
MCB CamLej
North Carolina



Technical Management Plan

2.1 Guidance, Regulations, and Policies

The ESI at Site UXO-17 will be conducted under the guidance documents, regulations, and polices described in Section 2.1 of the MRP Master Project Plans (CH2M HILL, 2008c).

2.2 MEC Contingency Procedures

Based on the documented history of DoD activities at Site UXO-17, it is anticipated that if MEC is discovered it can be destroyed onsite. Therefore, alternatives to onsite disposal are not identified in this WP. Likewise, the discovery of MEC that cannot be identified is not anticipated. If MEC items are discovered that cannot be identified, MEC contingency procedures will be followed in accordance with Section 2.2 of the MRP Master Project Plans (CH2M HILL, 2008c).

2.3 Chemical Warfare Materiel Contingency Procedures

Based on the documented history of DoD activities at Site UXO-17, it is not anticipated that CWM will be discovered. However, if it is encountered, all work will immediately cease and CWM contingency procedures will be conducted in accordance with **Section 2.3** of the MRP Master Project Plans (CH2M HILL, 2008c).

2.4 Project Organization, Personnel, Reporting, and Schedule

2.4.1 Project Organization

The key organizations involved in this project are Naval Facilities Engineering Command (NAVFAC), MCB CamLej, the North Carolina Department of Environment and Natural Resources (NCDENR), EPA, and CH2M HILL. Project execution will be conducted by CH2M HILL and its subcontractors; specific duties for CH2M HILL and its subcontractors are described in **Section 2.4** of the MRP Master Project Plans (CH2M HILL, 2008c). CH2M HILL will issue subcontracts for MEC support, buried utility locating, DGM, land surveying, vegetation clearing, direct push technology (DPT) soil sampling, monitoring well installation, laboratory analysis, data validation, and investigation-derived waste (IDW) disposal.

2.4.2 Project Personnel

The reporting relationship between key project personnel and the roles and responsibilities of the key personnel are discussed in **Section 2.4** of the MRP Master Project Plans (CH2M HILL, 2008c). Contact information for key project personnel is shown in **Table 2-1** of this WP.

2.4.3 Project Schedule

Figure 2-1 presents a detailed project schedule, including key project milestones.

2.5 Technical Approach

2.5.1 Task 1—Project Planning

This task includes project management, meetings, WP preparation, and subcontractor procurement.

Project management consists of all work necessary for controlling the project budget and schedule. This includes monthly status reports and invoicing, as well as all other administrative tasks needed for project performance.

Meetings will be held throughout the course of this project to discuss proposed work, present investigation findings, and discuss project status. The meetings are planned to be held at MCB CamLej, CH2M HILL's Charlotte office, or other locations as necessary.

Subcontractor procurement is also included under this task. Anticipated subcontractor services include MEC support, buried utility locating, DGM, land surveying, vegetation clearing, DPT soil sampling, monitoring well installation, laboratory analysis, data validation, and IDW disposal.

2.5.2 Task 2—Site Investigation

All field investigation activities will be performed under this task. The scope of the field investigation and the technical approach are presented in **Section 3**. The primary field investigation activities include:

- MEC avoidance
- Surveying
- Vegetation clearance
- DGM
- Field work support
- Well installation and abandonment
- Environmental sampling
- IDW disposal

2.5.3 Task 3—Sample Management, Analysis, and Validation

This task consists of managing environmental sample data from the time the samples are collected until the validated data are received and incorporated into the project reports. Details for this task are provided in **Section 8.1** of the MRP Master Plans (CH2M HILL, 2008c).

2.5.4 Task 4—Geographical Information System

All environmental data will be collected in preparation for the creation of a geographical information system (GIS) tailored for the investigative needs of Site UXO-17. All digital data will be created using a software platform that will allow it to be loaded directly into the GIS.

The main purpose of the GIS is to assemble all the data required to associate the non-intrusive subsurface geophysics investigative data with their correct geographical locations, the relational database, mapping, and remote sensing data. The GIS tools will be used to manage the project, assemble data, and help identify areas requiring further investigation.

CH2M HILL also will provide the Site UXO-17 GIS data for upload into the existing MCB CamLej GIS. These data will include ArcView project and shape files that best delineate the area on the basis of uses, site conditions, and other information gathered during the study.

2.5.5 Task 5—Reporting

ESI Report

A draft ESI report will be prepared to document the findings of the field investigation. The report will be submitted electronically for concurrent review by NAVFAC and MCB CamLej. Following receipt of review comments, CH2M HILL will issue a revised draft report to NAVFAC, MCB CamLej, EPA and NCDENR for review. A final report will be prepared that will address all comments received on the draft document. The report will summarize the site history, all field activities, and geophysical and environmental data and will present the findings of the human health and ecological risk screenings.

Ecological and human health risk screenings will be conducted if analytical results indicate concentrations of contaminants exceed two times the mean base background concentration and one other regulatory screening criterion. The human health risk screening will be conducted using data collected during the investigation. The data will be screened using the following criteria:

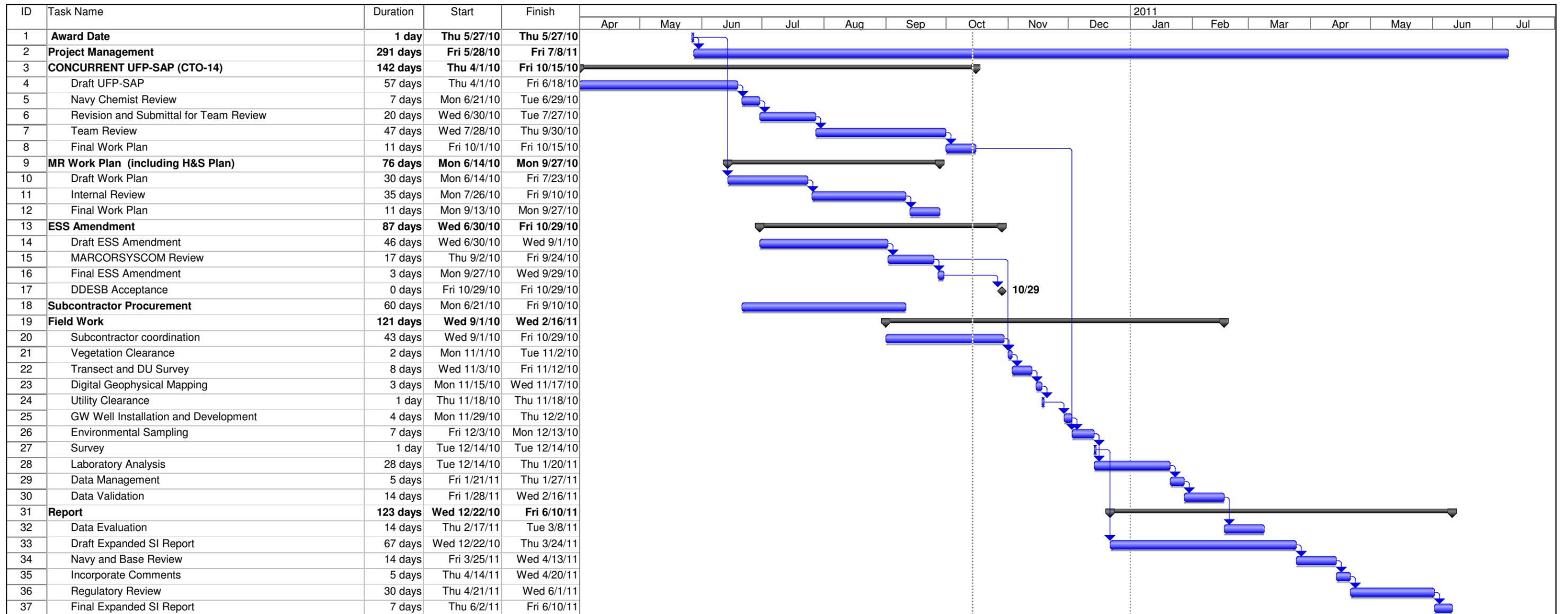
- Soil data will be compared to EPA RSLs for chemical contaminants at superfund sites (EPA, 2009) and the NC SSLs.
- Groundwater data will be compared to EPA RSLs for chemical contaminants at superfund sites (EPA, 2009) and North Carolina 2L Groundwater Standards (North Carolina Administrative Code, 2010).

The soil and groundwater data will also be compared to the MCB CamLej background soil and groundwater data from the *Final Base Background Soil Study Report* (Baker, 2001). The background values used will be two times the average site background concentrations.

The ecological risk screening will include a brief description of the ecosystems potentially at risk, a figure depicting the ecosystems, results of a comparison of maximum detected concentrations (of composite samples) to ecological screening values in tabular form and recommendations for further evaluation, if required. This preliminary ecological risk screening will not constitute a full screening-level ecological risk assessment.

TABLE 2-1
 Project Personnel Contact Information
ESI Work Plan, UXO-17
MCB CamLej
Jacksonville, North Carolina

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Phil Smith Program Manager	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-518-9666 (office) 757-460-4592 (fax) Phillip.Smith@ch2m.com
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Project: CTO-141
 UXO-17 Expanded SI
 Date: Thu 10/14/10



Field Investigation Plan

3.1 Overall Approach

The objectives for the field investigation are to evaluate the presence and nature of MC contamination that may exist within the 12-acre area of investigation and to evaluate the number and density of anomalies that represent potential subsurface MEC. All field activities will be conducted in accordance with the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) for the 12-acre portion of Site UXO-17 (CH2M HILL, 2010b) and the SOPs provided in the MRP Master Project Plans (CH2M HILL, 2008c).

The field investigation will accomplish these objectives through completing the following activities:

- Perform DGM over 10 percent of the investigation area
- Collect composite surface soil samples from three DUs using the incremental sampling approach described in the *Systematic Random Multi-Increment Sampling SOP* in **Appendix C** of the MRP Master Project Plans
- Collect 19 surface soil samples using the TR-02-1 sampling approach
- Collect 15 subsurface soil samples from soil borings using DPT
- Collect one sediment and one surface water sample from the onsite pond
- Collect seven shallow groundwater samples from monitoring wells installed within the surficial aquifer

The field investigation activities are described in more detail below. MEC disposal activities, if needed, are addressed in **Section 4**.

3.2 Site Preparation and Restoration

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment, and preparation for fieldwork.

3.2.1 Mobilization

Mobilization will consist of identifying, briefing, and mobilizing personnel, as well as securing and deploying equipment.

General Activities

- Identify/procure, package, ship, and inventory project equipment, including geophysical instrumentation, hand tools and supplies, and vegetation clearance equipment

- Coordinate with local agencies, including MCB CamLej, Base Range Control, police, hospital, and fire department, as appropriate
- Coordinate communications and other logistical support with subcontractors
- Test and inspect equipment
- Conduct site-specific training on the WP and MEC procedures and hazards
- Review subcontractor Activity Hazard Analysis forms
- Verify that all forms and project documentation are in order and project team members understand their responsibilities regarding project reporting requirements
- Coordinate with Base personnel and obtain needed approvals to bring on-call commercial explosives onto the Base in the event that MEC is found

Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted to review this WP and review and acknowledge the HSP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

3.2.2 Buried Utility Clearance

All buried utilities will be identified within a 20-foot radius of each site sampling location before sampling begins.

3.2.3 Site Survey

Land surveying services will be conducted in accordance with **Section 7.4** of the MRP Master Project Plans (CH2M HILL, 2008c). The surveying at Site UXO-17 will consist of two phases:

- **Phase 1** will consist of DGM transect marking (after vegetation clearance), DU layout, and geophysical seed location survey. The marking of DGM transects will delineate the extent of the area that will be subjected to DGM (**Figure 3-1**). The DU layout survey will identify the boundary of each DU shown on **Figure 3-2**. The geophysical seed location survey will record the locations of geophysical seeds emplaced throughout the site during the DGM activities at Site UXO-17.
- **Phase 2** will occur after environmental sampling activities have concluded and will entail surveying the coordinates and elevations of the monitoring wells.

MEC avoidance will be performed during both phases of surveying. UXO technicians will escort surveying personnel during onsite operations and will select locations free of anomalies where stakes are driven.

3.2.4 Vegetation Clearing

Transects in vegetated parts of Site UXO-17 will be cleared to allow the use of DGM equipment and to provide access for soil and groundwater sampling activities. Vegetation smaller than 6 inches in diameter will be removed to within 6 inches of the ground surface. Vegetation will be cleared using a combination of mechanical and manual methods. Felled

brush and trees will be mulched and left in place. Trees larger than 6 inches in diameter will not be removed unless absolutely necessary. Vegetation will be cleared in approximately 1.2 meter (m) (4 ft) -wide paths in order that a 1-m-wide instrument can traverse along the path. Branches and overhanging vines will also be removed from the paths to a height of 6 feet.

Personnel using non-powered or powered hand tools such as hand saws, machetes, chainsaws, and string trimmers/brush cutters must use appropriate personal protective equipment. To prevent accidental contact with exposed MEC, string trimmers/brush cutters with a metal blade and chainsaws shall be used only in areas where there is a clear view of the cutting path of the blade.

During vegetation clearing, UXO technicians will conduct MEC avoidance activities in accordance with the MEC avoidance procedures included in the HSP (**Appendix A**).

The Base will coordinate with MCB CamLej's Environmental Management Division office to identify federally protected species or archaeological sites that may be encountered during vegetation clearing activities. Federally listed plant species will be identified and left in place in accordance with the Environmental Protection Plan (refer to **Section 8**).

3.2.5 Site Restoration and Demobilization

Site Restoration

Damage caused by equipment or other site activities (e.g., deep ruts) will be repaired and revegetated as necessary to prevent erosion.

Demobilization

Full demobilization will occur when the project is completed and appropriate quality assurance (QA)/QC checks have been performed. The following activities will occur before demobilization takes place:

- Confirmation that DGM is complete
- Review of chain-of-custody (COC) records to ensure that all field and QC samples were collected as planned and were submitted for appropriate analyses
- Verification of adequate site restoration
- Inspection, packaging, and shipment of all field equipment to the appropriate location

3.3 Geophysical System Verification Plan

Geophysical system verification (GSV) will be performed as part of the process for validating DGM systems to be utilized during the DGM activities. A GSV Plan is provided in Attachment 6 of the UFP-SAP (CH2M HILL, 2010b), which provides details of the equipment, approach, methods, operational procedures, and QC to be used in performing GSV at Site UXO-17.

3.4 Geophysical Investigation Plan

DGM will be conducted over approximately 1.2 acres, representing approximately 10 percent of the 12-acre investigation area, along approximately 16,000 linear feet of 1-meter-

wide transects. DGM will be conducted using a single coil EM61-MK2 to map geophysical anomalies that could represent subsurface MEC within the subject site. The EM61-MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. DGM survey results will be compared to a threshold response of 2.5 millivolts, which is the lowest amplitude at which a metallic item can be positively distinguished from signal noise using the EM-61 instrumentation. Those DGM survey results exceeding the threshold response will be identified as anomalies. The locations and actual transects surveyed will be based on field conditions, including the presence of trees larger than 6 inches in diameter, utilities, and other cultural features that may interfere with the collection of DGM data.

The Geophysical Investigation Plan provided in Attachment 7 of the UFP-SAP (CH2M HILL, 2010b) provides details about the equipment, approach, methods, operational procedures, and QC to be used in performing the geophysical investigations at Site UXO-17. QC requirements at Site UXO-17 will consist of one seed item being buried approximately every 10,000 feet of transect. Based on the estimated linear footage, two seed items will be emplaced within transects and professionally surveyed before the DGM subcontractor arrives onsite. The seed items will consist of industry standard objects with known responses to detection by the EM61-MK2 (see *EM61-MK2 Response of Three Munitions Surrogates*, [U.S. Navy, 2009]).

3.5 Geospatial Information and Electronic Submittals

The methods, equipment, accuracy, and submittal requirements for location surveys and mapping are described in Section 7.4 of the MRP Master Project Plans (CH2M HILL, 2008c).

3.6 Field Sampling Plan

3.6.1 Field Operations

In order to assess the presence and nature of MC contamination that may exist at the 12-acre investigation area, the project team will investigate soil, groundwater, surface water, and sediment within the site boundaries. This will include collecting surface soil samples using incremental sampling procedures, composite surface soil samples using the TR-02-1 sampling method, subsurface soil samples by DPT, grab sediment and surface water samples, and groundwater samples from monitoring wells. QA/QC samples will be collected in accordance with the descriptions in **Section 3.6.2**.

TR-02-1 Surface Soil Sampling

Nineteen surface soil samples will be collected using the TR-02-1 sampling method, which is used to assess shallow soil conditions in areas constrained by development or dense vegetation. Each sampling location will be defined as an area 1m by 1m (**Figure 3-2**). The location of each sample will be pre-populated in a handheld global positioning system (GPS) before the sampling event takes place. The field team will make every effort to locate the coordinates; however, the sample location may be slightly adjusted to a field-suitable location (for example, to a location free of poison ivy). The actual coordinates of the sampling locations will then be logged into the GPS and will be based on the center of the sampling area. Soil samples will be collected by compositing a minimum of 30 sample

increments from random locations within each 1m x 1m sampling location. The sample increments will be approximately equal in the amount of soil, which will be collected from depths of 0 to 2 inches. The sample increments at each location will be composited into a single sample following the *Homogenization of Soil and Sediment Samples* SOP in Appendix C of the MRP Master Project Plans (CH2M HILL, 2008c) before being transferred to the appropriate sample containers.

Laboratory analysis is specified below.

Incremental Surface Soil Sampling

Three composite incremental surface soil samples will be collected from each of three DUs (designated MR17-DU01-SS01/02/03 through MR17-DU03-SS01/02/03,) for a total of nine composite incremental samples (**Figure 3-2**). MEC anomaly avoidance will be practiced as described in **Section 2.3** of the HSP (**Appendix A**). The size of each DU was established based on past site usage and current site layout. Site UXO-17 has not been developed, so DUs were sized to fit the unvegetated areas within the site. The incremental samples will be collected using the *Systematic Random Multi-Increment Sampling* SOP in Appendix C of the MRP Master Project Plans (CH2M HILL, 2008c). Because explosives residues are generally immobile within the soil profile, the samples will be collected from depths of 0 to 2 inches bgs where the highest MC contamination is mostly likely to exist if present (Thiboutot et al., 2002). Each composite sample will consist of a total of 30 soil increments with a minimum weight of 3 kilograms (6.6 pounds) of soil.

All surface soil samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (including pentaerythritol tetranitrate [PETN] and nitroglycerin) (SW-846 EPA Method 8330)
- Perchlorate (SW-846 EPA Method 6850)
- RCRA metals (SW-846 EPA Method 6010B series and 7471A) (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc)

Surface Water and Sediment Sampling

One surface water sample and one sediment sample will be collected from the pond at Site UXO-17, as shown on **Figure 3-2**. The surface water sample will be collected before the sediment sample to minimize the turbidity caused by the sediment sampling. The surface water sample will be collected by submersing the sampling container directly into the surface water body or by using a “thief” type sampler and then transferring the sample to the sample container. If the volume of surface water encountered is insufficient to allow the direct submersion of the sampling containers, a glass interim vessel will be used to transfer the surface water sample to the sample containers. Field parameters dissolved oxygen, temperature, specific conductance, and pH) will be measured before sample collection.

One sediment sample will be collected in the same location as the surface water sample. Sediment will be collected using a pre-washed trowel and bowl, drained of excess water, and placed into the appropriate sample containers.

Actual surface water and sediment sample location coordinates will be determined using a handheld GPS in the field. All coordinates will be recorded in the field logbook.

Subsurface Soil Sampling

A track-mounted DPT rig will be used to collect subsurface soil samples in accordance with the *Direct-Push Soil Sample Collection SOP* in Appendix C of the MRP Master Project Plans (CH2M HILL, 2008c). The sample locations will be selected in a manner similar to that described earlier for TR-02-1 sampling. Actual sample location coordinates will be determined using a handheld GPS. All coordinates will be recorded in the field logbook.

Anomaly avoidance will be practiced during DPT subsurface soil sampling as described in **Section 2.3** of the HSP (**Appendix A**). All monitoring well locations will be hand-augered down to 5 feet bgs. A UXO technician will screen each location with a downhole magnetometer at 1-foot increments. A separate borehole will be advanced adjacent to the borehole cleared by the UXO technician in order to collect a subsurface soil sample.

Fifteen subsurface soil samples (designated MR17-IS01 through MR17-IS15) will be collected from approximately 2 feet above the water table at the approximate locations shown in **Figure 3-3**. Continuous cores at each sampling location will be advanced using an open core barrel and piston DPT sampling device along with 4- or 5-foot disposable acetate liner to a depth just above the water table. A new liner will be used in collecting each continuous sample from the ground surface down to the bottom of the borehole, and the downhole sampling equipment will be decontaminated between each sample location.

The continuous core will be logged for lithological characterization from the ground surface throughout the anticipated screen interval. Soil types encountered will be classified according to ASTM Standard D2488-69, "Description of Soils (Visual-Manual Procedure)." The soil boring logs will show the depths at which each distinct stratum is encountered. Soil descriptions will comply with the Unified Soil Classification System, including grain-size classifications (i.e., fine, medium, and coarse sand and gravel); the use of the percentage terms "trace" (1 to 10 percent), "little" (11 to 20 percent), "some" (21 to 35 percent), and "and" (36 to 50 percent); the group symbols; the color; and relative moisture.

The depth to the water table in each boring will be estimated in the field by visually assessing soil saturation in the soil cores removed from the boreholes. The water table is estimated to be encountered at approximately 2 to 8 feet bgs throughout the site.

Samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (including PETN and nitroglycerin) (SW-846 EPA Method 8330)
- Perchlorate (SW-846 EPA Method 6850)
- RCRA metals (SW-846 EPA Method 6010B series and 7471A) (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc)

Three samples (from borings in proximity to surface water bodies) will also be analyzed for:

- Chromium (SW-846 EPA Method 6010B series) and
- Hexavalent chromium (SW-846 EPA Method 7196A)

DPT Temporary Well Installation and Groundwater Sampling

Temporary monitoring wells will be installed in seven of the boreholes used for subsurface soil sample collection, as shown on **Figure 3-3**. Each well will consist of 2-inch inner diameter 0.010-inch machine slotted Schedule 40 polyvinyl chloride screen with a bottom cap. The screen will be connected to a new, threaded, flush-jointed, polyvinyl chloride riser casing with the O-rings removed prior to assembly. The wells will be constructed in accordance with *Installation of Shallow Monitoring Wells* SOP in **Appendix C** of the MRP Master Project Plans (CH2M HILL, 2008c). Optimally, the static groundwater table will intersect 1 to 2 feet below the top of the screen of each monitoring well so that 8 to 9 feet of the screen is below the water.

The monitoring wells will be developed by the drilling subcontractor before groundwater sampling begins to reduce turbidity.

Static groundwater elevations will be measured in all monitoring wells using a water level indicator or oil/water interface probe, as appropriate. The depth from the top of casing to fluid level will be recorded to the nearest 0.01 foot. The indicator will be decontaminated after use in each well.

Groundwater samples will be collected from each temporary well using a peristaltic or bladder pump and low-flow purge rates in accordance with the *Low-Flow Groundwater Sampling from Monitoring Wells* SOP in **Appendix C** of the MRP Master Project Plans (CH2M HILL, 2008c).

All groundwater samples will be collected by placing the sample tubing or pump intake in the middle of the well screen interval. Water quality parameters (WQPs) (i.e., specific conductance, pH, turbidity, temperature, dissolved oxygen, and oxidation reduction potential) will be measured and recorded (approximately every 5 minutes) before sampling using a multi-parameter water quality meter, calibrated on a daily basis and as subsequently warranted. Sampling will begin when WQPs have stabilized to within 10 percent for three consecutive readings. Depth to water, WQPs, and total well depth measurements will be recorded in the field logbook.

Samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (including PETN and nitroglycerin) (SW-846 EPA Method 8330)
- Perchlorate (SW-846 EPA Method 6850)
- Total RCRA metals (SW-846 EPA Method 6010B series and 7470A) (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc)

Three samples (from monitoring wells in proximity to surface water bodies) will also be analyzed for:

- Dissolved RCRA metals (SW-846 EPA Method 6010B series and 7470A)
- Total chromium (SW-846 EPA Method 6010B series)
- Hexavalent chromium (SW-846 EPA Method 7196A)

Following sampling and surveying, the monitoring wells will be abandoned by the DPT subcontractor following NCDENR guidelines (North Carolina Administrative Code, 2001) by grouting from the bottom of the boring to the ground surface.

A summary of the sampling program for ESI activities at Site UXO-17 is presented in **Table 3-1**.

3.6.2 Analytical Requirements and Sample Handling

Sample Preservation and Handling

Sample preservation must occur in the field immediately after collection. The containers supplied by the laboratory will contain the applicable preservative. This will protect field personnel from transporting, handling, and measuring concentrated acids and bases. QA/QC samples will be collected in the same types of preserved containers as the field samples. The preservative and holding time requirements for analysis are shown in **Table 3-2**.

Quality Assurance and Quality Control

QA/QC requirements for environmental sampling, handling, and management are detailed in **Section 4** of the MRP Master Project Plans (CH2M HILL, 2008c). Field QC samples (including field blanks, equipment blanks, duplicate samples, and matrix spike/matrix spike duplicate samples) will be collected during the investigation and submitted for laboratory analysis. Required QA/QC samples and the required frequency of collection are summarized in **Table 3-3**.

Sample Collection Frequencies

Table 3-4 presents the anticipated number of field samples and their associated QA/QC samples.

Sample Identification System

The following is a general guide for sample identification; an electronic sample-tracking program will be used to manage the flow of information from the field sampling team to the laboratory and to internal and external data users. The tracking program is also used to manage the entry of sampling-related data, such as station locations and field measurements.

For each sample collected, the sampling team will record the sample identification, analytical requirements, date and time of collection, and other pertinent information in the field logbook.

Labels for samples sent to a laboratory for analysis must be written in indelible ink.

The following information typically is included on the sample label:

- Site name or identifier
- Sample identification number

- Date and time of sample collection
- Sampler's initials
- Sample matrix or matrix identifier
- Type of analyses to be conducted

Each analytical sample will be assigned a unique number using the following format:

Site#-Media/Station# or QA/QC-Year/Quarter or Depth Interval

An explanation of each of these identifiers is given below.

Site#: This investigation includes MRP Site UXO-17 under the Munitions Response Program. Therefore, the prefix "MR17-" will be used

Media: MW = Groundwater from monitoring wells
 SS = Surface soil
 IS = Subsurface soil
 SW = Surface water
 SD = Sediment

Station#: Each monitoring well will be identified with a unique identification number. Soil borings will be numbered consecutively.

QA/QC: D = Duplicate sample (following sample type/number)
 FB = Field blank
 ER = Equipment rinsate
 MS = Matrix spike
 SD = Matrix spike duplicate

Year/Quarter#: Year/Quarter indicators will be used for samples collected from monitoring wells. Each round of sampling will have a distinct identification number:

"10" = year 2010

"D" = Sampling during the fourth quarter at the site

Depth Interval: Depth indicators will be used for soil samples collected using direct push technology. The number will reference the depth interval of the sample:

2-3 = 2 to 3 ft bgs

Under this sample designation format, "MR17-MW05-10D" would mean the following:

<u>MR17</u> -MW05-10D	MRP Site UXO-17
MR17- <u>MW05</u> -10D	Groundwater sample from monitoring well #5
MR17-MW05- <u>10D</u>	Sampled during the fourth quarter of 2010

This sample designation format will be followed throughout the project. Required deviations to this format in response to field conditions will be documented in the logbook.

Sample Packaging and Shipping

Samples will be packed in a cooler with bubble wrap packaging material and double-bagged ice. The samples will either be picked up at the site by the analytical laboratory or shipped to the laboratory via overnight courier. The Field Team Leader is responsible for the following activities related to shipment of the samples:

- Verification that all sample bottles are correctly labeled, sealed, and packaged
- Check to ensure that sample bottles in each cooler correspond to the accompanying COC form
- Affixing a custody seal to each cooler
- Use of appropriate labels and forms required for shipment

Custody of the samples will be maintained and documented at all times. COC will begin with the collection of the samples in the field and will continue through the analysis of the sample at the analytical laboratory (field personnel who collect the samples must transfer custody to the person responsible for shipping the samples).

3.6.3 IDW Management

All IDW generated during the investigation will be managed in accordance with **Section 10** of the MRP Master Project Plans (CH2M HILL, 2008c). IDW includes soil cuttings from the DPT borings and liquid waste (e.g., purged groundwater or decontamination fluids) generated during temporary well development and sampling.

3.7 Health and Safety Plan

The HSP is provided in **Appendix A**. Because of the potential presence of MEC at this site, MEC avoidance techniques will be employed throughout the field investigation to ensure the safety of all onsite personnel. Procedures for conducting MEC avoidance are provided in the HSP.

3.8 Data Documentation and Processing Procedures

Documentation and processing of field data, lab data, and investigation results will be completed in accordance with Section 7.2 of the MRP Master Project Plans (CH2M HILL, 2008c).

3.9 Project File Requirements

This project will require the administration of a central project file. Project data and records will be managed in accordance with Section 7.3 of the MRP Master Project Plans (CH2M HILL, 2008c).

TABLE 3-1
 Summary of Sampling Program
 ESI Work Plan, UXO-17
 MCB CamLej
 Jacksonville, North Carolina

Sample Media	Sample ID Number	Sample Depth/Location and Rationale	Analysis				
			Explosives Residue	Perchlorate	RCRA Metals	Dissolved Metals	Chromium and Hexavalent Chromium
Incremental Soil Samples	MR17-DU01-SS(01,02,03) through MR17-DU03-SS(01,02,03)	Collected from a 0 – 2 inches bgs at each location shown on Figure 3-2. Will allow for characterization of surface soil across the site.	X	X	X		
TR-02-1	MR17-SS01 through MR17-SS19	Collected from a 0 – 2 inches bgs at each location shown on Figure 3-2. Will allow for characterization of surface soil across the site.	X	X	X		
Direct Push Subsurface Soil	MR17-IS01-T-B through MR17-IS15-T-B	Collected from a 2 ft interval just above the water table at each location shown on Figure 3-3. Will allow for characterization of subsurface soil across site.	X	X	X		
	MR17-IS10-T-B through MR17-IS12-T-B	See above for sample depth/location. Will allow for characterization of subsurface soil for chromium in limited portion of the site.					X

Sample Media	Sample ID Number	Sample Depth/Location and Rationale	Analysis				
			Explosives Residue	Perchlorate	RCRA Metals	Dissovled Metals	Chromium and Hexavalent Chromium
Monitoring Well Groundwater	MR17-MW09 through MR17-MW15	Samples will be collected from shallow wells at each location shown on Figure 3-3. Will allow for characterization of groundwater across site	X	X	X		
	MR17-MW10 through MR17-MW12	See above for sample depth/location. Will allow for characterization of groundwater in proximity to surface water sources at the site.				X	X
Surface Water	MR17-SW01	Sample will be collected by submersing sample container at the location shown on Figure 3-2. Will allow for characterization of surface water at the site.	X	X	X	X	
Sediment	MR17-SD01	Sample will be collected from the same location as the surface water sample as shown on Figure 3-2. Will allow for characterization of sediment at the site.	X	X	X		

Notes and Abbreviations:

For Direct Push Soil Samples: "T-B" refers to the top depth and bottom depth of the sample interval

TABLE 3-2
Analyses, Bottleneck, Preservation, and Holding Time Requirements
ESI Work Plan, Firing Position 2
MCB Camp Lejeune
Jacksonville, North Carolina

Media	Analysis	Method/Laboratory SOP Reference	Container	Preservation & Storage	Holding Times
Surface soil, Subsurface soil, Sediment	Explosives Residue (including PETN and Nitroglycerin)	SW8330/SOP-327	1x4 oz glass jar	4°C	14 days to extraction, 40 days from extraction to analysis
	RCRA Metals	SW-846 6010B, SW7471A/SOP-100/104/105	1 x4 oz glass jar	4°C	180 days, Mercury: 28 days
	Perchlorate	SW-846 6850/SOP-239	1 x4 oz glass jar	4°C	28 days
Subsurface soil	Hexavalent Chromium	SW7196/SOP-166,197	4-ounce glass	4°C	28 days
Groundwater, Surface Water	Explosives Residue (including PETN and Nitroglycerin)	SW8330/SOP-327	2x1-L amber glass bottles	4°C	7 days to extraction, 40 days from extraction to analysis
	Total and Dissolved RCRA Metals	SW-846 6010B, SW7470A/SOP-100/103/105	1x500 ml Poly bottle	HNO ₃ to pH <2 and cool to 4°C	180 days to analysis, Mercury: 28 days
	Perchlorate	SW-846 6850/SOP-239	1x250 ml Poly bottle	4°C	28 days
Groundwater	Hexavalent Chromium	SW7196/SOP-166	250 ml plastic	4°C	24 hours

Notes: L = Liter, oz = ounce, ml= milliliter, HNO₃ = nitric acid

TABLE 3-3
 Required QA/QC Samples
ESI Work Plan, UXO-17
MCB CamLej
Jacksonville, North Carolina

Sample Type	Description	Frequency	Analytes
Field Blank	Designed to detect contamination in the decontamination water. A field blank is decontamination water collected directly in the sample bottle. It shall be handled like a sample and transported to the laboratory for analysis.	One field blank from each source of decontamination water for each sampling event, where a sampling event is defined as one week	All laboratory analyses requested for the environmental samples collected at the site for that week
Equipment Blank	Designed to detect contamination of environmental samples caused by contamination of sampling equipment. An equipment blank is analyte-free water that is poured into or pumped through the sampling device, transferred to a sample bottle, and transported to the laboratory for analysis.	One per each day of sampling	All laboratory analyses requested for environmental samples collected at the site on that day
Field Duplicate	Designed to check precision of data in the laboratory. A field duplicate is a sample collected in addition to the native sample at the same sampling location during the same sampling event.	10%	Same parameters as native sample
MS/MSD	Designed to evaluate potential matrix interferences, accuracy, and precision. Three aliquots of a single sample—one native and two spiked with the same concentration of matrix spike compounds—are analyzed.	5%	Same parameters as native sample

TABLE 3-4
 Sample Collection Frequencies
ESI Work Plan, UXO-17
MCB CamLej
Jacksonville, North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Groundwater Samples						
Explosives Residue (including PETN and Nitroglycerin)	Aqueous	7	1	2	1	1
Perchlorate		7	1	2	1	1
RCRA Metals		7	1	2	1	1
Dissolved RCRA Metals		3	1	1	1	1
Total Chromium		3	1	1	1	1
Hexavalent Chromium		3	1	1	1	1
Surface Soil Samples						
Explosives Residue (including PETN and Nitroglycerin)	Solid	28	3	2	1	2
Perchlorate		28	3	2	1	2
RCRA Metals		28	3	2	1	2
Direct Push Subsurface Soil Samples						
Explosives Residue (including PETN and Nitroglycerin)	Solid	15	2	2	1	1
Perchlorate		15	2	2	1	1
RCRA Metals		15	2	2	1	1
Total Chromium		3	1	1	1	1
Hexavalent Chromium		3	1	1	1	1
Surface water Samples						
Explosives Residue (including PETN and Nitroglycerin)	Aqueous	1	1	1	1	1
Perchlorate		1	1	1	1	1
RCRA Metals		1	1	1	1	1
Dissolved RCRA Metals		1	1	1	1	1
Sediment Samples						
Explosives Residue (including PETN and Nitroglycerin)	Solid	1	1	1	1	1
Perchlorate		1	1	1	1	1
RCRA Metals		1	1	1	1	1

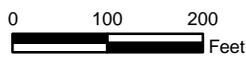
Notes:

MS/MSD = Matrix Spike and Matrix Spike Duplicate pair
 Field duplicates are collected at the rate of 1 for every 10 environmental samples
 Equipment rinsate blanks are typically collected at the rate of 1 per day per media
 Field blanks are typically collected at the rate of 1 per week during sampling
 MS/MSDs are collected at the rate of 1 for every 20 samples



Legend

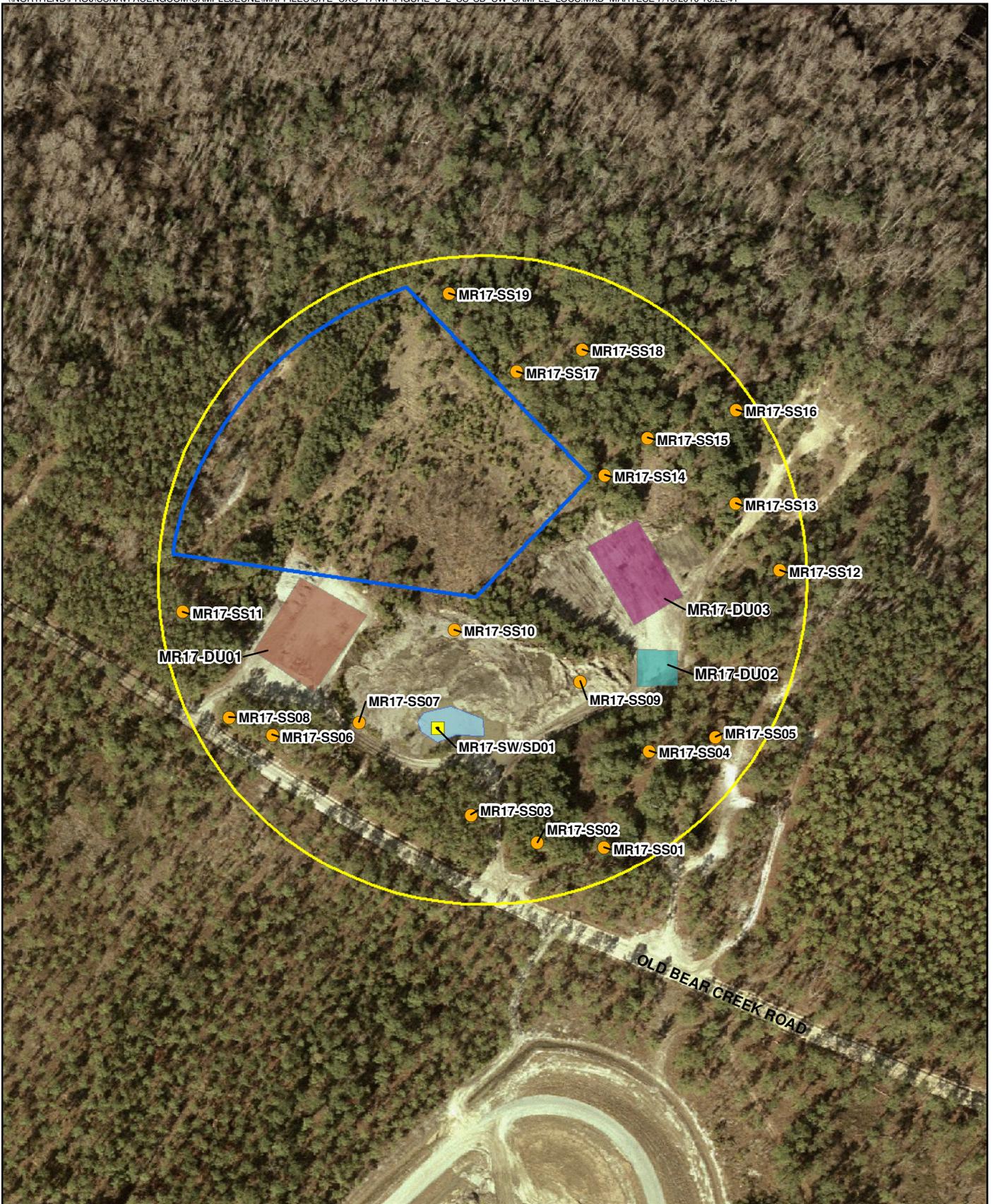
-  Transect (10 Meter spacing)
-  4-acre Focused PA/SI
-  Site UXO-17 Boundary



1 inch = 200 feet

Figure 3-1
Generalized DGM Transect Layout
Site UXO-17
MCB CamLej
North Carolina





Legend

- Surface/Subsurface Soil Sampling Location
- Surface Water/Sediment Sample Location
- ▭ Focused MILCON PA/SI Investigation
- Site UXO-17 Boundary
- Pond

- Decision Unit**
- MR17-DU01 (40x35 Meters)
 - MR17-DU02 (18x16 Meters)
 - MR17-DU03 (40x26 Meters)

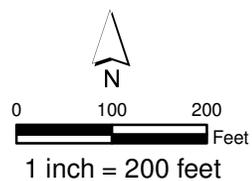
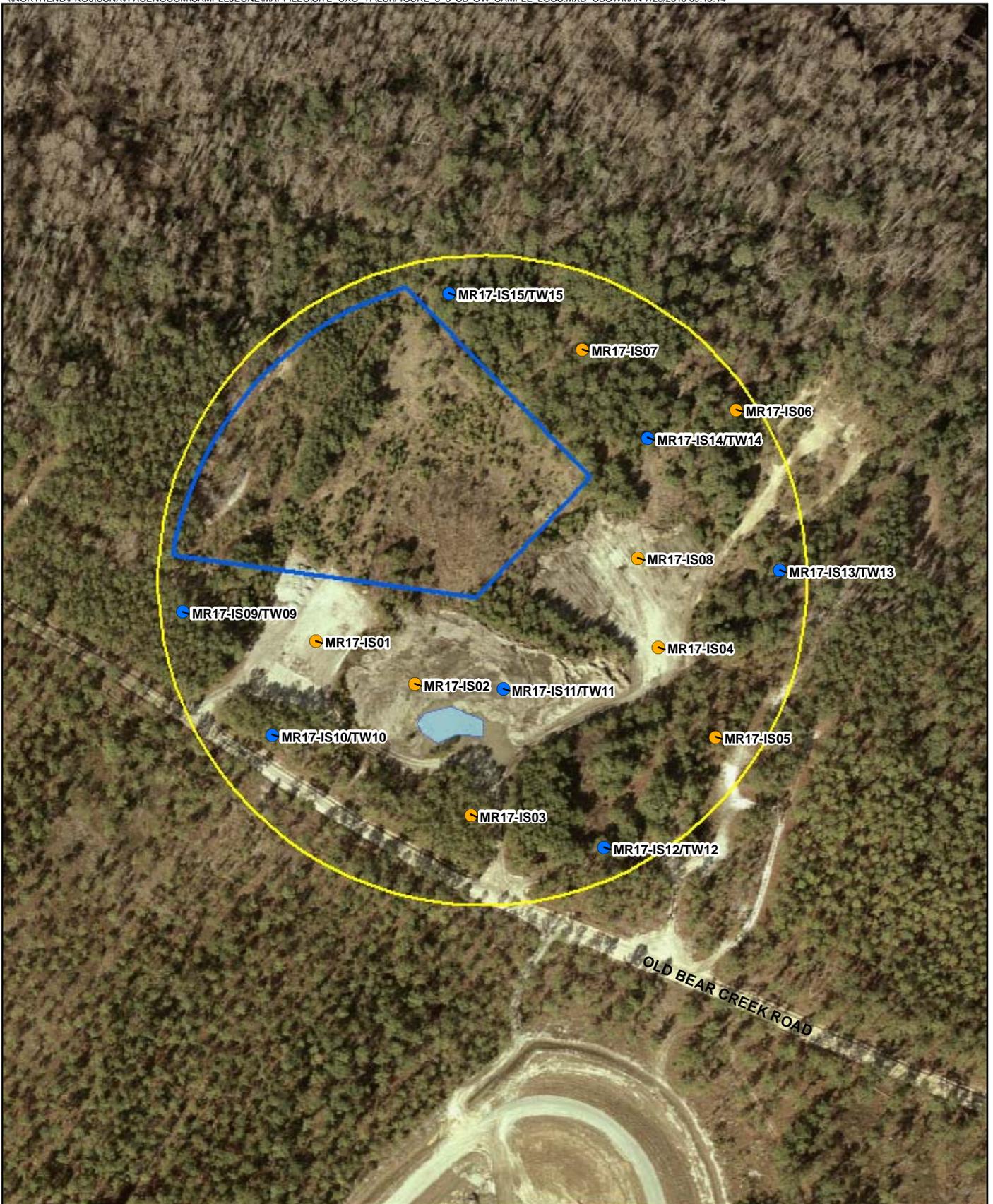


Figure 3-2
Surface Soil, Sediment and
Surface Water Sample Locations
Site UXO-17
MCB CamLej
North Carolina





Legend

- Subsurface Soil Sample and Monitoring Well Location
- Subsurface Soil Sampling Location
- 4-acre Focused PA/SI
- Site UXO-17 Boundary
- Pond

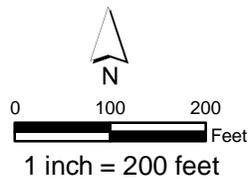


Figure 3-3
Subsurface Soil and
Groundwater Sample Locations
Site UXO-17
MCB CamLej
North Carolina



MEC Contingency Plan

Intrusive investigation of anomalies is not planned for the ESI field activities at Site UXO-17. However, if MEC or MPPEH is encountered during the ESI, this contingency plan will be implemented to ensure proper disposal of MEC/MPPEH. The equipment, approach, methods, operation procedures and quality controls to be used are detailed below.

4.1 Planning

The following actions require advanced planning and will be conducted before mobilization begins:

- Finalize procurement actions for items and services needed during the mobilization.
- Hold a pre-mobilization meeting and Operations Readiness Review with the project team.
- Coordinate with NAVFAC project manager (PM) and Base point of contact on notification to local stakeholders of upcoming project activities.
- Reconfirm site personnel documentation of proper training, certifications, and medical monitoring.

4.2 Site Preparation

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment and the activities required to prepare the site for fieldwork.

4.2.1 Mobilization

A mobilization period will include identifying, briefing, and mobilizing the staff and securing and deploying equipment. Mobilization activities include general activities, establishing support facilities, and holding a kickoff and safety meeting.

General Activities

- Identify/procure, package, ship, and inventory project equipment, including geophysical detection equipment, hand tools and supplies, portable toilets, and any other miscellaneous supplies.
- Coordinate with local agencies, including police, hospital, and fire department, as appropriate.
- Coordinate communications with MCB CamLej Explosive Ordnance Disposal and other logistical support.

- Finalize operating schedules.
- Establish MD/non-MD scrap storage area.
- Organize support facilities and test communication equipment.
- Test and inspect equipment.
- Assemble and transport the work force.
- Conduct site-specific training on the WP, HSP, and MEC procedures and hazards.
- Verify that all forms and project documentation are in order and project team members understand their responsibilities with regard to project reporting requirements.
- Coordinate with Base personnel and obtain needed approvals to bring commercial explosives onto the Base in the event that MEC is found.

Support Facilities

- A field office equipped with power and communications will be established. The field office will be the central point of communications for the project. Site documents, including health and safety records, will also be maintained in the field office.
- Sanitary facilities will be located at the field office.
- Lockable storage will be provided, either in the field office or in storage trailers, for portable field equipment.

Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted to review this WP and review and acknowledge the HSP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

4.3 Procedures for Reporting and Disposition of MEC and MPPEH Items

This section discusses the procedures for reporting and disposing of MEC and MPPEH items encountered during the project, including the responsibilities of personnel, overall safety precautions, data reporting, transportation, safe holding areas, operations in populated/sensitive areas, demolition operations, and required engineering controls and EZs for intentional detonations.

Until ESS Amendment No. 2 has been approved and approved by MARCOSYSCOM and DDESB, the MARCOMSYSCOM ESS Determination, dated 30 September 2010 will be followed. The 30 September 2010 ESS Determination permits investigation while conducting anomaly avoidance procedures (i.e. no contact with MEC/MPPEH is permitted). In the event MEC/MPPEH is found, prior to approval of ESS Amendment No. 2, CamLej EOD will be notified for disposal.

4.3.1 Responsibilities of Personnel

The general responsibilities of project personnel are described in **Section 2.4** of the MRP Master Project Plans (CH2M HILL, 2008c).

4.3.2 Overall Safety Precautions

The overall safety precautions described in **Section 2.5.1** of the MRP Master Project Plans (CH2M HILL, 2008c) will be adhered to during the fieldwork.

Qualified UXO personnel will dispose of all MEC items using blow-in-place procedures by countercharging these items with an explosive donor charge and detonating the donor charge. This will be performed by a demolition team consisting of one UXO Technician III as the Demolition Supervisor and two UXO Technician II personnel, with the Senior UXO Supervisor (SUXOS) responsible for the operation.

The MPPEH storage container will be equipped with grounding for lightning protection.

4.3.3 Data Reporting

Data reporting for each metallic anomaly will be performed in accordance with Section 2.5.2 of the MRP Master Project Plans (CH2M HILL, 2008c).

4.3.4 EZs and Separation Distances

Based on the types of munitions used at Site UXO-17, the munition with the greatest fragmentation distance (MGFD) assumed for the site is a net explosive weight (NEW) RDX 0.06025-pound Fuze Mechanical Time Super Quick (MTSQ). A NEW 38.8-pound Comp B 8-inch M106 High Explosive (HE) is included as a contingency in the unlikely event that such an item is identified. Explosives Safety Quantity Distance (ESQD) arcs were developed based on the primary and contingency MGFD calculations and are shown on **Figures 4-1 and 4-2**, respectively.

Primary and contingency ESQD values are identified on **Tables 4-1 and 4-2** respectively, which include the minimum separation distance (MSD) for non-essential personnel, the public transportation route distance, and the inhabited building distance for the Fuze MTSQ, the 8-inch M106 HE, and MPPEH under specified scenarios.

If, during the course of this project, a MEC item with a greater fragmentation distance than the primary MGFD is encountered, the ESQD arcs will be adjusted to the contingency MGFD distances. In the unlikely case a MEC item with a greater fragmentation distance than the contingency MGFD is encountered, the ESQD arcs will be adjusted and the ESS will be amended. Work must stop until the amended ESS is approved.

4.3.5 Operations in Populated and Sensitive Areas

There are no populated areas located directly within the Site UXO-17 EZ for demolition activities (based on the primary MGFD). However, Old Bear Creek Road is located south of Site UXO-17 and will be closed during intentional detonation operations if the road falls within the public transportation route distance for the actual detonation location. The SUXOS will coordinate with Base operations to implement traffic controls (**Figures 4-1 and 4-2**). As shown on **Figure 4-1**, no buildings are located within the inhabited building distance. If the contingency MGFD is implemented, evacuation of buildings within the EZ

will be required. There are no known sensitive habitats or threatened and endangered species located within the project area.

4.4 Scrap and MD Disposition

4.4.1 Inspection and Segregation

The approach for collecting, inspecting, and segregating site debris is discussed in Section 2.6.1 of the MRP Master Project Plans (CH2MHILL, 2008a). If the item is identified as MEC, it is handled as described in **Section 4.3 and Section 6**.

4.4.2 Inspection, Certification, and Verification

MPPEH will be inspected, certified, and verified in accordance with Section 2.6.2 of the MRP Master Project Plans (CH2M HILL, 2008c). MPPEH that cannot be certified and verified as “acceptable to move” will remain at the grid collection point and will be treated in the same manner as MEC (see **Section 6**).

4.4.3 Recording, Reporting, and Implementation of Lessons Learned during the Project

Lessons learned will be recorded, reported, and implemented in accordance with Section 2.7 of the MRP Master Project Plans (CH2M HILL, 2008c).

TABLE 4-1
 Exclusion Zone Parameters
ESI Work Plan, Firing Position 2
MCB Camp Lejeune
Jacksonville, North Carolina

Scenario	Item	Net Explosives Weight (NEW)	MSD (feet)	MSD for Public and Nonessential Personnel (feet)	IBD (feet)	PTR (feet)
Unintentional Detonation (Hand Excavation)	Fuze MTSQ M564	RDX 0.06025 lb.	18	65	NA	NA
Unintentional Detonation (mechanical Excavation)	Fuze MTSQ M564	RDX 0.06025 lb	18	305	NA	NA
Intentional Detonation	Fuze MTSQ M564	RDX 1.06025 lb.(includes donor charge)	305	305	NA	NA
Onsite Consolidation, Storage, and Re-inspection	MPPEH	1 lb.	NA	NA	291	175

NOTES:

All exclusion zone parameters are based on the fragmentation distances in Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 16

IBD – Inhabited Building Distance
 MPPEH – Material Presenting a Potential Explosive Hazard
 MSD – Minimum Separation Distance
 MTSQ –Mechanical Time Super Quick
 NA – Not Applicable
 PTR – Public Transportation Route

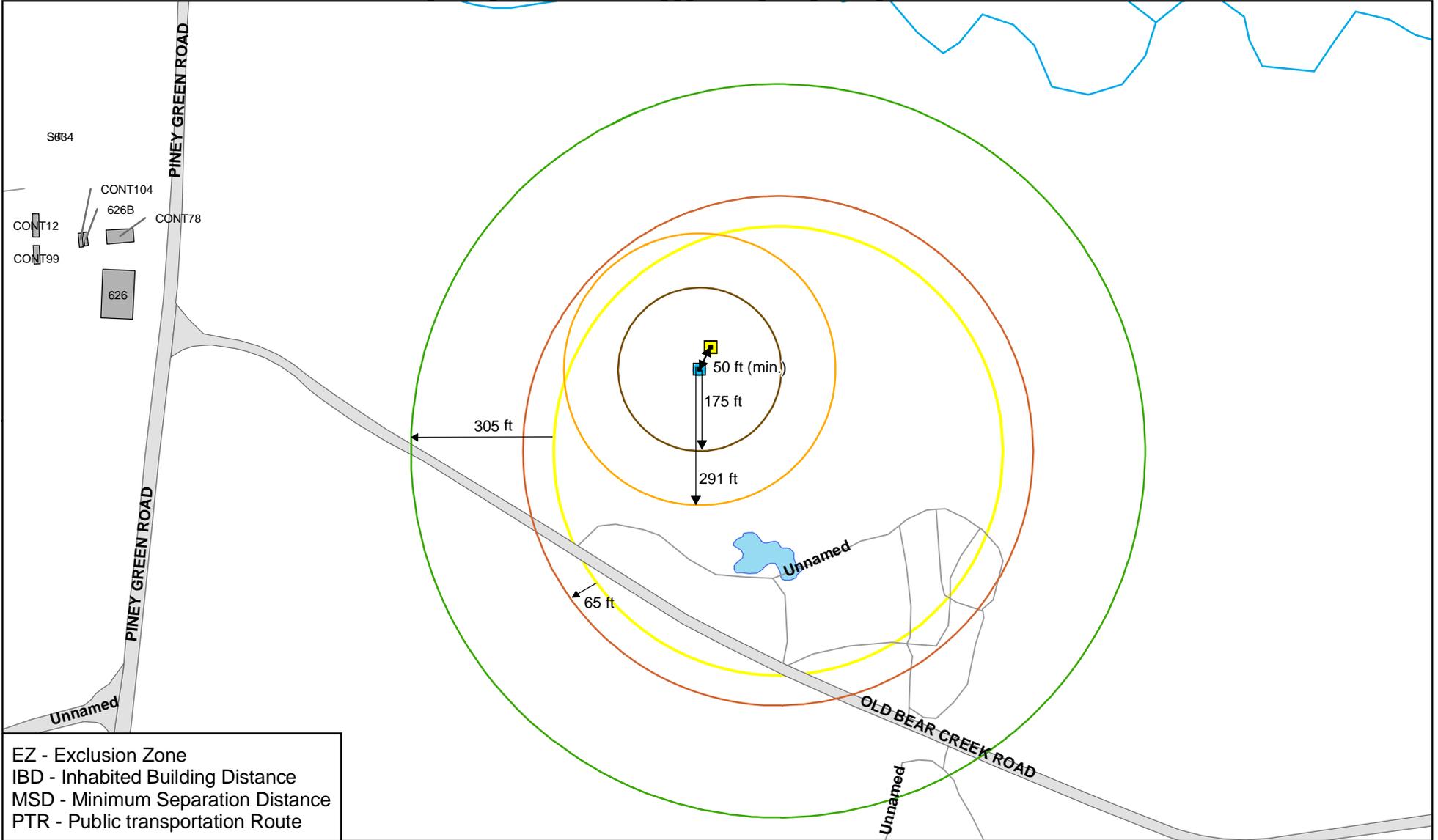
TABLE 4-2
 Contingency Exclusion Zone Parameters
ESI Work Plan, Firing Position 2
MCB Camp Lejeune
Jacksonville, North Carolina

Scenario	Item	Net Explosives Weight (NEW)	MSD (feet)	MSD for Non-essential Personnel (feet)	IBD (feet)	PTR (feet)
Unintentional Detonation	8-inch M106 HE	38.8 lbs of Comp B	142	537	NA	NA
Intentional Detonation for public and all personnel	8-inch M106 HE	39.8 lbs of Comp B (includes donor charge)	NA	3, 171	NA	NA
Onsite Consolidation, Storage, and Re-inspection	MPPEH	1 lb	NA	NA	291	175

NOTES:

All exclusion zone parameters are based on the fragmentation distances in DDESB TP 16

IBD – Inhabited Building Distance
 MPPEH – Material Presenting a Potential Explosive Hazard
 MSD – Minimum Separation Distance
 MTSQ – Fuze Mechanical Time Super Quick
 NA – Not Applicable
 PTR – Public Transportation Route



EZ - Exclusion Zone
 IBD - Inhabited Building Distance
 MSD - Minimum Separation Distance
 PTR - Public transportation Route

Legend

- MPPEH Scrap Collection Point
- Non-MPPEH Scrap Collection Point
- Surface Water Centerline
- EZ/MSD Unintentional Detonation (Hand Excavation) = 65 ft
- EZ/MSD Unintentional Detonation (Mechanical Excavation)/Intentional Detonation (Hand and Mechanical Excavation) = 305 ft
- MPPEH Scrap Collection Point IBD = 291 ft
- MPPEH Scrap Collection Point PTR = 175 ft

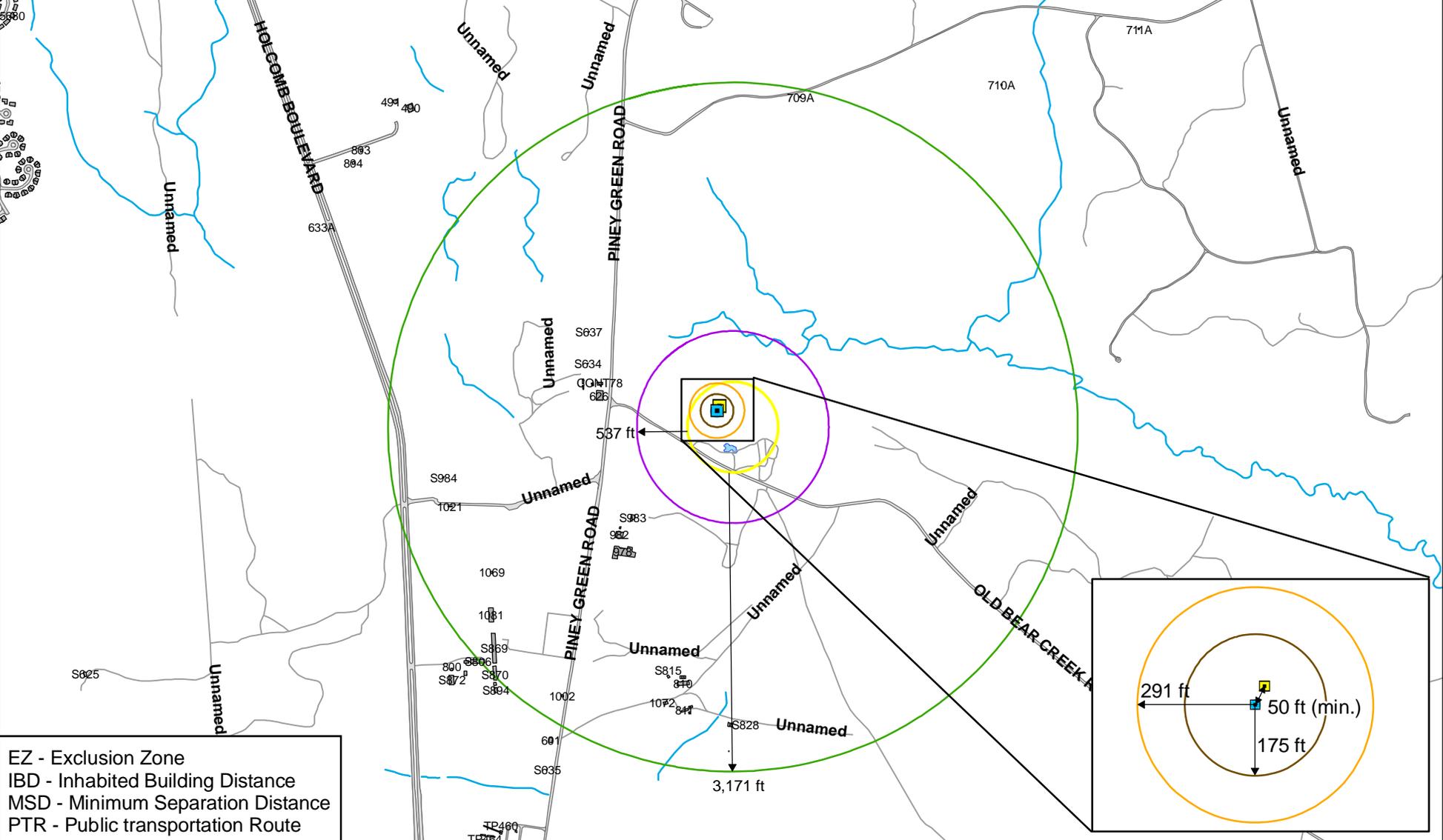


- Roads
- Buildings
- Pond
- MRS Boundary

Figure 4-1
 Explosives Safety Quantity Distance (ESQD) Arcs
 for Primary MGF (Fuze MTSQ)
 Site UXO-17- Former Firing Position 2
 MCB CamLej
 North Carolina

1 inch = 300 feet





EZ - Exclusion Zone
 IBD - Inhabited Building Distance
 MSD - Minimum Separation Distance
 PTR - Public transportation Route

- Legend**
- MPPEH Scrap Collection Point
 - Non-MPPEH Scrap Collection Point
 - EZ/MSD for Intentional Detonation= 3,171 ft
 - EZ/MSD for Unintentional Detonation = 537 ft
 - MPPEH Scrap Collection Point IBD = 291 ft
 - MPPEH Scrap Collection Point PTR= 175 ft
 - Surface Water Centerline
 - MRS Boundary
 - Roads
 - Buildings
 - Pond

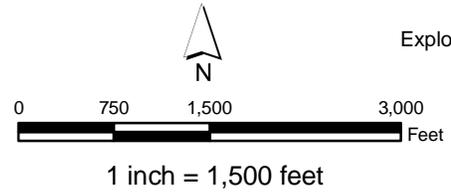


Figure 4-2
 Explosives Safety Quantity Distance (ESQD) Arcs
 for Contingency MGF (8-Inch M106 HE)
 Site UXO-17- Former Firing Position 2
 MCB CamLej
 North Carolina



SECTION 5

Explosives Management Plan

The management of on-call explosives to support disposal of MEC and MPPEH items that may be discovered during the investigation at Site UXO-17 will be done in accordance with **Section 3** of the MRP Master Project Plans (CH2M HILL, 2008c).

SECTION 6

Explosives Siting Plan

Explosives safety criteria for planning and siting explosives operations for MEC/MPPEH disposal at Site UXO-17 are provided in Section 4 of the MRP Master Plans (CH2M HILL, 2008c). There are no planned or established MEC detonation areas. MEC will be blown in place where it is found. MPPEH that cannot be certified and verified as “safe” will remain at location of discovery and will be treated in the same manner as MEC.

SECTION 7

Quality Control Plan

All applicable work conducted by CH2M HILL and its subcontractors at Site UXO-17 will be performed in accordance with the Quality Control Plan (QCP) in Section 8 of the MRP Master Project Plans (CH2M HILL, 2008c). The QCP describes the QC approach and procedures to be employed during the investigation of Site UXO-17. The QCP is divided into two parts: **Section 8.1** addresses ESI activities and **Section 8.2** addresses MEC avoidance, surveying, and DGM activities.

The specific QC audit procedures for the definable features of work to be employed at Site UXO-17 (as specified by the UFP-SAP), including the phase during which it is performed, the frequency of performance, the pass/fail criteria, and actions to take if failure occurs, are presented in **Table 7-1**.

TABLE 7-1
 Definable Features of Work Auditing Procedures
 ESI Work Plan, UXO-17
 MCB CamLej
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Planning						
Geographical Information System (GIS) Setup (Pre-mobilization Activities)	Project GIS Manager	Verify GIS system has been set up and is ready for site data.	PP	O	GIS system has been set up and is ready for site data.	Do not proceed with field activities until criterion is passed.
Document management and control (Pre-mobilization Activities)	Project Manager/Site Manager	Verify appropriate measures are in place to manage and control project documents.	PP	O	Appropriate measures are in place to manage and control project documents.	Do not proceed with field activities until criterion is passed.
Data Management (Pre-mobilization Activities)	Project Manager, Project Geophysicist	Verify appropriate measures are in place to manage and control project data.	PP	O	Appropriate measures are in place to manage and control project data.	Do not proceed with field activities until criterion is passed.
Subcontracting (Pre-mobilization Activities)	Project Manager, Site Manager	Verify subcontractor qualifications, training, and licenses.	PP/IP	O	Subcontractors' qualifications, training, and licenses are up to date and acceptable.	Ensure subcontractor provides the qualifications, training, and licenses or change subcontractor.
Technical and Operational approach (Project Planning)	Project Manager/Site Manager	Verify technical and operational approaches have been agreed on by the project team.	PP/IP	O	Technical and operational approaches have been agreed on by project team and incorporated into the Work Plans.	Do not proceed with field activities until criterion is passed
Geophysical Systems Verification Plan preparation and approval	Project Manager/Site Manager	Verify GSV Plan has been prepared and approved.	PP/IP	O	GSV Plan has been approved	Do not proceed with field activities until criterion is passed.
Work Plan preparation and approval	Project Manager	Verify Work Plan prepared and approved.	PP/IP	O	Work Plan has been approved	Do not proceed with field activities (excluding site mobilization) until criterion is passed.
Field Operations						
Site preparation (Mobilization)	Project Manager, Site Manager	Verify local agencies are coordinated.	PP/IP	O	Local agencies are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager, Site Manager	Verify equipment has been inspected and tested.	PP/IP	E	Equipment passes inspection and testing.	Proceed only with activities for which equipment has passed inspection and testing.
Site preparation (Mobilization)	Project Manager, Site Manager	Verify communications and other logistical support are coordinated.	PP/IP	O	Communications and other logistical support are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager, Site Manager	Verify emergency services have been coordinated.	PP/IP	O	Emergency services are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	UXOQCS, Project Manager, Site Manager	Verify site-specific training is performed and acknowledged.	PP/IP	O	Site-specific training is performed and acknowledged	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	UXOQCS, Project Manager, Site Manager	Hold pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.	PP/IP	O	Project plans are reviewed and acknowledged by team members.	Do not proceed with field activities until criterion is passed.
Site Preparation (Site Survey)	Site Manager	Verify benchmarks for survey have been established and documented.	PP/IP	O	Benchmarks for survey have been established and documented.	Ensure benchmarks for survey are established and documented prior to performing survey.
Site Preparation (Site Survey)	Site Manager	Verify site boundaries and grids have been established.	PP/IP	O	Site boundaries and grids have been established.	Do not proceed with dependent field activities until criterion is passed.
Site Preparation (Site Survey)	Site Manager	Verify surveyor notes are legible, accurate, and complete.	IP	O	Surveyor notes are legible, accurate and complete.	Ensure surveyor replaces deficient notes with legible, accurate and complete notes.
Site Preparation (Vegetation Clearance)	Site Manager	Verify personnel qualifications and training.	PP/IP	O	Personnel qualifications and training are appropriate.	Ensure subcontractor provides appropriately trained and qualified personnel or replace with properly trained personnel.
Site Preparation (Vegetation Clearance)	Site Manager	Verify environmental controls are correct and functional.	IP/FP	O	Environmental controls are correct and functional.	Ensure that appropriate environmental controls are in place prior to proceeding with vegetation removal.
Site Preparation (Vegetation Clearance)	Site Manager, UXOQCS	Verify vegetation removal is conducted IAW Work Plan.	FP	D	Vegetation removal is conducted IAW Work Plan.	Stop vegetation removal activities until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.

TABLE 7-1
 Definable Features of Work Auditing Procedures
 ESI Work Plan, UXO-17
 MCB CamLej
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
GSV Execution	Project Manager, Project Geophysicist	Verify data quality objectives (DQOs) established in GSV Plan have been accomplished.	PP/IP	O	DQOs identified in GSV Plan have been achieved	Continue with GPO until DQOs are achieved.
DGM Survey	Project Geophysicist	Verify DGM Survey conducted IAW Geophysical Investigation Plan	IP/FP	O/D	DGM Survey conducted IAW Geophysical Investigation Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
DGM Survey	Project Geophysicist	Check results of QC tests performed as specified in GIP	FP	E	QC tests must pass IAW standards determined during the GIP	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Survey	Project Geophysicist	Confirm that DGM survey DQOs established during GSV are being met.	FP	E	DGM survey DQOs are being met.	If the DQOs are not being met, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Data Processing	Project Geophysicist	Verify data checks specified in GIP and GPO Work Plan	FP	E	Data checks must pass in accordance with standards determined during the GPO and referenced SOPs.	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
MPPEH/MD Management	UXOQCS	Verify inspections conducted IAW Work Plan	IP/FP	D/E	Inspections being conducted IAW Work Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
MPPEH/MD Management	UXOQCS	Verify certification conducted IAW Work Plan	IP/FP	D/E	Certification is conducted IAW Work Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
MPPEH/MD Management	UXOQCS	Verify disposal is conducted IAW Work Plan, if MEC/MPPEH disposal operations are conducted	IP/FP	D/E	Disposal is conducted IAW Work Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
Site Restoration	Site Manager	Verify the damage caused by excavation and removal is backfilled and laid to original grade and completed IAW Work Plan.	FP	O	Damage caused by excavation and removal is backfilled and laid to original grade	Ensure that damage caused by excavation and removal of anomalies is backfilled and laid to original grade
Demobilization	Project Manager, Site Manager	Verify facilities-support infrastructures are dismantled and shipped to appropriate location and area is returned to original condition.	FP	O	Facilities-support infrastructures are dismantled and shipped to appropriate location and site is returned to original condition.	Ensure that all support facilities are removed and that the site is returned to original condition
Final Project Reports and Closeout						
ESI Report preparation and approval	Project Manager, Project Geophysicist	Verify tabulations of all anomalies and material identified/recovered during the field actions are accurate and complete.	FP	O	Tabulations of all anomalies and material identified/recovered during the field actions are accurate and complete.	Ensure tabulations of all anomalies and material identified/recovered during the field actions are accurate and complete.
Archiving	GIS Manager	Verify data back-up systems are in place.	FP	O	Data back-up systems are in place	Ensure data back-up systems are in place
Project Closeout	Project Manager	Verify purchase orders have been closed out.	FP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	FP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
 IAW = in accordance with

QC Phase
 PP = Preparatory Phase
 IP = Initial Phase
 FP = Follow-up Phase

Frequency
 O = Once
 D = Daily
 W = Weekly
 E = Each occurrence

¹ The responsible person (if other than the UXOQCS) is the individual with whom the UXOQCS will coordinate with to ensure compliance with requirements and to verify that any necessary follow-up actions are taken.

² Where appropriate, a reference has been included referring the reader to a more detailed description of the procedures being audited.

³ Documentation to be in accordance with the three-phase control process as outlined in the Quality Control Plan.

Environmental Protection Plan

8.1 Regional Ecological Summary

A summary of the regional ecology is provided in **Section 9.1** of the MRP Master Project Plans (CH2M HILL, 2008c).

8.2 Endangered/Threatened Species within the Project Site

Many protected species have been sighted in the vicinity of and aboard MCB CamLej, such as the American alligator, the green sea turtle, the loggerhead sea turtle, the piping plover, the red-cockaded woodpecker, bald eagle, seabeach amaranth, and the rough-leaf loosestrife (U.S. Marine Corps, 2006). **Table 8-1** lists those species that could occur in or adjacent to MCB CamLej that are listed as threatened, endangered, or of special concern by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended.

MCB CamLej has active programs in place to protect the three federally protected avian species (American bald eagle, piping plover, and red cockaded woodpecker) that are known to occur on the base. Site UXO-17 is not within the vicinity of any of the current red-cockaded woodpecker management areas.

A bald eagle's nest is documented aboard MCB CamLej. The nest is located at the junction of Sneads Creek and the New River, approximately 8.2 miles southwest from Site UXO-17. Three protective buffers that restrict ground and air-use activities have been established at approximately 750 feet, 1,000 feet, and 1,500 feet from the nest site. Site UXO-17 is not within any of these buffer zones. Non-nesting eagles may use the site for foraging habitat. However, the proposed work is not expected to impact any special habitat where eagles are concentrating.

Suitable habitat for the piping plover does not exist at Site UXO-17.

The eastern cougar is the only federally listed mammal species that could occur in Onslow County. The only extant population of eastern cougar is located in south Florida and the species has not been observed in North Carolina in more than 50 years.

Two of the four federally listed plant species have been identified on the base: rough-leaved loosestrife and seabeach amaranth. Approximately 22 rough-leaved loosestrife sites are found on MCB CamLej, with 76 acres buffered and marked to protect this species. Rough-leaved loosestrife sites are visited annually to visually inspect for changes in extent and apparent health. Approximately half of the rough-leaved loosestrife sites occur within protected red-cockaded woodpecker sites, obviating the need for marking each of these sites individually. The other sites, mostly falling within the Greater Sandy Run Area, are marked with white paint around a perimeter that extends 100 ft from the outermost individuals. None of these sites are located on or adjacent to Site UXO-17.

Seabeach amaranth is an annual that has been described as a dune-builder because it frequently occupies areas seaward of primary dunes often growing closer to the high tide line than any other coastal plant. As such, this plant is generally found along Onslow Beach and therefore is not located on or adjacent to Site UXO-17.

Environmental reviews completed in preparation for the Integrated Natural Resource Management Plan concluded that the remaining species listed in **Table 8-1** are not expected to exist at the site. No adverse impacts to listed species are expected to result from the proposed work at Site UXO-17. Project design features have been developed to prevent impacts to listed species.

8.3 Wetlands within the Project Site

Jurisdictional wetland areas are not known to be located at Site UXO-17 (**Figure 8-1**). No wetlands on or downstream of Site UXO-17 are expected to be affected by the project. Due to the small size of the disturbed area in Site UXO-17, the site falls below the threshold for requiring a stormwater pollution prevention plan. However, if the potential for runoff to jurisdictional wetlands becomes apparent, appropriate protection measures will be put in place.

8.4 Cultural and Archaeological Resources within the Project Site

The environmental sampling and DGM activities proposed to support this WP involve a limited degree of intrusive activity. The probability that any significant cultural or archaeological resources will be affected by the field investigation is low. Consultation with the Base archaeologist confirms that no cultural or archaeological resources are known to be within the project area. If any unmapped cultural or archaeological materials or resources are discovered within the project area, the Base archaeologist will be notified and asked to provide guidance on performing further work in the area.

8.5 Water Resources within the Project Site

As shown on **Figure 8-1**, one surface water body is located within the Site UXO-17 boundary. The water resource is not expected to be affected by the project. There is adequate vegetative buffer surrounding the site to protect surface water from additional runoff. Should clearing of vegetation be required in areas adjacent to the water body, appropriate silt barriers or other best management practices will be put in place to prevent sediment from migrating to the water body.

8.6 Coastal Zones within the Project Site

Onslow County is subject to the rules and policies of the North Carolina Coastal Resources Commission, which administers the Coastal Area Management Act (CAMA). The CAMA requires permits for development in an Area of Environmental Concern (AEC) if it meets all of the following conditions:

- It is in one of the 20 counties covered by CAMA

- It is considered "development" under CAMA
- It is in, or it affects, an AEC established by the Coastal Resources Commission
- It does not qualify for an exemption

"Development" includes activities such as dredging or filling coastal wetlands or waters, and construction of marinas, piers, docks, bulkheads, oceanfront structures, and roads.

The ESI activities at Site UXO-17 will include surface investigations and the collection of subsurface soil and groundwater samples using DPT. These activities do not fit the definition of "development" under CAMA; therefore, a CAMA permit is not necessary for this project.

8.7 Vegetation Clearance within the Project Site

Vegetation clearance is anticipated in association with the field investigations described in this WP. Vegetation will be removed primarily for the geophysical survey and temporary well installation. It is estimated that vegetation smaller than 6 inches in diameter will be cleared to allow DGM equipment to be used. Consultation with the Base wildlife biologist has confirmed that no threatened or endangered species have been located within the project area. Procedures in place will prevent excessive exposure of bare ground.

8.8 Existing Waste Disposal Sites within the Project Site

No waste disposal sites are present at Site UXO-17.

8.9 Compliance with Applicable or Relevant and Appropriate Requirements

CH2M HILL will follow all applicable regulations concerning environmental protection, pollution control, and abatement for the proposed project work as described in Section 9.3 of the MRP Master Project Plans (CH2M HILL, 2008c). No permits have been found to be required for the proposed work.

8.10 Detailed Procedures and Methods to Protect and/or Mitigate the Resources/Sites Identified

During the proposed work, field personnel will conduct a general survey of the project area to identify obvious environmental concerns. The PM, in conjunction with a qualified ecologist, will provide instructions to field personnel regarding the protection of onsite environmental resources. Such protective measures will include, but are not limited to, the following:

- Should federally protected plants be identified within the project area, the specimens will be flagged for easy relocation and verification

- Should cultural or archaeological material or resources be discovered within the project area, a qualified archaeologist will be notified and asked to provide guidance on performing further work in the area
- The PM will seek the guidance of the qualified ecologist to develop appropriate mitigation measures if the work activities would affect an environmental resource

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

ESI Work Plan, UXO-17

MCB CamLej

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Anguilla rostrata</i>	American eel	FSC	The American eel is catadromous; it spawns in oceanic waters but uses freshwater, brackish and estuarine systems for most of its developmental life. Migrates in autumn to the Sargasso Sea to spawn. Occurs usually in permanent streams with continuous flow. Hides during the day in undercut banks and in deep pools near logs and boulders.
<i>Chelonia mydas</i>	Green sea turtle	T	Green turtles are generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. The turtles are attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with a sloping platform and minimal disturbance are required for nesting.
<i>Caretta caretta</i>	Loggerhead sea turtle	T	The loggerhead is widely distributed within its range. It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers.
<i>Dermochelys coriacea</i>	Leatherback sea turtle	E	An open ocean species, it sometimes moves into shallow bays, estuaries and even river mouths.
<i>Trichechus manatus</i>	West Indian Manatee	E	Manatees inhabit both salt and fresh water of sufficient depth (1.5 meters to usually less than 6 meters) throughout their range.
<i>Alligator mississippiensis</i>	American alligator	T(S/A)	Rivers, swamps, estuaries, lakes, and marshes
<i>Charadrius melodus</i>	Piping plover	T	Open, sandy beaches close to the primary dune of the barrier islands and coastlines of the Atlantic for breeding. They prefer sparsely vegetated open sand, gravel, or cobble for a nest site. They forage along the rack line where the tide washes up onto the beach.
<i>Aimophila aestivalis</i>	Bachman's sparrow	FSC	Occurs only in pine forests of the southeastern U.S.
<i>Haliaeetus leucocephalus</i>	American bald eagle	T	A single bald eagle's nest is found on Camp Lejeune- at the junction of Sneads Creek and the New River near the back gate. Three protective buffers have been established at approximately 750', 1000', and 1500' from the nest site.
<i>Laterallus jamaicensis</i>	Black rail	FSC	Marsh/wetlands; The "Eastern" Black Rail can be found in appropriate saltmarsh habitat along the eastern seaboard from Connecticut to Florida and along the Gulf Coast.

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS
ESI Work Plan, UXO-17
MCB CamLej
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	E	Sturgeon inhabits the lower sections of larger rivers and coastal waters along the Atlantic coast. It may spend most of the year in brackish or salt water and move into fresh water only to spawn. The fish feeds on invertebrates (shrimp, worms, etc.) and stems and leaves of macrophytes.
<i>Rana capito capito</i>	Carolina crawfish frog	FSC	Carolina crawfish frogs live primarily in the sandhills and pine barrens of the North Carolina Coastal Plain. Crawfish frogs are more terrestrial than most frogs, generally only coming to the water to breed. They are also nocturnal, spending daylight hours underground in burrows.
<i>Puma concolor cougar</i>	Eastern cougar	E	No preference for specific habitat types has been noted. The primary need is apparently for a large wilderness area with an adequate food supply. Male cougars of other subspecies have been observed to occupy a range of 25 or more square miles, and females from 5 to 20 square miles.
<i>Passerina ciris ciris</i>	Eastern painted bunting	FSC*	Found mainly in southern states and Mexico, where the brushy, weedy shrub-scrub habitat that this bird prefers abound
<i>Ammodramus henslowii</i>	Eastern Henslow's sparrow	FSC	A species of tallgrass prairies, agricultural grasslands, and pine savannas of the eastern U.S.; the species migrates south to spend the non-breeding season in the native pine savanna habitats of the southeastern U.S.
<i>Ophisaurus mimicus</i>	Mimic glass lizard	FSC	This species is found in the southeastern Coastal Plain. They are most common in pine flatwoods and open woodlands.
<i>Picoides borealis</i>	Red-cockaded Woodpecker	E	For nesting/roosting habitat, open stands of pine containing trees 60 years old and older. Red-cockaded woodpeckers need live, older pines in which to excavate their cavities. Longleaf pines (<i>Pinus palustris</i>) are most commonly used, but other species of southern pine are also acceptable. Dense stands (stands that are primarily hardwoods, or that have a dense hardwood understory) are avoided. Foraging habitat is provided in pine and pine hardwood stands 30 years old or older with foraging preference for pine trees 10 inches or larger in diameter. In good, moderately-stocked, pine habitat, sufficient foraging substrate can be provided on 80 to 125 acres.

TABLE 8-1

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MCB CamLej
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Heterodon simus</i>	Southern hognose snake	FSC	These snakes are found in sandy fields and woods of the Coastal Plain, particularly in the Sandhills region.
<i>Agrotis buchholzi</i>	Buchholz's dart moth	FSC	Found in Forested wetlands, scrub-shrub wetlands, shrubland/chaparral and coniferous woodlands. This moth is found mostly in recently burned habitats. Populations can persist up to about a decade or rarely two without fire, until litter accumulates sufficiently to cover foodplants. In most cases habitat is probably suboptimal beginning about five years after a fire.
<i>Atrytonopsis sp.</i>	a skipper	FSC	One species, the dusteds are fairly rare at the coast but found throughout North Carolina (<i>A. hianna</i>). An assumption is made that the genus is generally defined.
<i>Isoetes microvela</i>	A quillwort	FSC	Quillworts are usually restricted to areas of clean water where other plants are absent. Occasionally, quillwort may grow partly or entirely out of the water.
<i>Rhexia aristosa</i>	Awed meadowbeauty	FSC	Found in a variety of wet habitats in the Coastal Plain from New Jersey to Alabama
<i>Lobelia boykinii</i>	Boykin's lobelia	FSC	Grows in swamps and cypress ponds from the coastal plain of Delaware to Florida. The lower portion is often immersed in water, at least seasonally.
<i>Solidago pulchra</i>	Coastal goldenrod	FSC	Bogs, freshwater habitats, grasslands
<i>Parnassia caroliniana</i>	Carolina grass-of-parnassus	FSC	Bogs, freshwater habitats, grasslands
<i>Trillium pusillum var. pusillum</i>	Carolina trillium	FSC	Grows in alluvial woods, pocosin borders and savannahs
<i>Asplenium heteroresiliens</i>	Carolina (wagner) spleenwort	FSC	Rock outcrops
<i>Rhynchospora pleiantha</i>	Coastal beaksedge	FSC	Extremely rare, found at fewer than 25 sites throughout its North Carolina-to-Alabama range

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS
ESI Work Plan, UXO-17
MCB CamLej
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Solidago villosicarpa</i>	Coastal Goldenrod	FSC	Known to occur in only 5 populations in three counties in eastern North Carolina. Three of these populations occur on Camp Lejeune. The other sites occur in Pender and Brunswick Counties. Currently the North Carolina Natural Heritage Program is conducting a survey of likely habitat to look for coastal goldenrod.
<i>Thalictrum cooleyi</i>	Cooley's meadowrue	E	Cooley's meadowrue occurs in moist to wet bogs and savannahs. It grows along fireplow lines, roadside ditches, woodland clearings, and powerline rights-of-way, and needs some type of disturbance to maintain its open habitat.
<i>Carex lutea</i>	Golden sedge	E	Biologists have located golden sedge in only eight locations, all in coastal savannas in Onslow and Pender Counties that are underlain by calcareous, or chalk, deposits.
<i>Sagittaria weatherbiana</i>	Grassleaf arrowhead	FSC	Found in shallow water of brackish swamps
<i>Dichantherium sp.</i>	Hirst's panic grass	FSC	Worldwide, Hirst's panic grass occurs in four extant populations. Historically, it was found in coastal plain habitats in the states of New Jersey, Delaware, North Carolina and Georgia. Currently Hirst's panic grass is known to exist in one site in Delaware and two known sites in North Carolina, both of which are on Camp Lejeune.
<i>Miriophyllum laxum</i>	Loose watermilfoil	FSC	Riparian habitats
<i>Calopogon multiflorus</i>	Many-flower grass-pink	FSC	Grasslands, pinelands; typically in wet areas
<i>Plantago sparsiflora</i>	Pineland plantain	FSC	Savannahs, roadsides and ditches
<i>Lindera melissifolia</i>	Pondberry	E	Associated with wetland habitats such as bottomland and hardwoods in the interior areas, and the margins of sinks, ponds and other depressions in the more coastal sites. The plants generally grow in shaded areas but may also be found in full sun.
<i>Litsea aestivalis</i>	Pondspice	FSC	Freshwater habitats

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

ESI Work Plan, UXO-17

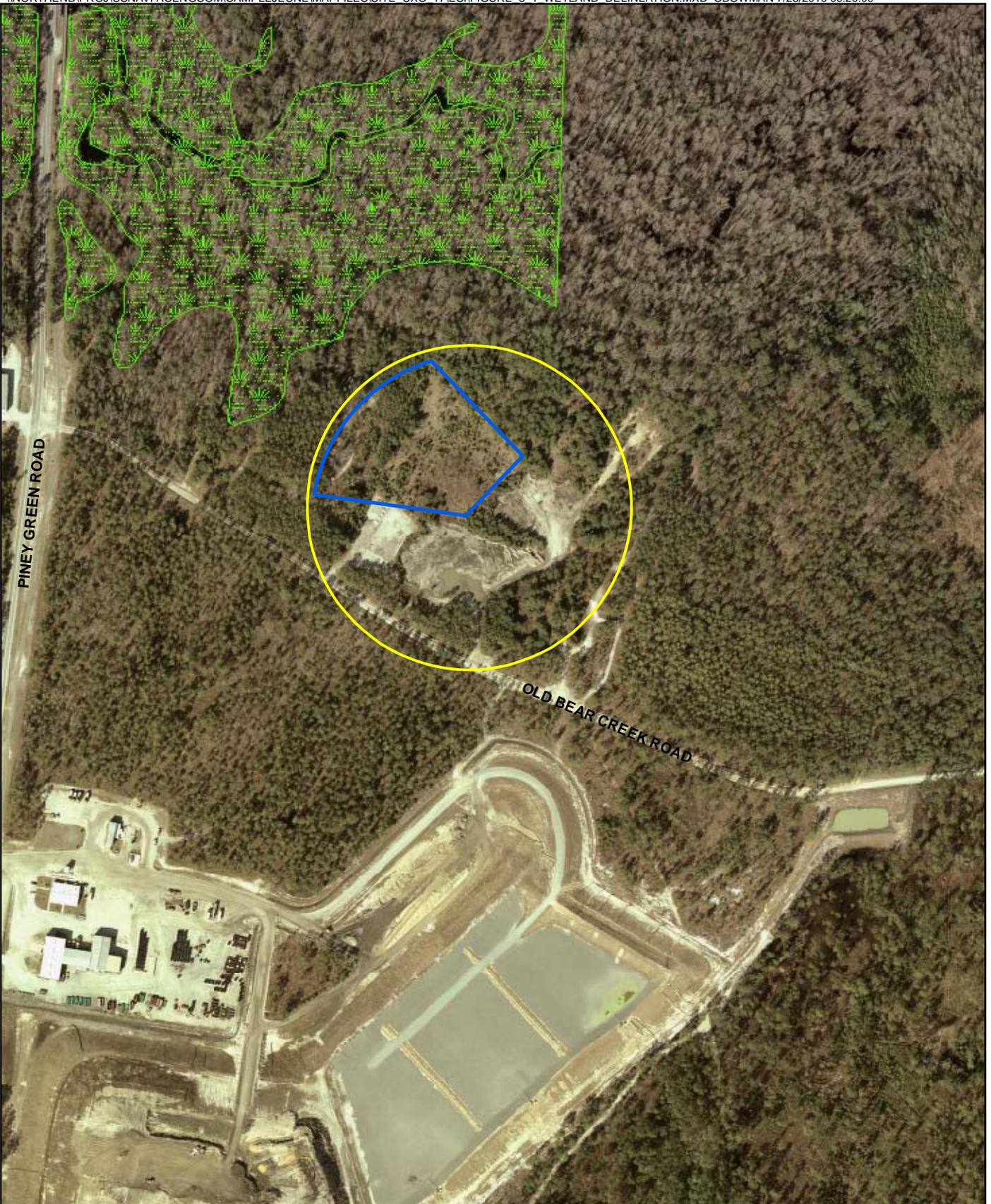
MCB CamLej

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Lysimachia asperulaefolia</i>	Rough-leaved loosestrife	E	Species generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil), on moist to seasonally saturated sands and on shallow organic soils overlaying sand. Rough-leaved loosestrife has also been found on deep peat in the low shrub community of large Carolina bays
<i>Amaranthus pumilus</i>	Seabeach amaranth	T	Occurs on barrier island beaches
<i>Allium sp.</i>	Savanna onion	FSC	Wet savannahs
<i>Scleria sp.</i>	Smooth-seeded hairy nutrush	FSC	Dry woods, pineland and savannahs (<i>S. triglomerata</i>)
<i>Rhynchospora decurrens</i>	Swamp forest beakrush	FSC	Swamp forests, very rare
<i>Solidago verna</i>	Spring-flowering goldenrod	FSC	The only spring-flowering goldenrod that occurs in the Sandhills and Coastal Plain of the Carolinas. It can be found in a wide array of habitats, including pine savannas, pocosins, and pine barrens
<i>Rhynchospora thornei</i>	Thorne's beaksedge	FSC	Bogs, freshwater habitats, pinelands
<i>Dionea muscipula</i>	Venus flytrap	FSC	Bogs, pinelands

E = Endangered—A taxon in danger of extinction throughout all or a significant portion of its range.
T = Threatened—A taxon likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
FSC = Federal species of special concern—species may or may not be listed in the future.
T(S/A)—Threatened due to similarity of appearance (e.g., American alligator)—a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

*Historic record—the species was last observed in the county more than 50 years ago.



Legend

-  4-acre Focused PA/SI
-  Site UXO-17 Boundary
-  Jurisdictional Wetlands



1 inch = 400 feet

Figure 8-1
UXO-17 Wetland Delineation
Site UXO-17
MCB CamLej
North Carolina



SECTION 9

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Appendix A
Health and Safety Plan

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HASP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Safety Coordinator- Haz Waste (SC-HW) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 406817

CLIENT: NAVFAC Atlantic

PROJECT/SITE NAME: LANTDIV CLEAN 1000 CTO-141 / MCB CamLej, UXO-17 Expanded Site Inspection

SITE ADDRESS: Piney Green Rd, MCB CamLej, Jacksonville, North Carolina

CH2M HILL PROJECT MANAGER: Lael Feist/HNV

CH2M HILL OFFICE: Huntsville

DATE HEALTH AND SAFETY PLAN PREPARED: October 27, 2009

DATE(S) OF SITE WORK: September- December 2010

SITE ACCESS: Access to the site is not restricted after entering the Base. Site UXO-17 may be accessed through the MCB CamLej Main Gate on the east side of the New River. From Piney Green Road, Old Bear Creek Rd (unpaved) provides direct access to the site.

SITE SIZE: MCB CamLej is approximately 236 square miles. Site UXO-17 is located on approximately 16 acres of land.

SITE TOPOGRAPHY: The topography of MCB CamLej is relatively flat with ground surface elevations ranging from mean sea level (msl) to 72 feet above msl. Most of the MCB CamLej lies between 20 and 40 feet msl. Site UXO-17 is also a relatively flat area with surface elevation at 25 feet above msl. The 100-year flood plain elevation for this area of MCB CamLej is approximately 10 feet above msl.

PREVAILING WEATHER: The climate at MCB CamLej is characterized by mild winters and hot humid summers. Winters are usually short and mild with occasional and short duration cold periods. Summers are long, hot and humid. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 to 53 degrees Fahrenheit (°F) in the winter months, and 71°F to 88°F during the summer months. Winds are generally south-southwesterly in the summer, and north-northwesterly in the winter (Water and Air Research, 1983). The hurricane season in the immediate area surrounding Camp Lejeune begins on June 1 and continues through November 30. Storms of non-tropical origins such as frontal passages, local thunderstorms, and tornadoes are more frequent and can occur year-round.

BASE HISTORY: Construction of MCB CamLej began in 1941 with the objective of developing the "World's Most Complete Amphibious Training Base". Construction of the Base started at Hadnot Point where the major functions of the Base are centered. During World War II, MCB CamLej was used as a training area to prepare Marines for combat. MCB CamLej was again used for training during the Korean and Vietnam conflicts, and the Gulf War. MCB CamLej is host to five Marine Corps commands and one Navy command.

In addition, MCB CamLej provides support and training for the following tenet commands: Headquarters Nucleus; Second Marine Expeditionary Force; Second Marine Division; Second Marine Force Service Support Group; Second Marine Surveillance, Reconnaissance, and Intelligence Group; Sixth Marine Expeditionary Brigade; the Naval Hospital; and the Naval Dental Clinic. All of the real estate and infrastructure are owned, operated, and maintained by the host command. The mission of Camp Lejeune is to maintain combat ready units for expeditionary deployment.

MCB CamLej is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The Atlantic Ocean forms the southeastern boundary of the facility. The western and northwestern boundaries are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville, North Carolina is located immediately northwest of MCB CamLej.

Land use surrounding MCB CamLej is varied, with mainly industrial properties along the northern boundary. Estuaries along the coast support commercial fishing and residential resort areas are located adjacent to MCB CamLej along the Atlantic Ocean.

Site UXO-17 is 16 acres in size and consists of former Firing Position 2, (defined as Archives Search Report (ASR) Area 2.212). The site is located east of Piney Green Road and north of the current base landfill. Access to Firing Position 2 is restricted to military personnel and authorized contractors. The focus of this Expanded SI (ESI) will be on a 12-acre portion of Site UXO-17. The remaining 4 acres of the site were previously investigated.

As reported in *Site Specific Work Plan Addendum for Focused Preliminary Assessment/Site Inspection Landfill Firing Position 2*(CH2M HILL, 2008a), Site UXO-17 was reportedly used from the 1950s through at least 1985. The MCB CamLej Range Safety Officer stated that 105 millimeter (mm) and 155 mm howitzer guns were used at this site and fired practice rounds into the K-2 and G-10 Impact Areas. A former MCB CamLej Range Control Officer indicated that 4.2-inch mortars, 175 mm guns 8-inch howitzers and 120 mm mortars may also have been used with unused projectile propellant being burnt on the ground. No chemical warfare materiel was reported to have been used at this site.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

Site UXO-17 has the potential to include munitions and explosives of concerns (MEC) and/or environmental contamination with munitions constituents (MC). Due to historical activities within the project area an ESI is being conducted to accomplish the following objectives:

1. Evaluate the presence and nature of any MC contamination that may exist at Site UXO-17 by conducting an investigation of groundwater, surfacewater, sediment, and soil

Evaluate the number and density of geophysical anomalies that may represent potential subsurface MEC at Site UXO-17. The field investigation for the ESI will accomplish these objectives through the following activities in the portion of Site UXO-17 that was not previously investigated, which will be conducted in accordance with CH2M HILL Standard Operating Procedures (SOPs), and the MRP Master Project Plans:

- Collect surface soil samples throughout the 12-acre investigation area at the site
- Collect subsurface soil samples using direct-push technology (DPT)
- Collect shallow depth groundwater samples from temporary wells installed using Hollow Stem Auger (HSA)
- Perform digital geophysical mapping (DGM) to identify subsurface anomalies potentially representing subsurface MEC

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1 Tasks to be performed under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to “clean” tasks that do not involve hazardous waste operations and emergency response (Hazwoper). All work will be performed in accordance with approved Work Plan.

1.1.1 Hazwoper-Regulated Tasks

- Direct-push technology (DPT) soil boring
- Monitoring well installation
- Groundwater sampling
- Surface and subsurface soil sampling
- MEC Avoidance
- Vegetation Clearing Oversight

1.1.2 Non-HAZWOPER-Regulated Tasks

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

Potential Hazards	Monitoring Well Installation /DPT Soil Boring	Soil and Sediment Sampling	Surface Water Sampling	Groundwater Sampling	Vegetation Clearing
Flying debris/objects	X				X
Noise > 85dBA	X				X
Electrical	X	X	X	X	X
Suspended loads	X				
Buried utilities, drums, tanks	X				
Slip, trip, fall	X	X	X	X	X
Back injury	X	X	X	X	X
Visible lightning	X	X	X	X	X
Vehicle traffic	X	X	X	X	X
Fires	X				X
MEC	X	X	X	X	X
Entanglement	X				
Drilling	X				
Heavy equipment	X				X
IDW Drum Sampling	X	X	X	X	

2 Hazard Controls

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

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Principles

Risk management is, and will continue to be, integrated into the planning, preparation, and execution of work on all operational sites during this project. Risk management is a dynamic process that continuously improves as personnel become familiar with site operations, the equipment, the environment, and such. Personnel are urged to continuously identify hazards and assess accident risks. Once identified, these hazards will be brought to the attention of the supervisor and/or the Project Manager (PM). Control measures will be developed and coordinated. All personnel are responsible for continuously assessing variable hazards and implementing risk controls.

Constraints

Risk management does not convey authority to violate the law or deliberately disobey local, state, or national laws. Neither does it justify bypassing risk controls required by the law, such as life safety and fire protection codes, physical security, and transport and disposal of hazardous material and waste.

Risk Management Process

The risk management process will be used by all personnel involved in the operations of the project. Every individual is responsible for the safety of operations and the identification of potential hazards. The UXOSO will cover all aspects of the appropriate AHA prior to that activity being conducted and ensure that all personnel understand the engineering controls being used and the personal protective equipment (PPE) that is issued. During operations, if any new hazards are identified or it is determined that the engineering controls or PPE are not appropriate, operations will cease and the following risk management process will be used to determine the appropriate course of action. The final actions or changes will be coordinated and approved by the Corporate MR Safety/Quality Officer, the UXOSO, and the PM. Prior to the changes being placed into effect, a written and approved change document will be in place. Once changed, all personnel on site will be briefed to this change and documentation of this briefing will be made available.

The AHAs and the pre-task safety plans are key elements to this process. All personnel are required to read and understand each document. This shall be accomplished in the morning safety briefing and again at the daily debriefing to bring out any changes or discrepancies in the process.

Step 1 - Identify hazards.

Tasks, terrain and weather, biological hazards, chemical/explosive hazards, physical hazards, health hazards, lack of resources, physical and emotional health of personnel, long-term project, and lack of planning time.

Step 2 - Assess hazards to determine risks.

Hazard Probability: The possibility of any hazard that may be present having an effect on personnel H&S or the working environment.

Hazard Severity: The severity of the impact on personnel if they were exposed to the hazard without any engineering controls or PPE. The severity can range from negligible to severe, which could cause loss of life.

Step 3 - Develop controls and make risk decisions.

Engineering Controls - Engineering controls are the most effective means to eliminate a hazard. Through engineering controls, the unpredictable human element is removed from the equation. Engineering controls can include such measures as barriers and guards, substitution, distance, or other measures to separate personnel from existing hazards.

Personal Protective Equipment - Where engineering controls cannot eliminate the hazard, PPE will be used in conjunction with engineering controls to prevent the hazardous exposure from impacting personnel.

Administrative Controls - Administrative controls are used to supplement engineering controls and PPE to ensure that the controls in place are working as planned. Administrative controls include training and education of the workforce, monitoring, standard operating procedures, inspection program, and signs to warn individuals that a hazard exists. Oversight personnel responsible for locating specific hazards fall into this category.

Avoidance - Avoidance controls are applied when positive action is required to prevent contact with an identified hazard.

Criteria for controls - To be effective, each control developed must meet the following criteria:

Suitability - It must remove the hazard or mitigate (reduce) the residual risk to an acceptable level.

Feasibility - Personnel must have the capability to implement the control.

Acceptability - The benefit gained by implementing the control must justify the cost in resources and time.

Step 4 - Implement controls.

Controls are converted into clear, simple execution orders understood at all levels.

Personnel are trained to ensure understanding of controls.

Step 5 - Supervise and evaluate.

Supervisors ensure controls are followed.

Project-specific frequency for completing self-assessments: Bi-weekly or at the beginning of each project phase.

2.1 Project Specific Hazards

2.1.1 Arsenic

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

- 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.
- Arsenic is considered a “Confirmed Human Carcinogen.”
- Arsenic particulates (inorganic metal dust) are odorless. Vapor and gaseous odor varies depending upon specific organic arsenic compound.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.2 Cadmium

(Reference CH2M HILL SOP HSE-504, *Cadmium*)

- 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.
- Cadmium is considered a “Suspected Human Carcinogen.”
- Cadmium particulates (fumes and dust) are odorless.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.3 Drilling Safety

- 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. A minimum distance of 15 feet between mast and overhead lines (<50 kV) is recommended. Increased separation may be required for lines greater than 50 kV.
- 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

2.1.4 Drum Handling

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries.
- 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 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.
- Throughout handling, personnel should be alert for information leading to the identity of new hazards. Exercise extreme caution in handling drums that are not intact and tightly sealed.
- Before moving anything, determine the most appropriate sequence in which the various drums 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.

2.1.5 Electrical

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

General Electrical Safety

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

Portable Generator Hazards

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.
- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

2.1.6 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles or project vehicles.
- Fleet vehicles are equipped with emergency supplies. It is a project responsibility to equip all project vehicles with emergency equipment.
- Maintain both a First Aid kit and Fire Extinguisher in the field vehicle at all times.
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Car rental must meet the following requirements:

- Dual air bags
 - Antilock brakes
 - Be midsize or larger
- Familiarize yourself with rental vehicle features:
 - Mirror adjustments
 - Seat adjustments
 - Cruise control features, if offered
 - Pre-program radio stations
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van.
- Pull off the road, put the car in park and turn on flashers before talking on a mobile phone.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.

2.1.7 Fire Prevention

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

2.1.8 Groundwater Sampling/Water Level Measurements

- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (refer to Section 4).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to Section 5 on air monitoring).
- 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 with the groundwater and acid used in sample preservation, wash exposed 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.

2.1.9 Hand and Power Tools

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

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

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

Machine Guarding

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

2.1.10 Knife Use

Open-bladed knives (e.g., box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leathermen™) 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).
- Knife users have been trained and follow the AHA.

Responsibilities	<ul style="list-style-type: none"> • Supervisors with assistance from the FTL/SC are responsible for funding and ensuring the correct tool is being used, employees wear the proper PPE when using knives, and they have reviewed this policy. • Employees are responsible for having and utilizing the proper PPE while performing an activity requiring the use of a knife. Employees are also responsible for understanding the proper use of a knife.
Glove Requirements	<ul style="list-style-type: none"> • In general, Kevlar cut resistant gloves are to be worn when using a knife in an occupational setting. • Other types of gloves may be required and will be identified within the AHA / written procedure. Example - Leather gloves may be worn when using the acetate sleeve cutter.

Training (Ref. VO for additional hand safety topics)

All employees that will use a knife must be trained in the proper use.

- When using a knife always cut away from yourself.
- Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade.
- If you use a folding knife, it must be a locking blade type.
- Never use a knife that will fold under pressure.
- If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non- greasy/slippery to assure a better grip.
- When cutting, make the force of the cut carry the blade away from any part of your body. If you have a peculiar situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device.
- If you carry a fixed blade knife, use a sheath or holder.
- Store utility knives safely, retract the blade or sheath an open blade before storing. Never, leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet.
- Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake.
- Knives used on the job, but not carried with you , must be properly stored when not in use
- Never use a defective knife.
- Utility knife blades are brittle and can snap easily. Don't bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a prybar, screw driver, hole punch, and other assorted things that make it seem so easy.
- If you do get cut, seek medical attention to treat the injury by notifying your supervisor and contacting WorkCare at 1-866-893-2514.

Examples of preferred tools and Kevlar cut resistant gloves:





A safety spring provides for automatic blade "shoot-back" into the handle when contact w/cutting surface is lost

Stay focused on the cutting job. It only takes a second of inattention with a sharp blade to produce a serious cut. Letting the mind wander or talking with others while using a knife greatly increases the risk of an accident and injury. If you are interrupted while working with a knife, stop cutting, retract the blade, and place the knife down on a secure surface before dealing with the interruption. You should never continue cutting while distracted!

As always, utilize the hierarchy of controls and first attempt to engineer out the hazard and frequently ask ourselves do we have the right tool for the job.

2.1.11 Lead

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

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

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

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

Exposure Monitoring

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

- Initial exposure monitoring is conducted to document employees' breathing-zone exposures over the course of a full shift. A representative 8-hour TWA sample shall be collected for each job classification in each work area.
- When initial monitoring results are below the AL, monitoring may be suspended.
- Additional monitoring is required when there has been a change in production process, control equipment, personnel, or work practices that may result in new or additional exposures.
- Employees shall be informed in writing of exposure monitoring results within 5 working days after receipt of the results.
- Air sampling will also be performed outside the regulated area to verify that lead is not being generated outside the regulated area. One sample shall originate upwind from the work and one downwind from the work.

Respiratory Protection

- Respiratory protection must be used during the following: periods when employee exposure to lead exceeds the PEL; work operations for which engineering and work-practice controls are not sufficient to reduce employee exposure to or below the PEL; periods when an employee requests a respirator; and periods when respirators are required to provide interim protection during initial exposure assessments.
- Respiratory protection selection shall be based on the most relevant exposure monitoring results.
- A respiratory protection program, including respirator selection, shall be implemented in accordance to OSHA 29 CFR 1910.134 and with CH2M HILL SOP HSE-121, Respiratory Protection. Subcontractor respiratory protection programs shall meet or exceed these requirements.
- When air-purifying respirators are utilized, the HEPA filters shall be replaced at the beginning of each shift.
- Powered air-purifying respirators (PAPR) shall be provided to employees who request such a respirator and where it will provide adequate protection.
- If an exposure assessment for this type of removal is not available, the assumption is that this is an abrasive blasting operation. It will be assumed that concentrations of airborne lead will be in excess of 2,500 ug/m³ and supplied air respiratory protection will be required within the regulated area.

TABLE FROM 29 CFR 1926.62 - RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use	Required respirator ¹
Not in excess of 500 ug/m ³	<ul style="list-style-type: none"> - 1/2 mask air purifying respirator with high efficiency filters^{2,3}. - 1/2 mask supplied air respirator operated in demand (negative pressure) mode.
Not in excess of 1,250 ug/m ³	<ul style="list-style-type: none"> Loose fitting hood or helmet powered air purifying respirator with high efficiency filters³. - Hood or helmet supplied air respirator operated in a continuous-flow mode - e.g., type CE abrasive blasting respirators operated in a continuous-flow mode.
Not in excess of 2,500 ug/m ³	<ul style="list-style-type: none"> Full facepiece air purifying respirator with high efficiency filters³. - Tight fitting powered air purifying respirator with high efficiency filters³. - Full facepiece supplied air respirator operated in demand mode. - 1/2 mask or full facepiece supplied air respirator operated in a continuous-flow mode. - Full facepiece self-contained breathing apparatus (SCBA) operated in demand mode.
Not in excess of 50,000 ug/m ³	<ul style="list-style-type: none"> 1/2 mask supplied air respirator operated in pressure demand or other positive-pressure mode.
Not in excess of 100,000 ug/m ³	<ul style="list-style-type: none"> - Full facepiece supplied air respirator operated in pressure demand or other positive-pressure mode - e.g., type CE abrasive blasting respirators operated in a positive-pressure mode.
Greater than 100,000 ug/m ³ unknown concentration, or fire fighting	<ul style="list-style-type: none"> Full facepiece SCBA operated in pressure demand or other positive-pressure mode.

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

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

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

PPE

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

Written Lead Compliance Program

When employee exposures are greater than the PEL, a written lead compliance program shall be established and implemented prior to commencement of operations. The written program shall outline the plans for maintaining employee exposure below the PEL. The compliance program shall be based on the most recent exposure monitoring data. The program shall be revised when exposure monitoring data is updated or at least annually to reflect the status of the program.

Regulated Areas

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

Housekeeping

- Where airborne lead concentrations exceed the PEL, housekeeping procedures shall be documented in the written lead compliance program.
- All surfaces shall be maintained as free as possible of accumulations of lead. Methods selected for cleaning of surfaces and floors shall be those that minimize the likelihood of lead becoming airborne (for example, vacuuming).
- Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner that minimizes the reentry of lead into the workplace.

- Compressed air shall not be used to remove lead from any surface unless used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air.
- Waste containing significant amounts of lead may be subject to hazardous waste regulations and the corresponding generation, treatment and disposal requirements.

Medical Monitoring

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

Training

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

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

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

2.1.12 Manual Lifting

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

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

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

2.1.13 Noise

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

- A noise assessment shall be conducted by the RHSM or designee based on potential to emit noise above 85 dBA.
- 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 84 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.
- Hearing protection is selected based upon noise levels and specific tasks to be performed.
- Employees are trained in the hazards of noise and how to properly wear and maintain their hearing protection.
- 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.

2.1.14 Utilities (underground)

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted. The use of as-built drawings and utility company searches must be supplemented with a

geophysical or other survey by a qualified, independent survey contractor to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include:

- **Ground Penetrating Radar (GPR)**, which can detect pipes, including gas pipes, tanks, conduits, cables, etc., both metallic and non-metallic, at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF)**, involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.
- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF.
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers**, are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

Procedure

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

- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project, based on the survey contractor's experience and expertise, types of utilities anticipated to be present, and specific site conditions.
- The survey contractor shall employ the same geophysical techniques used on the project to identify the buried utilities, to survey the proposed path of subsurface construction work, and to confirm no buried utilities are present.
- Identify customer specific permit and/or procedural requirements for excavation and drilling activities. For military installations contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.
- Contact utility companies or the state/regional utility protection service at least two (2) working days prior to excavation activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation.
- Schedule the independent survey.
- Obtain utility clearances for subsurface work on both public and private property.

- Clearances are to be in writing, signed by the party conducting the clearance.
- Underground utility locations must be physically verified by hand digging using wood or fiberglass-handled tools when any adjacent subsurface construction activity (e.g. mechanical drilling, excavating) work is expected to come within 5 feet of the marked underground system. If subsurface construction activity is within 5 feet and parallel to a marked existing utility, the utility location must be exposed and verified by hand digging every 100 feet.
- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Conduct a site briefing for employees regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.

2.1.15 Utilities (overhead)

Proximity to Power Lines

No work is to be conducted within 50 feet of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet of overhead power lines without first making this determination.

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
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

(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 Project Manager/Construction Manager prior to the start of work.

2.1.16 Visible Lighting

- While work is in progress outside construction areas shall have at least 33 lux (lx).
- Construction work conducted inside buildings should be provided with at least 55 lux light.
- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

2.1.17 Working Alone

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

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

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

Accountability Systems

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

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

2.2 General Hazards

2.2.1 General Practices and Housekeeping

- Site work should be performed during daylight hours whenever possible.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others.
- Familiarize yourself with, understand, and follow jobsite emergency procedures.
- Do not fight or horseplay while conducting the firm's business.
- Do not use or possess firearms or other weapons while conducting the firm's business.
- Report unsafe conditions or unsafe acts to your supervisor immediately.
- Report occupational illnesses, injuries, and vehicle accidents.
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment.
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor.
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion.
- Do not run in the workplace.
- When ascending or descending stairways, use the handrail and take one step at a time.
- Do not apply compressed air to any person or clothing.

- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location.
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery.
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations.
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible.
- Check the work area to determine what problems or hazards may exist.

2.2.2 Personal Hygiene

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

2.2.3 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. Drug and/or alcohol testing is applicable under CCI 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 VO.

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.
- Arrival at work under the influence of legal or illegal drugs or alcohol.

2.2.4 Driving

- Always be aware of surroundings while operating a vehicle. Avoid intellectual stress & worries, talking on a cellular phone, eating, drinking, smoking, reading a map, adjusting controls or looking at a passenger while driving.

- Use prudent speed limits, assure that backup warning devices are working, be aware of blind spots or other hazards associated with low visibility, etc. Use a spotter if necessary.
- Do not drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep.

2.2.5 Hazard Communication

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

The Hazard Communication Coordinator is to perform the following:

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

2.2.6 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) and ceasing intrusive work inside a building (i.e. DPT), 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.
- 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/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.

2.2.7 Shipping and Transportation of Chemical Products

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

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the RHSM or the Warehouse Coordinator for additional information.

2.2.8 Ultraviolet (UV) Radiation (sun exposure)

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

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

Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).

- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

Provide Shade

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

Clothing

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

Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- Remember – no sunscreen provides 100% protection against UV radiation. Other precautions must be taken to avoid overexposure.

2.2.9 Temperature Extremes

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
- Communicating any concerns regarding heat and cold stress to their supervisor or SC

2.2.9.1 Heat Stress

General

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 retained body heat – a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is the degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions. Acclimatization affects their ability to do work. Acclimatized individuals sweat sooner and more profusely than unacclimatized individuals. Acclimatization occurs gradually over 1 to 2 weeks of continuous exposure, but it can be lost in as little as 3 days in a cooler environment.

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°F to 60°F should be available. Under severe conditions, drink 1 to 2

cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.

- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SC to avoid progression of heat-related illness.

Thermal Stress Monitoring

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

- The heart rate should be measured by the radial pulse for 30 seconds, as early as possible in the resting period.
- The heart rate at the beginning of the rest period should not exceed 110 beats per minute, or 20 beats per minute above resting pulse.
- If the heart rate is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 110 beats per minute 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 110 beats per minute, or 20 beats per minute above resting pulse.
- Alternately, the oral temperature can be measured before the workers have something to drink.
- If the oral temperature exceeds 99.6 degrees F at the beginning of the rest period, the following work cycle should be shortened by 33 percent.

- Continue this procedure until the oral temperature is maintained below 99.6 degrees F. While an accurate indication of heat stress, oral temperature is difficult to measure in the field.

2.2.9.2 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

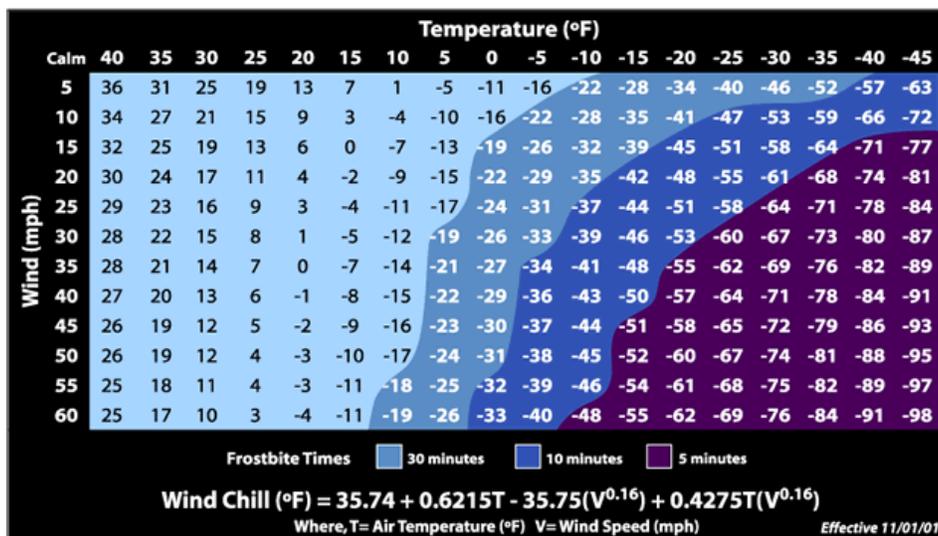
- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) 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.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- 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



2.2 Biological Hazards and Controls

2.2.1 Snakes

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

2.2.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in most areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.2.3 Ticks

Ticks present a year-round hazard for field staff at MCB CamLej. While there is some potential for ticks to be present in low grasses, mown lawns, or low tree branches, they are more likely to be present in wooded areas, bushes, tall grass, and brush. Ticks thrive in tall weeds and grass. Adults will climb into shrubs at shun to waist heights, nymphs are picked up at shin to knee heights, and larvae are typically picked up at shoe levels. Ticks are black, black and red, or brown and can be up to one-quarter inch in size.

Clothing Options

Several clothing options are available for tick prevention, as described below.

- **Self Applied 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 repellent, and works primarily by killing ticks on contact with the clothes (although it also has some repellent properties). Repellents 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). Instructions on product labels should be followed for proper application. 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). While skin reactions are not common, it is recommended to avoid contact with face eyes or skin when treating clothing.
- **Pretreated Clothing** - There are some manufacturers which produce clothing that has already been treated with Permethrin. Typically, the fibers are impregnated with the repellent, reportedly making them able to withstand up to 70 wash cycles. Purchasing pre-treated clothing is one alternative to applying a Permethrin based repellent to your clothing.
- **Bug 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 (including ticks and chiggers). Typically, these garments are not treated with repellents and still are susceptible to infiltration through seams. Additionally, mesh hoods may result in impaired vision. Bug Suits add an additional layer of clothing to the wearer, and may result in increased heat stresses to the body. Bug suits are an approved alternative to treated clothing, but particular attention must be paid to seams, vision impairment and heat stress when they are worn for tick bite prevention. Bug suits should not be used around heavy equipment or moving parts that could catch the material and pull an individual into the equipment.

- **TyvekSuits** - 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 Tyvek 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, which may make use difficult at MCB CamLej in late spring through early fall.

Skin Treatment

The use of skin applied repellents is required when working in areas where the presence of ticks is anticipated. While other repellents may provide some level of protection, DEET (*N,N*-Diethyl-*meta*-toluamide), based repellents are preferred for use on CH2M HILL projects. However, alternative repellent that can be used have to include one of the following active ingredients: Picaridin, IR3535, Oil of Lemon Eucalyptus (also known as PMD), IR3535, methyl nonyl ketone, and Oil of Citronella.

These repellents 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.

Active Ingredients in Insect Repellents

- **Conventional Repellents**

DEET (chemical name, *N,N*-diethyl-*meta*-toluamide or *N,N*-diethyl-3-methyl-benzamide) is the active ingredient found in many insect repellent products. It is used to repel biting pests such as mosquitoes and ticks, including ticks that may carry Lyme disease. Products containing DEET currently are available to the public in a variety of liquids, lotions, sprays, and impregnated materials (e.g., wrist bands). Formulations registered for direct application to human skin contain from 4 to 100 percent DEET. Picaridin (chemical name, 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester) is a colorless, nearly odorless liquid active ingredient that is used as an insect repellent against biting flies, mosquitoes, chiggers, and ticks. Picaridin products were sold in Europe and Australia for several years before being introduced to the U.S. market in 2005. Products contain a range of 5 to 20 percent of the active ingredient.
- **Biopesticide Repellents**

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. These include: IR3535 (chemical name, 3-[*N*-Butyl-*N*-acetyl]-aminopropionic acid, ethyl ester), also called Merck 3535, oil of lemon, *P*-Mentane-3,8-diol (the chemically synthesized version of oil of lemon eucalyptus), methyl nonyl ketone, and oil of citronella.
- **Repellents Used on Clothing**

Permethrin is registered for use as both an insecticide and a repellent. Permethrin products are used on clothing, shoes, bed nets, and camping gear. Permethrin-impregnated clothing such as pre-treated shoes, socks, and pants repel and kill ticks, mosquitoes, and other insects and retain this effect after repeated laundering. Permethrin is also found in treated tents, tarps, bed nets, sleeping bags, and mattresses.

Required Protective Actions

Ticks can come in contact with skin anywhere that there is an uncovered area or an opening. Tyvek suits and bug suits provide continuous protection from the legs to the upper torso. The following actions are required for CH2M HILL project employees when working in potential tick habitats at MCB CamLej:

- wear light colored clothing;
- wear long sleeves and long pants;

- shirts will be tucked into pants and should be long enough to not easily come untucked
- tuck pants into socks or tape pant legs to boots (close cuff openings);
- remove clothing within 1 hour of being in the woods (and shower soon afterwards);
- place clothes in hot dryer for 1 hour (or in sealed plastic bag); and
- apply repellents (both skin and clothing repellents)

TICKS- REQUIRED PROTECTIVE MEASURES	
Body Part	Protective Measure
Head	Light colored hat (recommended) Treat neck with approved repellent (required)
Upper Body	Light colored long sleeve shirt (required) Treat exposed skin with approved repellent (required) One of the following must be followed: 1) Permethrin clothing treatment 2) Tyvek coverall 3) Bug Suit
Lower Body	Long pants (required) One of the following must be followed: 1) Permethrin clothing treatment 2) Tyvek coverall 3) Bug suit
Feet	White socks (recommended) Taped pant cuffs to boots (required) Pants tucked into socks (recommended) Permethrin-treated gaiters (optional)

Tick Checks

By checking ourselves and others for ticks, ticks may be located and removed before they have a chance to attach or transfer diseases. Field staff will conduct personal checks often and at lunch and the end of the day, they will perform a full-body check for ticks.

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). It is essential to remove the tick as soon as possible (best if found and removed within 24 hours of attachment). Wash your hands and skin after removing the tick. Place the tick in a Ziploc bag for testing at a later date. Call 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. Report the tick bite to your supervisor and project manager. Complete HITS (incident report). Follow the nurse's advice regarding monitoring symptoms and follow-up contact. Monitor for symptoms that might include chills, fever, headache, fatigue, stiff neck, and bone pain may develop, symptoms indicative of Rocky Mountain spotted Fever and Lyme Disease. If symptoms appear, seek medical attention.

2.2.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SC-HW and/or buddy. If a stinger is present,

remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.2.5 Bloodborne Pathogens

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

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-202, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.2.6 Mosquito Bites

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

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

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

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

If you have any questions or to report any suspicious symptoms, contact the project Health and Safety Manager.

2.2.7 Fire Ant Bites

Fire ants are common in the southern U.S. These insects typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. However, it is possible that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention

2.3 MEC

2.3.1 Munitions and Explosives of Concern

No documentation has been identified to indicate that MEC or material potentially presenting an explosive hazard (MPPEH) has ever been found at Site UXO-17.

An interview with the Base Safety specialist indicated that the Site UXO-17 was established as a training ground. A howitzer was also positioned at this site and fired 105mm and 155mm ammunition into the G-10 Impact Area. As a result of the historical usage the probability of finding MPPEH/MEC is low ; although, ammunition packaging, blanks, range residue, barbwire, and buried garbage may be present. All work will follow the approved Work Plan which is based on the DDESB approved ESS.

2.3.2 Munitions with the Greatest Fragmentation Distance

The MGF used to determine safe working distances at Site UXO-17 is a Fuze Mechanical Time Super Quick (MTS), which has a net explosives weight (NEW) RDX 0.06025 pound (lb).

The Explosives Safety Quantity-Distance (ESQD) information for the MGF is provided in Chapter 3 of the ESS for this project. During the course of this project, if MEC with a greater fragmentation range is encountered, the ESQD requirements will be adjusted. In the unlikely case a MEC item with a greater fragmentation range than the contingency MGF is encountered, the ESQD arcs will be adjusted and the Explosives Safety Submission (ESS) will be amended. Work must stop until the amended ESS is approved.

2.3.3 Hazard Mitigation

According to Mr. James Gagnon of the Natural Resources Conservation Service (NRCS), Edenton Technical Services Office, frost upheaval in the coastal plain region of North Carolina is considered unlikely since the climate only allows frost action to occur to a maximum depth of approximately 6 inches. No other natural phenomena (e.g., drought, flooding, erosion, tidal changes) exist for this area. Therefore, migration of MEC (other than through human transport) is not considered likely.

2.3.4 Types of Explosives to be used on Site

No explosives are anticipated to be stored or used on the project site. During the course of this project, if MEC is encountered MEC disposal will be performed in accordance with the DDESB approved ESS.

2.3.5 Explosives Storage, Transportation and Management

No explosives are anticipated to be stored or used on the project site. If MEC is encountered, explosives storage, transportation and management will be in compliance with the Explosives Siting Plan (ESP), the DDESB-approved ESS and the Explosives Management Plan (EMP) for the project.

2.3.6 MEC Avoidance Procedures

MEC avoidance operations will be required at UXO-17 during all tasks associated with the ESI. Avoidance operations will consist of a team composed of one or more UXO Technicians. **Contact with MEC is prohibited during avoidance activities.** The UXO Team will initiate disposal operations for any MEC/MPPEH encountered. All Additional MEC avoidance procedures are described as follows:

Access routes to sampling locations. Prior to sampling, the UXO Technician will conduct a reconnaissance of the sampling area. The reconnaissance will include locating the designated sampling or drilling location(s) and insuring that they are free of surface MEC. If surface MEC is detected the point will be relocated as directed. Once the designated point has been cleared, an access route for the sampling crew's vehicles and equipment will be cleared for surface MEC. The access route, at a minimum will be twice the width of the

widest vehicle and the boundaries will be clearly marked to prevent personnel from straying into non-cleared areas. If surface MEC is encountered, the UXO Team will mark and report the item and divert the approach path around the MEC.

Soil Sampling and Monitoring Well Locations. The UXO Technicians will clear the surface area of the work site for soil sampling and monitoring well installation. The area will be clearly marked, and large enough to accommodate the direct push equipment and provide a work area for the crews. As a minimum, the cleared area will be a square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment for use on site. If a pre-selected area indicates magnetic anomalies, a new sampling / drill site will be chosen.

Borehole Sampling. If surface samples are required they will be obtained prior to the start of boring. The borehole procedures will be completed using direct push technology (DPT) equipment and hollow stem auger drilling techniques. Prior to sampling, the driller will advance a borehole using a hand auger, with the UXO Technician checking the borehole with a down hole magnetometer a minimum of every one foot, to the deepest sampling depth or a maximum of 5 feet to ensure that smaller items of MEC, undetectable from the surface will be detected. The anticipated depth of potential MEC items is anywhere from near-surface to < 1 ft, based on penetration calculations of the types of ammunition previously used on the site. The types of ammunition used included 105 millimeter (mm), 155 mm, and 8-inch howitzers, as well as 4.2-inch mortars, and 175 mm guns. Should any MEC item be identified during sampling, work will stop and the depth of down hole sampling will be re-evaluated. The driller will then advance the borehole for sampling just adjacent to this location.

2.4 Contaminants of Concern					
(Refer to Project Files for more detailed contaminant information)					
Contaminant	Location and Maximum^a Concentration (ppm)	Exposure Limit^b	IDLH^c	Symptoms and Effects of Exposure	PIP^d (eV)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	GW: SB: SS:	NR	UN	Toxic by injection and ingestion.	NA
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	GW: SB: SS:	1.5 mg/m ³	50	Skin, eye, and mucous membrane irritant. Exposure can cause convulsions.	NA
1,3,5-Trinitrobenzene (1,3,5-TNB)	GW: SB: SS:	NR	UN	Toxic by injection and ingestion. Some mutagenic data reported.	NA
1,3-Dinitrobenzene (1,3-DNB)	GW: SB: SS:	1 mg/m ³	10	Toxic by skin contact. Liver and kidney damage. Damage to the central nervous system	NA
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	GW: SB: SS:	0.1 mg/m ³	5	Toxic by injection and ingestion. Some mutagenic and tetragenic data reported	NA
Nitrobenzene	GW: SB: SS:	1 ppm	25	Toxic by skin exposure. Skin, eye, and mucous membrane irritant. Respiratory disruption. Anemia	9.92
2,4,6-Trinitrotoluene (2,4,6-TNT)	GW: SB: SS:	0.5 mg/m ³	500	Toxic by skin exposure. Skin, eye, and mucous membrane irritant, Liver damage, jaundice. Cyanosis, dermal sensitization, sneezing, anemia, cardiac irregularity.	10.5 9
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2-Amino-4,6-dinitrotoluene (2-AM-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2,4-Dinitrotoluene (2,4-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2,6-Dinitrotoluene (2,6-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN

2.4 Contaminants of Concern					
(Refer to Project Files for more detailed contaminant information)					
Contaminant	Location and Maximum^a Concentration (ppm)	Exposure Limit^b	IDLH^c	Symptoms and Effects of Exposure	PIP^d (eV)
2-Nitrotoluene (2-NT)	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis, anemia, headache, lassitude, dizziness	9.45
3-Nitrotoluene (3-NT)	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis, anemia, headache, lassitude, dizziness	9.45
4-Nitrotoluene (4-NT)	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis, anemia, headache, lassitude, dizziness	9.45
Perchlorate	GW: SB: SS:	UK	UK	Irritants to skin, eyes, and mucous membranes.	NA
Arsenic	GW: SB: SS:	0.01 mg/m ³	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Barium	GW: SB: SS:	0.5 mg/m ³	50	Skin and eye irritation, slowed pulse, skin burns, gastroenteritis	NA
Cadmium	GW: SB: SS:	0.005 mg/m ³	9 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	GW: SB: SS:	0.5 mg/m ³	25	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Lead	GW: SB: SS:	0.05 mg/m ³	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Mercury	GW: SB: SS:	0.05 mg/m ³	10	Skin and eye irritation, cough, chest pain, difficult breathing, bronchitis, pneumonitis, tremors, insomnia, irritability, indecision, headache, fatigue, weakness, GI disturbance	NA
Selenium	GW: SB: SS:	0.2 mg/m ³	1	Skin and eye irritation, visual disturbance, metallic taste in the mouth, skin burns, dermatitis, chills.	NA

2.4 Contaminants of Concern (Refer to Project Files for more detailed contaminant information)					
Contaminant	Location and Maximum^a Concentration (ppm)	Exposure Limit^b	IDLH^c	Symptoms and Effects of Exposure	PIP^d (eV)
Silver	GW: SB: SS:	0.01 mg/m ³	1	Argyrosis, discoloration of skin and nail beds, cyanosis.	NA
Footnotes: ^a Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water). ^b Appropriate value of PEL, REL, or TLV listed. ^c IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen. ^d PIP = photoionization potential; NA = Not applicable; UK = Unknown. NR = Not Regulated					UK
Footnotes: ^a Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water). ^b Appropriate value of PEL, REL, or TLV listed. ^c IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen. ^d PIP = photoionization potential; NA = Not applicable; UK = Unknown.					
Potential Routes of Exposure					
Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.		Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.		Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).	

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

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

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated “SC-HW” have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SC-HW with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated “FA-CPR” are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least two FA-CPR designated employees must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Employee Name	Office	Responsibility	SC-HW/FA-CPR
Brooke Propst	CLT	FTL	Level D SC-HW: FA-CPR
TBD	TBD	TBD	Level D SC-HW: FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact

Bryan Beck
NAVFAC Mid-Atlantic
Code: OPCEV
6506 Hampton Blvd
Norfolk, Virginia 23508-1278
Direct: (757) 322-4734
Fax: (757) 322-4805
bryan.k.beck@navy.mil

Base Contact

Robert Lowder
Camp Lejeune - EMD
Building 12
Marine Corps Base Camp Lejeune, NC 28542-0004
Direct (910) 451-9607
Fax: (910) 451-5997
robert.a.lowder@usmc.mil

3.2.2 CH2M HILL

Project Manager: Lael Feist /HNV
Munitions Response Safety/Quality Officer: Dan Young/NVR
Health and Safety Manager: Carl Woods/CIN
Munitions Response Senior Advisor: Tom Roth/ATL
Field Team Leader: Brooke Propst
Safety Coordinator- Hazardous Waste (SC-HW): TBD
UXO Safety Officer (UXOSO): TBD

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

UXO TECHNICIAN III (UXOSO)

The UXO Technician III for this project will report directly to the Project Manager on issues pertaining to the MEC operations at the Firing Position 2. The UXO Technician III will have the following safety and health related responsibilities:

- Reports directly to the CH2M HILL Project Manager;
- Managing the funding, manpower and equipment necessary to safely conduct site operations;
- Reviewing and becoming familiar with the site Work Plan (WP) and HASP;
- Provide copies of the WP and SSHP to site personnel;
- Review the scope of work (SOW) and ensure that the required safety and health elements are addressed in the SSHP and/or WP;
- Coordinating the assignment of personnel and ensuring that the personnel and equipment provided meet the requirements of the WP and SSHP;
- Ensuring implementation of project quality, safety and health procedures;
- Early detection and identification of potential problem areas, including safety & health matters, and instituting corrective measures;
- Directly interfacing with the Project manager and advising him of safety and health matters related to conduct of the site operations.
- Acts as the On-Scene-Incident-Commander (OSIC) in the event of an MEC emergency, notifying and coordinating with off site emergency and medical response agencies.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-215, *Contracts, Subcontracts, and HSE&Q Management Practices*)

Survey Subcontractor: TBD

Subcontractor Contact Name:TBD

Telephone:TBD

Utility Locator Subcontractor: Accumark

Subcontractor Contact Name:TBD

Telephone:TBD

Vegetation Clearance Subcontractor: Wetlands and Woodlands, Inc.

Subcontractor Contact Name:TBD

Telephone:TBD

Geophysical Subcontractor: TBD

Subcontractor Contact Name:TBD

Telephone:TBD

Drilling Subcontractor: Parratt Wolff

Subcontractor Contact Name:TBD

Telephone:TBD

IDW Management Subcontractor: Shamrock

Subcontractor Contact Name:TBD

Telephone:TBD

Laboratory Subcontractor: Empirical Laboratories

Subcontractor Contact Name:TBD

Telephone:TBD

Data validation Subcontractor (Chromium IV data) : Environmental Data Services, Inc.

Subcontractor Contact Name: **TBD**

Telephone:TBD

Data validation Subcontractor (Chromium IV data) : Environmental Data Quality, Inc.
Subcontractor Contact Name: **TBD**
Telephone: TBD

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to these procedures submit (SOP & AHA, etc.) to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SC-HW should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. 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. In addition to this level of observation, the SC-HW is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SC-HW to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-117, *Personal Protective Equipment*, HS-121, *Respiratory Protection*)

Note: UXO Technicians will NOT wear Steel-toed footwear, but will wear safety toed boots (e.g. composite materials or titanium)

PPE Specifications ^a

Task	Level	Body	Head	Respirator ^b
General site entry Surveying Surface soil sampling Vegetation clearing	D	Work clothes; steel-toe, leather work boots; work glove.	Hardhat ^c Safety glasses Ear protection ^d	None required
Monitoring Well Installation /Geoprobe boring	Modified D	Work clothes or cotton coveralls Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Safety glasses Ear protection ^d	None required
Groundwater sampling Soil boring Investigation-derived waste (drum) sampling and disposal	Modified D	Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Safety glasses Ear protection ^d	None required.
Tasks requiring upgrade	C	Coveralls: Uncoated Tyvek® Boots: Steel-toe, chemical-resistant boots OR steel-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 Ear protection ^d	Full face air purifying respirator fitted with organic vapor cartridges.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade ^f	Downgrade
<ul style="list-style-type: none"> Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels (Section 5) exceeded. 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought. Change in site conditions that decreases 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-HW.

^d Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

^e Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)—then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

^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 HSM, and an SC-HW qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-207 - *Exposure Monitoring*)

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels ^a		Frequency ^b	Calibration
FID: OVA model 128 or equivalent	Soil sampling, drilling and other intrusive work.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
PID: OVM with 10.6eV lamp or equivalent	Soil sampling, drilling and other intrusive work.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
Dust Monitor: Miniram model PDM-3 or equivalent	Soil sampling, drilling and other intrusive work.	<0.5 mg/m ³ > 0.5 mg/m ³	Level D Level C	Initially and periodically during tasks	Zero Daily
CGI: MSA model 260 or 261 or equivalent	Soil sampling, drilling and other intrusive work.	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily
O₂Meter: MSA model 260 or 261 or equivalent	Soil sampling, drilling and other intrusive work.	>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	Continuous during advancement of boring or trench	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-HW; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., “Breathing Zone/MW-3”, “at surface/SB-2”, etc.).

^c If the measured percent of O₂ is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O₂ action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O₂ action levels are required for confined-space entry (refer to Section 2).

^d Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

^e Noise monitoring and audiometric testing also required.

5.2 Calibration Specifications

(Refer to the respective manufacturer’s instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing
FID: OVA	100 ppm methane	3.0 ± 1.5	100 ppm	1.5 lpm reg T-tubing
FID: TVA 1000	100 ppm methane	NA	100 ppm	2.5 lpm reg T-tubing
Dust Monitor: Miniram-PDM3	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 ± 5% LEL	1.5 lpm reg direct tubing
5 Gas Meter (MultiRAE) PID: OVM, 10.6 eV lamp	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing/ tedlar bag
LEL/O₂/H₂S/CO Sensors	Methane	NA	2.5% (50% LEL)	1.5 lpm reg T-tubing/ tedlar bag
	Oxygen	NA	20.9%	1.5 lpm reg T-tubing/ tedlar bag
	Hydrogen Sulfide	NA	25	1.5 lpm reg T-tubing/ tedlar bag
	Carbon Monoxide	NA	50	1.5 lpm reg T-tubing/ tedlar bag
				1.5 lpm reg T-tubing/ tedlar bag

5.3 Air Sampling

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

Method Description

None anticipated.

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to all personnel at the project site.

HSM: Carl Woods/CIN

6 Decontamination

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

6.1 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
<ul style="list-style-type: none"> • Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Body-suit removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower ASAP • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal 	<ul style="list-style-type: none"> • Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal 	<ul style="list-style-type: none"> • Power wash • Steam clean • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

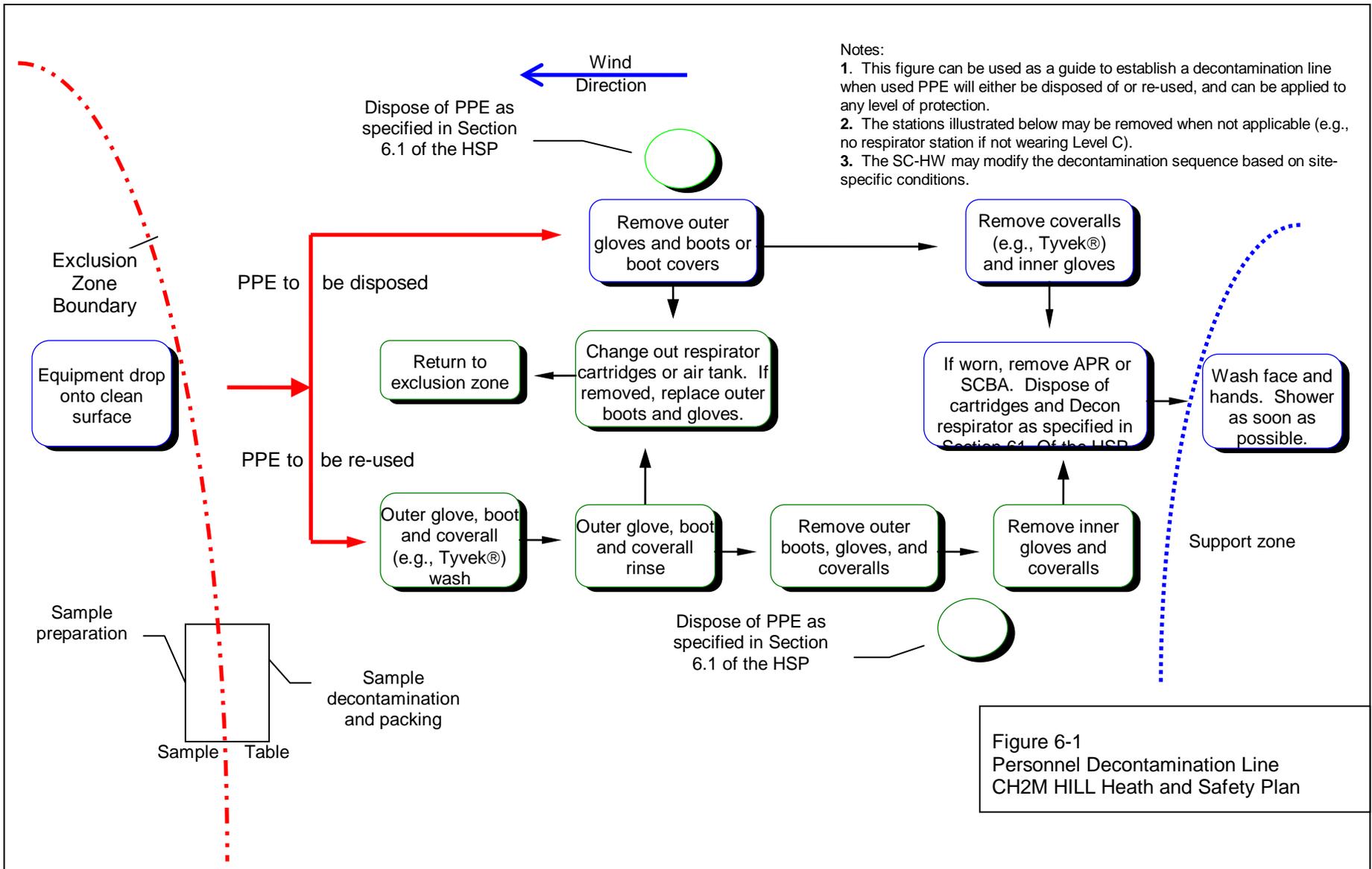
6.2 Diagram of Personnel-Decontamination Line

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

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

7 Spill-Containment Procedures

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



Notes:

1. This figure can be used as a guide to establish a decontamination line when used PPE will either be disposed of or re-used, and can be applied to any level of protection.
2. The stations illustrated below may be removed when not applicable (e.g., no respirator station if not wearing Level C).
3. The SC-HW may modify the decontamination sequence based on site-specific conditions.

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

8 Site-Control Plan

8.1 Site-Control Procedures

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

8.2 Site Control

The UXO Technician III coordinates access control and security on site. Due to the hazardous nature of MEC work, only authorized personnel will be allowed within the specified Exclusion Zone (EZ). Authorized personnel are those that have completed the required training, meet medical requirements and are essential to the ongoing operation. During duty hours, personnel will provide security at the site. All work will stop if any unauthorized personnel enters the EZ. This will ensure the field team’s safety and the safety of those approaching the work site. Equipment will be returned to a designated area and secured at the end of each work day. Future site control measures to ensure safety are as follows;

- Eating, drinking and smoking are prohibited except in designated areas;
- MEC operations will cease if non-UXO trained or non-essential personnel are present;
- The UXO Technician III or II will escort all authorized visitors to the site;
- The UXO Technician III will maintain the site entry control log to ensure accurate accountability of personnel;
- The UXO Technician III will brief this UXO Avoidance Plan to all personnel entering the site to inform them of the potential site hazards. All personnel will acknowledge this briefing by signing the briefing log;
- In case of an emergency, personnel will exit the site and move to the designated safe area. The UXO Technician III will determine the severity of the emergency. If the emergency warrants evacuation, the UXO Technician III will evacuate the area and notify the Project Manager.

8.3 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in

Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SC-HW must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
 - nature of the existing contamination and its locations
 - limitations of their access
 - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

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

9.1 Pre-Emergency Planning

The SC-HW performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post “Exit” signs above exit doors, and post “Fire Extinguisher” signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SC-HW will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SC-HW should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	

9.3 Incident Response

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

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

Work Related injuries will be reported via the 1-800-756-1130 after the individual’s supervisor has been notified.

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SC-HW 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.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SC-HW before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SC-HW 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 SC-HW will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SC-HW will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 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.

9.7 Incident Notification and Reporting

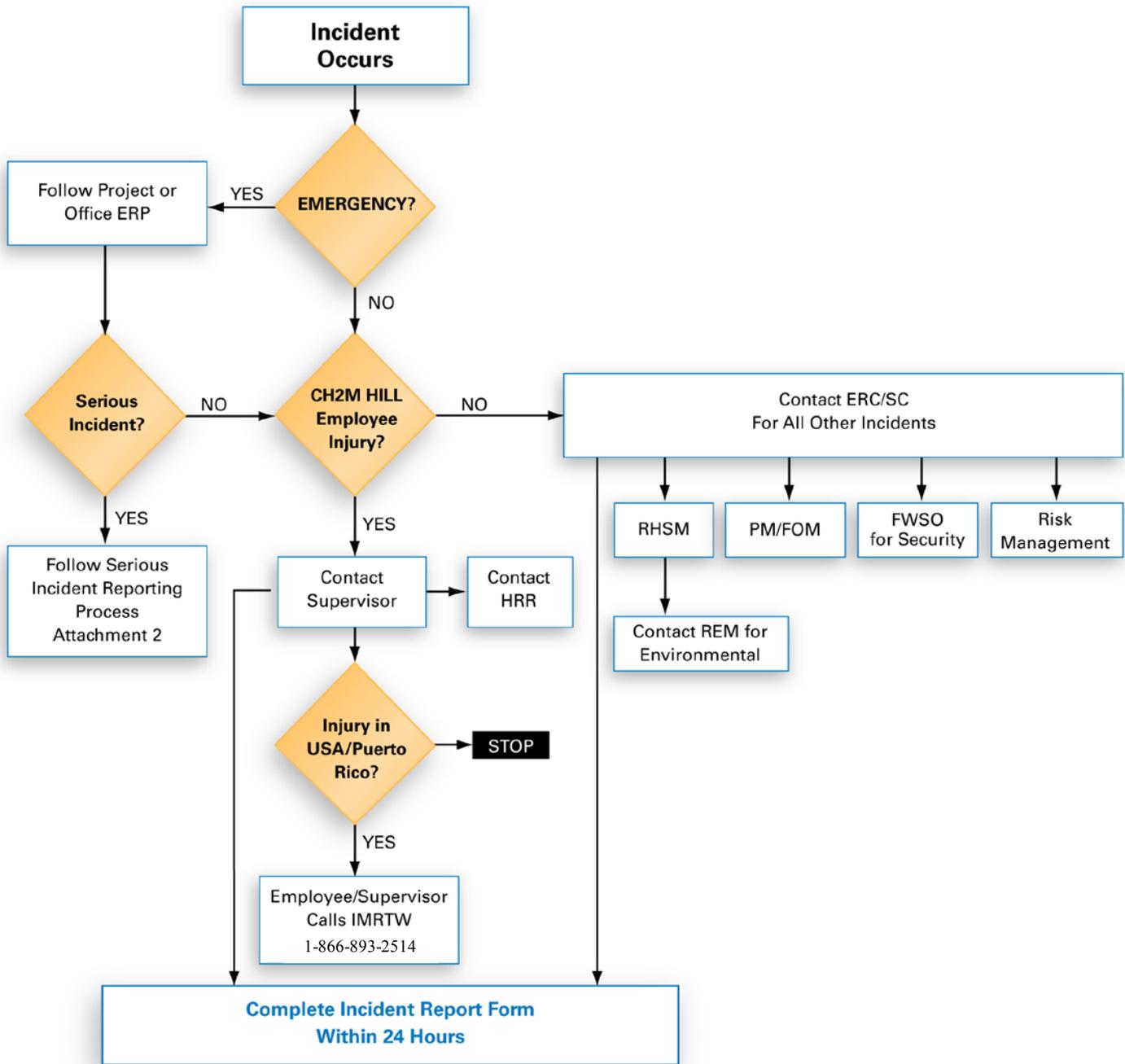
(Reference CH2M HILL SOP HSE-111, *Incident Notification, Reporting and Investigation*)

- If you are injured at work, notify your supervisor immediately and contact the Injury Management/Return-to-Work toll free number (for US and Puerto Rico) 1-866-893-2514. All supervisors must contact their Human Resources Representative and complete the employee injury/illness in the Incident Report Form (IRF) in the HITS database within 24 hours of the incident.
- Immediately notify the Project Manager (PM), Emergency Response Coordinator (ERC), and/or Responsible Health and Safety Manager (RHSM) for any project incident (fire, spill/release, injury/illness, near miss, property damage, or security-related).
- Report any **serious incidents** (life-threatening injury/illness, death, kidnap/missing person, terrorism, property damage greater than \$500K, significant environmental release) **immediately** to your ERC, PM, or RHSM. The Serious Incident Reporting number is 720-286-4911.

- For serious incidents, the Corporate Legal Department will determine who completes the IRF.
- For CH2M HILL subcontractor incidents, immediately notify the ERC and HSM to complete and submit an IRF.
- The RHSM will inform the Responsible Environmental Manager (REM) of any environmental incidents.
- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, REM, or FWSO. The Business Group (BG) HSE Lead will review all BG incidents and modify as required.
- Incident Investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.
- See the following flowcharts for Immediate Incident Reporting and Serious Incident Reporting.



Attachment 1 CH2M HILL Immediate Incident Notification

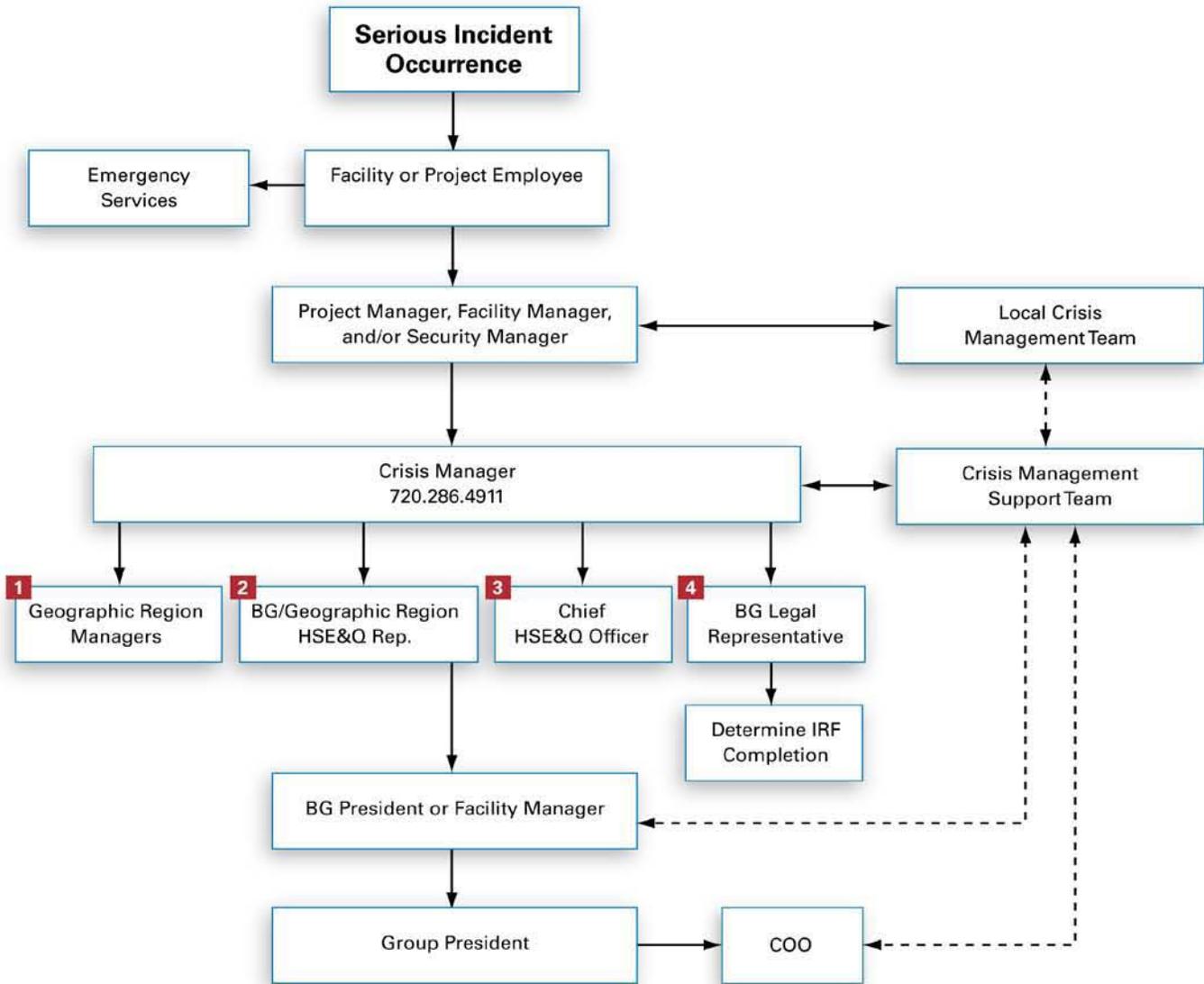


ERC = Emergency Response Coordinator
(designated in Emergency Response Plan)
ERP = Emergency Response Plan
FOM = Facility Office Manager
FWSO = Firm Wide Security Operations
HRR = Human Resources Representative

IMRTW = Injury Management/Return-to-Work
PM = Project Manager
REM = Responsible Environmental Manager
RHSM = Responsible Health & Safety Manager
SC = Safety Coordinator



Attachment 2 CH2M HILL Serious Incident Notification



LEGEND:

- Direct line of communication
- ← - - - → Indirect line of communication

DEFINITIONS:

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

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

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

10.0 Behavior Based Loss Prevention System

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

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

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

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

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

10.1 Activity Hazard Analysis

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

Activity Hazard Analysis will be prepared before beginning each project activity posing H&S hazards to project personnel using the AHA form provided in Attachment 10. The AHA shall identify the work tasks required to perform each activity, along with potential H&S hazards and recommended control measures for each work task. In addition, a listing of the equipment to be used to perform the activity, inspection requirements and training requirements for the safe operation of the equipment listed must be identified.

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

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

10.2 Pre-Task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/AHAs, which apply for each day's project activities. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP, provided in Attachment 10, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required H&S procedures, as identified in the AHA. The use of PTSPs, better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry.

10.3 Safe Behavior Observations

Safe Behavior Observations (SBOs) shall be conducted by SC or designee for specific work tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific HSP and AHAs. SBOs are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss. The SC or designee shall perform at least one SBO each week for tasks/operations addressed in the project-specific HSP or AHA. The SC or designee shall complete the SBO form in **Attachment 8** for the task/operation being observed and submit the SBO form weekly to Margaret Dombrowski/MKE.

10.4 Loss/Near Loss Investigations

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

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

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

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

The SC or designee shall perform an incident investigation, as soon as practical after incident occurrence during the day of the incident, for all Loss and Near Loss Incidents that occur on the project. Loss and Near Loss incident investigations shall be performed using the following incident investigation forms provided in **Attachment 11**.

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

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

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 1

Employee Signoff Form

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 2

Project-Specific Chemical Product Hazard Communication Form

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SC-HW shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: CTO-141 / MCB CamLej, Site UXO-17 (Former Firing Position 2)

Project Number: 406817

MSDSs will be maintained at the following location(s): 3 ring binder containing HASP

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Nitric acid	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
pH buffers	< 500 ml	Support Zone			
MSA Sanitizer	< 1 liter	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 3

Chemical-Specific Training Form

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 406817
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

Emergency Contacts

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 720-286-4911

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

Medical Emergency – 911 or Hospital ER (On-Base) #: (910) 451-4840 (910) 451-4841 (910) 451-4842 Onslow County ER (Off-Base) #: (910) 577-2240 Ambulance (On-Base) #: (910) 451-3004 (910) 451-3005 Ambulance (Public) #: (910) 451-9111 LEPC (Poison Control)#: (800) 222-1222	CH2M HILL- Medical Consultant Health Resources Dr. Jerry H. Berke, M.D., M.P.H. 600 West Cummings Park, Suite 3400 Woburn, MA 01801-6350 781/938-4653 After Hours 800/350-4511 (After hours calls will be returned within 20 minutes) Local Occupational Physician Occupational Medicine Specialists 4815 Oleander Dr. Wilmington, NC 28403 910 452-1111
Fire/Spill Emergency – 911 or Base Fire Response #: (910) 451-9111	CH2M HILL Director Security Operations Thomas Horton/DEN 720/273-3100 (cell) or 720/286-0022 (office)
Security & Police – 911 or Base Security #: (910) 451-2555	Health and Safety Manager (HSM) Name: Carl Woods/CIN Phone: (513) 889-5771
On-Scene Coordinator Name: Fire Chief Phone: (910) 451-5815	Regional Human Resources Department Name: Mary Jo Jordan Phone: 352/335-5877
Utilities Emergency Water: Gas: Contact Base EMD Electric:	Worker's Compensation: Contact Business Group HR dept. to have form completed or contact Albert Jerman after hours: 303/741-5927
Safety Coordinator (SC) Name: TBD Phone:	Media Inquiries Corporate Strategic Communications Name: John Corsi Phone: (720) 286-2087
Project Manager Name: Lael feist/HNV Phone: 256-837-5844	Automobile Accidents: Rental: Linda Anderson/COR 720/286-2401 CH2M HILL owned vehicle: Linda George 720-286-2057
Federal Express Dangerous Goods Shipping Phone: 800/238-5355	CH2M HILL Dangerous Goods Shipping Phone: 800/255-3924
Facility Alarms: TBD	Evacuation Assembly Area(s): TBD by the SC-HW.

Facility/Site Evacuation Route(s): follow main roads towards access gates and off the Base

Directions to Local Hospital

Nearest On-Base hospital:

Base Naval Hospital (only to be used in extreme emergency)
Building NH100
100 Brewster Blvd.
Camp Lejeune, NC 28547
Phone: (910) 451-4840, (910) 451-4841, (910) 451-4842

Local hospital:

Onslow County Memorial Hospital
317 Western Boulevard
Jacksonville, NC 28546
Phone: (910) 577-2240

Local ambulance service:

Base Ambulance: (910) 451-3004, (910) 451-3005
Public Ambulance: (910) 451-9111

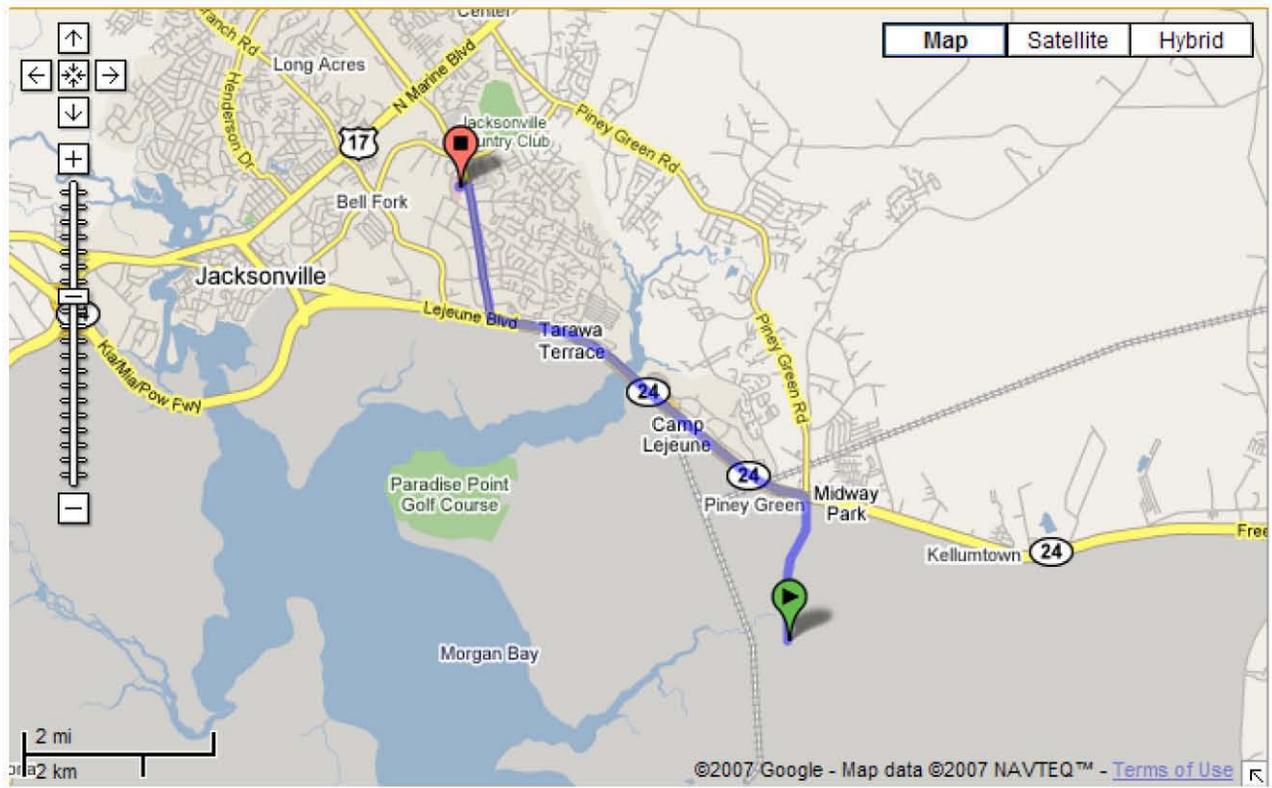
From MCB Camp Lejeune

Directions to the Base Naval Hospital (Building NH100)
(nearest hospital; only to be used in an extreme emergency)

1. Proceed north to Holcomb Boulevard (towards Highway 24).
2. Turn left onto Brewster Boulevard (heading west)
3. Continue on Brewster Boulevard until intersection with the driveway to the Naval Hospital.
4. Turn onto Hospital driveway, and proceed to emergency room.

Directions to Onslow County Memorial Hospital:

1. Proceed north to Holcomb Boulevard, exit Base through main gate.
2. Follow Highway 24 west until intersecting with Western Boulevard.
3. Turn right onto Western Boulevard.
4. The Onslow County Memorial Hospital is on the left, approximately 2 miles (fifth stop light) from Highway 24.
5. Follow the signs to the emergency room.



CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

To be completed as needed for task specific operations.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists

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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Personnel clear of rotating parts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Personnel not positioned under hoisted loads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Loose clothing and jewelry removed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Smoking is prohibited around drilling operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Personnel wearing appropriate personal protective equipment (PPE), per written plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Personnel instructed not to approach equipment that has become electrically energized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SECTION 2 - SUPPORT FUNCTIONS (4.2)					
FORMS/PERMITS (4.2.1)					
8.	Driller license/certification obtained	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Well development/abandonment notifications and logs submitted and in project files	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Water withdrawal permit obtained, where required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Dig permit obtained, where required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UTILITY LOCATING (4.2.2)					

12. Location of underground utilities and structures identified

SECTION 2 (Continued)				
WASTE MANAGEMENT (4.2.3)	Yes	No	N/A	N/O
13. Drill cuttings and purge water managed and disposed properly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Appropriate decontamination procedures being followed, per project's written safety plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILLING AT MUNITIONS RESPONSE SITES (4.2.5)				
16. OE plan prepared and approved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. OE/UXO avoidance provided, routes and boundaries cleared and marked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Initial pilot hole established by UXO technician with hand auger	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Personnel remain inside cleared areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)				
GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Daily safety briefing/meeting conducted with crew	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Daily inspection of drill rig and equipment conducted before use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Safe clearance distance maintained from overhead power lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Drilling pad established, when necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Drill rig leveled and stabilized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Additional precautions taken when drilling in confined areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Tools and equipment secured prior to rig movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Only personnel seated in cab are riding on rig during movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Safe clearance distance maintained while traveling under overhead power lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Backup alarm or spotter used when backing rig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. All machine guards are in place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Rig ropes not wrapped around body parts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Pressurized lines and hoses secured from whipping hazards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Drill operation stopped during inclement weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Air monitoring conducted per written safety plan for hazardous atmospheres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Rig placed in neutral when operator not at controls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Equipment and tools properly stored	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. All vehicles locked and keys removed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Lockout/tagout procedures used prior to maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Cathead in clean, sound condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Drill rig ropes in clean, sound condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Rig in neutral and augers stopped rotating before cleaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

34. Good housekeeping maintained on and around rig

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Applicable Material Safety Data Sheets

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 8

SWO Form

CH2MHILL

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

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 9

Biological Hazard Fact Sheets

Biological Hazard Fact Sheets

Tick-Borne Pathogens

There are 6 notifiable tick-borne pathogens that present a significant field hazard, and in some areas account for more than half of our serious field incidents. These procedures should be applied during any field activity – even those field efforts that are predominantly paved but with bordering vegetation.

Hazard Control

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

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

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

Avoidance and Reduction of Ticks

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

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

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

Personal Protection

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

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

- Wear Bug Suit, Tyvek Suit, or permethrin treated clothing.
- Frequently check for ticks and remove from clothing.
- At the end of the day search your entire body for ticks (particularly groin, armpits, neck and head) and shower.
- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves anytime ticks are handled.

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

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

Tick Removal

1. Use fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.
2. Grasp the tick as close to the skin surface as possible (at the head) and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.)
3. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.
4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.
5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
6. You may wish to save the tick for identification in case you become ill. Your doctor can use the information to assist in making an accurate diagnosis. Place the tick in a plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

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

First-Aid and Medical Treatment

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

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

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

Hazard Recognition

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

Tick Identification

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

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture. On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. Here, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

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:

1. Lyme (bacteria)
2. RMSF (bacteria)
3. Ehrlichiosis (bacteria)
4. STARI (Southern Tick-Associated Rash Illness) (bacteria)
5. Tularemia (Rabbit Fever) (bacteria)
6. Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. A variety of long-term symptoms may result when untreated, including debilitating effects and death.

Poison Oak (Ivy and Sumac too)

Reaction to Poison Oak is an allergic response and ranges from no reaction to a severe “rhus” dermatitis. Rhus is the class of poisonous plants which also includes poison ivy and poison sumac, mango, and other urushiol containing plants. 3 of 4 people will develop dermatitis on contact with urushiol.

Shrubs are usually 12" to 30" high, or a tree-climbing vine, with triple leaflets and short, smooth hair underneath. A project site in Portland had 8' tall poison oak bushes. Early berries are fuzzy and white; later, dun-colored. 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 the plant loses its (yellowed, then brown) leaves in Winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons.

Primary contamination results from contact with bruised or broken plant parts that release "toxicodendrol", an oily resin containing the toxic chemical "urushiol".

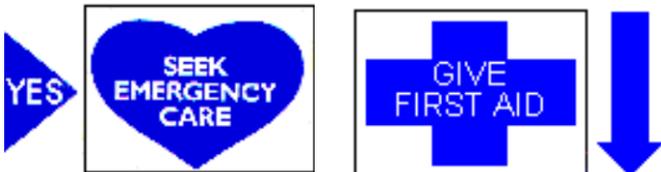
Exposure to Poison Oak is Preventable

Exposure to poison oak often becomes an OSHA recordable illness. The dermatitis is so severe that many people seek medical care and get prescription cortisone creams to reduce the suffering caused by the itch.

Exposure to Poison Oak is not an unavoidable part of working outdoors!

- Identify Poison Oak – The best way to prevent exposure is to recognize the plant and avoid working in areas where poison oak is present.
- If you must work in areas with poison oak, contact your project manager and health and safety manager to determine the best procedures to prevent contamination.
- Contamination with poison oak can happen through several pathways. These include
 - Direct skin contact with any part of the plant.
 - Contact with clothing that has been contaminated
 - Contact from removing shoes that have been contaminated. (your shoes are coated with oil)
 - Sitting in a vehicle that has become contaminated
 - Contact with any objects or tools that have become contaminated.
- If you must work on a site with poison oak the following precautions are necessary.
 - Do not drive vehicles onto the site where it will come into contact with poison 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 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 "Tecnu" or other product designed for removing urushiol. If you do not have Tecnu wash with cold water. Do not take a bath, as the oils can form an invisible film on top of the water and contaminate your entire body upon exiting the bath.
 - Tecnu may also be used to decontaminate equipment.
- If there is exposure use the following first aid procedures, or others you may find to alleviate the pain and itch.

Poison Oak First Aid

<p>Are there any of these problems?</p> <ul style="list-style-type: none"> • Swelling in the throat, tongue and/or lips • A hard time breathing or swallowing • Weakness, dizziness • Bluish lips and mouth • Unconsciousness 	
<p style="text-align: center;">NO</p>	<p>Use emergency kit with adrenalin, if available, and Get Emergency Care.</p>
<p>Do you have any of these problems?</p> <ul style="list-style-type: none"> • Skin that is very bright red. • Pus. • Rash that has spread to the mouth, eyes or genitals. • Rash on large areas of the body or the face. 	
<p style="text-align: center;">NO</p>	<p>See Doctor and Give first aid before seeing doctor:</p> <ul style="list-style-type: none"> • Take a hot shower (only after rash develops), put the rash area in hot water or pour hot water over it. Make sure the water is not too hot to burn the skin. The hot water causes itching at first, but brings relief later. Do not use soap. • Take an over-the-counter antihistamine, such as Benadryl, as stated on the label. • For weeping blisters: <ul style="list-style-type: none"> • Mix 2 teaspoons of baking soda in 1 quarter (4 cups) of water. • Dip squares of gauze in this mixture. <ul style="list-style-type: none"> • Cover the blisters with the wet gauze for 10 minutes, four times a day. (Do not apply this to the eyes.)

Self-Care/First Aid

- Make sure you wash all clothes and shoes with hot water and a strong soap. Also, bathe pets who have come in contact with poison ivy, oak or sumac. The sap can stay on pets for many days.
- Keep your hands away from your eyes, mouth and face.
- Do not scratch or rub the rash.
- Apply any of these to the skin rash:
 - Calamine (not Caladryl) lotion
 - Zinc oxide ointment
 - Paste made with baking soda - mix 3 teaspoons of baking soda with 1 teaspoon of water
- Take an over-the-counter antihistamine such as Benadryl, as stated on the label
- If self-care/first aid measures don't bring relief, call your doctor.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 10

Activity Hazard Analyses

**Contract Task Order 141 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilization/Site Preparation	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. 	<p>Standard Level D PPE *</p> <p>* Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.</p>
	Heavy Equipment	<ul style="list-style-type: none"> • Workers to remain beyond the swing radius of heavy equipment. • Communicate with equipment operators with clear hand signals. 	Standard Level D PPE
	Manual Lifting	<ul style="list-style-type: none"> • CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level. 	Standard Level D PPE
	Noise	<ul style="list-style-type: none"> • Personnel exposed to loud working environments shall wear hearing protection. 	Standard Level D PPE
	High Ambient Temperature	<ul style="list-style-type: none"> • Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion. 	Standard Level D PPE (light colored clothing)

**Contract Task Order 141 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilization/Site Preparation (continued)	Struck/pinched	<ul style="list-style-type: none"> • Wear reflective warning vests or high visibility clothing. • Isolate equipment swing areas from workers, fixed objects or other equipment. • Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators. • Ensure equipment has operable back-up alarms. • Avoid positioning between fixed objects and operating equipment. • No one shall walk under or in front of suspended loads. Only tagged, load rated and inspected rigging shall be used to lift loads. Become familiar with vertical, basket and choker load ratings of rigging. 	Standard Level D PPE
	Biological	<ul style="list-style-type: none"> • Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. Notify supervisors of known allergies to stinging insects and location of antidotes. • Use insect repellent. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens 	Standard Level D PPE
	Electric Hazards	<ul style="list-style-type: none"> • If/when electrical extension cords are required to complete work, extension cords must be: <ul style="list-style-type: none"> - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment. 	Standard Level D PPE
	Fire Prevention	<ul style="list-style-type: none"> • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area. 	Standard Level D PPE

**Contract Task Order 141 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Pressure Washing/Equipment Decon	<ul style="list-style-type: none"> • Only qualified personnel will operate high pressure water cleaning equipment. • Operator will be aware of surroundings at all times. • Operator will never point pressure wand in direction of other personnel. • Pressure wands shall not be modified in field (i.e. shortened, bent, or trigger tied open). • Non-operating support personnel must never walk in front of operator during operation. • High pressure equipment shall be equipped with pressure dump safety valves. • Operator to wear pressure resistant foot wear and face splash shield. • Operator shall inspect high pressure hoses, fittings and safety equipment daily. 	Modified Level D PPE with pressure resistant footwear and face splash shield
	Other	<ul style="list-style-type: none"> • Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio <u>while driving</u> on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices. 	NA
EQUIPMENT REQUIRED		INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Fire extinguisher (with fuel and electrical sources) <ul style="list-style-type: none"> • Eye wash (small portable type) • Miscellaneous power and manual hand tools. <ul style="list-style-type: none"> • Miscellaneous rigging. 		<ul style="list-style-type: none"> • Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension chords if used. 	<ul style="list-style-type: none"> • Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

PRINT

SIGNATURE

Supervisor Name:

Date/Time: _____

Safety Officer Name:

Date/Time: _____

Site Personnel:

Date/Time: _____

Site Personnel (continued):

_____	_____	Date/Time: _____

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Utility Location**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilize to utility designation location	Driving Hazards – mobilization to and from and traffic movement in areas of designation	<ul style="list-style-type: none"> • Driving – drive defensively and obey all traffic laws; • Establish route to site prior to trip and park vehicles in a secure area out of vehicle and pedestrian traffic; • Set up traffic control measures, if necessary on site; 	Standard Level D PPE * * Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots
Confirmation of area being designated and inspection/review of designation equipment	Traffic – observing ingress & egress of vehicular & pedestrian traffic; Fall – caution in locating possible landscape irregularities; Exertion – lifting and maneuvering equipment Biological Hazards – Insects and poisonous plants	<ul style="list-style-type: none"> • Perform tailgate safety meeting covering the scope of the job and any safety issues specific to the site/sites being designated. • Inspection of equipment for proper operation. • Employees will wear hi-visibility vests, long pants and bug spray during site activities and additional protective clothing (i.e. longsleeves, taped pants, light colors, etc) as necessary to protect against biological hazards. 	Standard Level D PPE
Designation of utilities as defined by the scope of work	Traffic, Fall, Exertion (see descriptions above) and Exposure – heat exhaustion during the summer months and cold during the winter months Exposed Energized Electrical Contact Points – Contact with exposed electrical contact points Biological Hazards – Insects and poisonous plants	<ul style="list-style-type: none"> • Perform designation duties by first verifying the proper operation of equipment, inspecting the designation area for possible hazards (holes, ruts, objects, etc.) that could cause injury; using proper bending/lifting techniques to minimize injury (bending at the knee and lifting with your legs); • wearing appropriate personal protective equipment (PPE); • taking sufficient break periods and consumption of appropriate amounts of fluids to replenish loss from heat exposure and or access to a heated area and breaks during cold weather months. • Additionally, employees will be familiar with the symptoms of heat stress and heat exhaustion. • Employees will wear long pants and bug spray during site activities and additional protective clothing (i.e. longsleeves, taped pants, light colors, etc) as necessary to protect against biological hazards. • Do not tie into energized lines with exposed electrical contact points. 	Standard Level D PPE
Leaving designation site and loading truck	Traffic, Exertion	<ul style="list-style-type: none"> • Remove all equipment/supplies from the work area and use appropriate bending/lifting procedures (bending from the knees and lifting with your legs) when loading equipment into the truck; • visually scan all areas to insure that all equipment/supplies have been accounted for and placed in the truck. 	Standard Level D PPE
Depart from site	Traffic	<ul style="list-style-type: none"> • Drive defensively and obey all traffic laws; • establish exit from site prior to leaving the area and be aware of vehicle and pedestrian traffic 	Standard Level D PPE

PRINT

SIGNATURE

Supervisor Name: _____

Date/Time: _____

Safety Officer Name: _____

Date/Time: _____

Site Personnel: _____

Date/Time: _____

Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Soil, Sediment, Surface Water, and Groundwater Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Soiland Groundwater Sampling	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. 	<p>Standard Level D PPE *</p> <p>* Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.</p>
	Manual Lifting	<ul style="list-style-type: none"> • CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level. 	Standard Level D PPE
	Noise	<ul style="list-style-type: none"> • Personnel exposed to loud working environments shall wear hearing protection. 	Standard Level D PPE
	High Ambient Temperature	<ul style="list-style-type: none"> • Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion. 	Standard Level D PPE (light colored clothing)
	Struck/pinched	<ul style="list-style-type: none"> • Wear reflective warning vests or high visibility clothing. • Isolate equipment swing areas from workers, fixed objects or other equipment. • Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators. • Ensure equipment has operable back-up alarms. • Avoid positioning between fixed objects and operating equipment. • No one shall walk under or in front of suspended loads. Only tagged, load rated and inspected rigging shall be used to lift loads. Become familiar with vertical, basket and choker load ratings of rigging. 	Standard Level D PPE

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Soil, Sediment, Surface Water, and Groundwater Sampling**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Sediment/Surface water Sampling (continued)	Biological	<ul style="list-style-type: none"> • Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. Notify supervisors of known allergies to stinging insects and location of antidotes. • Use insect repellent. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens 	Standard Level D PPE
	Electric Hazards	<ul style="list-style-type: none"> • If/when electrical extension cords are required to complete work, extension cords must be: <ul style="list-style-type: none"> - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment. 	Standard Level D PPE
	Fire Prevention	<ul style="list-style-type: none"> • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area. 	Standard Level D PPE
	Pressure Washing/Equipment Decon	<ul style="list-style-type: none"> • Only qualified personnel will operate high pressure water cleaning equipment. • Operator will be aware of surroundings at all times. • Operator will never point pressure wand in direction of other personnel. • Pressure wands shall not be modified in field (i.e. shortened, bent, or trigger tied open). • Non-operating support personnel must never walk in front of operator during operation. • High pressure equipment shall be equipped with pressure dump safety valves. • Operator to wear pressure resistant foot wear and face splash shield. • Operator shall inspect high pressure hoses, fittings and safety equipment daily. 	Modified Level D PPE with pressure resistant footwear and face splash shield

Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Soil, Sediment, Surface Water, and Groundwater Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Chemical Exposure	<ul style="list-style-type: none"> • All personnel performing this task shall be trained in accordance with 29CFR1910.120 and be deemed “fit for duty” by a licensed occupation physician. • Follow PPE and action level requirements identified in the site specific HSP. • Do not allow dermal contact or incidental ingestion of impacted soil or groundwater. Skin contact with contaminated water, soils, debris, or equipment shall be avoided at all times. Do not kneel or step in potentially contaminated media (soil or ground water). • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Following sample collection, sample container lids should be tightened securely to prevent any leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents. 	Modified Level D ₁ or D ₂ PPE (see table G5-1)
	Other	<ul style="list-style-type: none"> • Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio <u>while driving</u> on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices. 	NA

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Fire extinguisher (with fuel and electrical sources) <ul style="list-style-type: none"> • Eye wash (small portable type) • Miscellaneous power and manual hand tools. <ul style="list-style-type: none"> • Miscellaneous rigging. 	<ul style="list-style-type: none"> • Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension cords if used. 	<ul style="list-style-type: none"> • Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

PRINT

SIGNATURE

Supervisor Name: _____

Date/Time: _____

Safety Officer Name: _____

Date/Time: _____

Site Personnel: _____

Date/Time: _____

Site Personnel (continued):

_____	_____	Date/Time: _____

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Equipment Decontamination**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Equipment Decontamination	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. 	<p align="center">Standard Level D PPE *</p> <p>* Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.</p>
	Heavy Equipment/Haul Trucks	<ul style="list-style-type: none"> • Operator experienced with safe operation of excavation/loading equipment. • Workers to remain beyond the swing radius of heavy equipment. • Workers to remain out of the haul route when possible. • Communicate with equipment and haul truck operators with clear hand signals. 	Standard Level D PPE
	Manual Lifting	<ul style="list-style-type: none"> • CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level. 	Standard Level D PPE
	Noise	<ul style="list-style-type: none"> • Personnel exposed to loud working environments shall wear hearing protection. 	Standard Level D PPE
	High Ambient Temperature	<ul style="list-style-type: none"> • Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion. 	Standard Level D PPE (light colored clothing)
	Struck/pinched	<ul style="list-style-type: none"> • Wear reflective warning vests or high visibility clothing. • Isolate equipment swing areas from workers, fixed objects or other equipment. • Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators. • Ensure equipment has operable back-up alarms. • Avoid positioning between fixed objects and operating equipment. • No one shall walk under or in front of suspended loads. Only tagged, load rated and inspected rigging shall be used to lift loads. Become familiar with vertical, basket and choker load ratings of rigging. 	Standard Level D PPE

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Equipment Decontamination**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Equipment Decontamination (continued)	Biological	<ul style="list-style-type: none"> • Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. Notify supervisors of known allergies to stinging insects and location of antidotes. • Use insect repellent. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens 	Standard Level D PPE
	Electric Hazards	<ul style="list-style-type: none"> • If/when electrical extension cords are required to complete work, extension cords must be: <ul style="list-style-type: none"> - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment. 	Standard Level D PPE
	Fire Prevention	<ul style="list-style-type: none"> • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area. 	Standard Level D PPE
	Pressure Washing/Equipment Decon	<ul style="list-style-type: none"> • Only qualified personnel will operate high pressure water cleaning equipment. • Operator will be aware of surroundings at all times. • Operator will never point pressure wand in direction of other personnel. • Pressure wands shall not be modified in field (i.e. shortened, bent, or trigger tied open). • Non-operating support personnel must never walk in front of operator during operation. • High pressure equipment shall be equipped with pressure dump safety valves. • Operator to wear pressure resistant foot wear and face splash shield. • Operator shall inspect high pressure hoses, fittings and safety equipment daily. 	Modified Level D PPE with pressure resistant footwear and face splash shield
	Overhead/Suspended Loads	<ul style="list-style-type: none"> • No personnel are allowed to walk under elevated buckets on excavation equipment • If personnel have to work beneath elevated buckets for maintenance purpose, then safety blocks must be positioned on hydraulic arms to prevent lowering. • Hardhats to be worn at all times if potential for falling objects 	Standard Level D PPE

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Equipment Decontamination**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Equipment Decontamination (continued)	Chemical Exposure	<ul style="list-style-type: none"> • All personnel performing this task shall be trained in accordance with 29CFR1910.120 and be deemed “fit for duty” by a licensed occupation physician. • Follow PPE and action level requirements identified in the site specific HSP. • Do not allow dermal contact or incidental ingestion of impacted soil or groundwater. Skin contact with contaminated water, soils, debris, or equipment shall be avoided at all times. Do not kneel or step in potentially contaminated media (soil or ground water). • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Following sample collection, sample container lids should be tightened securely to prevent any leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents. 	Modified Level D ₁ or D ₂ PPE (see table G5-1)
	Other	<ul style="list-style-type: none"> • Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio <u>while driving</u> on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices. 	NA
EQUIPMENT REQUIRED		INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Fire extinguisher (with fuel and electrical sources) <ul style="list-style-type: none"> • Eye wash (small portable type) • Miscellaneous power and manual hand tools. <ul style="list-style-type: none"> • Miscellaneous rigging. 		<ul style="list-style-type: none"> • Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension cords if used. 	<ul style="list-style-type: none"> • Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

PRINT

SIGNATURE

Supervisor Name:

Date/Time: _____

Safety Officer Name:

Date/Time: _____

Site Personnel:

Date/Time: _____

Site Personnel (continued):

_____	_____	Date/Time: _____

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – IDW Handling and Management**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
IDW Handling and Management	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. 	<p align="center">Standard Level D PPE *</p> <p>* Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.</p>
	Heavy Equipment/Haul Trucks	<ul style="list-style-type: none"> • Operator experienced with safe operation of excavation/loading equipment. • Workers to remain beyond the swing radius of heavy equipment. • Workers to remain out of the haul route when possible. • Communicate with equipment and haul truck operators with clear hand signals. 	Standard Level D PPE
	Manual Lifting	<ul style="list-style-type: none"> • CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level. 	Standard Level D PPE
	Noise	<ul style="list-style-type: none"> • Personnel exposed to loud working environments shall wear hearing protection. 	Standard Level D PPE
	High Ambient Temperature	<ul style="list-style-type: none"> • Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regimen to avoid heat stress symptoms and overexertion. 	Standard Level D PPE (light colored clothing)
	Struck/pinched	<ul style="list-style-type: none"> • Wear reflective warning vests or high visibility clothing. • Isolate equipment swing areas from workers, fixed objects or other equipment. • Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators. • Ensure equipment has operable back-up alarms. • Avoid positioning between fixed objects and operating equipment. • No one shall walk under or in front of suspended loads. Only tagged, load rated and inspected rigging shall be used to lift loads. Become familiar with vertical, basket and choker load ratings of rigging. 	Standard Level D PPE

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – IDW Handling and Management**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
IDW Handling and Management (continued)	Biological	<ul style="list-style-type: none"> • Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. Notify supervisors of known allergies to stinging insects and location of antidotes. • Use insect repellent. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens 	Standard Level D PPE
	Fire Prevention	<ul style="list-style-type: none"> • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area. 	Standard Level D PPE
	Overhead/Suspended Loads	<ul style="list-style-type: none"> • No personnel are allowed to walk under elevated buckets on excavation equipment • If personnel have to work beneath elevated buckets for maintenance purpose, then safety blocks must be positioned on hydraulic arms to prevent lowering. • Hardhats to be worn at all times if potential for falling objects 	Standard Level D PPE
	Chemical Exposure	<ul style="list-style-type: none"> • All personnel performing this task shall be trained in accordance with 29CFR1910.120 and be deemed “fit for duty” by a licensed occupation physician. • Follow PPE and action level requirements identified in the site specific HSP. • Do not allow dermal contact or incidental ingestion of impacted soil or groundwater. Skin contact with contaminated water, soils, debris, or equipment shall be avoided at all times. Do not kneel or step in potentially contaminated media (soil or ground water). • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Following sample collection, sample container lids should be tightened securely to prevent any leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents. 	Modified Level D ₁ or D ₂ PPE (see table G5-1)

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – IDW Handling and Management**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
IDW Handling and Management (continued)	Other	<ul style="list-style-type: none"> • Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio <u>while driving</u> on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices. 	NA
EQUIPMENT REQUIRED		INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Fire extinguisher (with fuel and electrical sources) <ul style="list-style-type: none"> • Eye wash (small portable type) • Miscellaneous power and manual hand tools. <ul style="list-style-type: none"> • Miscellaneous rigging. 		<ul style="list-style-type: none"> • Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension chords if used. 	<ul style="list-style-type: none"> • Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

PRINT

SIGNATURE

Supervisor Name:

Date/Time: _____

Safety Officer Name:

Date/Time: _____

Site Personnel:

Date/Time: _____

Site Personnel (continued):

_____	_____	Date/Time: _____

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Demobilization/ Cleanup	Slips, Trips, Falls	<ul style="list-style-type: none"> • Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Use sturdy hard toe work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. 	<p align="center">Standard Level D PPE *</p> <p>* Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.</p>
	Heavy Equipment/Haul Trucks	<ul style="list-style-type: none"> • Operator experienced with safe operation of excavation/loading equipment. • Workers to remain beyond the swing radius of heavy equipment. • Workers to remain out of the haul route when possible. • Communicate with equipment and haul truck operators with clear hand signals. 	Standard Level D PPE
	Manual Lifting	<ul style="list-style-type: none"> • CH2M HILL or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities. • When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. If heavy equipment isn't available to have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Use heavy equipment to transfer heavy or awkward loads wherever possible. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level. 	Standard Level D PPE
	Noise	<ul style="list-style-type: none"> • Personnel exposed to loud working environments shall wear hearing protection. 	Standard Level D PPE
	High Ambient Temperature	<ul style="list-style-type: none"> • Provide fluids to prevent worker dehydration. • Monitor for heat stress in accordance with HSP (maintain use of buddy system). • Institute a proper work-break regiment to avoid heat stress symptoms and overexertion. 	Standard Level D PPE (light colored clothing)

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Demobilization/ Cleanup (continued)	Struck/pinched	<ul style="list-style-type: none"> • Wear reflective warning vests or high visibility clothing. • Isolate equipment swing areas from workers, fixed objects or other equipment. • Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators. • Ensure equipment has operable back-up alarms. • Avoid positioning between fixed objects and operating equipment. • No one shall walk under or in front of suspended loads. Only tagged, load rated and inspected rigging shall be used to lift loads. Become familiar with vertical, basket and choker load ratings of rigging. 	Standard Level D PPE
	Biological	<ul style="list-style-type: none"> • Observe ground surfaces especially in wet or grassy areas, tree trunks, and rock piles for evidence and presence of snakes (poisonous). • Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives etc. • Observe areas for presence of stinging insects. Notify supervisors of known allergies to stinging insects and location of antidotes. • Use insect repellent. Tape pant legs to boots. Frequently check body and clothing for ticks, chiggers, spiders. • Avoid exposure to blood borne pathogens 	Standard Level D PPE
	Electric Hazards	<ul style="list-style-type: none"> • If/when electrical extension cords are required to complete work, extension cords must be: <ul style="list-style-type: none"> - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/ampereage of equipment. 	Standard Level D PPE
	Fire Prevention	<ul style="list-style-type: none"> • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Allow warm engine parts (generator motor) to cool before refueling. • Appropriately sized, easily accessible ABC fire extinguisher in work area. 	Standard Level D PPE

**Contract Task Order 0014 MCB Camp Lejeune- Site UXO-17
ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup**

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Pressure Washing/Equipment Decon	<ul style="list-style-type: none"> • Only qualified personnel will operate high pressure water cleaning equipment. • Operator will be aware of surroundings at all times. • Operator will never point pressure wand in direction of other personnel. • Pressure wands shall not be modified in field (i.e. shortened, bent, or trigger tied open). • Non-operating support personnel must never walk in front of operator during operation. • High pressure equipment shall be equipped with pressure dump safety valves. • Operator to wear pressure resistant foot wear and face splash shield. • Operator shall inspect high pressure hoses, fittings and safety equipment daily. 	Modified Level D PPE with pressure resistant footwear and face splash shield
	Overhead/Suspended Loads	<ul style="list-style-type: none"> • No personnel are allowed to walk under elevated buckets on excavation equipment • If personnel have to work beneath elevated buckets for maintenance purpose, then safety blocks must be positioned on hydraulic arms to prevent lowering. • Hardhats to be worn at all times if potential for falling objects 	Standard Level D PPE
Demobilization/Cleanup (continued)	Other	<ul style="list-style-type: none"> • Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio <u>while driving</u> on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain and lightning. • Buddy System maintained for all phases of work. • Base Emergency Dispatch numbers programmed into CH2M HILL personnel cellular phones. Have hospital route maps readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately. • Site work should always be performed with adequate lighting. • Site equipment, materials, and waste should be maintained according to good housekeeping practices. 	NA
EQUIPMENT REQUIRED		INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging. 		<ul style="list-style-type: none"> • Visual Inspections of designated work areas identify and address hazardous conditions. • Equipment inspections and maintenance. • Inspections of hand tools (power) and extension chords if used. 	<ul style="list-style-type: none"> • Review AHA with all task personnel • Review Site Specific Health and Safety Plan for new site personnel. • Review operations/safety manuals for all equipment utilized. • Behavior Based Loss Prevention Training (supervisors). • Power tool and equipment operators qualified by previous training or experience.

PRINT

SIGNATURE

Supervisor Name:

Date/Time: _____

Safety Officer Name:

Date/Time: _____

Site Personnel:

Date/Time: _____

Site Personnel (continued):

_____	_____	Date/Time: _____

CH2MHILL

Pre-Task Safety Plan (PTSP)

Project: _____ Location: _____ Date: _____		
Supervisor: _____ Job Activity: _____ _____		
Task Personnel: _____ _____ _____		
List Tasks: _____ _____ _____		
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):		
<input type="checkbox"/> Chemical burns/contact	<input type="checkbox"/> Trench, excavations, cave-ins	<input type="checkbox"/> Ergonomics
<input type="checkbox"/> Pressurized lines/equipment	<input type="checkbox"/> Overexertion	<input type="checkbox"/> Chemical splash
<input type="checkbox"/> Thermal burns	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Poisonous plants/insects
<input type="checkbox"/> Electrical	<input type="checkbox"/> Cuts/abrasions	<input type="checkbox"/> Eye hazards/flying projectile
<input type="checkbox"/> Weather conditions	<input type="checkbox"/> Spills	<input type="checkbox"/> Inhalation hazard
<input type="checkbox"/> Heights/fall > 6 feet	<input type="checkbox"/> Overhead Electrical hazards	<input type="checkbox"/> Heat/cold stress
<input type="checkbox"/> Noise	<input type="checkbox"/> Elevated loads	<input type="checkbox"/> Water/drowning hazard
<input type="checkbox"/> Explosion/fire	<input type="checkbox"/> Slips, trip and falls	<input type="checkbox"/> Heavy equipment
<input type="checkbox"/> Radiation	<input type="checkbox"/> Manual lifting	<input type="checkbox"/> Aerial lifts/platforms
<input type="checkbox"/> Confined space entry	<input type="checkbox"/> Welding/cutting	<input type="checkbox"/> Demolition
Other Potential Hazards (Describe): _____ _____ _____		

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Hazard Control Measures (Check All That Apply):

PPE <input type="checkbox"/> Thermal/lined <input type="checkbox"/> Eye <input type="checkbox"/> Dermal/hand <input type="checkbox"/> Hearing <input type="checkbox"/> Respiratory <input type="checkbox"/> Reflective vests <input type="checkbox"/> Flotation device	Protective Systems <input type="checkbox"/> Sloping <input type="checkbox"/> Shoring <input type="checkbox"/> Trench box <input type="checkbox"/> Barricades <input type="checkbox"/> Competent person <input type="checkbox"/> Locate buried utilities <input type="checkbox"/> Daily inspections	Fire Protection <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire watch <input type="checkbox"/> Non-spark tools <input type="checkbox"/> Grounding/bonding <input type="checkbox"/> Intrinsically safe equipment	Electrical <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Grounded <input type="checkbox"/> Panels covered <input type="checkbox"/> GFCI/extension cords <input type="checkbox"/> Power tools/cord inspected
Fall Protection <input type="checkbox"/> Harness/lanyards <input type="checkbox"/> Adequate anchorage <input type="checkbox"/> Guardrail system <input type="checkbox"/> Covered opening <input type="checkbox"/> Fixed barricades <input type="checkbox"/> Warning system	Air Monitoring <input type="checkbox"/> PID/FID <input type="checkbox"/> Detector tubes <input type="checkbox"/> Radiation <input type="checkbox"/> Personnel sampling <input type="checkbox"/> LEL/O2 <input type="checkbox"/> Other	Proper Equipment <input type="checkbox"/> Aerial lift/ladders/scaffolds <input type="checkbox"/> Forklift/heavy equipment <input type="checkbox"/> Backup alarms <input type="checkbox"/> Hand/power tools <input type="checkbox"/> Crane with current inspection <input type="checkbox"/> Proper rigging <input type="checkbox"/> Operator qualified	Welding & Cutting <input type="checkbox"/> Cylinders secured/capped <input type="checkbox"/> Cylinders separated/upright <input type="checkbox"/> Flash-back arrestors <input type="checkbox"/> No cylinders in CSE <input type="checkbox"/> Flame retardant clothing <input type="checkbox"/> Appropriate goggles
Confined Space Entry <input type="checkbox"/> Isolation <input type="checkbox"/> Air monitoring <input type="checkbox"/> Trained personnel <input type="checkbox"/> Permit completed <input type="checkbox"/> Rescue	Medical/ER <input type="checkbox"/> First-aid kit <input type="checkbox"/> Eye wash <input type="checkbox"/> FA-CPR trained personnel <input type="checkbox"/> Route to hospital	Heat/Cold Stress <input type="checkbox"/> Work/rest regime <input type="checkbox"/> Rest area <input type="checkbox"/> Liquids available <input type="checkbox"/> Monitoring <input type="checkbox"/> Training	Vehicle/Traffic <input type="checkbox"/> Traffic control <input type="checkbox"/> Barricades <input type="checkbox"/> Flags <input type="checkbox"/> Signs
Permits <input type="checkbox"/> Hot work <input type="checkbox"/> Confined space <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Excavation <input type="checkbox"/> Demolition <input type="checkbox"/> Energized work	Demolition <input type="checkbox"/> Pre-demolition survey <input type="checkbox"/> Structure condition <input type="checkbox"/> Isolate area/utilities <input type="checkbox"/> Competent person <input type="checkbox"/> Hazmat present	Inspections: <input type="checkbox"/> Ladders/aerial lifts <input type="checkbox"/> Lanyards/harness <input type="checkbox"/> Scaffolds <input type="checkbox"/> Heavy equipment <input type="checkbox"/> Cranes and rigging	Training: <input type="checkbox"/> Hazwaste <input type="checkbox"/> Construction <input type="checkbox"/> Competent person <input type="checkbox"/> Task-specific (THA) <input type="checkbox"/> Hazcom

Field Notes: _____

Name (Print): _____

Signature: _____

Date: _____

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 11

HITS Form

HITS Incident Report Hardcopy (Phase 1 – Initial Entry)
Rev. 1, 12/03/2007

Phase 1 – Initial Entry

Type of Incident (May select more than one)

- Injury/Illness
- Property Damage
- Spill/Release
- Environment/Permit
- Near Miss
- 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: _____

CH2M HILL Health and Safety Plan
Attachment 12

Working Alone Standard

CALL – IN CONTACT FORM

Date of site work: _____ Expected start time: _____

Name of CH2M HILL employee in the field: _____

Name of CH2M HILL employee responsible to receive contact:

Client Emergency Contact (if any):

CH2M HILL employee's contact numbers:

Radio # _____

Cell Phone # _____

Address and Location of work: _____

Directions/Map:

Planned Activity: _____

Specified Frequency and time for call in: _____

Time

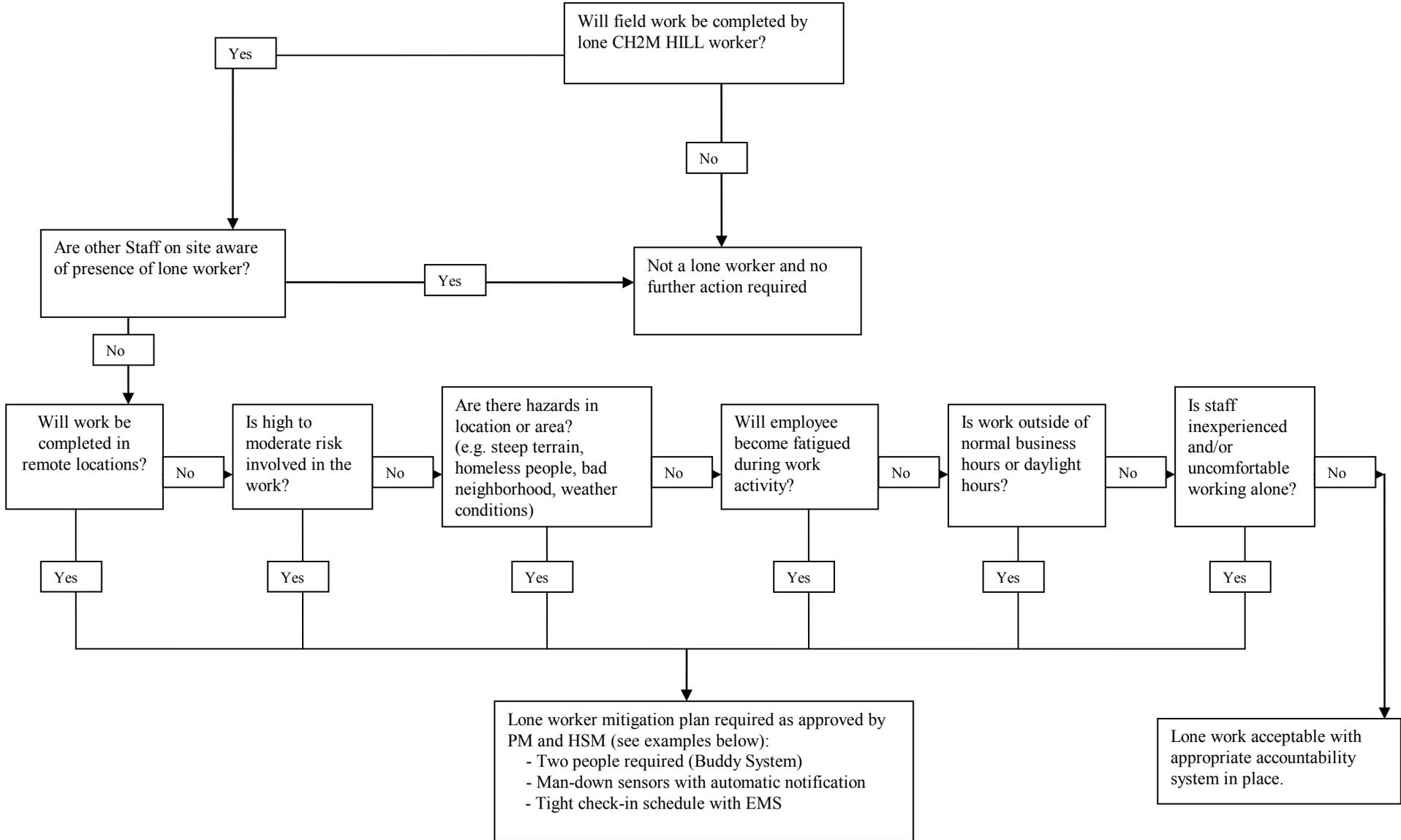
Verified

Location

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

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

Lone Worker Protocol



CH2M HILL HEALTH AND SAFETY PLAN
Attachment 13

Notice of Safety Violation Form



Notice of Safety Violation

REPORT PREPARED BY:

Name:	Title:	Signature:	Date:

VIOLATION:

Description:	Date:

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.**

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	Title:	Signature:	Date:

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 14

Stop Work Order Form



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 15

Material Safety Data Sheets

Appendix B
Standard Operating Procedures

**STANDARD OPERATING PROCEDURE – OPS-14
MEC ANALOG DETECTION AND REMOVAL ACTIONS****1.0 PURPOSE**

The purpose of this Standard Operating Procedure (SOP) is to provide all USA Environmental, Inc. (USAE) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of analog detection and removal actions (mag and dig) at sites potentially containing unexploded ordnance (UXO) and/or munitions and explosives of concern (MEC).

2.0 SCOPE

This SOP applies to all USAE site personnel, including contractor and subcontractor personnel, involved in the conduct of analog detection and removal actions (mag and dig) on a UXO/MEC contaminated site. The following USAE policies and procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with Work Plans, other USAE SOPs, the USAE Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance. Consult the documents listed in Section 7.0 of this SOP for additional compliance issues.

3.0 RESPONSIBILITIES**3.1 PROJECT MANAGER**

The Project Manager is responsible for ensuring availability of resources to safely and effectively implement this SOP.

3.2 SITE MANAGER

The Site Manager is responsible for incorporating this SOP in plans, procedures, and training. In addition, he is responsible for oversight and supervision of field personnel, and ensuring compliance with this SOP.

3.3 UXO SAFETY OFFICER

The UXO Safety Officer (UXOSO) ensures that all mag and dig activities are conducted in a safe manner, in accordance with the approved Work Plan, the SSHP, this SOP, and all applicable regulatory guidance. The UXOSO's duties shall include, but are not limited to: analyzing UXO explosives operational risk, hazards, and safety requirements; establishing and ensuring compliance with all site-specific safety requirements for UXO and explosives operations; enforcing personnel limits and safety exclusion zones (EZ) for UXO clearance operations; and all activities associated with UXO and explosives transportation, storage, and destruction.

3.4 UXO QUALITY CONTROL SPECIALIST

The UXO Quality Control Specialist (UXOQCS) ensures compliance with the project Quality Control (QC) Plan and performs analog QC checks of completed grids in accordance with the Work Plan.

4.0 OPERATIONS**4.1 ANALOG DETECTION AND REMOVAL ACTIONS**

All analog detection and removal (mag and dig) activities at MEC sites will be under the supervision of UXO qualified personnel. Non-UXO qualified personnel will not be allowed in the EZ during intrusive operations. If access is required by non-UXO qualified personnel, all work will stop while they are in the EZ. During operations, USAE personnel will strictly adhere to the SSHP and the following general safety practices:

-
- Operations will be conducted during daylight hours only.
 - Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation.
 - UXO will only be handled by qualified UXO Technicians.
 - During UXO operations the minimum separation distance (MSD) between UXO and non-UXO operations is fragmentation distance of the munition with the greatest fragmentation distance (MGFD), as stated in the Work Plan.
 - During demolition operations personnel remaining on site will be limited to those personnel needed to safely and efficiently prepare the item/s for destruction.).
 - All personnel will attend the daily safety briefing (tailgate safety briefing) prior to entering the operating area.
 - Anyone can stop operations for an unsafe act or situation.
 - Safety violations and/or unsafe acts will be immediately reported to the UXOSO.
 - Failure to comply with safety rules/procedures may result in termination of employment.

4.2 GRID LAYOUT

A registered land surveyor will survey each of the clearance areas, accompanied by a UXO escort. Surveying activities will consist of locating clearance area boundaries, establishing permanent survey monuments, and establishing grids for geophysical investigation activities within the clearance areas.

Depending on the method selected and approved by the customer, the site layout and search grids will be established using a Global Positioning System (GPS), licensed surveyor, or compass and measuring tape. Survey crews will be escorted in the field by a UXO Technician II or above who will provide UXO avoidance including checking the intended survey stake locations with a magnetometer prior to driving stakes into the ground. This will prevent driving stakes into buried MEC.

4.3 ANALOG SWEEP PROCEDURES

Intrusive investigation team(s) will consist of a Team Leader (UXO Technician III) and UXO Technicians II/I. During intrusive operations UXO Technicians I will operate under the supervision of UXO Technicians II or III. UXO operations will only be performed by qualified UXO Technicians, which are defined as:

- MEC identification
- Access procedures such as excavation, either by hand or using heavy equipment
- Handling of MEC/UXO, explosives, or explosive items
- Disposal, including movement, transportation, and final disposal of MEC

Analog detector sweeps (i.e., mag and dig) are particularly effective in areas where vegetation and terrain limit the use of larger digital systems. Also, mag and dig approaches should be used when there is insufficient difference between UXO at the site and other metallic fragments and debris, such that digital discrimination is ineffective or cost prohibitive.

Initially, individual search lanes will be established approximately 5 feet (ft) wide. Each lane will be surveyed using a Schonstedt GA-52CX and/or White's XLT magnetometer. The operation will begin at one end of each lane and move in a forward direction toward the opposing baseline. During the forward movement the technician moves the magnetometer back and forth from one side of the lane to the other. Both forward movement and the swing of the magnetometer are performed at a pace that ensures the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies. When a subsurface anomaly or metallic surface object is encountered, the UXO Technician halts and investigates the anomaly at that time. Throughout this operation the team leader closely monitors the team's individual performance to ensure these procedures are being performed correctly.

4.4 SURFACE UXO

Upon encountering a surface MEC it will be identified by two UXO Technicians and marked in accordance with the approved Work Plan for future disposition. If detonation cannot be arranged the same day as the MEC is identified, a guard will be posted during the non-working hours to ensure the item is not disturbed.

4.5 SUBSURFACE ANOMALIES

4.5.1 MANUAL EXCAVATIONS

Subsurface anomalies will be investigated by UXO-qualified personnel as they are identified during the sweep. All identified anomalies within the grid will be intrusively investigated. Excavations for individual anomalies will be conducted using the Schonstedt GA-52CX and/or White's XLT magnetometers to assist the team in determining the location and orientation of the target item. The UXO Technicians excavating anomalies shall initially remove no more than a 6-inch layer of soil along side the location of the anomaly, being careful not to impact the anomalous feature. The UXO Technician will conduct a visual and electronic search of the excavation to further pin point the anomaly source as needed. This process shall be repeated until the audible signal from the magnetometer indicates the object is close to the surface. Once this determination has been made, soil will be removed by hand until the source of the anomaly is located. Excavations on individual anomalies greater than 4 ft below the ground surface (bgs) will not be made without prior approval of the U.S. Army Corps of Engineers (USACE) OE Safety Specialist.

4.5.2 MECHANICAL HANDLING EQUIPMENT

Mechanical Handling Equipment (MHE) may be used to excavate large anomalies (e.g., pits) or those deeper than 4 ft bgs if required (e.g., to confirm the anomaly is not a MEC). Any decision to use MHE to excavate these anomalies will be made by the SUXOS and the USACE OE Safety Specialist (see SOP OPS-06, Excavation and Trenching for detailed MHE procedures). The excavation will proceed slowly to ensure the item is not broached by the MHE. If the excavated material is considered to be a MEC, it shall be uncovered sufficiently by hand to obtain a positive identification of the item. If the item is identified as UXO/MEC, a determination will subsequently be made as to whether it is fused or not.

While excavating with MHE, a UXO Technician will be stationed in a position that is out of the reach of the excavation equipment but affords a view of the excavation site. This observer will ensure that the next lift is visually free of UXO. The excavated material will be placed onto the ground within a screening area that has been surface swept and the boundaries recorded. The soil spoils will be spread across the screening area using the excavator bucket. The excavated material will be screened for range related debris, munitions debris, and UXO/MEC items. UXO technicians will recover all pieces of munitions debris or range related debris and any ordnance items. After screening, the soil spoils will be stockpiled to the side of the screening area.

5.0 RECORD KEEPING

The team leader will maintain a field logbook, which at a minimum will contain a record of the following:

-
- Weather
 - Instrument details and serial number
 - Team Personnel
 - Grids worked
 - Start and stop times
 - MEC/UXO items encountered

The data to be recorded for each item discovered during anomaly excavation will include the following (as applicable):

- Type (e.g., MD, MPPEH, UXO, and non-MEC Scrap)
- Description (e.g., "projo, 20-mm, practice, MK105" and "base, coupling, firing device")
- Initial Condition (e.g., expended, inert, live, and to be determined [TBD])
- Approximate length
- Approximate width
- Depth
- Approximate weight
- Found in a pit?
- Piece of frag?
- Initial disposition (e.g., left in place and removed to scrap pile)
- Requires demolition?

All data will be turned into the Site Geophysicist at the end of the day.

6.0 DISPOSAL OPERATIONS

Fuzed UXO/MEC items will be blown in place (BIP), and un-fuzed UXO/MEC items will be consolidated whenever possible in accordance with USACE Engineer Pamphlet 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects, dated 16 July 1999, Appendix D. In no case shall the SUXOS authorize or undertake destruction of UXO/MEC when there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage. The USACE OE Safety Specialist will be consulted for guidance in the event that there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage.

7.0 REFERENCES

- USACE Safety Considerations for UXO

- USAE Corporate Safety and Health Program (CSHP)
- OSHA, 29 CFR 1910, Occupational Safety and Health Standards
- OSHA, 29 CFR 1926, Construction Standards
- Applicable sections of EPA, 40 CFR Parts 260 to 299, Protection of Environment
- Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation
- USACE EM 385-1-1, Safety and Health Requirements Manual
- USACE ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous Waste Remedial Actions
- DOD 4145.26-M, Contractors' Safety Manual for Ammunition and Explosives
- DOD 6055.9-STD, DOD Ammunition and Explosives Safety Standards
- DOD 4160.21-M, Defense Reutilization and Marketing Manual
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- AR 385-64, Ammunition and Explosives Safety Standards
- AR 200-1, Environmental Protection and Enhancement
- AR 385-10, The Army Safety Program
- AR 385-16, System Safety Engineering and Management
- AR 385-40 w/USACE supplement, Accident Reporting and Records
- TM 9-1300-200, Ammunition General
- TM 9-1300-214, Military Explosives
- TM 60 Series Publications

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

Standard Operating Procedures for Geophysical Mapping

Unexploded Ordnance (UXO) Site– 17 CTO-0141

MCB Camp Lejeune, North Carolina

NEW YORK
50 N. Harrison Avenue
Suite 11
Congers
New York 10920
(845) 268-1800
(845) 268-1802 Fax

VIRGINIA
P.O. Box 7325
Charlottesville
Virginia 22906
(434) 978-3187
(434) 973-9791 Fax

October 2010

1.

1. Purpose

The purpose of this Standard Operating Procedures (SOP) is to provide specific procedures for data collection, processing and equipment for the geophysical investigations for the Expanded Site Inspection for Unexploded Ordnance (UXO) Site - 17 at MCB Camp Lejeune, North Carolina.

2. Equipment and Theory

This SOP is applicable for the Geonics EM61-MK2, and Trimble's 5700/R7/R8 RTK (Real Time Kinematic) GPS.

The EM61-MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. In comparison with other metal detectors, especially magnetometers, it is much better suited for work in close proximity to man-made structures and in areas of dense subsurface metallic debris (i.e. impact ranges). The Standard EM61-MK2 system consists of two air-cored coils, a digital data recorder, batteries and processing electronics. The EM61-MK2's transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects. Each of the two spatially separated receiver coils measures these eddy currents. The EM61-MK2 offers the ability measure the eddy currents at three distinct time intervals in the bottom coil or four intervals if no top coil measurements are recorded. Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils are measured in millivolts (mV). The arrangement of coils is such that there is a vertical separation of 40 cm. Assuming accurate data positioning, target resolution of approximately 0.5 meters can be expected. The data is collected into Geomar's Nav61MK2 program and temporarily stored in an Allegro CX prior to downloading to a laptop computer.

Trimble's 5700 GPS is a 24-channel dual frequency RTK receiver that uses both L1 and L2 satellites. This system operates with a base and a rover unit; the base sends corrections to the rover via radio link, thus maintaining a 3cm horizontal accuracy and a 5cm vertical accuracy. For configuration with the EM61-MK2, the rover is set to output a GGA NMEA string at 1 Hz, which is captured into the NAV61MK2 program and on the Allegro CX.

3. Instrument Standardization

All instruments will be assembled and calibrated (where required) as specified in their User Manuals. Additionally, each instrument will be field tested daily to ensure that the instrument is operating properly (explained in Section 7).

4. Data Acquisition

Whether the survey area is established as grids or as transect lines, the EM61-MK2 is operated at a walking pace by one or two people. Data will be collected on wheels at one reading/10 cm or in tandem mode (the instrument is carried by two operators) with readings triggered at a minimum of 10 readings/second. Selection of the appropriate method is based primarily on local terrain conditions.

4.1. Instrument Setup

When the instrument is operated in wheel mode, it is setup according to Geonics EM61-MK2 Manual. For tandem mode, the EM61-MK2 coils are centered suspended on two 10ft long fiberglass poles. The instrument is attached to the poles by the top coil with zip ties and webbing. The webbing wraps around the poles and is attached to the bottom coil clamps. For both modes of data collection, the cables are tape to keep them from getting tangled and possible yanked out

by brush. If GPS is used, a three-leg tripod is attached to the top coil and the satellite antenna is fastened to the top.

4.2. Navigation

Depending on site conditions, navigation of the system is accomplished through either Fiducial (FID) method or Global Positioning System (GPS/RTK) method.

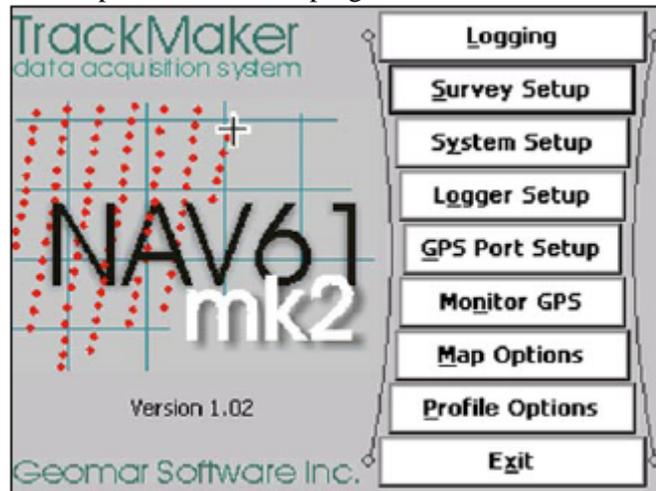
The FID method is used in wooded areas where GPS positioning is unavailable. This method uses reference locations (stakes) surveyed in by PLS on evenly spaced centers (approximately every 20 meters down line) to identify locations for the placement of fiducial marks within the recorded data.

The second method of navigation is GPS/RTK. The base station is setup on a control point and corrections are sent via radio link to the rover receiver. The rover GPS antenna is mounted over the center of the EM61-MK2 coil and provides real time positional tracking capabilities that is streamed into the same software program as the EM61-MK2 data.

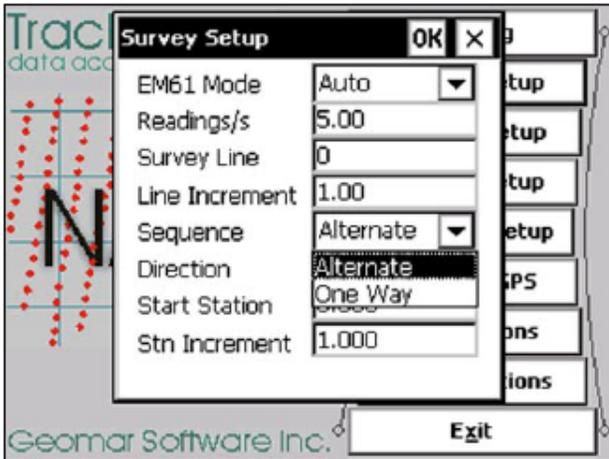
4.3. Data collection Steps

Below are the steps to begin surveying with the EM61-MK2:

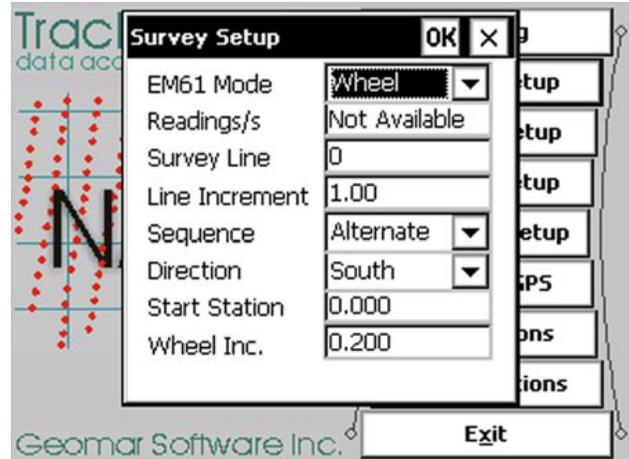
- ◆ Turn on instrument by pushing in the fuse on the top of the console/electronics
- ◆ Allow instrument to warm up for at least 15 minutes
- ◆ Turn on Allegro CX and open NAV61MK2 program. The screen below will be displayed.



- ◆ Click on “Survey Setup” and specify the below options. For GPS/RTK Method, the Mode is set to “Auto” and Readings/s is set to “10”. For Fid Method, the Mode is set to “Wheel”, Readings/s is “Not Available”, and Wheel Inc. now shows up instead of Stn Increment and it is set to 0.1. If the data is collected in locals using fiducials, the remaining options become important for maintaining positioning.



GPS/RTK Method



Fiducial Method

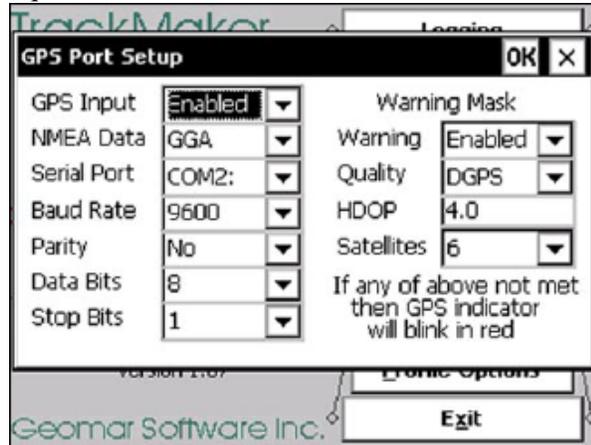
- ◆ Click on “System Setup” and specify the below options. These setting will usually remain the same throughout the project.



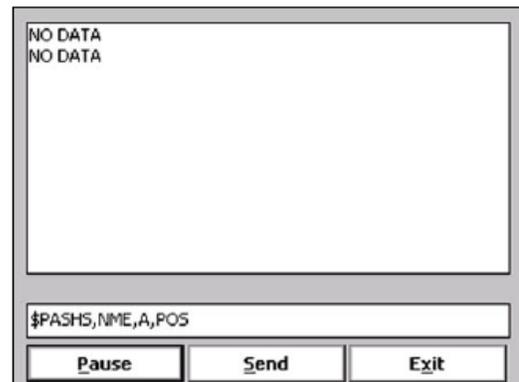
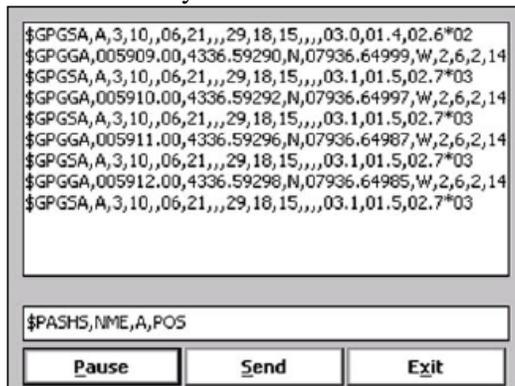
- ◆ Click on “Logger Setup” and specify the below options. These setting will remain the same throughout the project.



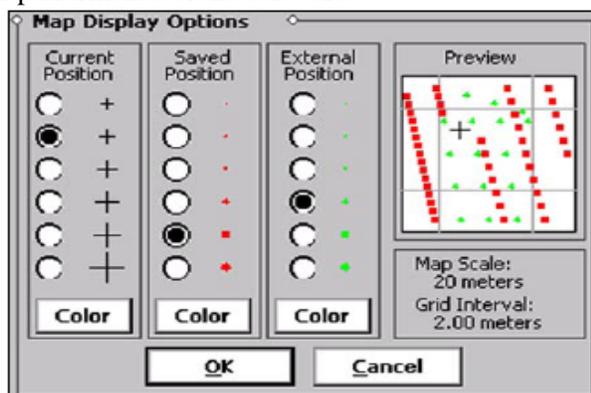
- ◆ Click on “GPS Port Setup” and specify the below options. When using GPS the below setting will be used. For Fiducials, the *GPS Input* is set to “Disabled” and everything else is grayed out. On the left side of the screen is where parameters can be set for alerts to go off if the GPS string is inadequate.



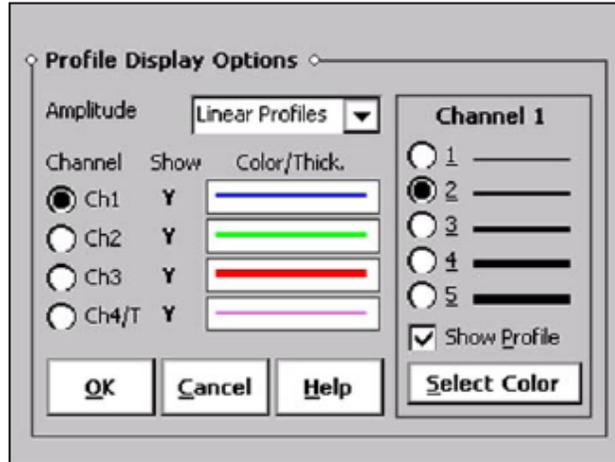
- ◆ Click on “Monitor GPS” and the below window will open. If the NMEA string is coming in correctly, the screen will appear like the one on the left. If there is a problem with the baud rate, “No Data” will appear once a second. If there is nothing coming through “No Data” will flash once every 6 seconds.



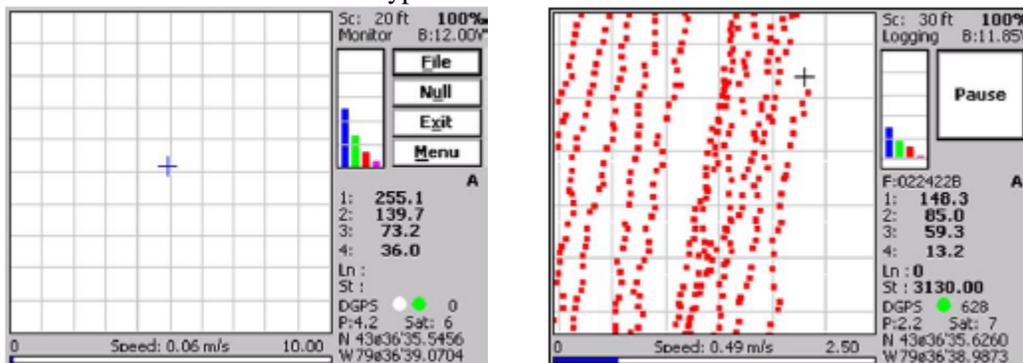
- ◆ Click on “Map Options” and specify the below options. These are more operator preferences for aesthetics then for performance of the software.



- ◆ Click on “Profile Options” and specify the below options. These are more operator preferences for aesthetics than for performance of the software.



- ◆ Once all the parameters are set click on the logging screen. The below screens will be displayed. Find a quiet spot and *Null* the instrument, then click on *File* and name your file and save it. Line up on the grid or transect and select *Go*. The software will start logging the readings and a large *Pause* button will appear on the screen. At the end of the line, tap the *Pause* button or hit enter on the keypad.



- ◆ On the above screens, both the EM61-MK2 data and the GPS/RTK data are monitored, as well as the data coverage.
- ◆ At the end of the file, the *Exit* button is selected. The file automatically saves at the end of every line.

5. Data Storage and Preliminary Processing

EM61-MK2 data are temporarily stored in an Allegro data logger via Geomar’s NAV61 software and then downloaded into a laptop computer for further on-site processing using Geomar’s Trackmaker and Geosoft Oasis Montaj software version 7.2.1.

Initial data processing is performed by the field team and includes reviewing data for integrity and repeatability. In the case of traditional surveying methods, positional data are edited based on the known locations of fiducial marks.

6. Post Processing

Once the initial editing steps have been performed, the data is turned over to NAEVA's processors for advanced analysis, target selection, and preparation of deliverables. The processor will go through five steps before the final data packages are delivered.

Step 1) QC of the field forms. This QC check insures that the forms are filled out correctly with the following item

- ◆ The appropriate grid block name
- ◆ transects associated with the block (grid cells)
- ◆ QC test file names (Static/Spike Tests, Personnel Test, and Cable Shake Test)
- ◆ Block file name
- ◆ Repeat file name
- ◆ Instrument used (EM61MK2 Wheeled, EM61MK2 Tandem)
- ◆ Collection/navigation method (RTK or FID)
- ◆ Daily conditions
- ◆ Cultural features

Step 2) Preprocessing of the QC tests and block data. The QC test data is actually finalized here but the block data is preprocessed. This step is to check the data for the following:

- ◆ Data quality
- ◆ Location
- ◆ Coverage
- ◆ Line path positioning
- ◆ Down line density
- ◆ Check of QC tests

First, a folder needs to be created where the Geosoft files are to be saved. Next open Geosoft and create a new project in the folder you just made (File – Project – New).

After this project is made, NAEVA uses several script files in Geosoft that help expedite the preprocessing/processing procedures. They are listed below with a brief description.

- ◆ **Import File 1.gs.** This script is partially interactive. This is the only script needed for the QC tests. The block data uses this one and the others listed below. It does the following:
 - Asks you to name the new Geosoft database it is about to create.
 - Asks you to locate then import the Geosoft xyz file.
 - Asks for the correct import template. For this project, there are three different import templates: GPS/RTK, RTS and FID.
 - Asks for the file name that was just imported.

If there is more than one block xyz file then Import File 2, Import File 3, etc. scripts will be needed. They go through the same steps as the Import File 1 script except naming and creating a new database. In most cases, there is just one xyz file with an associated repeat xyz file. After all block xyz files are imported, the next script to run is:

- ◆ **Import Repeat 1.gs.** Again this script is partially interactive and does the following:
 - Asks you to locate then import the Geosoft repeat xyz file.
 - Asks for the correct import template. For this project, there are three different import templates: GPS/RTK, RTS and FID.
 - Asks for the file name that was just imported.

If there is more than one repeat xyz file then Import Repeat 2, Import Repeat 3, etc. scripts will be needed.

If the collection was done in locals (FID), the data has to be warped to UTM zone 18 North before running the next script.

The last script to run in preprocessing is:

◆ **GPS UTM Setup.gs**

- Set X_UTM and Y_UTM as current in UTM zone 18 North.
- Makes x_d and y_d channels by using the differences filter by 1.
- Creates a data_density channel then runs a math expression “data_density = sqrt((x_d*x_d)+(y_d*y_d)).
- Creates and displays a data density map showing a 1.2m footprint for possible gaps and flags any readings over 0.2m.
- Preliminary auto levels (NAEVA’s Stlevel.gx) and preliminary lag corrects channels 1, 2, 3 & 4. NAEVA’s leveling gx is similar to the drift correct in Geosoft except we use a median filter. Preliminary leveling for channel 1 is Low window = 0, High window = 80 and Window length = 100. Preliminary leveling for channel 2 is Low window = 0, High window = 75 and Window length = 100. Preliminary leveling for channel 3 is Low window = 0, High window = 65 and Window length = 100. Preliminary leveling for channel 4 is Low window = 0, High window = 60 and Window length = 100.
- Grids raw, leveled and leveled lagged data using MinCurv or Kriging with a grid cell of 0.2 and a blanking distance of 0.6.
- Creates and displays preliminary contour maps of channels 2 with line paths.
- Selects the appropriate lines and asks for the combined preprocessed xyz file name to be exported with the correct export template. Exported as a Geosoft xyz file.
- Selects the appropriate lines and asks for the combined preprocessed repeat xyz file name to be exported with the correct export template. Exported as a Geosoft xyz file.

To finish the preprocessing, the following steps are to be taken:

- ◆ Add appropriate culture files to the preliminary maps and any GIS/CADD information.
- ◆ Create Geosoft maps and pdf files of the preliminary repeat profiles.
- ◆ Create Geosoft maps, pdf files and Geosoft xyz files of the QC tests.
- ◆ Put header information on all Geosoft xyz files.
- ◆ Fill out the Database.

Step 3) QC of the preprocessing. The QC criteria are as follows:

- ◆ Check Location & Coverage
- ◆ Check grid block name & corresponding grid cells
- ◆ Check that the appropriate file names are listed in the correct area in the database
- ◆ Check header information on the xyz files.
- ◆ Fill out QC of the preprocessing in the database
- ◆ Create a DGM Raw Data Delivery Report
- ◆ Upload preprocessing xyz file & Raw Data Delivery Report to CH2M HILL’s ftp site.

Step 4) Final processing stage. The final processor opens the Geosoft project created in Step 2 and performs the following:

- ◆ Refines the leveling in channel 2. A larger or smaller window length if needed i.e. a larger window length may be needed over very high response features. Manual leveling if needed.
- ◆ Refine lag/latency of the data if needed
- ◆ Add filters to the data if needed. Some filters you would expect to see are non-linear, low pass & high pass.

- ◆ Grid the data with MinCurv or Kriging. The parameters for both are a grid cell of 0.2 & a blanking distance of 0.6. Kriging better defines high response anomalies. MinCurv on the other hand will usually create false anomalies between lines near high response anomalies.
- ◆ Select anomalies in Geosoft's UX-Detect Module by using either "Pick Peaks Along Profile" or "Blakely Test"

Pick Peaks Along Profile

Blakely Test

- ◆ Refine target selection. Check validity and position. Targets found to be invalid or incorrectly located are adjusted or removed. Additionally, anomalies not selected by UX-Detect, yet deemed to represent a potential UXO target, are being manually selected.
- ◆ Export out grid block processed Geosoft xyz file. Add header information.
- ◆ Split grid block and target Geosoft databases into their cells.
- ◆ Re-sort the target database in descending order by amplitude. Export in a Access Database format and a Geosoft xyz file with header information.
- ◆ Create and display a colored contour Geosoft map of the grid cell with the following; title block, color scale, index map, legend, target locations & target numbers.
- ◆ Create a pdf of the colored contoured cell map.
- ◆ Create and display final repeat profiles with line path profiles.
- ◆ Create pdf's of the final repeat profiles.
- ◆ Fill out DGM processing form in the database
- ◆ Export out repeat processed Geosoft xyz file. Add header information.
- ◆ Create a final delivery package that includes the following:
 - All the Geosoft colored contour grid cell maps that are included in the grid block.
 - All the pdf's for the grid cell maps that are included in the grid block.
 - Repeat Geosoft maps with their pdf's. The repeat maps will go into the QC by block folder on the ftp site.
 - Processed Geosoft xyz files of the grid block & repeat data. The repeat xyz files will go into the QC by block folder on the ftp site.
 - Geosoft grd files for the grid cells.
 - Target lists in both xls & xyz formats.

Step 5) QC of the processed data. The QC criteria are as follows:

- ◆ Check to see if leveling and the lag is appropriate.
- ◆ Check anomaly selections on the maps, xyz file and xls file.
- ◆ Check maps title block, index map and legend (map & pdf).
- ◆ Check repeat data profiles (map & pdf).
- ◆ Check header information on xyz files.
- ◆ Check entries on the processing form in the database.

- ◆ Get QC data (maps, pdf's & xyz files) for the corresponding block. Add repeat data (maps, pdf's & xyz files). Zip it. Upload to CH2M HILL ftp site.
- ◆ Fill out QC form in the database then create a "Final Data Delivery Report". Add this report to the final delivery package listed above. Zip it. Upload to CH2M HILL ftp site.

7. Quality Control

The following quality control (QC) procedures are performed and documented during the data collection process and reviewed by a qualified geophysicist on a daily basis.

- ◆ Equipment Warm-up: For at least 15 minutes
- ◆ Record Sensor Positions: Positioning accuracy of the final processed data will be demonstrated by operating the equipment over one or more known points. The accuracy of the data positioning will be assessed by calculating the difference between a known location over which a positioning instrument is held and the displayed position. The sensor position test will be conducted at the beginning of the survey operation for each workday.
- ◆ Personnel Test: This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action and transmitted back to the processor, and analyzed and checked for spikes in the data that can possibly create false anomalies. The personnel test will be conducted at the beginning of the survey operation for each workday.
- ◆ Cable Shake Test: On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to vibrations in the cables. The response will be observed in the field for immediate corrective action, transmitted back to the processor, analyzed, and checked for spikes in the data that can possibly create false anomalies. The vibration test will be conducted at the beginning of the survey operation for each workday.
- ◆ Static Background and Static Spike: Static tests will be performed by positioning the survey equipment within or near the survey boundaries in an area free of metallic contacts and collecting data for a 3-minute period. During this time, the instrument will be held in a fixed position without a spike (known standard), with a spike and then without a spike. The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist. The static background and static spike test will be conducted at the beginning and end of each grid block.
- ◆ Repeat Data: This test is performed to verify repeatability of the data and will be performed after the initial survey over an area. At least 2% of the survey lines will be repeated.

Additionally, all work will follow the extensive QC program laid out in the workplan.