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Final

Site Specific Work Plan Addendum for Preliminary Assessment/Site Inspection Site UXO-11, B-5 Practice Hand Grenade Course (ASR #2.81)

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0014

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Acronyms and Abbreviations

AHA	Activity Hazard Analysis
ASR	Archives Search Report
bgs	below ground surface
BMP	best management practice
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain-of-custody
DCM	Division of Coastal Management
DFOW	definable feature of work
DGM	digital geophysical mapping
DPT	direct push technology
DU	decision unit
ESV	ecological screening values
ft	foot/feet
FTL	Field Team Leader
GIP	Geophysical Investigation Plan
GIS	geographical information system
GPO	Geophysical Prove-Out
HSP	Health and Safety Plan
IDW	investigation-derived waste
INRMP	Integrated Natural Resource Management Plan
IRP	Installation Restoration Program
m	meter
MC	munitions constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
MI	multi-increment
MRP	Munitions Response Program
MS	matrix spike
MSD	matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NCDENR	North Carolina Department of Environment and Natural Resources

NCGWQS	North Carolina groundwater quality standard
PA/SI	Preliminary Assessment/Site Inspection
PETN	Pentaerythritol tetranitrate
PM	Project Manager
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QCP	Quality Control Plan
RSL	regional screening level
SLERA	Screening Level Ecological Risk Assessment
SOP	standard operating procedure
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance
WP	Work Plan

SECTION 1

Introduction

1.1 Background and Project Objectives

The United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) are in the process of investigating closed ranges at Marine Corps Base (MCB) Camp Lejeune following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. Due to historical activities at Site Unexploded Ordnance (UXO)-11, B-5 Practice Hand Grenade Course, Archive Search Report (ASR) #2.81, a munitions response program (MRP) Preliminary Assessment/Site Inspection (PA/SI) is being conducted to accomplish the following objectives:

1. Identify historical activities at Site UXO-11 that may have resulted in environmental contamination by munitions and explosives of concern (MEC) or munitions constituents (MC).
2. Evaluate the presence and nature of MC contamination that may exist within the areas of investigation at Site UXO-11.
3. Conduct ecological and human health risk screenings using analytical data derived from the analysis of environmental media samples collected from the Site UXO-11 area of investigation.
4. Estimate the number and density of geophysical anomalies that may represent subsurface MEC.
5. Provide geophysical data for potential future MEC intrusive investigations.

1.2 Purpose of a Preliminary Assessment/Site Inspection

The purpose of a PA is to evaluate whether a site poses a potential risk to human health and the environment, and if further investigation may be warranted. PA investigations collect readily available information about a site and its surrounding area. The PA is designed to distinguish, based on limited data, between sites that present little or no risk to human health and the environment and sites that may pose a risk and require further investigation. The PA also identifies sites requiring assessment for possible emergency response actions.

SIs typically involve the collection of environmental and waste samples to determine whether hazardous substances are present at a site; to determine if these substances are being released to the environment; and to assess if the substances have reached nearby targets.

1.3 Work Plan Scope and Organization

The following PA/SI activities will be performed in accordance with methods and procedures detailed in the MCB Camp Lejeune MRP Master Project Plans (CH2M HILL, 2008) (referred to herein as the MRP Master Project Plans) to accomplish the objectives described in Section 1.1:

- Conduct a detailed historical archive search for documents pertaining to Site UXO-11 and prior uses of the property. Interview current Installation personnel, and attempt to identify and interview former military personnel, to obtain their accounts of activities that may have impacted the project area.
- Conduct a field investigation for MC contamination by installing temporary groundwater monitoring wells and sampling and analyzing groundwater, surface water, sediment, and soil.
- Perform DGM over approximately 10 percent of Site UXO-11.
- Prepare a PA/SI Report.

This Work Plan (WP) is divided into sections providing information on the detailed approach to conducting the PA/SI, including procedures to be employed during the execution of the project. Appendices to the WP provide supporting documentation that details specific procedures for the execution of the project.

This WP is organized as follows:

- **Section 1, Introduction,** provides general information about this WP, describes Site UXO-11, summarizes the site history, 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 PA/SI project.
- **Section 3, Field Investigation Plan,** identifies the technical approach, methods, and operational procedures that will be used to execute field investigation activities, including mobilization and demobilization, land surveying, temporary well installation, sampling of environmental media, and DGM.
- **Section 4, Quality Control Plan (QCP),** provides details on the approach, methods, and operational procedures to be employed for quality control (QC) of the PA/SI at Site UXO-11.
- **Section 5, 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-11.
- **Section 6, References,** lists the references cited in the preceding sections.
- **Appendix A, Archival Records Search Report,** presents the results of the records search and personnel interviews conducted to identify historical activities that may have resulted in environmental contamination of the project area.

- **Appendix B, Geophysical Prove-Out (GPO) Plan**, details the activities to be performed for validating DGM systems to be utilized at the site.
- **Appendix C, Geophysical Investigation Plan (GIP)**, details the approach, methods, and operational procedures that will be used in performing geophysical investigations at the site.
- **Appendix D, Health and Safety Plan (HSP),** provides an interface with CH2M HILL's overall health and safety program and with the MCB Camp Lejeune Master Health and Safety Plan (CH2M HILL, 2005). The 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.

1.4 Site Location and Description

Site UXO-11, also referred to in the *Range Identification and Preliminary Range Assessment* (USACE, 2001) as ASR #2.81, is approximately two acres in size. Site UXO-11 is located north of Sixth Street and east of Seventh Street at the Marine Corps Air Station New River (**Figure 1-1**). Based on review of publicly available aerial photographs and site reconnaissance, Site UXO-11 is primarily free of dense vegetation, and based on current aerial photography, appears to be covered by grass with no current use. There is a small drainage channel on the southeast corner of the Site and several other drainage channels surrounding the Site. The Preliminary Range Assessment states that the types of munitions used at the range are unknown but it is assumed that practice hand grenades were used based on the name of the site.

1.5 Site History

CH2M HILL conducted a detailed investigative review of existing information relating to Site UXO-11 and interviewed site personnel in August 2008 with an emphasis on obtaining information that might indicate historical activities resulting in environmental contamination of the project area. Information obtained during this effort is summarized in the Archival Records Search Report presented in **Appendix A**.

The earliest information obtained for Site UXO-11 is displayed on existing conditions maps from 1947 and 1953. These conditions map feature a mockup structure (Building 507), presumably used for training exercises, in the area designated as Site UXO-11 (Figure 2-3 of **Appendix A**). This building is also seen on aerial photographs from 1946, 1948, and 1951. Building 507 does not appear on any maps after 1953. All aerial photographs obtained by CH2M HILL, (Figures 2-4, 2-5 and Attachment 2 of **Appendix A**), show the area designated as Site UXO-11 is clear of vegetation. Site UXO-11 first appeared as a practice hand grenade course on the June 30, 1954 range overlay map, Plate 8 in the *Range Identification and Preliminary Range Assessment* (USACE, 2000; Figure 2-2 of **Appendix A**). This document also references a map from September 1, 1953 (not provided), and states that while the range appeared on the 1954 range overlay map, Site UXO-11 was in use only during 1953. CH2M HILL personnel have found no reference to this area being used as a practice hand grenade range other than this document.

1.6 Climate

The climate in the MCB Camp Lejeune area is discussed in Section 1.4 of the MRP Master Project Plans.

1.7 Geology and Hydrogeology

The regional geology and hydrogeology at MCB Camp Lejeune is discussed in Section 1.6 and 1.7 of the MRP Master Project Plans. Site-specific geologic and hydrogeologic data is not available for this site, but will be collected during this phase of investigation and presented in the PA/SI Report. Based on previous hydrogeologic investigations conducted in the general vicinity of Site UXO-11, groundwater is likely to be encountered at depth of approximately 5 to 10 feet below ground surface (ft bgs). It is anticipated that the subsurface soils encountered during the PA/SI field activities will consist of silty sands interbedded with sandy clay lenses of varying thicknesses.

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Legend

Site UXO-11 Boundary

Installation Boundary

N

0 100 200 400 Feet

1 inch equals 200 feet

Figure 1-1
Site UXO-11
Site Location Map
MCB Camp Lejeune
North Carolina

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SECTION 2

Technical Management Plan

2.1 Project Personnel, Organization, and Schedule

2.1.1 Project Organization

The key organizations involved in this project are NAVFAC, the North Carolina Department of Environment and Natural Resources (NCDENR), the United States Environmental Protection Agency (USEPA) and CH2M HILL, Inc. 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 will issue subcontracts for MEC support, utility locating, DGM, land surveying, direct push technology (DPT) soil sampling and temporary well installation, laboratory analysis, and data validation.

2.1.2 Project Personnel

The reporting relationship between key project personnel and the roles and responsibilities of key personnel are discussed in Section 2.4 of the MRP Master Project Plans. Contact information for key project personnel is indicated in **Table 2-1**. The project team organizational structure is presented on **Figure 2-1**.

2.1.3 Project Schedule

A detailed project schedule, including key milestones, is provided in **Figure 2-2**.

2.2 Technical Approach

2.2.1 Task 1—Project Planning

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

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

Three versions of the WP will be prepared. A draft WP will be submitted electronically for NAVFAC review and comment before being submitted for USEPA and NCDENR review, and a final WP will be submitted to address USEPA and NCDENR comments.

Subcontractor procurement is also included under this task. Anticipated subcontractor services include MEC support, utility locating, land surveying, DPT soil sampling and temporary well installation, laboratory analysis, and data validation.

2.2.2 Task 2—Data Evaluation/Archive Review

This task includes the archival records search. The archival records search was performed during preparation of this WP and the results are presented in **Appendix A**.

2.2.3 Task 3—Site Investigation

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

- Buried utility clearance
- Surveying
- DGM
- MEC support
- Field work support
- Temporary well installation and abandonment
- Environmental sampling

2.2.4 Task 4—Sample Management, Analysis, and Validation

This task includes management of environmental sample data from the time samples are collected until the validated data is received and incorporated into project reports. Details for this task are provided in Section 8.1 of the MRP Master Plans.

2.2.5 Task 5—Geographical Information System

All digital field data will be created using a software platform that will allow it to be loaded directly into the geographical information system (GIS). The main purpose of the GIS is to assemble all data required to associate the non-intrusive subsurface geophysics investigative data with its correct geographical location, the relational database, mapping, and remote sensing data. The GIS tools are used to manage the project, assemble data for the administrative record, and help determine areas requiring further investigation.

CH2M HILL will also input the collected mapping data into the existing ArcView GIS for MCB Camp Lejeune. This data includes ArcView project and shape files that best delineate the area on the basis of uses, site conditions, and other information gathered during the study.

2.2.6 Task 6—Reporting

A draft PA/SI Report will be prepared to document the findings of the field investigation. Prior to submittal of the draft report, a preliminary draft will be provided in electronic format to NAVFAC and MCB Camp Lejeune for review. The report will summarize all field activities, provide an evaluation of collected geophysical and environmental data, provide a summary of site history and results of previous investigations, and present human health and ecological risk screenings.

The preliminary ecological screening will include a brief description of the ecosystems potentially at risk, a figure depicting the ecosystems, the results of the comparison of maximum detected concentrations (of composite samples) to ecological screening values (ESVs) in tabular form and recommendations for further evaluation. This preliminary ecological screening will not constitute a full Screening Level Ecological Risk Assessment (SLERA).

The human health risk screening will be conducted using data collected during the investigation. The data will be screened using the following criteria:

- Soil and sediment data will be screened against the July 2008 United States Environmental Protection Agency (USEPA) screening criteria, the adjusted USEPA Residential and Industrial soil regional screening levels (RSLs) (USEPA, 2008), and the North Carolina (NC) soil screening levels (SSLs) (NCDENR, 2005).
- Groundwater data will be screened against USEPA Adjusted Tap Water RSLs, Federal Drinking Water Standards Maximum Contaminant Levels (MCLs) and NC groundwater quality standards (NCGWQS) (NCDENR, 2006).
- Surface water will be screened against the NC surface water standards (the most conservative values from the NC2B-SW-Human Health and Water supply criteria (NCDENR, 2007)), the USEPA Tap Water RSLs (USEPA, 2008), and the National Recommended Water Quality Criteria (organisms and water + organisms criteria) (USEPA, 2006).

The soil and groundwater data will also be compared to the MCB Camp Lejeune background soil and groundwater data from the *Final Base Background Soil Study Report* (Baker, 2001) and the *Draft Base Background Groundwater Study Report* (Baker, 2002). The background values used will be two times the average site background concentration.

TABLE 2-1
Project Personnel Contact Information
Site-Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
Jacksonville, North Carolina

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Doug Dronfield Program Manager	CH2M HILL 15010 Conference Center Drive Suite 200 Chantilly, VA 20151	(703) 376-5090 (office) 703-376-5010 (fax) Doug.Dronfield@ch2m.com
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Matt Louth Activity Manager	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-518-9666 (office) 757-460-4592 (fax) Matt.Louth@ch2m.com
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Michael Goldman, C.I.H. Program H&S Manager	CH2M HILL 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	770-604-9095 (office) 770-604-9183 (fax) Michael.Goldman@ch2m.com
Ben Redmond Munitions Response Market Segment Director	CH2M HILL 2035 Lakeside Centre Way Suite 200 Knoxville, TN 37922	865-560-2801 (office) 865-560-2802 (fax) bredmond@ch2m.com
Tim Garretson MEC Integrator/Senior MEC Technical Consultant	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-8311 (office) 757-460-4592 (fax) timothy.garretson@ch2m.com
Dan Young, CSP, CSRP Corporate MEC H&S Manager	CH2M HILL 10687 Aloe Lane Lillian, AL 36549	251-962-2963 (home office) 251-752-0148 (cell) Dan.Young@ch2m.com
Tamir Klaff Program Geophysicist	CH2M HILL 490 Marshall Dr Leesburg, VA 20176	703-669-9611 (office) 202-415-9472 (cell) 703-471-1508 (fax) Tamir.Klaff@ch2m.com
TBD Field Team Leader	CH2M HILL	

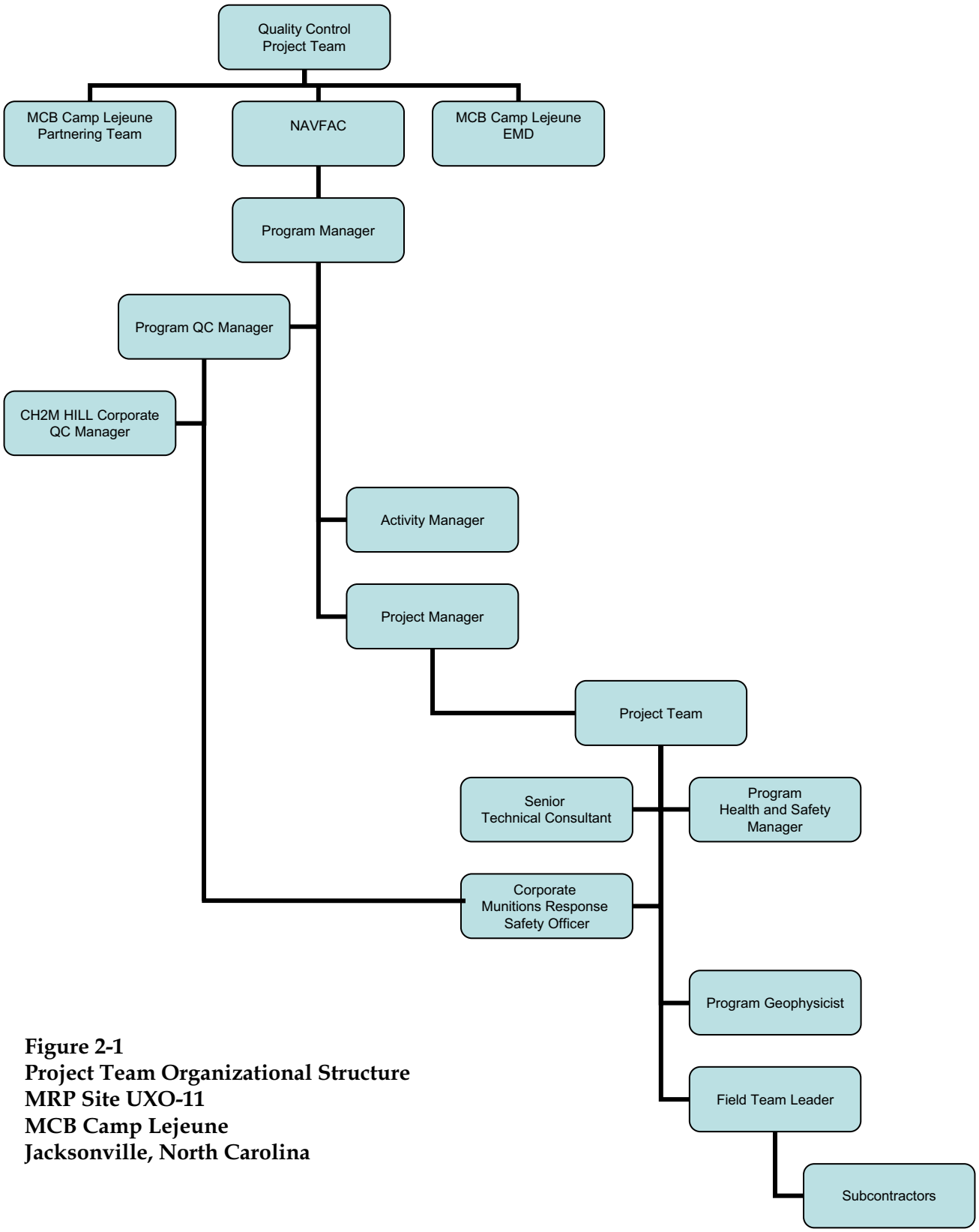
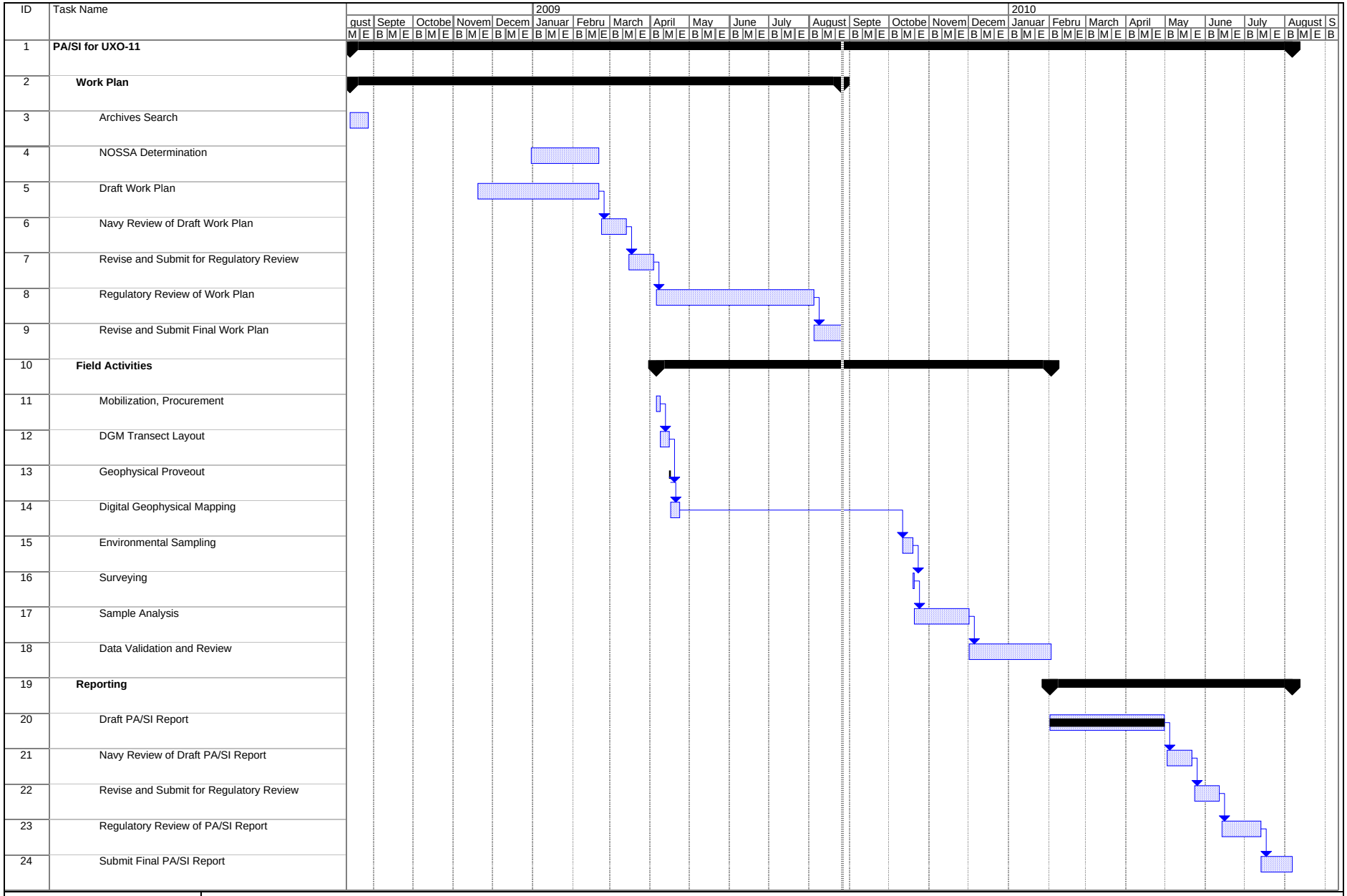


Figure 2-1
Project Team Organizational Structure
MRP Site UXO-11
MCB Camp Lejeune
Jacksonville, North Carolina



Project: Figure_2-2_Schedule
Date: Wed 8/26/09

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Figure 2-2
Project Schedule
Site UXO-11 B-5 Practice Hand Grenade Course
MCB Camp Lejeune, North Carolina

SECTION 3

Field Investigation Plan

3.1 Overall Approach

The objectives for this field investigation are to:

- Identify the presence and nature of MC contamination that may exist within the area of investigation.
- Evaluate the nature, number, and density of geophysical anomalies that could potentially represent subsurface MEC within the area of investigation.
- Provide geophysical data for potential future MEC intrusive investigations.

The field investigation will accomplish the above objectives through the following activities, which will be conducted in accordance with CH2M HILL Standard Operating Procedures (SOPs) and the MRP Master Project Plans:

- Perform DGM on approximately 10% of the area if investigation.
- Collect twelve surface soil samples from four decision units (DUs) using the *Systematic Random Multi-Increment Sampling* SOP as detailed in Appendix C of the MRP Master Project Plans.
- Collect subsurface soil samples from five locations using direct push technology (DPT).
- Collect one surface water sample and one sediment samples if free standing surface water is present.
- Install five temporary groundwater monitoring wells within the surficial aquifer using DPT, and collect groundwater samples.

The field investigation activities are detailed below and reference the MRP Master Project Plans throughout.

3.2 Site Preparation and Restoration

The following subsections describe the procedures associated with site preparation, mobilization of personnel and equipment, preparation for intrusive environmental and investigation activities.

3.2.1 Mobilization

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

General Activities

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

Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted. This meeting will include a review of this WP and review and acknowledgment of 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 Utility Clearance

Prior to initiation of intrusive sampling activities, all buried utilities will be identified by a subcontracted utility locator.

3.2.3 Land Surveying

Land surveying services will be conducted in accordance with Section 7.4 of the MRP Master Project Plans. MEC anomaly avoidance will be practiced as described in Section 2.2 of the HSP (**Appendix D**). The surveying at Site UXO-11 will consist of two phases:

- **Phase 1** will consist of a site boundary survey, DGM area layout, and DU layout of Site UXO-11. The site boundary survey will delineate the extent of the area of Site UXO-11 (**Figure 1-1**), while the DGM area layout will delineate the extent of the area that will be subjected to the DGM effort (Figure C-1 of **Appendix C**). The DU layout survey will identify the boundary of each DU shown on **Figure 3-1.**
- **Phase 2** of the land surveying will occur after environmental sampling activities have concluded and will entail surveying of the coordinates and elevations of temporary monitoring wells.

3.2.4 Vegetation Clearing

Vegetation clearing is not expected to be necessary at Site UXO-11 because the site is predominantly landscaped grass. If vegetation clearing activities are warranted, federally

listed plant species will be identified and left in place in accordance with the Environmental Protection Plan (refer to Section 5).

3.2.5 Site Restoration and Demobilization

Site Restoration

Restoration of the site to an appropriate level (e.g., repair of deep ruts) will be verified by the CH2M HILL Field Team Leader (FTL). MEC anomaly avoidance will be practiced as described in Section 2.2 of the HSP (**Appendix D**).

Demobilization

Full demobilization will occur when the project is completed and appropriate quality assurance (QA)/QC checks have been performed. Personnel no longer needed during the course of field operations may be demobilized prior to the final project completion date. The following will occur prior to demobilization:

- Chain-of-custody (COC) records will be reviewed to ensure that all samples were collected as planned and submitted for appropriate analyses.
- Site restoration to an appropriate level will be verified.
- All equipment will be inspected, packaged, and shipped to the appropriate location.

3.3 Geophysical Prove-Out Plan

The GPO Plan (**Appendix B**) provides details of the equipment, approach, methods, operational procedures and quality control to be used in performing the GPO at Site UXO-11.

3.4 Geophysical Investigation Plan

DGM will be conducted over approximately 10 percent of the area of investigation (approximately 0.3 acres) using single-coil manually-towed methods. DGM surveys will be conducted along regularly-spaced transects (approx. 2,302 ft) across the site at approximately 10-meter (m) intervals. The locations and actual acreages surveyed will be based on field conditions, including the presence of utilities, buildings, fences, and other cultural features that may interfere with the collection of DGM data (Figure C-1 of **Appendix C**). MEC anomaly avoidance will be practiced as described in Section 2.2 of the HSP (**Appendix D**).

The GIP provided in **Appendix C** provides details of the equipment, approach, methods, operational procedures and QC to be used in performing the geophysical investigations at Site UXO-11.

3.5 Geospatial Information and Electronic Submittals

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

3.6 Field Sampling Plan

3.6.1 Field Operations

In order to identify the presence and nature of MC contamination that may exist in the project area, soil, sediment, surface water and groundwater will be investigated. Subsurface soil samples and shallow groundwater samples will be collected using DPT equipment. QA/QC samples will be collected in accordance with Section 3.6.2. Due to the lack of historical information that would suggest the likely presence of MEC and associated MC to be present in specific areas, the environmental sampling locations are distributed across the site (as conditions permit). If geophysical anomalies indicative of potential subsurface MEC are identified during the DGM surveys, the subsurface soil and groundwater sampling locations may be altered to be within the vicinity of these anomalies.

Surface Soil Multi-increment Sampling

Three composite surface soil samples will be collected from each of the four DUs (MR11-DU01-SS01-09B through MR11-DU01-SS03-09B, MR11-DU02-SS01-09B through MR11-DU02-SS03-09B, MR11-DU03-SS01-09B through MR11-DU03-SS03-09B, and MR11-DU04-SS01-09B through MR11-DU04-SS03-09B), shown on **Figure 3-1,** for a total of twelve composite surface soil samples**.** MEC anomaly avoidance will be practiced as described in Section 2.2 of the HSP (**Appendix D**). The size of each DU is approximately 190 ft x 120 ft. The soil samples will be collected using the *Systematic Random Multi-Increment Sampling* SOP in Appendix C of the MRP Master Project Plans. The samples will be collected from 0 to 2 inches bgs with a minimum of 6.5 pounds of soil collected.

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

- Explosives residues (SW-846 USEPA Method 8330)
- Pentaerythritol tetranitrate (PETN) (SW-846 USEPA Method 8330)
- Nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- Total metals (SW-846 USEPA Method 6010B)

Subsurface Soil Sampling

A 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. A total of five subsurface soil samples (MR11-IS01-09B through MR11–IS05-09B) will be collected from just above the water table at the locations indicated in **Figure 3-2**. However, if a hot spot in the soil column is identified by a flame ionization detector, the sample will be taken from that interval rather than from above the water table.

MEC anomaly avoidance will be practiced during DPT subsurface soil sampling as described in Section 2.2 of the HSP (**Appendix D**). At the start of each borehole, a UXO technician will hand auger to a depth of five ft bgs checking the borehole with a down-hole magnetometer at one ft increments.

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

- Explosives residues (SW-846 USEPA Method 8330)
- PETN (SW-846 USEPA Method 8330)
- Nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- Total metals (SW-846 USEPA Method 6010B)

Sediment Sampling

If free-standing surface water is present, two sediment samples (MR11-SD01-09B through MR11-SD02-09B) will be collected according to the *Sediment Sampling* SOP located in Appendix C of the MRP Master Project Plans. MEC anomaly avoidance will be practiced as described in Section 2.2 of the HSP (**Appendix D**). The sediment sample locations are indicated on **Figure 3-3**. Sediment samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (SW-846 USEPA Method 8330)
- PETN (SW-846 USEPA Method 8330)
- Nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- Total metals (SW-846 USEPA Method 6010B)

Surface Water Sampling

If surface water is present during the field activities, two samples (MR11-SW01-09B and MR11-SW02-09B) will be collected in accordance with the *Surface Water Sampling* SOP located in Appendix C of the MRP Master Project Plans. MEC anomaly avoidance will be practiced as described in Section 2.2 of the HSP (**Appendix D**). The surface water sample locations are shown on **Figure 3-3**. The samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**)

- Explosives residues (SW-846 USEPA Method 8330)
- PETN (SW-846 USEPA Method 8330)
- Nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- Total and dissolved metals (SW-846 USEPA Method 6010B)

Temporary Well Installation and Sampling

A total of five, one-inch diameter, temporary groundwater monitoring wells (MR11-TW01 through MR11–TW05) will be installed using DPT equipment and will be co-located with the subsurface soil samples. The wells will be constructed within the surficial aquifer, and screened to bracket the water table. The well construction activities will be conducted in accordance with the *Temporary Well Installation* SOP in Appendix C of the MRP Master Project Plans. Proposed temporary monitoring well locations are presented on **Figure 3-2**. Samples will be collected near the water table.

MEC anomaly avoidance will be practiced during DPT temporary well installation as described in Section 2.2 of the HSP (**Appendix D**). At the start of each borehole, a UXO technician will hand auger to five ft bgs checking the bore hole with a down-hole magnetometer at one ft increments.

Following installation and development of the temporary wells, groundwater samples will be collected from each temporary well using low-flow sampling methodology in accordance with the *Low-Flow Groundwater Sampling from Monitoring Wells* SOP in Appendix C of the MRP Master Project Plans.

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

- Explosives residues (SW-846 USEPA Method 8330)
- PETN (SW-846 USEPA Method 8330)
- Nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- Total and dissolved metals (SW-846 USEPA Method 6010B)

Following sampling and surveying, all temporary wells will be removed from boreholes and abandoned by the licensed drilling subcontractor in accordance with NC Well Construction Standards. Boreholes within asphalt or concrete slab will be patched at the surface with a similar material.

A summary of the sampling program for PA/SI activities at the Site UXO-11 is presented in **Table 3-1**.

3.6.2 Analytical Requirements and Sample Handling

Sample Preservation and Handling

Sample preservation occurs in the field immediately after collection. The laboratory supplied sample containers will contain the appropriate preservative. This will protect field personnel from transporting, handling, and measuring concentrated acids and bases. QA/QC samples, with the exception of trip blanks, will be collected in the same containers with preservatives as the field samples. The preservative and holding time requirements for analysis are listed 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, 2008). Field QC samples (including field blanks, equipment blanks, duplicate samples, and matrix spike/matrix spike duplicate [MS/MSD] 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

The anticipated number of field samples and associated QA/QC samples for this PA/SI at Site UXO-11 is listed in **Table 3-4**.

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/external data users. The tracking program is used to produce sample labels and COC forms, and to manage sampling data entry, such as station locations and field measurements. The sample identification method used depends on the type of sample collected and sample container.

Field analysis data will be recorded in field logbooks, along with sample identity information, while in the custody of the sampling team.

Sample container labels will be produced electronically or if they cannot be produced electronically, 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
- Sample matrix or matrix identifier
- Type of analyses to be conducted

Each analytical sample will be assigned a unique number of the following format similar to other sample numbers for MCB Camp Lejeune under the Installation Restoration Program (IRP):

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

An explanation of each of these identifiers is given below.

Site#: This investigation includes MRP Site UXO-11 under the Munitions Response Program. Therefore, the prefix "MR11" will be used

Media: TW = Groundwater from temporary wells
SS = Surface soil
IS= Subsurface soil
SD = Sediment

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

QA/QC: D = Duplicate sample (following sample type/number)
FB = Field blank
EB = Equipment blank
TB = Trip blank

All MS/MSD samples will be entered in the same line as the field sample on the COC. The total number of sample containers submitted will be entered on the COC and "MS/MSD" will be indicated in the comments section.

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

"09" = year 2009
"B" = sample collected in the second quarter

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, "MR11-TW01-09B" would mean the following:

MR11-TW01-09B	MRP Site UXO-11
MR11-TW01-09B	Groundwater sample from temporary well #1
MR11-TW01-09B	Samples collected in the second quarter 2009

"MR11-TB1-09B" would mean the following:

MR11-TB1-09B	MRP Site UXO-11
MR11-TB1-09B	Trip Blank #1
MR11-TB1-09B	Samples collected in the second quarter 2009

This sample designation format will be followed throughout the project. Any deviations to this format in response to field conditions are required to be documented.

Sample Packaging and Shipping

Samples will be tightly packed on ice in a cooler with bubble wrap packaging material. The samples will be either picked up at the site by the analytical laboratory or shipped to the laboratory via overnight courier. The FTL is responsible for completion of the following forms:

- Sample labels and COC seals.
- COC forms.
- Appropriate labels and forms required for shipment.

Sample custody will be maintained and documented at all times. COCs will begin with the collection of the samples in the field and will continue through the analysis of the sample at the analytical laboratory.

3.6.3 Investigation-Derived Waste Management

All investigation-derived waste (IDW) generated during the investigation will be managed in accordance with Section 10 of the MRP Master Project Plans. 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 D**. Due to 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.

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.

TABLE 3-1
Summary of Sampling Program
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
Jacksonville, North Carolina

Sample Media	Sample ID Number	Sample Depth/Location and Rationale	Analysis					
			Explosives Residues	Perchlorate	PETN	Nitroglycerine	Total Metals	Dissolved Metals
Multi-Increment Surface Soil	MR11-DU01-SS01 through MR11-DU01-SS03 MR11-DU02-SS01 through MR11-DU02-SS03 MR11-DU03-SS01 through MR11-DU03-SS03 MR11-DU04-SS01 through MR11-DU04-SS03	Collected from an interval of 0 - 2 inches bgs at each location shown on Figure 3-1. Will allow for characterization of MC and metals in surface soil across the site.	x	x	x	x	x	
Direct Push Soil	MR11-IS01-T-B[1] through MR11-IS05-T-B	Collected from a 2 ft interval just above the water table[2] at each location shown on Figure 3-2. Will allow for characterization of soil across site.	x	x	x	x	x	
Sediment	MR11-SD01 and MR11-SD02	Sediment samples will be collected approximately 0-2 inches into the surface water soil interface if free standing water is present at each location shown in Figure 3-3. Will allow for characterization of MC and metals in sediment at upgradient and downgradient locations.	x	x	x	x	x	
Surface Water	MR11-SW01 and MR11-SW02	Surface water sample will be collected at location by collecting sample directly from the surface water into sample containers at each location shown in Figure 3-3. Will allow for characterization of MC and metals in surface water at upgradient and downgradient locations.	x	x	x	x	x	x
Temporary Well Groundwater	MR11-TW01 through MR11-TW05	Samples will be collected 1-2 feet into the water table at each location shown in Figure 3-2. Will allow for characterization of MC and metals in groundwater across site, including upgradient and downgradient locations.	x	x	x	x	x	x

Notes and Abbreviations:
[1] "T-B" refers to the top depth and bottom depth of the sample interval
[2] If a hot spot in the soil column is identified by a flame ionization detector, sample will be taken at that interval
-PETN: Pentaerythritol tetranitrate
-VOCs = volatile organic compounds
-SVOCs = semi-volatile organic compounds

TABLE 3-2
Analyses, Bottleware, Preservation, and Holding Time Requirements
Site Specific Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
Jacksonville, North Carolina

Media	Analysis	Method	Container	Preservation & Storage	Holding Times
Soil/Sediment	Explosive Residues, including PETN and Nitroglycerin	SW-846 USEPA Method 8330/8332	1x4-oz glass jar	4ºC	14 days to extraction, 40 days from extraction to analysis
	Perchlorate	SW-846 USEPA Method 6850	1x8-oz bottle, Teflon cap	4ºC	28 days to extraction, 40 days from extraction to analysis
	Total Metals	SW-846 USEPA Method 6010B	1x4-oz bottle, Teflon cap	4ºC	6 months, Mercury: 28 days
Groundwater/ Surface Water	Explosive Residues, including PETN and Nitroglycerin	SW-846 USEPA Method 8330/8332	2x1-L amber jars	4ºC	7 days to extraction, 40 days from extraction to analysis
	Perchlorate	SW-846 USEPA Method 6850	1x1-L Poly bottle	4ºC	28 days to extraction, 40 days from extraction to analysis
	Total Metals	SW-846 USEPA Method 6010B	1x500 mL Poly bottle	HNO_3 to pH <2, cool to 4ºC	6 months, Mercury: 28 days
	Dissolved Metals	SW-846 USEPA Method 6010B	1x500 mL Poly bottle	4ºC	48 hours to filtration, hold time 6 months

Notes:

L = Liter; mL= milliliter, oz = ounce; HNO_3 = nitric acid, HCL= hydrochloric acid,

TABLE 3-3
Required QA/QC Samples
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
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
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
Jacksonville, North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Surface Soil Samples						
Explosives Residues, including PETN and Nitroglycerine	Solid	12	2	3	1	1
Perchlorate		12	2	3	1	1
Total Metals		12	2	3	1	1
DPT Subsurface Soil Samples						
Explosives Residues, including PETN and Nitroglycerine	Solid	5	1	1	1	1
Perchlorate		5	1	1	1	1
Total Metals		5	1	1	1	1
Temporary Well Groundwater Samples						
Explosives Residues, including PETN and Nitroglycerine	Aqueous	5	1	1	1	1
Perchlorate		5	1	1	1	1
Total Metals		5	1	1	1	1
Dissolved Metals		5	1	1	1	1
Sediment Samples						
Explosives Residues, including PETN and Nitroglycerine	Solid	2	1	1	1	1
Perchlorate		2	1	1	1	1
Total Metals		2	1	1	1	1

TABLE 3-4
Sample Collection Frequencies
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
Jacksonville, North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Surface Water Samples						
Explosives Residues, including PETN and Nitroglycerine	Aqueous	2	1	1	1	1
Perchlorate		2	1	1	1	1
Total Metals		2	1	1	1	1
Dissolved Metals		2	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

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Legend
- Site UXO-11 Boundary
- Proposed Decision Unit (120 ft x190 ft)
- Wetlands
- Streams

N

0 100 200 400 Feet

1 inch equals 200 feet

Figure 3-1
Proposed Surface Soil Sampling Locations
MRP Site UXO-11
MCB Camp Lejeune
North Carolina

CH2MHILL

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Legend

- Proposed Temporary Well/Subsurface Soil Sampling Locations
- Streams
- Site UXO-11 Boundary
- Wetlands

N

0 100 200 400 Feet

1 inch equals 200 feet

Figure 3-2
Proposed Subsurface Soil and Groundwater Sampling Locations
MRP Site UXO-11
MCB Camp Lejeune
North Carolina

CH2MHILL

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Legend

- Proposed Surface Water Sampling Locations
- Proposed Sediment Sampling Locations
- Site UXO-11 Boundary
- Wetlands
- Streams

N

0 100 200 400 Feet

1 inch = 200 feet

Figure 3-3
Proposed Sediment and Surface Water Sampling Locations
MRP Site UXO-11
MCB Camp Lejeune
North Carolina

CH2MHILL

SECTION 4

Quality Control Plan

All applicable work performed by CH2M HILL and its subcontractors at Site UXO-11 will be in accordance with the QCP in Section 8 of the MRP Master Project Plans. This QCP describes the QC approach and procedures for Site UXO-11 and references the MCB Camp Lejeune Master Quality Assurance Project Plan (CH2M HILL, 2005). The QCP is divided into two parts: Section 8.1 addresses environmental investigation activities and Section 8.2 addresses MEC avoidance, surveying, and DGM activities.

The specific QC audit procedures for the definable features of work (DFOW) to be employed at Site UXO-11, including the phase during which it is performed, the frequency of performance, the pass/fail criteria, and actions to taken if failure occurs, are presented in **Table 4-1**.

TABLE 4-1
Definable Features of Work Auditing Procedures
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
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 (Technical 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 Prove-out (GPO) Plan preparation and approval	Project Manager	Verify GPO Plan has been prepared and approved.	PP/IP	O	GPO 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)	Project 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)	Project Manager	Hold pre-mobilization meeting and Operational 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)	Project Manager	Verify surveyor qualifications.	PP/IP	O	Surveyor's qualifications are up to date and acceptable.	Ensure surveyor provides the qualifications prior to starting work or change surveyor.
Site preparation (Site Survey)	Project Manager	Verify surveyor licenses.	PP/IP	O	Surveyor's licenses are up to date and acceptable.	Ensure surveyor provides the licenses prior to starting work or change surveyor.
Site Preparation (Site Survey)	Project 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)	Project Manager	Verify site boundaries and transects/grids have been established.	PP/IP	O	Site boundaries and transects/grids have been established.	Do not proceed with dependent field activities until criterion is passed.
Site Preparation (Site Survey)	Project 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.
GPO Execution	Project Manager, Project Geophysicist	Verify data quality objectives (DQOs) established in GPO Plan have been accomplished.	PP/IP	O	DQOs identified in GPO Plan have been achieved	Continue with GPO until DQOs are achieved.

TABLE 4-1
Definable Features of Work Auditing Procedures
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
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
GPO Report	Project Manager, Project Geophysicist	Verify recommendations in GPO Report for Digital Geophysical Mapping (DGM) system and associated DQOs have been approved.	PP/IP	O	Recommendations for DGM equipment and associated DQOs are approved by USACE.	Do not proceed with DGM field activities until recommendations of GPO Report are approved.
DGM Survey	Project Geophysicist	Verify DGM Survey conducted IAW Geophysical Investigation Plan (Appendix B) and DGM SOPs: EM61-MK2 Metal Detection Munition Response Surveys Geophysical Surveying with EM61-MK2 Configuration and Operation of the GPS Base-Station System Configuration and Operation of the GPS Rover System Field Methodology and Survey Setup	IP/FP	O/D	DGM Survey conducted IAW Geophysical Investigation Plan (Appendix B) and DGM SOPs.	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 QCP and DGM SOPs	FP	E	QC tests must pass IAW 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.
DGM Survey	Project Geophysicist	Confirm that DGM survey DQOs established during GPO 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 QCP and SOPs: EM61-MK2 Data Processing and Database Management Uploading and Downloading Data to the FTP Site	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.
Demobilization	Project 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						
Site Specific Final Report preparation	Project Manager, Project Geophysicist	Verify geophysical mapping and investigation activities performed are accurate and complete.	FP	O	Geophysical mapping and investigation activities performed are accurate and complete.	Ensure geophysical mapping and investigation activities performed are accurate and complete
Final Report	Project Manager	Verify Final Report has been approved.	IP	O	Final Report has been approved.	Take appropriate actions to ensure Report gets approved
Archiving	GIS Manager	Verify data back-up systems are in place.	IP	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.	IP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	IP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
IAW = in accordance with

QC Phase	Frequency
PP = Preparatory Phase	O = Once
IP = Initial Phase	D = Daily
FP = Follow-up Phase	W = Weekly
	E = Each occurrence

[1] The responsible person (if other than the MEC QCS) is the individual with whom the MEC QCS 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.

SECTION 5

Environmental Protection Plan

5.1 Regional Ecological Summary

A summary of the regional ecology is provided in Section 9.1 of the MRP Master Project Plans.

5.2 Endangered/Threatened Species within the Project Site

Many protected species have been sited near and on MCB Camp Lejeune 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 (USMC, 2006). Species that could occur in or adjacent to MCB Camp Lejeune that are listed as threatened, endangered, or of special concern by the United States Fish and Wildlife Service (USFWS) under the Endangered Species Act of 1973, as amended are identified in **Table 5-1**.

MCB Camp Lejeune has active programs in place to protect the three federally protected avian species (American bald eagle, piping plover, and red-cockaded woodpecker) known to occur on the base. Site UXO-10 is not within the vicinity of any of these management areas.

MCB Camp Lejeune worked with the USFWS to establish guidelines for military training in red-cockaded woodpecker cluster sites. Additionally, through Section 7 consultation, the Base implemented measures to properly manage the red-cockaded woodpecker habitats located on base (loblolly pine *[Pinus taeda]* and longleaf *[Pinus palustris]* and pond pine *[Pinus serotina]* areas). These guidelines and measures are presented in the 2007-2011 Integrated Natural Resource Management Plan (INRMP) (USMC, 2006). MCB Camp Lejeune's red-cockaded woodpecker population has been continually monitored since 1985. Reproductive success, population demographics, and habitat use are recorded annually to help successfully manage the population while facilitating the military use of the land. Site UXO-11 is not within the vicinity of any of the red-cockaded woodpecker management areas.

The bald eagle was removed from the USFWS endangered/threatened species list in August 2007 and is currently protected under the Federal Migratory Bird Treaty Act (MBTA) (16USC703712, as amended 1918) which protects all migratory birds, the Bald and Golden Eagle Protection Act (16USC668, amended 1962), and the National Bald Eagle Management Guidelines (USFWS, 2007). A bald eagle's nest is documented on MCB Camp Lejeune. The nest is located at the junction of Sneads Creek and the New River. Three protective buffers that restrict ground and air-use activities have been established at approximately 750 ft; 1,000 ft; and 1,500 ft from the nest site. Site UXO-11 is not located within any of these buffer zones. Non-nesting eagles are not expected to use the Site UXO-11 area for foraging habitat.

The proposed work is not expected to impact any special habitat where eagles are concentrated.

Suitable habitat for the piping plover does not exist at Site UXO-11. The Atlantic Coast populations of piping plovers tend to prefer sandy beaches close to the primary dunes of barrier islands and coastlines. They prefer sparsely vegetated open sand, gravel, or cobble for nesting sites and forage along the rack line where the tide washes up onto the beach. As such, it is unlikely that piping plovers are located on or adjacent to Site UXO-11 the site does not contain suitable habitat and is not located along the Atlantic Ocean coastline. Piping plovers are not expected to be present at the site for any reason (e.g., feeding, breeding, nesting).

Site UXO-11 is approximately 15 miles from the Atlantic Coast. The federally protected marine species (e.g., green sea turtle, leatherback sea turtle, loggerhead sea turtle, West Indian manatee) listed in **Table 5-1** are unlikely to inhabit the area of Site UXO-11. Site UXO-11 supports a moderate level of human activity. Additionally, site activities in support of this WP are limited to a small number of soil and groundwater samples and geophysical surveying. PA/SI activities are not likely to impact these species.

The American alligator is listed on the Federal Threatened and Endangered species list due to its similarity of appearance to the American crocodile. There is no potentially suitable habitat for the American alligator in the Site UXO-11 investigation area and the species would not occur in the project area. No impact to this species is expected.

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 Camp Lejeune 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-11.

Seabeach amaranth is an annual plant 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 thus is not located on or adjacent to Site UXO-11.

The eastern cougar is the only federally listed mammal species that could occur in Onslow County. The population extent of the eastern cougar is located in south Florida and the species has not been observed in North Carolina in over 50 years. Suitable habitat for the eastern cougar does not exist at Site UXO-11 and the level of human activity would tend to make the species avoid the area. Because the eastern cougar has not been verified in the area in more than 50 years and there is human activity in proximity to Site UXO-11, it is very unlikely that the eastern cougar would occur on the site and no impacts are expected.

Environmental reviews completed in preparation for the INRMP determined that the remaining species listed in **Table 5-1** 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-11. Project design features have been developed to prevent impacts to listed species.

5.3 Wetlands within the Project Site

No wetlands are known to exist at Site UXO-11. A jurisdictional wetlands area is located approximately 375 ft south of Site UXO-11. All jurisdictional wetland areas are located outside of the area of investigation and no work will be performed in wetland areas. No significant soil disturbance is anticipated from planned site work as described in this WP. No wetlands on or downstream of Site UXO-11 are expected to be impacted by the project.

Due to the size of the area of investigation, the site is below the threshold for requiring a storm water pollution prevention plan. However if the potential for runoff to jurisdictional wetlands exists, appropriate protection measures will be put in place (Section 5.5).

5.4 Cultural and Archaeological Resources within the Project Site

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

5.5 Water Resources within the Project Site

A small surface water drainage ditch is located in the southeastern boundary of the site (Figure 1-1). Surface water and sediment samples will be collected in the drainage if deemed necessary (Figure 3-3). No water resources are expected to be impacted by the project. Should clearing of vegetation be required in areas adjacent to a water body, appropriate silt barriers or other best management practices (BMP) will be put in place to prevent sediment from migrating to the water body.

5.6 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). Federal projects within a State's coastal zone are reviewed under the Coastal Zone Management Act, which requires that a proposed Federal action be consistent, to the maximum extent practicable, with the relevant enforceable policies of the State's coastal management program. North Carolina's coastal zone management program consists of, but is not limited to, the CAMA, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and the land use plan of the County and/or local municipality in which the proposed project is located.

The PA/SI at Site UXO-11 will include surface investigations and the collection of subsurface soil and groundwater samples using DPT. The U.S. Marine Corps is not required to apply for a CAMA permit for federal projects. No proposed project activities fall under the definition of "development" as defined by CAMA.

Further, as outlined in Subpart "C" of 15 Code of Federal Regulations (CFR) 930, the U.S. Marine Corps has determined that the proposed project would have no effects on any coastal use or resource. Therefore, a negative determination under §930.35 is not required and the U.S. Marine Corps will not coordinate with the North Carolina Division of Coastal Management (DCM) in advance of the proposed work.

Should it be determined by collection of new or additional information that development, as defined under CAMA, would occur under the proposed project further coordination with DCM would be initiated.

5.7 Vegetation to be removed within the Project Site

Vegetation removal is not anticipated in association with the field investigations described in this WP. Vegetation will be removed for geophysical transects and monitoring well installation if necessary based on field conditions. Only vegetation with less than 3 inches in diameter will be cut if required. Consultation with the base wildlife biologist confirms no threatened or endangered species have been located within the project area. Procedures in place will prevent excessive exposure of bare ground.

5.8 Existing Waste Disposal Sites within the Project Site

No waste disposal sites are present at Site UXO-11.

5.9 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. No permits are required for the proposed work.

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

During the proposed work, a general survey of the project area will be conducted by the field personnel to identify obvious environmental concerns. The Project Manager (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 any federally protected plant be identified within the project area, the specimens will be flagged for easy relocation and verification.

- Should any cultural or archaeological material or resource be discovered within the project area, a qualified archaeologist will be notified to provide guidance on performing further work in the area.
- The PM will seek the guidance of the qualified ecologist to determine appropriate mitigation measures in the event that the performed work activities impact an environmental resource.

TABLE 5-1
Species Potentially Occurring on or Adjacent to MCB Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS
Site Specific Work Plan Addendum for the Preliminary Assessment/Site Inspection, Site UXO-11, B-5 Practice Hand Grenade Course
MCB Camp Lejeune
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
Anguilla rostrata	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.
Chelonia mydas	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.
Caretta caretta	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.
Dermochelys coriacea	Leatherback sea turtle	E	An open ocean species, it sometimes moves into shallow bays, estuaries and even river mouths.
Trichechus manatus	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.
Alligator mississippiensis	American alligator	T(S/A)	Rivers, swamps, estuaries, lakes, and marshes
Charadrius melodus	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.
Aimophila aestivalis	Bachman's sparrow	FSC	Occurs only in pine forests of the southeastern U.S.
Haliaetus leucocephalus	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.
Laterallus jamaicensis	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.

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Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
Acipenser brevirostrum	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.
Rana capito capito	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.
Puma concolor couguar	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.
Passerina ciris ciris	Eastern painted bunting	FSC*	Found mainly in southern states and Mexico, where the brushy, weedy shrub-scrub habitat that this bird prefers abound
Ammodramus henslowii	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.
Ophisaurus mimicus	Mimic glass lizard	FSC	This species is found in the southeastern Coastal Plain. They are most common in pine flatwoods and open woodlands.
Picoides borealis	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 (Pinus palustris) 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.

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Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
Heterodon simus	Southern hognose snake	FSC	These snakes are found in sandy fields and woods of the Coastal Plain, particularly in the Sandhills region.
Agrotis buchholzi	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.
Atrytonopsis sp.	a skipper	FSC	One species, the dusteds are fairly rare at the coast but found throughout North Carolina (*A. hianna*). An assumption is made that the genius is generally defined.
Isoetes microvela	A quillwort	FSC	Quillworts are usually restricted to areas of clean water where other plants are absent. Occasionally, quilwort may grow partly or entirely out of the water.
Rhexia aristosa	Awned meadowbeauty	FSC	Found in a variety of wet habitats in the Coastal Plain from New Jersey to Alabama
Lobelia boykinii	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.
Solidago pulchra	Coastal goldenrod	FSC	Bogs, freshwater habitats, grasslands
Parnassia caroliniana	Carolina grass-of-parnassus	FSC	Bogs, freshwater habitats, grasslands
Trillium pusillum var. pusillum	Carolina trillium	FSC	Grows in alluvial woods, pocosin borders and savannahs
Asplenium heteroresiliens	Carolina (wagner) spleenwort	FSC	Rock outcrops
Rhynchospora pleiantha	Coastal beaksedge	FSC	Extremely rare, found at fewer than 25 sites throughout its North Carolina-to-Alabama range
Solidago villosicarpa	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.

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MCB Camp Lejeune
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
Thalictrum cooleyi	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.
Carex lutea	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.
Sagittaria weatherbiana	Grassleaf arrowhead	FSC	Found in shallow water of brackish swamps
Dichanthelium sp.	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.
Myriophyllum laxum	Loose watermilfoil	FSC	Riparian habitats
Calopogon multiflorus	Many-flower grass-pink	FSC	Grasslands, pinelands; typically in wet areas
Plantago sparsiflora	Pineland plantain	FSC	Savannahs, roadsides and ditches
Lindera melissifolia	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.
Litsea aestivalis	Pondspice	FSC	Freshwater habitats
Lysimachia asperulaefolia	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
Amaranthus pumilus	Seabeach amaranth	T	Occurs on barrier island beaches
Allium sp.	Savanna onion	FSC	Wet savannahs
Scleria sp.	Smooth-seeded hairy nutrush	FSC	Dry woods, pineland and savannahs (S. triglomerata)

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MCB Camp Lejeune
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
Rhynchospora decurrens	Swamp forest beakrush	FSC	Swamp forests, very rare
Solidago verna	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
Rhynchospora thornei	Thorne's beaksedge	FSC	Bogs, freshwater habitats, pinelands
Dionea muscipula	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.

SECTION 6

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Appendix A
Archival Records Search Report

Draft

Archival Records Search Report for the Preliminary Assessment/Site Inspection of Site UXO-11, B-5 Practice Hand Grenade Course (ASR #2.81)

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0014

March 2009

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

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

Prepared by

CH2MHILL

Raleigh, North Carolina

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Attachments

1 Resource Review Summary

2 Historical Aerial Photographs

Acronyms and Abbreviations

ASR	Archive Search Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTO	Contract Task Order
°F	degrees Fahrenheit
DGM	digital geophysical mapping
ft	feet/foot
HTW	hazardous and toxic waste
MC	munitions constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
MRP	Munitions Response Program
NARA	National Archives and Records Administration
NAVFAC	Naval Facilities Engineering Command
PA/SI	Preliminary Assessment/Site Inspection
U.S.	United States
UXO	unexploded ordnance
WW II	World War II

SECTION 1

Introduction, Purpose, and Scope

The United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) are in the process of investigating closed ranges at Marine Corps Base (MCB) Camp Lejeune following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. A munitions response program (MRP) Preliminary Assessment/Site Inspection (PA/SI) included under Contract Task Order (CTO)-0014 will be conducted at Site Unexploded Ordnance (UXO)-11, B-5 Practice Hand Grenade Course Archive Search Report (ASR) #2.81 in order to accomplish the following objectives:

- Identify historical activities at Site UXO-11 that may have resulted in environmental contamination with munitions and explosives of concern (MEC) or munitions constituents (MC).
- Evaluate the presence and nature of any MC contamination and/or hazardous and toxic waste (HTW) that may exist at Site UXO-11.
- Conduct ecological and human health risk screenings on analytical data collected at Site UXO-11.
- Estimate the number and density of geophysical anomalies that may represent subsurface MEC by conducting digital geophysical mapping (DGM) within representative portions of the site.

The results of the environmental investigation will determine if any impacts to soil and groundwater have occurred at Site UXO-11 due to past range activities. To support site investigation effort, this Archival Records Search Report has been prepared to provide a narrative of the historical activities at Site UXO-11 that may have resulted in environmental contamination with MEC.

Figure 1-1 shows the site in relation to the entire base.

The Archival Records Search Report is an investigative review of existing information about the site and its surrounding area, with an emphasis on obtaining information from personnel and historical resources that might indicate a potentially hazardous release to the environment. The scope of the report includes:

- A review of existing information about the site (including MCB Camp Lejeune maps, drawings, reports, and interviews with MCB Camp Lejeune personnel)
- Collection of additional information about the site

A complete listing of resources identified and investigated for this report is provided in **Attachment 1**. **Attachment 1** also includes details concerning the reviews of the historical information from the Alfred M. Gray Research Center at MCB Quantico, National Archives and Records Administration (NARA) map and text files, and MCB Camp Lejeune base files. **Attachment 2** contains photographs obtained during the research activities.

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Legend

Site UXO-11 Boundary

Installation Boundary

N

0 100 200 400 Feet

1 inch equals 200 feet

Figure 1-1
Site UXO-11
Site Location Map
MCB Camp Lejeune
North Carolina

CH2MHILL

SECTION 2

Site Information

2.1 Facility Information

MCB Camp Lejeune is located on the Atlantic coast in Jacksonville, North Carolina. The city of Jacksonville in Onslow County is the principal support community for the base. MCB Camp Lejeune occupies 153,000 acres including more than 450 miles of roads, approximately 6,800 buildings and facilities, and 14 miles of beach on the Atlantic Ocean for amphibious training. Approximately 14,000 acres of land have been developed for administrative, maintenance, logistics and personnel support facilities. Originally established in 1941, the base is home to several tenant commands including II Marine Expeditionary Force, 2nd Marine Division, and 2nd Marine Logistics Group, two Navy commands, one Coast Guard command, and several Marine Corps formal schools. MCB Camp Lejeune supports a total population of approximately 150,000 people, including active duty military and dependants, retirees, and civilian employees (Global Security, 2008).

2.2 Ownership and Operational History

2.2.1 Camp Lejeune Ownership History

The history of the land now occupied by MCB Camp Lejeune is documented primarily through land records and maps. Following the start of World War II (WW II), the War Department began purchasing tracts of land in 1941 from local residents to meet the need for an East Coast amphibious training facility. Prior to occupation by the Marine Corps, the land had been occupied by white and African-American communities and farms since the Colonial era. The land contained plantation houses, cabins, farm buildings, tobacco barns, stores, and various cemeteries (Global Security, 2008).

The initial land transferred to the government was acquired in 14 different transactions between April and October 1941 and totaled 173.8 square miles or 111,155 acres, of which there were 85,155 land acres and about 26,000 acres under water (Loftfield, 1981; Louis Berger Group, 2002). The individual tracts of land were grouped into various ”areas” for consolidation.

2.2.2 Site UXO-11 Practice Hand Grenade Course ASR #2.81

Site UXO-11 is approximately two acres in size and is identified in the *Range Identification and Preliminary Range Assessment* as ASR #2.81. The site is located just north of 6th Street and east of 7th Street at the New River Air Station. Presently, Site UXO-11 is primarily free of dense vegetation (**Figure 1-1**).

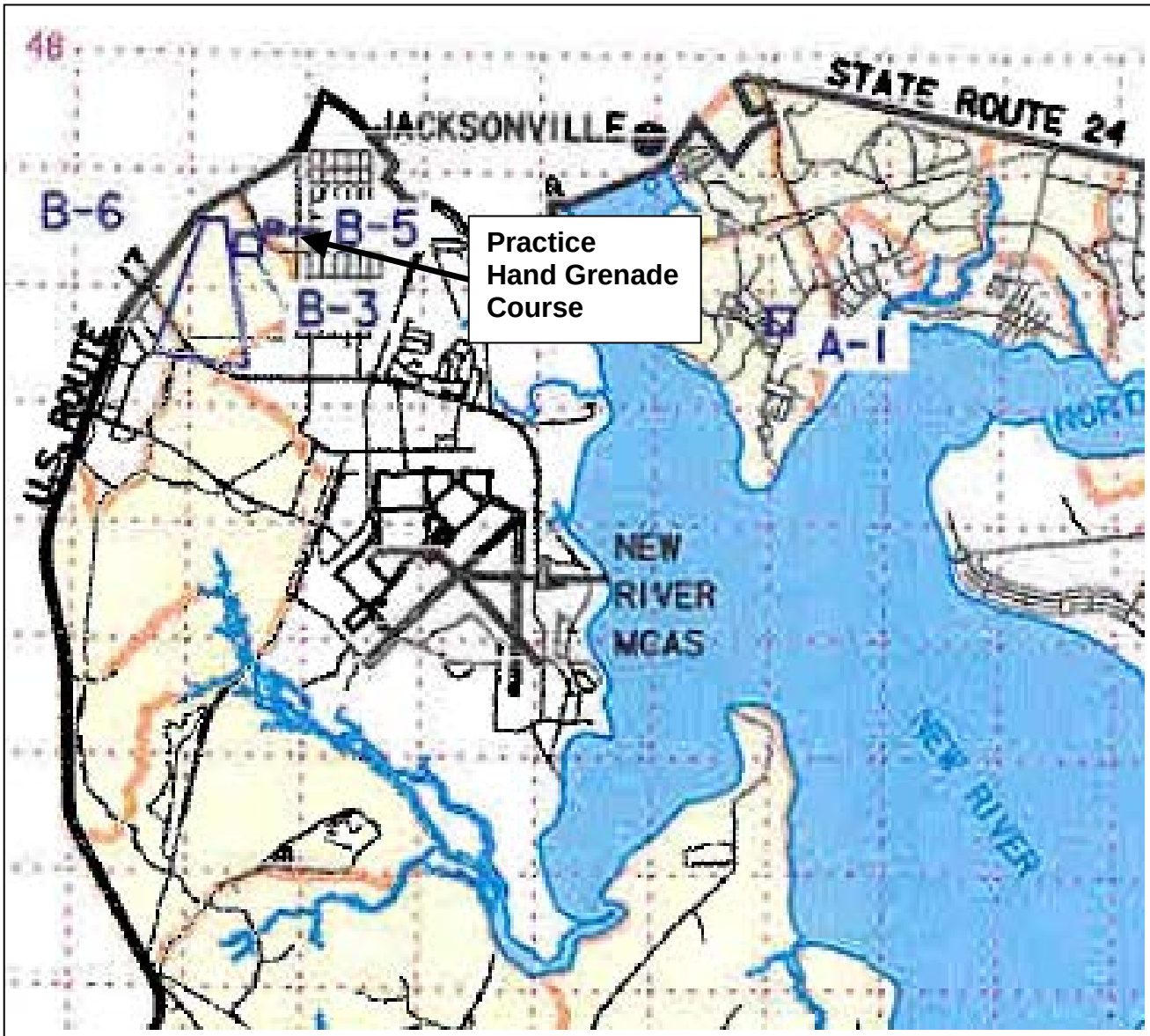
The B-5 Practice Hand Grenade Course appears on the June 30, 1954 range overlay map, Plate 8 in the *Range Identification and Preliminary Range Assessment* (USACE, 2000; **Figure 2-1**) and is located at 34°44’08” N and 77°27’38” W or military grid 7472 4653. This document

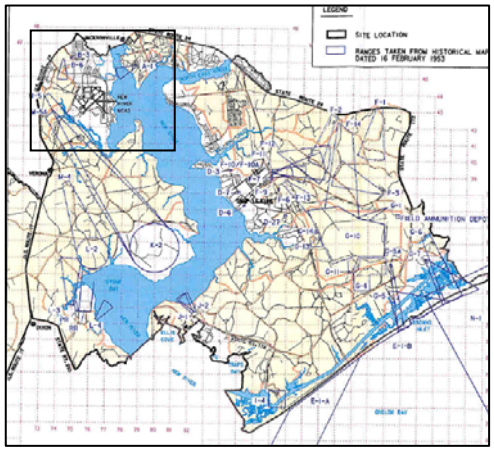
also references a map from September 1, 1953, and states that while the range appeared on the 1954 range overlay map, its actual time frame of use was 1953 only. The general types of munitions used in this area are unknown, although it is assumed that they were practice hand grenades based on the name of the range.

Existing conditions maps indicate that there was a mockup (Building 507), presumably used for training exercises, in the area of Site UXO-11 from 1947 until 1953, when 6th Street and 7th Street were extended to a traffic circle and connected to U.S. Route 17. Building 505 is a school building that is outside of the boundaries of Site UXO-11. **Figure 2-2** shows the 1947 and 1953 existing conditions maps for the Site UXO-11 area. Building 507 does not appear on any maps after 1953.

Aerial photographs from 1946, 1948, and 1951 indicate that the area for Site UXO-11 is a cleared field with the mock-up (Building 507) clearly visible in the location shown on the existing conditions maps. See **Attachment 2** for historic aerial photos.

Additional aerials of the site from 1962 (**Figure 2-3**) and 1989 (**Figure 2-4**) indicate that Site UXO-11 is cleared of heavy vegetation and trees and resembles its present-day condition. In the 1962 aerial a possible dirt road leads to the site and are present in the immediate area of Site UXO-11.





0 1500 3000

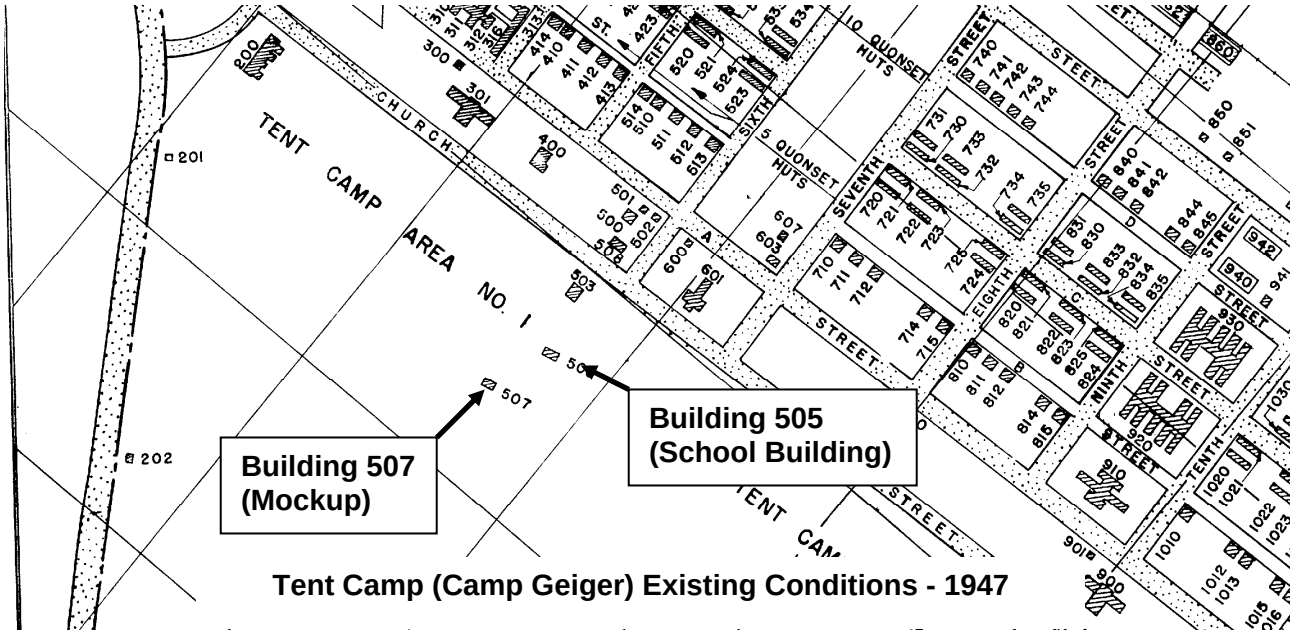
Approximate scale in Meters

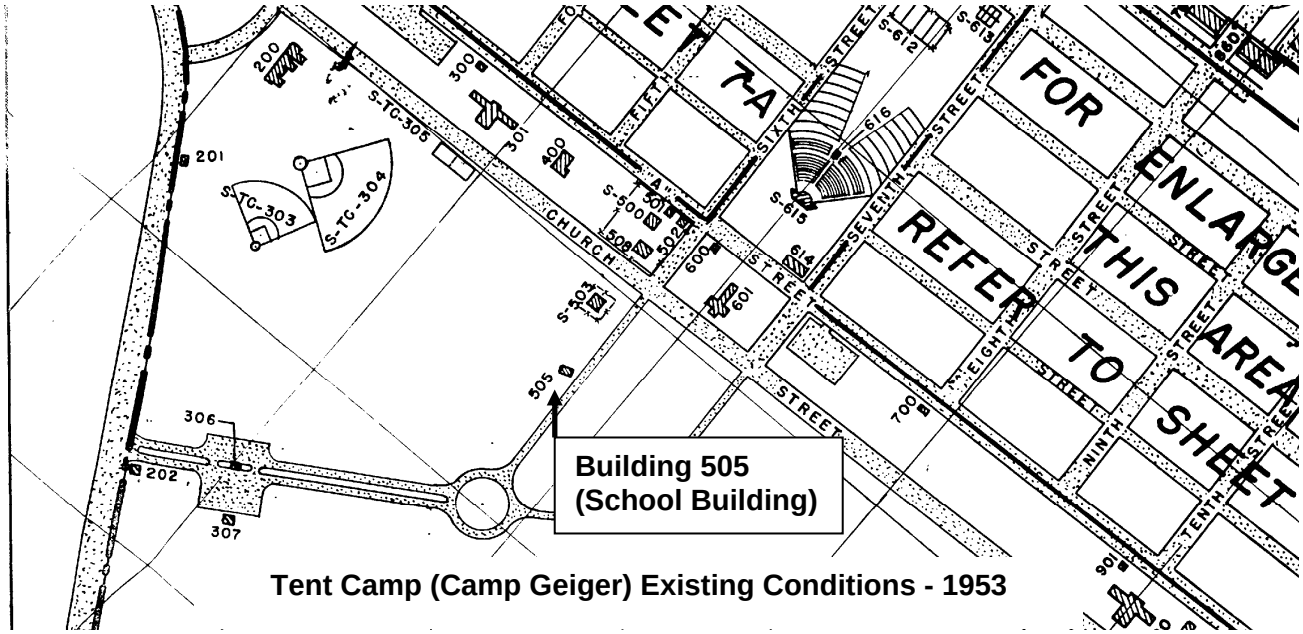
N

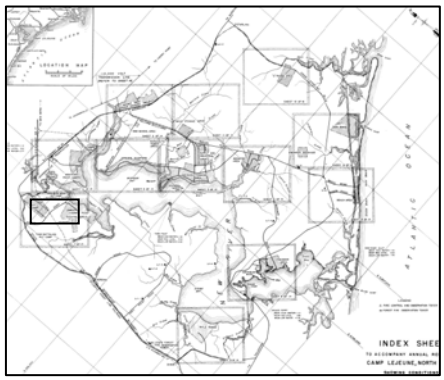
Figure 2-2
Sites UXO-11
Range Overlay Map - 1954
MCB Camp Lejeune
North Carolina

CH2MHILL

Source: USACE, 2000







0 1000 2000

Approximate Scale in Feet

N

Figure 2-3
Site UXO-11
Existing Conditions – 1947, 1953
MCB Camp Lejeune
North Carolina

CH2MHILL

Sources:
MCB Camp Lejeune, 1947
MCB Camp Lejeune, 1953

\\aphrodite\projects\USNavFaceNGCom\CampLejeune\Mapfiles\CTO-0014\ASR\Figure 2-18 Site UXO-11 and 12 1962.mxd

Legend
- Sites UXO-11 and UXO-12
- Installation Boundary

N

0 100 200 400 Feet

1 inch equals 200 feet

Figure 2-3
Site UXO-11 and UXO-12
Historical Aerial – 1962
MCB Camp Lejeune
North Carolina

CH2MHILL

\\aphrodite\projects\USNavFaceNGCom\CampLejeune\Mapfiles\CTO-0014\ASR\Figure 2-19 Site_UXO_11_and_12_1989.mxd

Legend
Sites UXO-11 and UXO-12
Installation Boundary

N

0 100 200 400 Feet

1 inch equals 200 feet

Figure 2-4
Site UXO-11 and UXO-12
Historical Aerial – 1989
MCB Camp Lejeune
North Carolina

CH2MHILL

SECTION 3

References

Cardinell, A.P, S. A Berg, and O. B. Lloyd, Jr. 1993. *Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina*. U.S. Geological Survey: Water Resources Investigations Report 93-4049.

Global Security. 2008. *Camp Lejeune.* Available online: http://www.globalsecurity.org/military/facility/camp-lejeune.htm. Accessed August 27.

Heath, R. 1989. *Basic Groundwater Hydrology*. U.S. Geological Survey WSP 2220.

Harned, D. A., O. B. Lloyd, Jr., and M. W. Treece, Jr. 1989. *Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina*. U.S. Geological Survey Water-Resources Investigation Report 89-4096, 64p.

Loftfield, Thomas C., Principal Investigator. 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune*. Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp, Vol. II. Contract # N62470-79-C-4273. University of North Carolina, Wilmington. August.

Louis Berger Group, Inc. 2002. *Semper Fidelis: A Brief History of Onslow County, North Carolina and MCB, Camp Lejeune, 2002, U.S.M.C.* LtCol Lynn J. Kimball (USMC Retired) USACE Wilmington District Contract DACWS4-99-C-0004.

United States Army Corps of Engineers (USACE). 2000. *Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune, Onslow, North Carolina.* St. Louis District. February.

Water and Air Research. 1983. Water and Air Research, Inc. *Initial Assessment Study of Marine Corps Base, Camp Lejeune. North Carolina*. Prepared for Naval Energy and Environmental Support Activity.

Winner, M. and R. Coble. 1989. *Hydrogeologic Framework of the North Carolina Coastal Plain Aquifer System*. U.S. Geological Survey Open File Report 87-690.

Attachment 1
Resource Review Summary

Resource Review Summary

The following table provides a summary of the specific references identified for review, interview, or contact for the archival report.

Resource	Actions Completed
Quantico, Virginia, Marine Corp History Division, Historical Research Branch (Kara Newcomer and Lena Kaljot)	Reviewed all available file folders related to Camp Lejeune and copied relevant reports and figures/maps (August 19, 2008)
Quantico, Virginia, Marine Corp Library Gray Research Center (Greg Cina)	Reviewed all maps related to Camp Lejeune and copied relevant maps (August 19, 2008)
US National Archives (NARA II) Historical Files	Reviewed text and drawing files from Text and Cartographic Divisions (August 20-22, 2008)
Camp Lejeune Personnel	
Andrew Smith, Environmental Management Division	Contacted and interviewed (August 21, 2008)
Dennis Dunham and Jerry Jordan (intern), Public Works Technical Records	Contacted and interviewed (August 15 and August 21, 2008)
Julie Rowe, MCB Camp Lejeune Archivist	Contacted and phone interviewed (August 21, 2008)
Duane Richardson, Base Range Safety Officer	Contacted and interviewed (August 15, August 21 and September 12, 2008)

A.1 Marine Corp Library Review

History Division: Text

Contact: Kara Newcomer
Historian, Historical Reference Branch
Quantico, Virginia
(703) 432-4872 DSN 378
kara.newcomer@usmc.mil
Site Visit: August 19, 2008

File review at Marine Corps Base, Quantico, VA, Historical Reference Branch.

Files found under **Posts and Stations: N.C., Camp Lejeune** included Activities, Guides and Base Litter, History, Maps, Administrative Papers, Linage and Honors, Acquisition and Jurisdiction and Health Survey 2000.

Copied:

1. Training Areas and Facilities. February 16, 1953. Relevant site information and maps of ranges.

2. Camp Lejeune, North Carolina. February 10, 1942. Map of area.
3. Camp Lejeune: Early History. June 1942. Discusses "Miscellaneous Marine Corps Training."
4. Brief History of Camp Lejeune, North Carolina. August 15, 1954
5. Commandant Letter dated August 25, 1951 – Subject – "Twelve quartermaster warehouses for Camp Lejeune, North Carolina; further justification for."
6. Camp Lejeune General Map. Date unknown. Map of area.

History Division: Photographic Division

Contact: Lena Kaljot
Photo Historian, Historical Reference Branch
Quantico, Virginia
(703) 432-4873 DSN 378
Lena.kaljot@usmc.mil
Site Visit: August 19, 2008

Photo review at Marine Corps Base, Quantico, VA, Historical Reference Branch.

Photo files found under **Lejeune** included Administrative Buildings, Aerial Views:1940s, Aerial Views: 1950-1960, Aerial Views: undated, Aerial Views:1948, Chapels, Ice Cream Plant, Lumber, Medical, Misc., Mess Hall; Housing, Recreation, Public Works, Storage, Training and Utilities.

Copied:

1. Aerial Photos: Camp Lejeune, NC. Various angles. May 6, 1948.
2. Aerial Photos: Tent Camp, Camp Lejeune. Various angles. June 1946.
3. Aerial Photos: Tent Camp, Camp Lejeune. Various angles. September and December 1948.
4. Aerial Photo: Tent Camp, Camp Lejeune. September 1951.
5. Aerial Photos: Division Training Area, Camp Lejeune. Looking West. September 1948.
6. Aerial Photo: Division Training Area, Camp Lejeune. Looking East. December 23, 1948.
7. Aerial Photo: Magazine Area, Camp Lejeune, NC. Looking South. September 17, 1948.
8. Aerial Photo: Officers Quarters, Camp Lejeune. October 13, 1948.
9. Aerial Photo: Officers Housing Area, Camp Lejeune, NC. September 14, 1951.
10. Aerial Photo: Montford Point, Camp Lejeune, NC. September 22, 1948.
11. Aerial Photo: Camp Knox Area, Camp Lejeune. Looking North. September 22, 1948.
12. Aerial Photo: Rifle Range Area, Camp Lejeune. Various angles. September 17, 1948.
13. Aerial Photo: Rifle Range Area, Camp Lejeune, NC. September 14, 1951.
14. Aerial Photo: Airfield, Camp Lejeune, NC. September 16, 1948.
15. Aerial Photo: New River Administration Building and Circle, Camp Lejeune. August 22, 1944.
16. Aerial Photo: MCAAF Camp Lejeune, NC. October 30, 1947.
17. Aerial Photo: USMCAF, Camp Lejeune, NC. November 5, 1951.
18. Aerial Photo: Peter Point Field, MCAAF, Camp Lejeune, NC. April, 13, 1948.
19. Aerial Photo: Peter Point Field, Camp Lejeune, NC: Building No. PP-106.
20. Seven Aerial Photos of "Unknown dates and locations".

Achieve and Special Collections: Maps

Contact: Greg Cina
Archivist, Achieves and Special Collections
Quantico, Virginia
(703) 784-4685
cinagl@grc.usmc.edu
Site Visit: August 19, 2008

Map review at Marine Corps Base, Quantico, VA, Achieves and Special Collections in Gray Research Center.

Maps were the only items in the collection pertaining to Camp Lejeune. Reviewed 12-15 maps all pertaining to Camp Lejeune through time.

Copied:

1. Topographical Map: Sneads Ferry, N.C. 1971.
2. Topographical Map: New River Inlet, N.C. 1971
3. Topographical Map: New River N.C. 1972
4. Topographical Map: Approaches to the New River. 1956

A.2 National Archives and Records Administration Review

Text Division

Site visit: August 20-22, 2008

Below are the topics and boxes of files reviewed in association with the Marine Corps.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. USMC Excercises, 1960-1983. 170A/54/07, Boxes 1-2.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Record of Training Exercise and Maneuvers, 1941-1950. 370/23/22 Boxes 5-15.

Record Ground 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Division of Public Information, General Correspondence, 1942-1950. 370/23/18 Box 1.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Command Chronologies, 2nd Marine Regiment, 1965-1979.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Command Chronologies, 2nd Marine Regiment, 1st Marine Battalion, 2nd Marine Battalion, 3rd Marine Battalion, 1965-1972.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Record of Field Organizations: 2nd Marine Division Regimental Orders and Other Issuance, 1951-1953. Boxes 1-11.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Record of Field Organizations: 2nd Marine Division, 10th Marine Regiment, 6th Marine Regiment and 8th Marine Regiment, 1960-1983. Boxes 1-11.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Ordnance, 1939-1950, Box 501.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Infantry Weapons, 1945, Box 508.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Geography, Boxes 885-886.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Experiments, Grenades, and Explosives, Box 1206.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. SOPs, Boxes 1158-1159.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Pistols, Box 1237.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Training Bullitins-1943, Box 1437.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Reports. Boxes 1470-1476.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Ranges. Box 1990.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Practice/Teams Pistols. Boxes 1994-1995.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Marine Corps Communications. Boxes 1059-1064.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Co. Drills and Instructions. Boxes 1076-1082.

The boxes contained information primarily related to weapons test results, weapons cost distribution, weapons training classes, weapon specifications, and cleaning and maintenance. The material was not specific to Camp Lejeune and included information for several MC bases.

Record Group 127 (USMC), Camp Lejeune, Command Chronologies, 1965-1979, Boxes 690-698.

List of Documents Obtained from National Archives

1. "Memorandum for the Personnel Division." June 6, 1942.
2. "Modification No. 2 to General Order Number 163: Training Facilities and Regulations Governing the Use of." October 11, 1942.
3. "Memorandum to the Quartermaster: Fuel Thickener (Napalm) for Flame Thrower H1A1." January 5, 1944.
4. "Marine Corps Training Bulletin: Use of Chlorine in Training" January 19, 1944.
5. Commandant Letter dated May 13, 1944 – Subject – "Chemical Warfare Class"
6. Commandant Letter dated May 19, 1944 – Subject – "Chemical Warfare Instruction"
7. Commandant Letter dated May 30, 1944 – Subject – "Chemical Warfare Class"
8. Commandant Letter dated July 7, 1944 – Subject – "Requirement Factors for Flame Thrower Fuels"
9. "Administrative Command Training Memorandum Number 5-44: Chemical Warfare." July 14, 1944.
10. Commandant Letter dated August 12, 1944 – Subject – "Chemical Warfare Training"
11. Commandant Letter dated September 6, 1944 – Subject – "Chemical Warfare Training"
12. Commandant Letter dated September 19, 1944 – Subject – "Distribution of Chemical Warfare Letter"
13. Commandant Letter dated December 2, 1944 – Subject – "Compressed Gases"
14. Commandant Letter dated December 15, 1944 – Subject – "Flame Thrower Expendable Supplies, requirement factors for."
15. "Marine Barracks Camp Lejeune Annual Report, North Carolina, Naval District Five." October 1, 1946.
16. "Camp General Order Number 163: Training Facilities and Regulations Governing the Use of." August 17, 1949.
17. "Lesson Plans for Training of the Organized Reserves" June –September 1950.
18. "Regimental General Order Number 39: Defense against Chemical and Radiological Warfare." August 28, 1951.
19. "Regimental Training Order Number 157-52: Training Schedule 4.2 Mortar Co, 16-21 June 1952." June 10, 1952.
20. "Regimental Training Order Number 180-52: Training Program 1 July to 30 September. 1952." June 30, 1952.
21. "Regimental Training Order Number 241-52: Training Program 1 October to 31 December 1952." September 29, 1952.

22. "Regimental Training Order Number 259-52: Preliminary Marksmanship Training Schedule for 6th Marines and attached Division Units from 4 to 11 October 1952." October 3, 1952.

23. "Regimental Training Order Number 9-53: Training Program 6 July-3 October 53" June 24, 1953.

24. "Change No.2 to Regimental Training Order Number 8-53: Training Facilities, Maneuver Areas and Firing Ranges" August 20, 1953.

25. "Regimental General Order 92: Interior Guard" October 20, 1953.

Cartographic Division

Site visit: August 22, 2008

Information for Camp Lejeune is located under Record Group (RG) 71-Bureau of Yards and Docks. The index for locating cartographic materials is then grouped by subject codes. The only available drawing for Camp Lejeune was for Subject Area 19- Water Systems, which contained no relevant materials. Subject Areas 44 is Rifle ranges, machine gun ranges, sighting ranges, bombing targets; however, no materials were located under this Subject Area.

A.3 MCB Camp Lejeune Base Records Review

Contact: Andrew Smith
Environmental Engineer, Environmental Management Division
Marine Corps Base, Camp Lejeune
(910) 451-9017
stephen.a.smith2@usmc.mil

Andrew provided electronic color copies of the RI/PRA Range Overlay Maps. Also suggested looking in documents that CH2M HILL has access to, including:

- US Army Corps of Engineers (USACE), St. Louis District. 2000. *Final Range Identification and Preliminary Range Assessment,* Marine Corps Base Camp Lejeune, Onslow, North Carolina, February.
- US Army Corps of Engineers (USACE), St. Louis District. 2001. *Archives Search Report for the Final Range Identification and Preliminary Range Assessment,* Marine Corps Base Camp Lejeune, Onslow, North Carolina, December.
- Water and Air Research. 1983. Water and Air Research, Inc. *Initial Assessment Study of Marine Corps Base, Camp Lejeune. North Carolina*. Prepared for Naval Energy and Environmental Support Activity.

Contact: Duane Richardson
Base Range Safety Officer
Marine Corps Base, Camp Lejeune
(910)451-1240
Duane.richardson@usmc.mil

Per email and phone conversations Duane described the areas as follows:

"Site UXO 11 ASR Area 2.81: same comments as above ASR 2.77. It was very common to have a practice hand grenade ranges close to where the Marines lived to make it easy to conduct training. Should not be any live ordanance/UXO in this area, it is in the present built up area of main side so I am sure the dirt berms, surrounding areas have been leveled out. Practice hand grenades had a small fuze (noise maker) and the steel body that was re-useable."

Contact: Dennis Dunham
Technical Records, Public Works Office
Marine Corps Base, Camp Lejeune
(910) 451-2818 ext 273

Per phone and e-mail conversations provided existing conditions maps. All maps and plans have been converted to electronic files and Dennis is happy to look up any information needed on builds and any civil work, sewage, electrical, etc.

Existing conditions for the all available areas of the base were provided for the following years:

1943, 1946 through 1960, 1963, 1966, 1985 and 2005.

Contact: Julie Rowe
Archivist, Combat Camera
Marine Corps Base, Camp Lejeune
(910) 451-1238

The archivist position at Camp Lejeune was create about a year ago and is still in development. Currently the office holds photos and oral histories of the main area of Camp Lejeune and the collection is growing. Julie did not have any information related to historical use of range areas.

Documents Reviewed at the Base Library

Site Visit: August 20 and 21, 2008

1. Lotfield, Thomas, C. Principal Investigator. UNCW, August 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune; Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp., Vol. II, Contract No. N62470-79-C-4273.*

2. Camp Lejeune Marines, On Land, On Sea, In the Air. Pamphlet (several from 1944 – 1988).

3. Carraway, Gertrude S. Camp Lejeune Leathernecks, United States Marine Corps Training Center, Camp Lejeune, North Carolina. October 1946.

4. Baker Environmental, 1992, Administrative Record (CTO-0021) *Section 1: Site Identification- Correspondence.* May

   Copies from Baker Source:

   5 Pages from "Doc. No: CLEJ-00648-01.02-02/20/81" (Related to site 69)

   5 Pages from "Doc. No: CLEJ-00226-1.02-01/01/01" (Related to site 69)

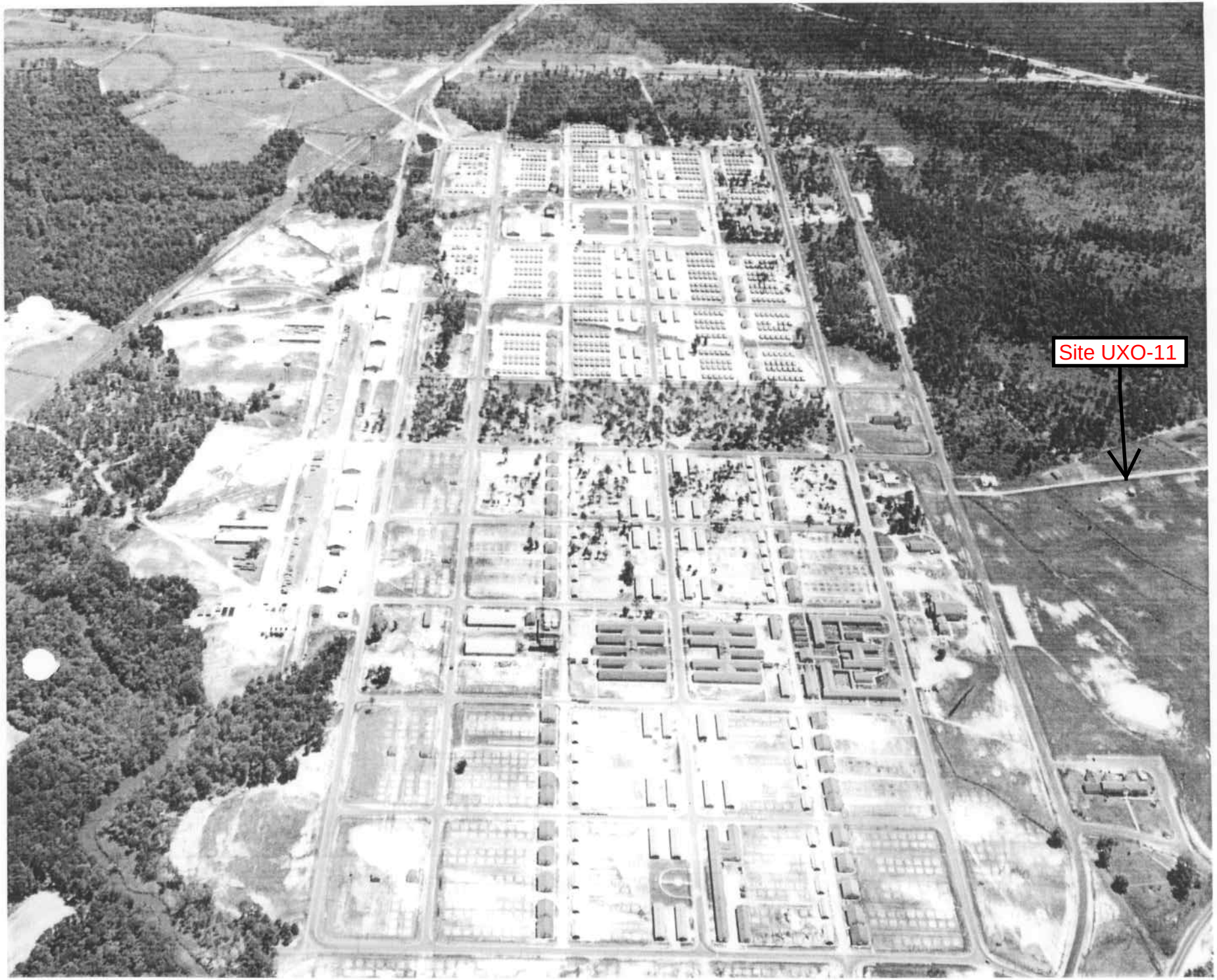
   1 Page from "Doc. No: CLEJ-00208-1.01- (unable to read date at the top of page, the date of the memo is 11/22/82)

   1 Page from "Doc. No: CLEJ-0090(?)-1.01-9/11/83"

   13 Pages from "Doc. No: CLEJ-00247-1.02-10/25/85"

   8 Pages from "Doc. No: CLEJ-00253-1.02-10/31/80"

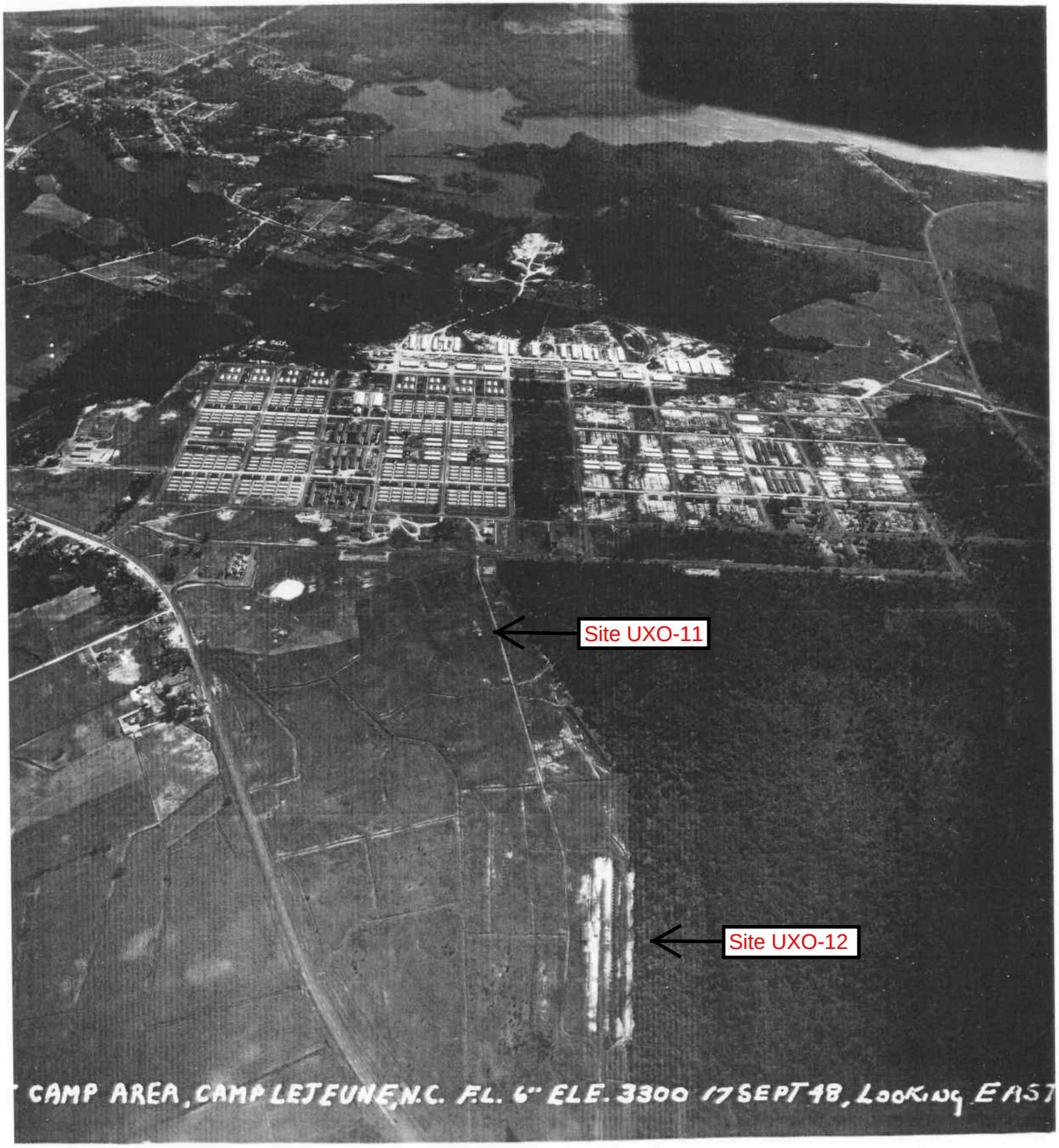
Attachment 2
Historical Aerial Photographs



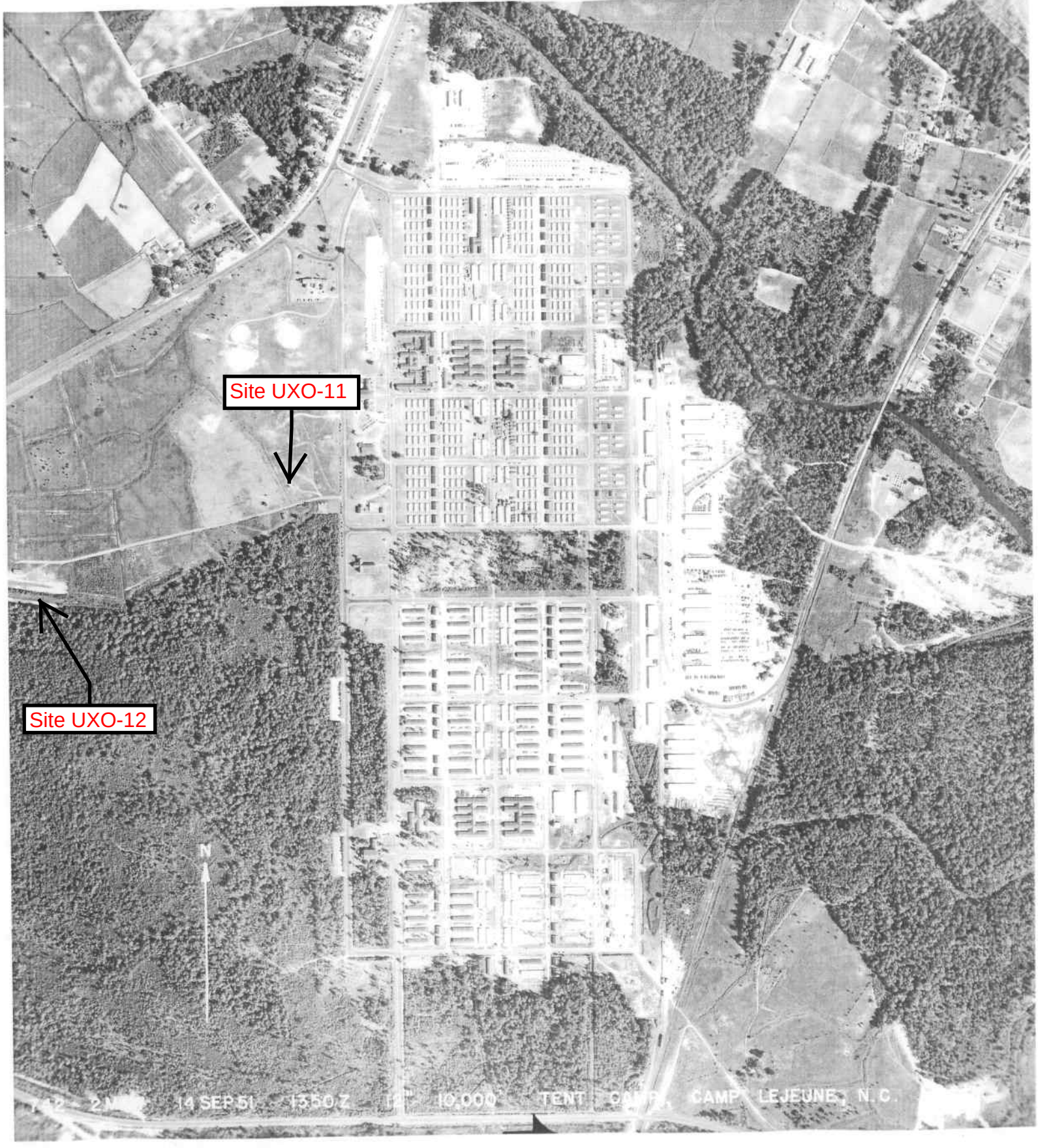
TENT CAMP 6/10/46 TENT camp 1 & 2

TENT CAMP May 30, 1948

Attachment 2


Site UXO-11
Site UXO-12
CAMP AREA, CAMP LEJEUNE, N.C. F.L. 6" ELE. 3300 17 SEPT 48, LOOKING EAST

TENT


Site UXO-11
Site UXO-12
N
14 SEP 51
1350 Z
10,000'
TENT
CAMP LEJEUNE, N.C.

Appendix B
Geophysical Prove-Out Plan

Geophysical Prove-Out Work Plan

Preliminary Assessment/ Site Inspection at Site UXO-11, B-5 Practice Hand Grenade Course (ASR #2.81)

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0014

March 2009

Prepared for

Department of the Navy
Naval Facilities Engineering Command

Under the

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

Prepared by

CH2MHILL

Raleigh, North Carolina

Contents

B.1 Project Data Quality Objectives B-1
B.2 Procedures B-1
B.3 Additional GPO Considerations B-5
B.3.1 GPO Plot Location B-5
B.3.2 Number and Types of Geophysical Instruments and Technologies Selected for Testing B-5
B.3.3 Number and Types of Positioning Instruments and Technologies Selected for Testing B-5
B.4 Quality Control B-6
B.4.1 DGM Instruments Quality Control B-6
B.4.2 QC Seed Items B-6
B.5 References B-6

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B-1 Geophysical Surveys to be Performed During GPO

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B-1 GPO Process

APPENDIX B

Geophysical Prove-Out Work Plan

This Geophysical Prove-Out (GPO) Work Plan (WP) is a supplement to the Master GPO WP from the Marine Corps Base (MCB) Camp Lejeune Munitions Response Master Project Plan (CH2M HILL, 2008) (herein referred to as MRP Master Project Plan) and provides additional site specific details related to GPO activities for digital geophysical mapping (DGM) surveys at Site Unexploded Ordnance (UXO)-11, B-5 Practice Hand Grenade Course Archive Search Report (ASR) #2.81, MCB Camp Lejeune, North Carolina. Only additional details, modifications or additions to the information provided in the Master GPO WP from the MRP Master Project Plan are discussed herein.

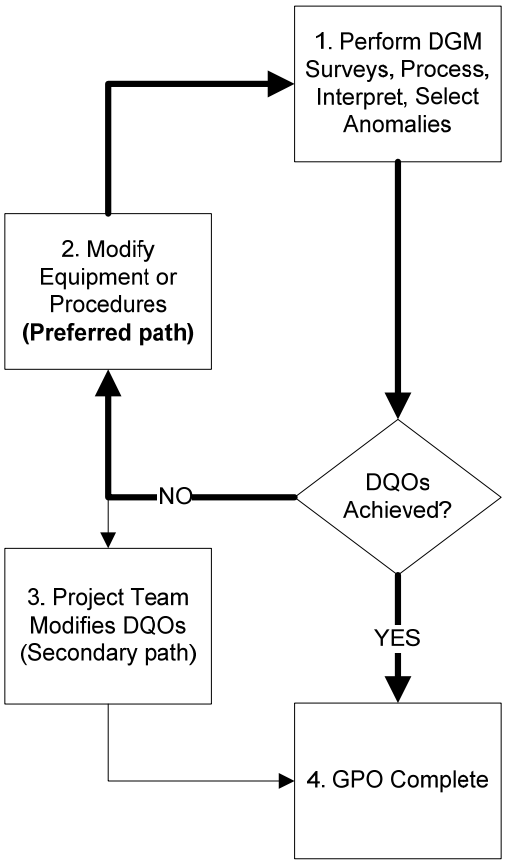
B.1 Project Data Quality Objectives

All data quality objectives (DQOs) from the Master GPO WP are applicable to the GPO for the subject site with the exception of the survey coverage (lane spacing). This DQO is only applicable to full coverage surveys and the surveys to be performed at the subject site are transect surveys (at 10-meter [m] spacing) only.

B.2 Procedures

Because an existing GPO plot is to be used (discussed in Section B.3.1) for the GPO activities, a modified **Figure B-1** is presented in this section that illustrates the GPO process and the procedures to be employed (numbered in accordance with the steps shown in this section).

FIGURE B-1
GPO Process



1. DGM surveys will be performed by the DGM subcontractor using an EM61-MK2 time domain metal detector system. The system configurations to be tested are shown in **Table B-1** but may be modified based on actual conditions observed along the site transects. The data will be processed and interpreted by the DGM subcontractor and anomaly selections made. Draft data will be provided to the CH2M HILL Project Geophysicist for evaluation within 4 hours of completing each GPO survey and final data packages within one working day of GPO completion.
2. If the initial DQOs have not been met, the CH2M HILL Project Geophysicist will meet with the DGM subcontractor to discuss whether modifications (e.g., sensor spacing) or procedures (e.g., lane spacing) can be made to the DGM system in order to meet the DQOs.
3. If the DQOs cannot be met by the DGM subcontractor, the CH2M HILL Project Manager and Project Geophysicist will meet with the NAVFAC Project Manager to discuss a resolution (i.e., modification of a DQO) prior to completing the GPO.
4. Once the surveys have been performed and at least one of the configurations has been determined capable of meeting the initial (or modified) DQOs, the GPO will be complete.

TABLE B-1
Geophysical Surveys to be Performed During GPO

Test	Instrument	Platform/Positioning System	Approximate Sensor Height Above Ground Surface (m)	Lane Width (m)	Data Collection Rate	Approximate Survey Speed (m/s)
1	EM61-MK2 Single Coil	Wheel mode/odometer positioning	0.4	1	Every 0.67 ft (0.2m)	1
2	EM61-MK2 Single Coil	Wheel mode/Fiducial (time based) positioning	0.4	1	10 or greater per second	1
3	EM61-MK2 Single Coil	Wheel mode/RTK GPS	0.4	1	10 or greater per second	1

Note: Some data elements are subject to evaluation and modification in the field.
ft = foot/feet; GPS = global positioning system; m = meter; m/s = meters per second; RTK = real-time kinetic

B.3 Additional GPO Considerations

Additional topics taken into consideration for the design of the GPO include plot location, size, and shape; quantities of seeded items; and geophysical and positioning instruments and technologies.

B.3.1 GPO Plot Location

The location of the GPO was determined on the basis that a plot already exists at Camp Lejeune in similar geologic conditions and multiple previous surveys have been performed over the plot that can be used to validate that the selected DGM system is functioning within industry standards.

B.3.2 Number and Types of Geophysical Instruments and Technologies Selected for Testing

Because of the type of targets to be detected at the site, a pre-field analysis of the two primary techniques used in the industry, magnetics and time domain electromagnetics (TDEM), CH2M HILL recommends testing of the TDEM technique only. This recommendation is based on experience at multiple other sites at which the small and shallow items have consistently been detected at a higher rate with TDEM than with magnetics. The geology at the site is not anticipated to be advantageous to either system.

A complete description of the EM61-MK2 is provided in the Master Geophysical Investigation Plan (GIP) as part of the MRP Master Project Plan.

B.3.3 Number and Types of Positioning Instruments and Technologies Selected for Testing

The positioning systems to be tested during the GPO for positioning of the geophysical data include fiducial methods (wheel and time-based) and a Real-Time Kinematic (RTK) Global Positioning System (GPS). The fiducial method is referenced to survey stakes emplaced by a licensed surveyor at regular intervals along a transect which are used for the placement of fiducial marks within the recorded data. Either 1) a wheel odometer is used to collect a data point every 0.2 m and the distances adjusted in the data based on the known distance between stakes, or 2) data are collected on a regular interval (i.e. 10 per second) while the operator(s) walk a constant pace and the total number of data points collected between fiducial points (stakes) are distributed evenly between the fiducial points. A full description of the positioning methods is provided in the Master GIP as part of the MRP Master Project Plan.

B.4 Quality Control

B.4.1 DGM Instruments Quality Control

All systems will be field tested by the DGM subcontractor to ensure that they are operating properly. All quality control (QC) tests described in the Master GPO WP will be performed with the exception of the test designed for magnetometers only.

B.4.2 QC Seed Items

At least one QC seed item will be emplaced per 3,050 m (~10,000 feet) of transects (equivalent to one every 0.7 acres of covered area) to be surveyed with the DGM system for the subject site.

B.5 References

CH2M HILL, 2008. *Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. May 2008.

Appendix C
Geophysical Investigation Plan

Geophysical Investigation Plan

Preliminary Assessment/Site Inspection at Site UXO-11, B-5 Practice Hand Grenade Course (ASR #2.81)

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0014

March 2009

Prepared for

Department of the Navy
Naval Facilities Engineering Command

Under the

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

Prepared by

CH2MHILL

Raleigh, North Carolina

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Appendix C

This Geophysical Investigation Plan (GIP) is a supplement to the marine Corps Base (MCB) Camp Lejeune Master GIP (Appendix D of the MCB Camp Lejeune MRP Master Project Plan) from the MCB Camp Lejeune MRP Project Plan (CH2M HILL, 2008) and provides additional site specific details related to the digital geophysical mapping (DGM) operations at Site Unexploded Ordnance (UXO)-11, B-5 Practice Hand Grenade Course Archive Search Report (ASR) #2.81, MCB Camp Lejeune, North Carolina. Only additional details, modifications or additions to the information provided in the Master GIP from the MRP Master Project Plan are discussed herein.

C.1 Areas to be Investigated

The investigation area covered in this GIP is discussed in the following subsections.

1.1.1 Site UXO-11, B-5 Practice Hand Grenade Course (ASR #2.81)

Site UXO-11 was a practice hand grenade course approximately one acre in size located north of Sixth Street and east of Seventh Street at the New River Air Station. The site is undeveloped and primarily free of dense vegetation. The types of munitions used on the range are unknown but are suspected to include fuzes and practice grenades. Based on the name of the range, it is assumed that practice hand grenades were used on the range.

C.2 Anticipated MEC Types, Composition, Quantities and Depth

The types of munitions and explosives of concern (MEC) and munitions debris (MD) potentially present in the areas to be surveyed are summarized in Table C-1. The maximum quantities and depths are unknown. The depths to which ordnance items penetrate are dependent on many different parameters and cannot be accurately predicted; however, industry experience indicates that most (>80%) fired ordnance has been found within the top 2 feet below ground surface.

C.3 Vegetation and Topography

The investigation area has a generally flat terrain and is primarily free of dense vegetation. DGM activities will be conducted on approximately 10 percent of the site area. Transects will be performed using an EM61-MK2 at approximately 10 meter (m) intervals (10 percent coverage) across the site (**Figure C-1**).

C.4 Geologic Conditions

Based on investigations at other areas of MCB Camp Lejeune, it is anticipated that shallow soils at the UXO sites consist of unconsolidated deposits of silty and clayey-sand, silt, and clay. These soils represent the Quaternary age "undifferentiated" formation which

characterizes the shallow water table aquifer. Sands are likely to be fine to coarse-grained and contain varied amounts of silt (5 percent to 50 percent) and clay (5 percent to 20 percent). Results of the standard penetration tests (commonly referred to as "blow counts," ASTM 1586) in other areas of MCB Camp Lejeune indicate the sands will likely have a relative density of loose to dense. Field observations in other areas of MCB Camp Lejeune have classified the sands as SM and/or SC according to the Soil Conservation Survey (SCS). Clays were plastic to nonplastic, contain varied amounts of silt (some of which contained organic matter) and clay (5 percent to 25 percent), and classified as CL or CH. Standard penetration results for cohesive soils (silts and clays) indicated a relative density of medium dense to stiff.

The local geology (interlayered, unconsolidated sediment) is likely to be amenable to either magnetics or electromagnetic detection techniques. Because the items of interest at the site are generally small, the magnetics technique will not be considered for use as it has been shown at multiple MEC sites to be less effective for finding smaller items at shallow depths than electromagnetic detection techniques. No geologic conditions that will impede geophysical operations at the site are known.

C.5 Shallow Groundwater Conditions

Groundwater is anticipated to be relatively shallow, within approximately 5 to 10 feet of ground surface. However, based on industry experience, most MEC items are found within 1 to 2 feet of the ground surface.

C.6 Adverse Geophysical Conditions

No geophysical conditions, other than those discussed under Section C.7 and C.8, that might interfere with electromagnetic near-surface geophysical instrument operation are anticipated.

C.7 Site Utilities

The presence of underground utilities is unknown at the site.

C.8 Manmade Features Potentially Affecting Geophysical Operations

There are no manmade structures or features at the site.

C.9 Site-Specific Dynamic Events

No site-specific dynamic events (e.g., unusually strong winds, harsh weather conditions) that might affect geophysical operations at the site are anticipated. Although it is possible that weather conditions may impede operations at some time during the project, no significant delays or effects on geophysical instruments resulting from abnormally severe weather are expected.

C.10 Overall Site Accessibility and Impediments

There are no known impediments that will limit access to the work areas at the site.

C.11 Potential Worker Hazards

No potential worker hazards are apparent at the site other than those associated with conducting project fieldwork, which are addressed in the project Health and Safety Plan (HSP) (refer to Appendix D in the PA/SI Work Plan).

C.12 Geophysical Prove-out

A site-specific GPO will be used to finalize project data quality objectives (DQOs) and validate the geophysical system selected for the DGM surveys at the subject site. The GPO Work Plan is provided as Appendix B to the PA/SI Work Plan.

C.13 DGM Data Quality Objectives

The primary objective of the DGM activities at the subject site is to identify metallic anomalies that may be MEC or material potentially presenting an explosive hazard (MPPEH). DQOs specific to the DGM survey at the site are identified in the GPO Work Plan (Appendix B to the PA/SI Work Plan) and will carry through to the site survey.

C.14 Geophysical Instrumentation

A geophysical subcontractor will use a single coil EM61-MK2 to map geophysical anomalies that could potentially represent subsurface MEC within the subject site. The EM61-MK2 is described in the Master GIP.

C.15 DGM Systems Quality Control

The QC program described in the Master GIP will be followed. Supplemental information for those steps is provided in the following subsections.

C.15.1 DGM Instruments Quality Control

Because the EM61-MK2 will be used for the DGM surveys, the QC tests designed for magnetometer operations (discussed in the Master GIP) will not be performed.

C.15.2 QC Seed Items

At least one QC seed item will be emplaced per 10,000 ft of transects (equivalent to one every 0.7 acres of covered area) to be surveyed with the DGM system at Site UXO-11 or a minimum of one per site if the size of the site is less than 0.7 acres.

C.16 References

CH2M HILL. 2008. *Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. May.

TABLE C-1
Anticipated Types of MEC and MD

MEC Type(s)	Composition
M 21 Hand Grenade, Practice	Ferrous metal components (cast iron), black powder
MD (Types)	**Composition**
Hand grenade (practice	Ferrous metal components (cast iron), black powder

\\aphrodite\Proj\USNavFacEngCom\CampLejeune\MapFiles\UXO_WP_Addendum\Figure_C1_UXO_11_Generalized_Transect_Layout.mxd

Legend
- Transects
- Site UXO-11 Boundary
- Wetlands

N

0 50 100 200 Feet

1 inch equals 100 feet

Figure C-1
Site UXO-11 Generalized Transect Layout
MRP Site UXO-11
MCB Camp Lejeune
North Carolina

CH2MHILL

Appendix D
Health and Safety Plan

Health and Safety Plan
Site Specific Work Plan Addendum
for Preliminary Assessment/Site Inspection
Site UXO-11, B-5 Practice Hand Grenade Course
(ASR #2.81)

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0014

March 2009

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

Under the

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

Prepared by

CH2MHILL

Raleigh, North Carolina

CH2M HILL HEALTH AND SAFETY PLAN

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

Project Information and Background

PROJECT NO: 378849

CLIENT: NAVFAC Atlantic

PROJECT/SITE NAME: LANTDIV CLEAN 1000/Contract No. N62470-80-D-1000 / TO 0014, MCB Camp Lejeune, MRP Focused Preliminary Assessment/Site Inspection (PA/SI) at Site Unexploded Ordnance (UXO)-11, B-5 Practice Hand Grenade Course.

SITE ADDRESS: Camp Lejeune, Jacksonville NC

CH2M HILL PROJECT MANAGER: Bill Schmithorst/RDU

CH2M HILL OFFICE: Raleigh, NC

DATE HEALTH AND SAFETY PLAN PREPARED: February 2009

DATE(S) OF SITE WORK: April 2009 through September 2009

SITE ACCESS: Access to the site is restricted. Site UXO-11 may be accessed through the MCB Camp Lejeune Air Station Main Gate on the west side of the New River.

SITE SIZE: MCB Camp Lejeune is approximately 236 square miles. The individual Site UXO-11 size is 2 acres

SITE TOPOGRAPHY: The topography of MCB Camp Lejeune is relatively flat with ground surface elevations ranging from mean sea level (msl) to 72 feet above msl. Most of the MCB Camp Lejeune lies between 20 and 40 feet msl. The l00-year flood plain elevation for this area of MCB Camp Lejeune is approximately 10 feet above msl.

PREVAILING WEATHER: The climate at MCB Camp Lejeune 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 Camp Lejeune 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 Camp Lejeune was used as a training area to prepare Marines for combat. MCB Camp Lejeune was again used for training during the Korean and Vietnam conflicts, and the Gulf War. MCB Camp Lejeune is host to five Marine Corps commands and one Navy command. In addition, MCB Camp Lejeune 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 Camp Lejeune 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 northwester boundaries are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville, North Carolina is located immediately northwest of MCB Camp Lejeune.

A majority of the land surrounding the facility is used for agriculture. Estuaries along the coast support commercial fishing and residential resort areas are located adjacent to MCB Camp Lejeune along the Atlantic Ocean.

SITE HISTORY:

Site UXO-11- B-5 Practice Hand Grenade Course

Site UXO-11 was a practice hand grenade course approximately two acre in size located north of Sixth Street and east of Seventh Street at the New River Air Station. The site is undeveloped and primarily free of dense vegetation. The types of munitions used on the range are unknown but are suspected to include fuzing and practice grenades. Based on the name of the range, it is assumed that practice hand grenades were used on the range.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

Site UXO-11 has the potential to include munitions and explosives of concerns (MEC) environmental contamination with munitions constituents (MC), and/or hazardous and toxic waste (HTW). Due to historical activities within the project areas, a PA/SI is being conducted to accomplish the following objectives:

1. Identify historical activities at Site UXO-11 that may have resulted in environmental contamination by munitions and explosives of concern (MEC) or munitions constituents (MC).
2. Evaluate the presence and nature of MC contamination that may exist within the areas of investigation at Site UXO-11.
3. Conduct ecological and human health risk screenings using analytical data derived from the analysis of environmental media samples collected from the Site UXO-11 area of investigation.
4. Estimate the number and density of geophysical anomalies that may represent subsurface MEC.
5. Provide geophysical data for future MEC intrusive investigations.

The field investigation will accomplish the above objective through the following activities, which will be conducted in accordance with CH2M HILL Standard Operating Procedures (SOPs), and the MRP Master Project Plans (CH2M HILL, 2008):

- Surface and sediment soil sampling
- Subsurface soil sampling using direct-push technology (DPT)
- Surface water and groundwater sampling from temporary wells installed using DPT
- Digital geophysical mapping (DGM) to identify subsurface anomalies
- Surveying
- Utility Location

Site Map

This page is reserved for a Site Map.

Note locations of Support, Decontamination, and Exclusion Zones; site telephone; first aid station; evacuation routes; and assembly areas.

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Chemical-Specific Training Form

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Project Activity Self-Assessment Checklists/Permits
Behavior Based Loss Prevention Forms
Material Safety Data Sheets

1. Tasks to be Performed under this Plan

1.1 Description of Tasks

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

1.1.1 Hazwoper-Regulated Tasks

- Direct-push technology (DPT) soil boring and temporary well installation
- Groundwater, Surface Water, and Sediment Sampling
- Surface and subsurface soil sampling

1.1.2 Non-Hazwoper-Regulated Tasks

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

Table 1 Hazard Analysis

(Refer to Section 2.0 for Hazard Controls)

Potential Hazards	Project Activities				
	Direct Push Drilling	Soil Sampling	Groundwater Sampling	IDW Management	Geophysical Mapping
Chemical Hazard-Dermal/Inhalation	X	X	X	X	X
Drilling	X				X
Electrical Safety	X				X
Fire Prevention	X	X	X	X	X
Hand & Power Tools	X	X			X
Heavy Equipment	X				X
Manual Lifting	X	X	X	X	X
MEC	X	X	X		X
Noise	X				
Pressure Washing/Equip Decon	X				
Pressurized Lines/Equipment	X				
Utilities (underground/overhead)	X				X
Vehicle Traffic	X	X	X	X	X
Visible Lighting	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 RHSM for clarification.

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

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 5. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the RHSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records.

Applicable project activity self-assessment checklists (see Attachment 5) shall be completed **weekly** by a CH2M HILL representative during the course of the project depending on the work performed at the time.

2.1 Project-Specific Hazards

2.1.1 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

2.1.2 Electrical

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

General Electrical Safety

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- CH2M HILL has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock.
  - GFCIs shall be used on all 120-volt, single phase 15 and 20-amphere receptacle outlets which are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
  - GFCIs can not be utilized
  - Client requires such a program to be implemented
  - Business group decides to implement program in addition to GFCI protection
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.

- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.1.3 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 manufacturers 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.

2.1.4 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.
- Effectiveness of manual handling control measures will be evaluated during assessments (HSE-114, Office & Warehouse Safety Program, or HSE-109, Audits).
- Manual handling incidents are reviewed as part of the HSE Program reviews, and the results influence program development, training, and education efforts.
- 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.
- Physical differences make it difficult to set up safe lifting limits, unless extensive individual testing is performed. 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.

2.1.5 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.

2.1.6 Pressure Washing Operations

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer’s safety and operating instructions.
- Inspect pressure washer before use and confirm deadman switch fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches from the trigger to the tip.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

2.1.7 Traffic Control

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

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

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route -- behind an established barrier, parked vehicle, guardrail, etc.
- Always pay attention to moving traffic – never assume drivers are looking out for you
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.

  Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers. Vehicles should be parked at least 40 feet away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.

2.1.8 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 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.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

2.1.9 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.

2.1.10 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.

2.2 MEC

2.2.1 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-11.

An ESS Determination has been prepared and approved. UXO-11 has been identified as a training range. The probability of finding MEC or MPPEH is low. All personnel entering this project site are required to undergo 3R (recognize, retreat and report) training.

2.2.2 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.

2.2.3 Types of Explosives to be used on Site and MEC Reporting Requirements

No explosives are anticipated to be stored or used on the project site.

If MEC is encountered during the course of this project, the following reporting procedures must be followed:

- Stop all site field work
- Contact Range Control (call sign “Blackburn”) at 910-451-3064 for EOD assistance

An ESS will be prepared based on the MEC finding.

2.3 General Hazards

2.3.1 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 don 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 toe work area to determine what problems or hazards may exist.

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.

Drugs and Alcohol

The following situations pertaining to drugs and alcohol are prohibited:

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

2.3.2 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.

2.3.3 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.

2.3.4 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.

2.3.5 Heat Stress

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

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	**Heat Rash**	**Heat Cramps**	**Heat Exhaustion**	**Heat Stroke**
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, head-ache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temper-ature 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	Use mild drying lotions and powders, and keep skin clean	Remove to cooler area. Rest lying down.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by	Cool rapidly by soaking in cool–but not cold–water.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	intake. Recovery usually is prompt and complete.	for drying skin and preventing infection.	Increase fluid intake.	mouth. Seek medical attention.	Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

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

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

2.3.6 Cold Stress

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- 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 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, 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	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow

	swelling present.		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.

2.4 Biological Hazards and Controls

2.4.1 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.

2.4.2 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 moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.4.3 Ticks

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

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.5 Tick Analysis Procedure for Lyme disease

1. For tick removal, follow the instructions in your tick removal kit using a fine pointed pair of tweezers. If the tick is alive, place it in two layered zip-lock bags. It is highly recommended that you wear gloves when removing the tick from the skin to avoid infection.
2. It is important to remove the entire tick and place it in a zip lock bag.

3. Place the zip-lock bag in an envelope and fill out the sample submission form from the Clongen website. Please identify yourself as a CH2M HILL employee by completing all the contact information in the form. The cost of the analysis will be paid for; you do not have to use a credit card or check. The account will be assigned a blanket PO and billed directly to Health Resources for payment.
4. In 1 – 3 days, you will be contacted to discuss the results of your tick testing and any necessary treatment. In the mean time, should your current condition change in any way, please contact the Health Resources Nurse Case Manager who assisted you.

2.5.1 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 your supervisor and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.5.2 Bloodborne Pathogens

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

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

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

Work Controls

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Consider all sharps encountered at industrial, medical, dental, or biological waste facilities or sampling locations to be contaminated and PIMs.
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes. These must be provided for employees who have been exposed to PIMs. When antiseptic cleansers or towelettes are used, always rewash your hands and

face with soap and running water as soon as available. Do not consume food or beverages until after thoroughly washing your hands and face.

- Decontaminate all potentially contaminated equipment and environmental surfaces with chlorine bleach as soon as possible. Clean and decontaminate on a regular basis (and immediately upon visible contamination) all bins, pails, cans, and other receptacles intended for reuse that have the potential for becoming contaminated.
- Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.
- Place regulated waste in containers that are closable; are constructed to contain all contents and prevent leakage of fluids during handling, storage, transport or shipping; are labeled with a Biological warning label or color-coded; and are tightly closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

Post Exposure

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

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

2.5.3 Mosquito Bites

Due to the recent detection of the West Nile Virus in the Southwestern United States it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquito’s 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.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor/PM.

2.6 Radiological Hazards and Controls

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

Hazards	Controls
None Known	None Required

2.7 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-1,3,5,7tetranitro-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.	10.59
4-Amino-2,6-dinitrotolune (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

2.7 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)
2,6-Dinitrotoluene (2,6-DNT)	GW: SB: SS:	1.5 mg/m^3	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
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, gastroentiritis	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

2.7 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)
Mercury	GW: SB: SS:	0.05 mg/m^3	10	Skin and eye irritation, cough, chest pain, difficult breathing, bronchitis, pneumontitis, 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
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

2.8 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.		

3. Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

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

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

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

Employee Name	Office	Responsibility	SC-HW/FA-CPR
Bill Schmithorst	RDU	PM	Level D SC-HW: FA-CPR
Simon Kline	RDU	TM	Level D SC-HW: FA-CPR
Erin Must	RDU	FTL	Level D SC-HW: FA-CPR
David Lubell	RDU	SSC	Level D SC-HW: FA-CPR
Beth Bevc	RDU	SSC	Level D SC-HW: FA-CPR
Rachel Zajac	RDU	SSC	Level D SC-HW: FA-CPR
Jeremy Diner	RDU	Site Worker	Level D FA-CPR
David Seed	RDU	SSC	Level D SC-HW: FA-CPR
Kristin Rogers	RDU	SSC	Level D SC-HW: FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact	Base Contact
Gary Tysor	Robert Lowder
NAVFAC Mid-Atlantic	Camp Lejeune - EMD
Code: OPCEV	Building 12
6506 Hampton Blvd	Marine Corps Base Camp Lejeune, NC 28542-0004
Norfolk, Virginia 23508-12780	
Direct: (757) 322-4851	Direct (910) 451-9607
Fax: (757) 322-4805	Fax: (910) 451-5997
gary.tysor@navy.mil	robert.a.lowder@usmc.mil

3.2.2 CH2M HILL

Program Manager: Doug Dronfield
Project Manager (PM): **Bill Schmithorst, LG**
Responsible Health and Safety Manager (RHSM): Rich Rathnow
Field Team Leader: TBD
Safety Coordinator (SC): TBD

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

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

- Ensure that the overall, job-specific, HS&E goals are fully and continuously implemented

The CH2M HILL RHSM is responsible for:

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

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

- Verify this HSP is current and amended when project activities or conditions change.
- Verify CH2M HILL site personnel and subcontractor personnel read the HSP and sign Attachment 1, Employee Sign-Off Form prior to commencing field activities.
- Verify CH2M HILL site personnel and subcontractor personnel have completed any required specialty training (e.g., fall protection, confined space entry) and medical surveillance as identified in Section 2.
- Verify compliance with the requirements of this HSP and applicable subcontractor health and safety plan(s).
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in Section 2.2.12.
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in Section 9.
- Post OSHA job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established.
- Verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (e.g., as tasks or hazards change).
- Verify that project H&S forms and permits, found in Attachment 5 and 6, are being used as outlined in Section 2.
- Perform oversight and/or assessments of subcontractor HS&E practices per the site-specific safety plan and verify that project activity self-assessment checklists, found in Attachment 6, are being used as outlined in Section 2.
- Verify that project files available to site personnel include copies of executed subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractors license, training and medical monitoring records, and site-specific safety procedures prior to start of subcontractor's field operations.
- Manage the site and interfacing with 3rd parties in a manner consistent with our contract/subcontract agreements and the applicable standard of reasonable care.
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3rd party interfaces.

- Ensure that the overall, job-specific, HS&E goals are fully and continuously implemented.

The training required for the SC is as follows:

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

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

3.2.3 CH2M HILL Subcontractors

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

Subcontractor: TBD

Subcontractor Contact Name: TBD

The subcontractors listed above are required to submit their own Accident Prevention Plan, specific to this project. Other plans, such as Lead or Asbestos Abatement Compliance plans, may be required as well. Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit their plans to CH2M HILL for review before the start of field work.

Subcontractors are also required to prepare an Activity Hazard Analysis (AHA) before beginning each activity posing H&S hazards to their personnel using the AHA form provided in Attachment 6 as a guide. The AHA shall identify the principle steps of the activity, potential H&S hazards for each step and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements and training requirements for the safe operation of the equipment listed must be identified.

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their Accident Prevention Plan and AHAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. Self-assessment checklists contained in Attachment 5 are to be used by CH2M HILL personnel to review subcontractor performance. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

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 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 PM and RHSM 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 HSE-117, *Personal Protective Equipment*)

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

Note that PPE is required when exposed to the general hazards listed below. Because certain tasks (e.g., welding, energized work, etc.) require specialized PPE, refer to Section 2 for task-specific PPE requirements.

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
General site entry Surveying	D	Work clothes; safety toed leather work boots and gloves	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
Soil sampling Geoprobe boring IDW Management	Modified D	Work clothes or cotton coveralls **Boots:** Safety-toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
Groundwater sampling	Modified D	Work Clothes **Boots:** Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Safety glasses with side shields Ear protection [d]	None required.
Tasks requiring upgrade	C	**Coveralls:** Polycoated Tyvek® **Boots:** Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent[e].

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

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SSC.
[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 SSC qualified at that level is present.

4.1 Respiratory Protection

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

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR).
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used.
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months.
- Respirator use shall be limited to those activities identified in this plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan.
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use.
- Canisters/cartridges shall be replaced according to the change-out schedule specified by the RHSM. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade.
- Respirators in regular use shall be inspected before each use and during cleaning.
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition.
- Respirators shall be properly stored to protect against contamination and deformation.
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service.
- The SC or designee shall complete the H&S Self-Assessment Checklist – Respiratory Protection included in Attachment 5 of this plan to verify compliance with CH2M HILL's respiratory protection program.

5. Air Monitoring/Sampling

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

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]	Action to be Taken when Action Level reached	Frequency [b]	Calibration
FID: OVA model 128 or equivalent	Geoprobe drilling, soil and groundwater sampling	<1 ppm ppm 1 to 10 ppm >10 ppm	Level D Level C Evacuate work area and contact the HSM	Initially and periodically during task	Daily
CGI: MSA model 260 or 261 or equivalent	Geoprobe drilling, soil and groundwater sampling	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
O_2Meter: MSA model 260 or 261 or equivalent	Geoprobe drilling, soil and groundwater sampling	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	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 SSC; 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 O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (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
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

5.3 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

Additional air sampling is not recommended.

Personnel and Areas

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

HSM: Michael Goldman/ATL

6. Decontamination

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

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

6.1 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
• Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower ASAP • Dispose of PPE as IDW • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	• Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal	• Power wash • Steam clean as necessary • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

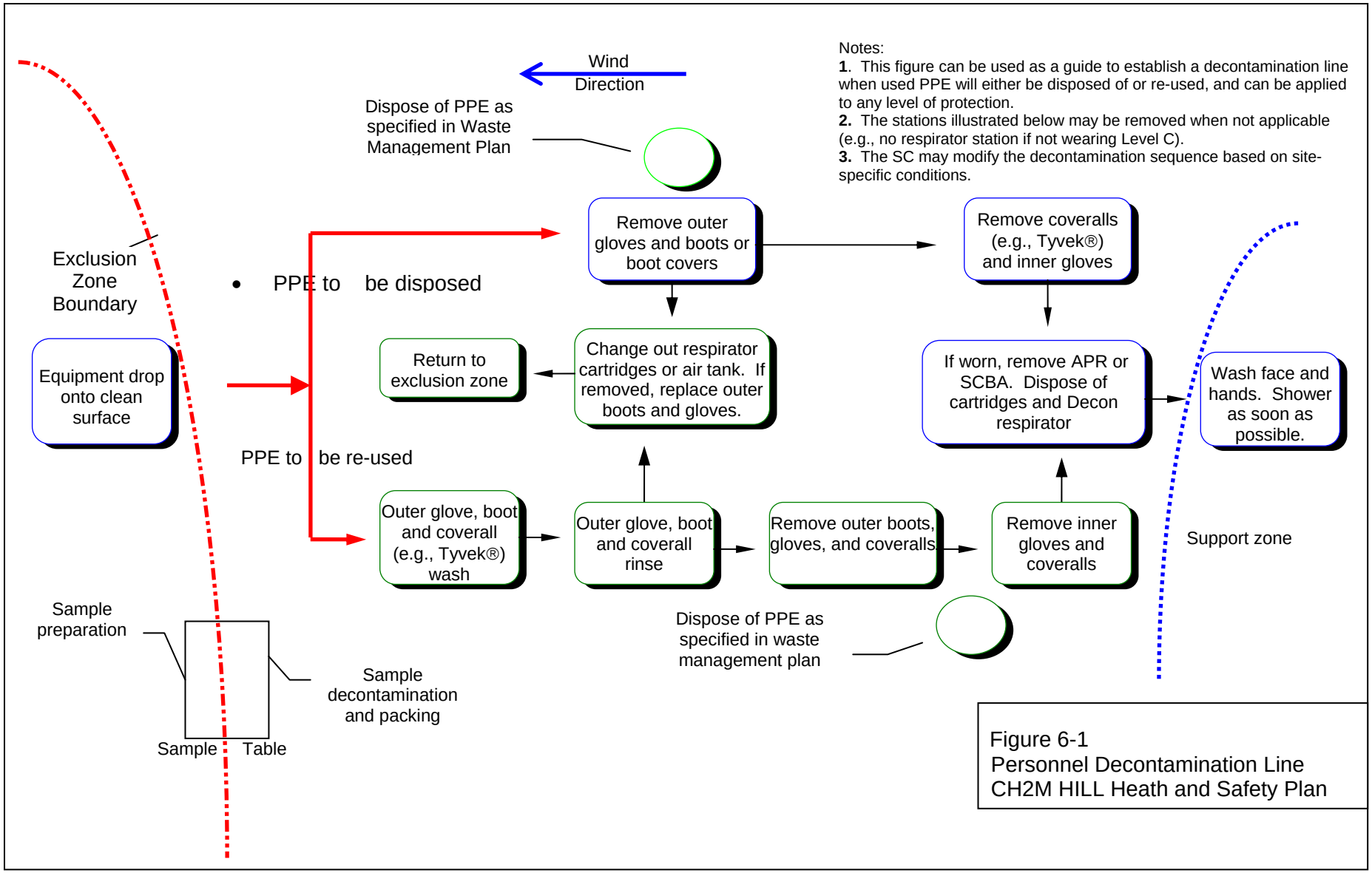
6.2 Diagram of Personnel-Decontamination Line

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

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

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 may modify the decontamination sequence based on site-specific conditions.

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

8. Site-Control Plan

8.1 Site-Control Procedures

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

- The SSC 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 SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL- SOP, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SC in appropriate level of protection.
- The SC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 Hazwoper Compliance Plan

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

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

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff is working in proximity to Hazwoper

activities. Other data (e.g., soil) also must document that there is no potential for exposure. The RHSM must approve the interpretation of these data. Refer to Sections 2.0 and 5.0 for contaminant data and air sampling requirements, respectively.

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

9. Emergency Response Plan

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

9.1 Pre-Emergency Planning

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

9.2 Emergency Equipment and Supplies

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

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

9.3 Incident Response

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

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

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in Section 5.7.

9.4 Emergency Medical Treatment

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

- Notify 911 or other appropriate emergency response authorities as listed in Attachment 4.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee. The supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.

- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report forms in Attachment 6.
- Notify and submit reports to client as required in contract

9.5 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in Section 5.7.

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.

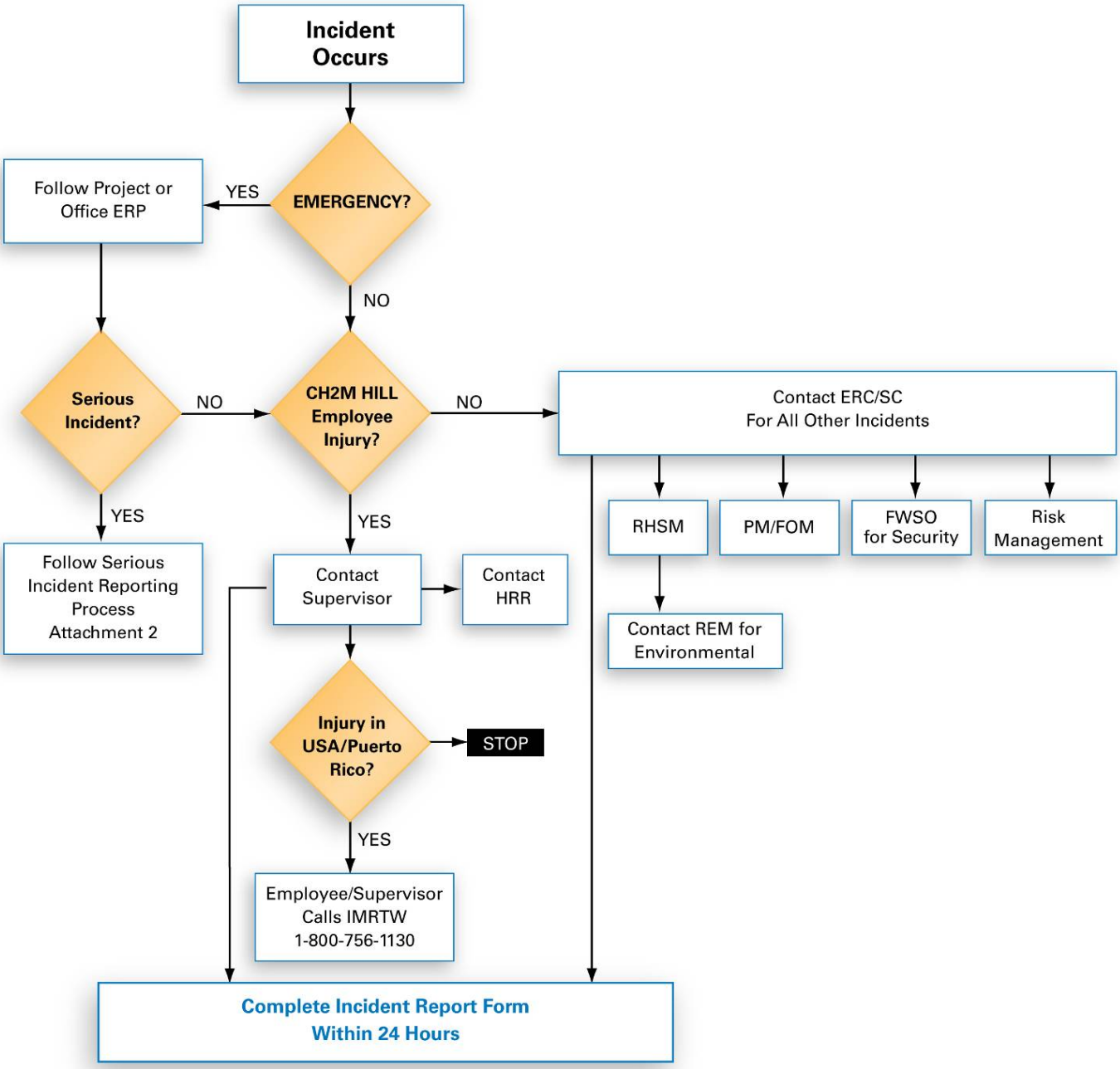
9.7 Incident Notification and Reporting

(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

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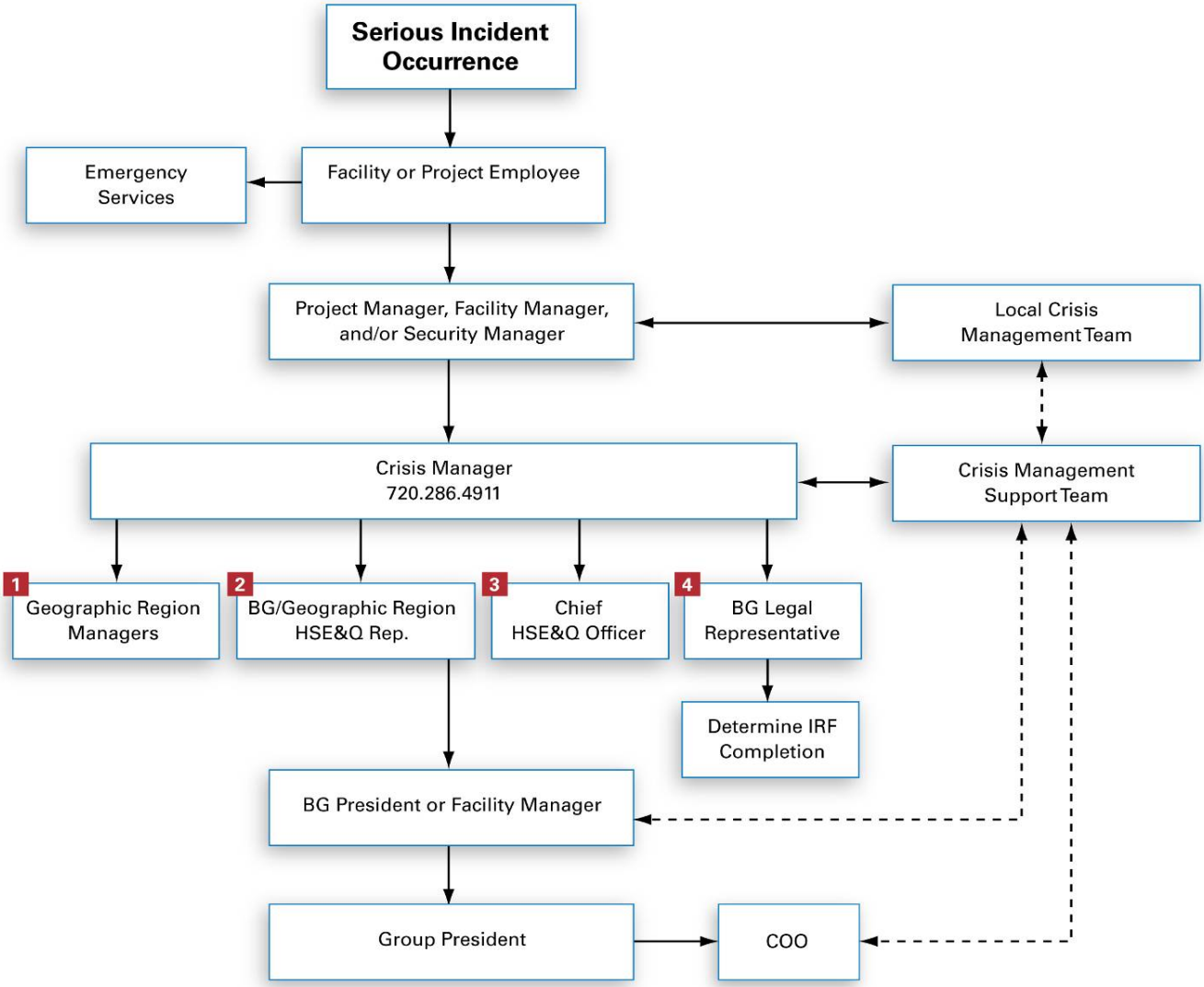
Attachment 2
CH2M HILL Serious Incident Notification



LEGEND:

Direct line of communication

Indirect line of communication

DEFINITIONS:

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

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

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

HS052007002MKT

10. 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 CH2M HILL projects to implement the BBLPS include:

- Activity Hazard Analysis (AHA)
- Pre-Task Safety Plans (PTSP)
- Loss Prevention Observations (LPO)
- 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 6. 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, that apply for each day's project activities. The

PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP, provided in Attachment 6, 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 Loss Prevention Observations

Loss Prevention Observations (LPOs) 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. LPOs 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 LPO each week for tasks/operations addressed in the project-specific HSP or AHA. The SC or designee shall complete the LPO form in **Attachment 6** for the task/operation being observed.

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 6**:

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

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

11. Approval

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

11.1 Original Plan

Written By: David Seed **Date:** February 12, 2009

Approved By: **Date:**

11.2 Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

CH2M HILL Health and Safety Plan

Health and Safety Plan Employee Sign-off Form

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

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

Project Name: CTO-0014 MRP PA/SI Site UXO-11, MCB Camp Lejeune **Project Number:** 378849

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

CH2M HILL Health and Safety Plan

Chemical Inventory/Register Form

CHEMICAL INVENTORY/REGISTER FORM

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

Location: _____

HCC: _____

☐ Office ☐ Warehouse ☐ Laboratory ☐ Project: _____

Project No.: _____

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)
Nitric acid	Support Zone / sample bottles		
Methanol	Support/Decon Zones		
Hexane	Support/Decon Zones		
pH buffers	Support Zone		
MSA Sanitizer	Support/Decon Zones		
Alconox/Liquinox	Support/Decon Zones		

MSDS for the listed products will be maintained at: _____

CH2M HILL Health and Safety Plan

Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

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

Location:	Project #:
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

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

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

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

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

CH2M HILL Health and Safety Plan

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: Michael Goldman/ATL Phone: (770) 604-9182 x 396
On-Scene Coordinator Name: Fire Chief Phone: (910) 451-5815	**Regional Human Resources Department** Name: Phone:
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: Bill Schmithorst Phone:919-760-1769	**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 Air Station and Camp Geiger

Directions to Onslow County Memorial Hospital:

1. Proceed through the main gate, turn right, and head north on Ocean Highway 17.
2. Follow Ocean Highway 17 north to Highway 24 and head east.
3. Travel east until Western Boulevard, turn left 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.

From MCB Camp Lejeune

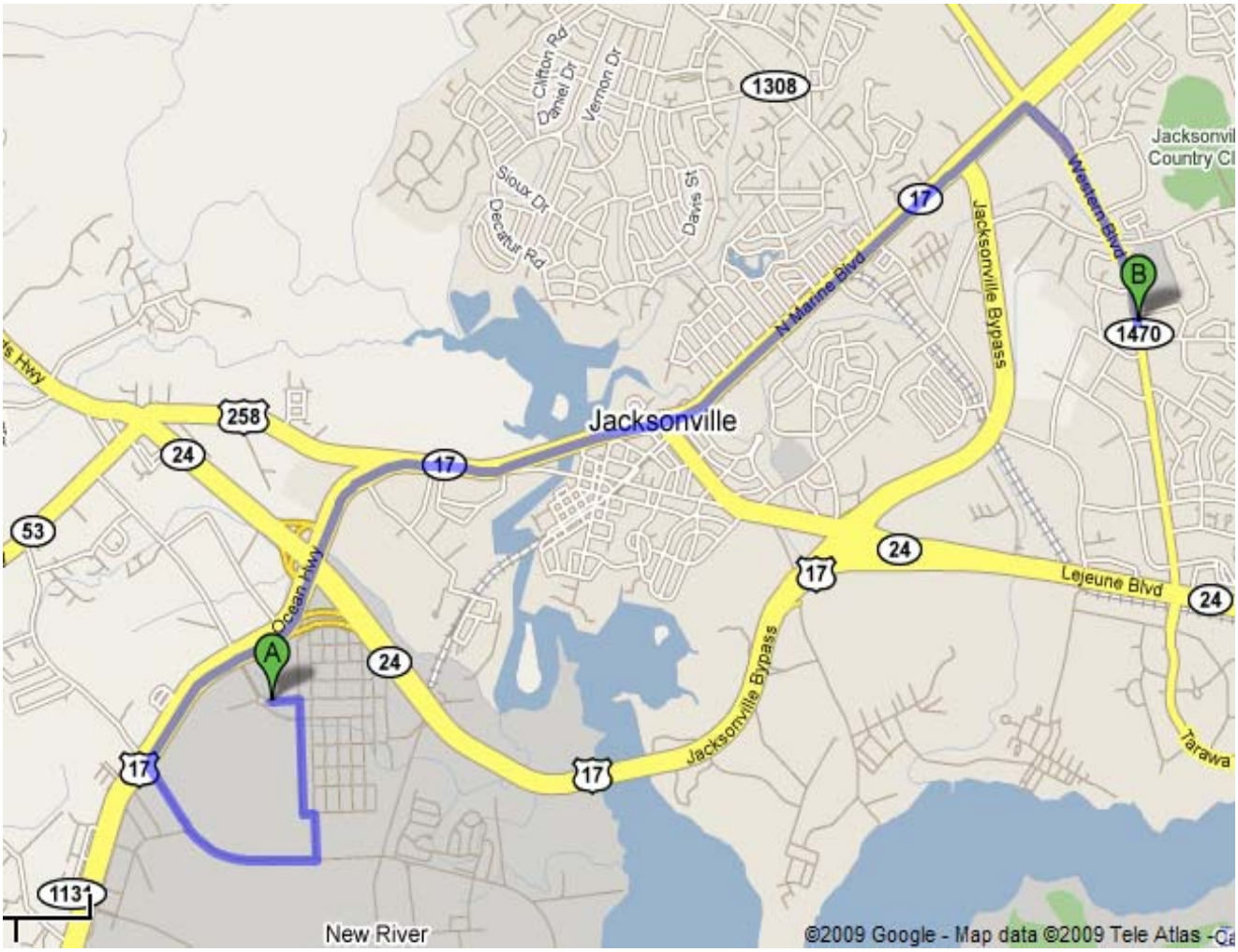
Directions to the Base Naval Hospital (Building NH100)

(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. From 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.


Clifton Rd
Daniel Dr
Vernon Dr
1308
Sioux Dr
Decatur Rd
Davis St
17
N Marine Blvd
Jacksonville Bypass
Western Blvd
Jacksonvil
Country Cl
B
1470
Jacksonville
258
24
17
53
Ocean Hwy
A
24
17
24
Lejeune Blvd
24
Jacksonville Bypass
17
17
Tarawa
113
New River
©2009 Google - Map data ©2009 Tele Atlas -

CH2M HILL Health and Safety Plan

Project Activity Self-Assessment Checklists/Permits/Forms

- **Drilling**
- **Traffic Control**

CH2MHILL

HS&E Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

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

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
☐ Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling safety requirements (complete entire checklist).
Subcontractors Name: _____

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

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-35.

SECTION 1 - SAFE WORK PRACTICES (4.1)

	Yes	No	N/A	N/O
1. Personnel cleared during rig startup	☐	☐	☐	☐
2. Personnel clear of rotating parts	☐	☐	☐	☐
3. Personnel not positioned under hoisted loads	☐	☐	☐	☐
4. Loose clothing and jewelry removed	☐	☐	☐	☐
5. Smoking is prohibited around drilling operation	☐	☐	☐	☐
6. Personnel wearing appropriate personal protective equipment (PPE), per written plan	☐	☐	☐	☐
7. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐

SECTION 2 - SUPPORT FUNCTIONS (4.2)

FORMS/PERMITS (4.2.1)

8. Driller license/certification obtained	☐	☐	☐	☐
9. Well development/abandonment notifications and logs submitted and in project files	☐	☐	☐	☐
10. Water withdrawal permit obtained, where required	☐	☐	☐	☐
11. Dig permit obtained, where required	☐	☐	☐	☐

UTILITY LOCATING (4.2.2)

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	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	☐	☐	☐	☐
15. Appropriate decontamination procedures being followed, per project's written safety plan	☐	☐	☐	☐
DRILLING AT ORDNANCE EXPLOSIVES (OE)/UNEXPLODED ORDNANCE (UXO) SITES (4.2.5)				
16. OE plan prepared and approved	☐	☐	☐	☐
17. OE/UXO avoidance provided, routes and boundaries cleared and marked	☐	☐	☐	☐
18. Initial pilot hole established by UXO technician with hand auger	☐	☐	☐	☐
19. Personnel remain inside cleared areas	☐	☐	☐	☐

SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)

GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	☐	☐	☐	☐
21. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
22. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	☐	☐	☐	☐
24. Safe clearance distance maintained from overhead power lines	☐	☐	☐	☐
25. Drilling pad established, when necessary	☐	☐	☐	☐
26. Drill rig leveled and stabilized	☐	☐	☐	☐
27. Additional precautions taken when drilling in confined areas	☐	☐	☐	☐
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
29. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
30. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
31. Safe clearance distance maintained while traveling under overhead power lines	☐	☐	☐	☐
32. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	☐	☐	☐	☐
34. All machine guards are in place	☐	☐	☐	☐
35. Rig ropes not wrapped around body parts	☐	☐	☐	☐
36. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
37. Drill operation stopped during inclement weather	☐	☐	☐	☐
38. Air monitoring conducted per written safety plan for hazardous atmospheres	☐	☐	☐	☐
39. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	☐	☐	☐	☐
41. Equipment and tools properly stored	☐	☐	☐	☐
42. All vehicles locked and keys removed	☐	☐	☐	☐
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	☐	☐	☐	☐
29. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
30. Cathead in clean, sound condition	☐	☐	☐	☐
31. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	☐	☐	☐	☐
33. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
34. Good housekeeping maintained on and around rig	☐	☐	☐	☐

SECTION 4

Complete this section for all items checked "No" in previous sections. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2MHILL

H&S Self-Assessment Checklist – TRAFFIC CONTROL

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

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

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

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

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to traffic hazards.
☐ Evaluate a CH2M HILL subcontractor's compliance with traffic control requirements.
Subcontractors Name: _____

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

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-24.

SECTION 1

SAFE WORK PRACTICES (3.1)	Yes	No	N/A	N/O
1. Personnel working on/adjacent to active roadways or in control zones are wearing safety vests.	☐	☐	☐	☐
2. Traffic control plan (TCP) is consistent with roadway, traffic, and working conditions.	☐	☐	☐	☐
3. TCP has been approved by regulatory or contractual authority prior to work.	☐	☐	☐	☐
4. TCP considers all factors that may influence traffic related hazards and controls.	☐	☐	☐	☐
5. Work areas are protected by rigid barriers.	☐	☐	☐	☐
6. Lookouts are used when applicable.	☐	☐	☐	☐
7. Vehicles are parked 40 feet away from work zone or are equipped with hazard beacon/strobe.	☐	☐	☐	☐
8. TMCC or TMA vehicle is used where appropriate.	☐	☐	☐	☐
9. All CH2M HILL traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
10. Traffic control devices are inspected continuously.	☐	☐	☐	☐
11. Flagging is only used when other means of traffic control are inadequate.	☐	☐	☐	☐
12. Additional traffic control zone controls have been implemented.	☐	☐	☐	☐
13. Cranes do not swing loads/booms over nor do workers enter/cross live roadways (as defined).	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
14. Lane closings are performed when required by this SOP.	☐	☐	☐	☐
15. Traffic control configurations are based on an engineering study of the location.	☐	☐	☐	☐
16. If no study, traffic control is performed with approval of the authority having jurisdiction.	☐	☐	☐	☐
17. TCP has been prepared and understood by all responsible parties prior to work.	☐	☐	☐	☐
18. Special preparation/coordination with external parties has been conducted where applicable.	☐	☐	☐	☐
19. All contractor traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
20. Traffic movement and flow are inhibited or disrupted as little as possible.	☐	☐	☐	☐
21. Supplemental equipment and activities do not interfere with traffic.	☐	☐	☐	☐
22. Drivers and pedestrians are considered when entering and traversing traffic control zone.	☐	☐	☐	☐
TRAFFIC CONTROL ZONES (3.2.2)				
23. Traffic control zones are divided into the necessary five areas.	☐	☐	☐	☐
24. Advances warning area is designed based on conditions of speed, roadways, and driver needs.	☐	☐	☐	☐
25. Advanced warning signage is spaced according to roadway type and conditions.	☐	☐	☐	☐
26. Transition areas are used to channelize traffic around the work area.	☐	☐	☐	☐
27. Buffer areas are used to provide a margin of safety for traffic and workers.	☐	☐	☐	☐
28. The buffer area is free of equipment, workers, materials, and worker vehicles.	☐	☐	☐	☐
29. The length of the buffer area is two times the posted speed limit in feet.	☐	☐	☐	☐
30. All work is contained in the work area and is closed to all traffic.	☐	☐	☐	☐
31. A termination area is used to provide traffic to return to normal lanes.	☐	☐	☐	☐
32. A downstream taper is installed in the termination area.	☐	☐	☐	☐
DEVICE INSTALLATION AND REMOVAL (3.2.3)				
33. All vehicles involved with device installation/removal have hazard beacons/strobes.	☐	☐	☐	☐
34. Devices are installed according to the order established by this SOP.	☐	☐	☐	☐
35. Devices are removed in the opposite order of installation.	☐	☐	☐	☐
36. Tapers are used to move traffic out of its normal path.	☐	☐	☐	☐
37. Tapers are created using channelizing devices.	☐	☐	☐	☐
38. The length of taper is determined by posted speed and width of lane to be closed (see formula).	☐	☐	☐	☐
39. Local police or highway patrol assist during taper installation and removal.	☐	☐	☐	☐
40. TMCC/ TMA vehicles are used to protect personnel during installation and removal of devices.	☐	☐	☐	☐
41. Cone trucks are equipped with platforms and railings.	☐	☐	☐	☐
42. Cones are the appropriate height for the specific roadway and are reflectorized.	☐	☐	☐	☐
43. Temporary sign supports are secured using sandbags to prevent movement.	☐	☐	☐	☐
44. Arrow panels are used on lane closures where required.	☐	☐	☐	☐
45. Concrete barriers are used where required.	☐	☐	☐	☐
46. Barrels, crash cushions, or energy absorbing terminals are used to protect traffic as required.	☐	☐	☐	☐
47. Changeable message signs (CMS) are used as required.	☐	☐	☐	☐
48. CMS are not used to replace required signage.	☐	☐	☐	☐
49. No more than two message panels are used in any message cycle on CMS.	☐	☐	☐	☐
FLAGGING (3.2.4)				
50. Flagging is used only when other traffic control methods are inadequate.	☐	☐	☐	☐
51. Only approved personnel with current certification are allowed to be used as flaggers.	☐	☐	☐	☐
52. Flaggers are located off the traveled portion of the roadway.	☐	☐	☐	☐
53. A communication system is established when more than one flagger is used.	☐	☐	☐	☐
54. Hand signaling by flaggers is by means of red flags, sign paddles, or red lights.	☐	☐	☐	☐
55. Flaggers are alert, positioned close enough to warn work crews, and easily identified from crew.	☐	☐	☐	☐
56. An escape plan is established by crew and flaggers prior to traffic control set up.	☐	☐	☐	☐
57. Signs indicating a flagger is present are used and removed as required.	☐	☐	☐	☐

SECTION 2

INSPECTION AND MAINTENANCE (3.2.5)

	Yes	No	N/A	N/O
58. Traffic control zones are monitored to determine their effectiveness under varying conditions.	☐	☐	☐	☐
59. Traffic control devices are inspected at the beginning and continuously during work shift.	☐	☐	☐	☐
60. Traffic control devices are restored to their proper position immediately and continuously.	☐	☐	☐	☐
61. Damaged, old, or ineffective devices are removed and replace immediately and continuously.	☐	☐	☐	☐
62. Devices using reflected light for illumination are cleaned and monitored continuously.	☐	☐	☐	☐

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SECTION 3

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

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2M HILL Health and Safety Plan

Behavior Based Loss Prevention System Forms

Pre-Task Safety Plans

Loss Prevention Observation

Biological Hazard Fact Sheets

Activity Hazard Analysis

Incident Report and Investigation

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):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

_____

_____

_____

_____

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

Name (Print): _____

Signature: _____ Date:_____

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Safe Work Observation Form		
Project:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

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 acracide
Personal protection through use of repellants and protective clothing
Frequent tick inspections and proper hygiene

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

Avoidance and Reduction of Ticks

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

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

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

Personal Protection

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

So that ticks may be seen on your clothing wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used.

To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots.

Wear long-sleeved shirts, a hat, and high boots.

Apply DEET repellent to exposed skin or clothing per product label.

Apply permethrin repellent to the outside of boots and clothing before wearing, per product label.

Frequently check for ticks and remove from clothing.

At the end of the day search your entire body for ticks (particularly groin, armpits, neck and head) and shower.

To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves anytime ticks are handled.

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

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

Tick Removal

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

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

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

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

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

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

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods

of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

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

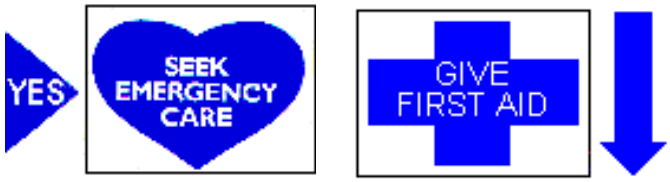
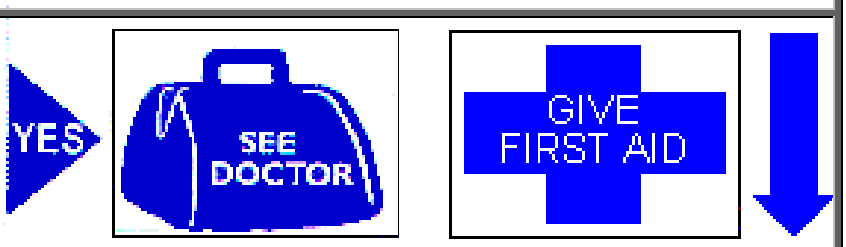
- Personal protective equipment, including tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.

- 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 and invisible film on top of the water and contaminate your entire body upon exiting the bath.

- Tecnu may also be used to decontaminate equipment.

- 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

Are there any of these problems? • Swelling in the throat, tongue and/or lips • A hard time breathing or swallowing • Weakness, dizziness • Bluish lips and mouth • Unconsciousness	
	Use emergency kit with adrenalin, if available, and Get Emergency Care.
Do you have any of these problems? • 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.	

	See Doctor and Give first aid before seeing doctor:
	• 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:
	  • Mix 2 teaspoons of baking soda in 1 quarter (4 cups) of water.
	  • Dip squares of gauze in this mixture.
	  • 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.

Activity Hazard Analyses (AHAs)

Contract Task Order 0014 MCB Camp Lejeune- Site UXO-11 ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Mobilization/Site Preparation	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe 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.	Standard Level D PPE * * 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.
	Heavy Equipment	• Workers to remain beyond the swing radius of heavy equipment. • Communicate with equipment operators with clear hand signals.	Standard Level D PPE
	Manual Lifting	• 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	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• 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-11 ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Mobilization/Site Preparation (continued)	Struck/pinched	• 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	• 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 repellant. 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	• If/when electrical extension cords are required to complete work, extension cords must be: • - Equipped with third-wire grounding. • - Covered, elevated, or protected from damage when passing through work areas. • - Protected from pinching if routed through doorways. • - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• 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-11 ACTIVITY HAZARD ANALYSIS – Mobilization/Site Preparation			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Pressure Washing/Equipment Decon	• 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	• Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio while driving on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain 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
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• 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.	• 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.

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Contract Task Order 0014 MCB Camp Lejeune- Site UXO-11 ACTIVITY HAZARD ANALYSIS – Surface water, groundwater, Surface and Subsurface Soil Sampling			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Surface and Subsurface Soil, Surface Water and Groundwater Sampling	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe 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.	Standard Level D PPE * * 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.
	Manual Lifting	• 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	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• 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	• 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-11 ACTIVITY HAZARD ANALYSIS – Surface water, groundwater, Surface and Subsurface Soil Sampling			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Surface and Subsurface Soil, Surface Water and Groundwater Sampling (continued)	Biological	• 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 repellant. 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	• If/when electrical extension cords are required to complete work, extension cords must be: • - Equipped with third-wire grounding. • - Covered, elevated, or protected from damage when passing through work areas. • - Protected from pinching if routed through doorways. • - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• 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	• 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-11 ACTIVITY HAZARD ANALYSIS – Surface water, groundwater, Surface and Subsurface Soil Sampling			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
	Chemical Exposure	• 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	• Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio while driving on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain 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
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• 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.	• 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.

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Contract Task Order 0014 MCB Camp Lejeune- Site UXO-11 ACTIVITY HAZARD ANALYSIS – Equipment Decontamination			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Equipment Decontamination	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe 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.	Standard Level D PPE * * 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.
	Heavy Equipment/Haul Trucks	• 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	• 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	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• 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	• 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-11 ACTIVITY HAZARD ANALYSIS – Equipment Decontamination			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Equipment Decontamination (continued)	Biological	• 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 repellant. 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	• If/when electrical extension cords are required to complete work, extension cords must be: • - Equipped with third-wire grounding. • - Covered, elevated, or protected from damage when passing through work areas. • - Protected from pinching if routed through doorways. • - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• 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	• 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	• 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-11 ACTIVITY HAZARD ANALYSIS – Equipment Decontamination			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Equipment Decontamination (continued)	Chemical Exposure	• 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	• Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio while driving on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain 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
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• 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.	• 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.

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Contract Task Order 0014 MCB Camp Lejeune- Site UXO-11 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	• 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.	Standard Level D PPE * * 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.
	Heavy Equipment/Haul Trucks	• 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	• 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	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• 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	• 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-11 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	• 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 repellant. 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	• 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	• 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	• 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-11 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	• Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio while driving on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain 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
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• 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.	• 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.

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Contract Task Order 0014 MCB Camp Lejeune- Site UXO-11 ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Demobilization/ Cleanup	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe 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.	Standard Level D PPE * * 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.
	Heavy Equipment/ Haul Trucks	• 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	• 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	• Personnel exposed to loud working environments shall wear hearing protection.	Standard Level D PPE
	High Ambient Temperature	• 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-11 ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Demobilization/ Cleanup (continued)	Struck/pinched	• 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	• 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 repellant. 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	• If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Fire Prevention	• 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-11
ACTIVITY HAZARD ANALYSIS – Demobilization / Cleanup

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Demobilization/ Cleanup (continued)	Pressure Washing/ Equipment Decon	• 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	• 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
	Other	• Always using a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never using a cell phone or two way radio while driving on military/government facilities. Violating these rules may result in loss of military/government facility driving privileges. • Shut down operations in heavy rain 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
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • Miscellaneous rigging.	• 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.	• 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:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

Site Personnel (continued):

_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____
_____	_____	**Date/Time:**_____

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 7

Material Safety Data Sheets

Manufacturer : Australian Chemical Reagents
A Division of Roache Analysts Pty Ltd
ACN No 010 524991
Address : 19 Kensal St Moorooka Qld 4105
Phone : (07) 38484828
Fax : (07) 38925936

Date : Sep 2004

MATERIAL SAFETY DATA SHEET

Not Classified as Hazardous According to Criteria of Worksafe Australia

IDENTIFICATION

pH4.00 Buffer

Part No	Product Code	Description & Volume
121381	GB4	pH4.00 Buffer, 200mL
121382	GB4L	pH4.00 Buffer, 1 Litre
121383	GB4T	pH4.00 Buffer, dry tablets and bottle to make 200mL
This MSDS also applies to other volumes of this buffer, labelled as custom standard.		

UN Number : None Allocated
Other Names : Nil
Manufacturers Code : GC4.00

Dangerous Goods Class : None Allocated
Subsidiary Risk : None Allocated
Hazchem Code : None Allocated
Poisons Schedule : Not Scheduled

Uses : Analytical Reagents for calibrating pH meters.

Physical Description / Properties :

Appearance : Green liquid
Boiling Point (^{0}C) : 100 (approx)
Vapour Pressure (mm of Hg @ 25^{0}C) : 25 (approx)
Specific Gravity : 1
Flash Point (^{0}C) : Not flammable
Flammability Limits (%) : Not flammable
Solubility in Water (g/L) : Completely miscible

Other Properties :

Ingredients :

Chemical Entity	CAS No	Proportion
Potassium Hydrogen Phthalate	[877-24-7]	<10%
Water	[7732-18-5]	to 100%

TPS Pty Ltd
A.B.N. No 30 009 773 371
4 Jamberoo Street
Springwood, Brisbane,
AUSTRALIA, 4127
Phone Australia (07) 32 900 400
International 61 7 32 900 400
Email tps@tps.com.au
Fax Australia (07) 3808 4871
International 61 7 3808 4871
Web www.tps.com.au

HEALTH HAZARD INFORMATION

Health Effects :

Swallowed : Consumption of large quantities may cause irritation of the gastric system.

Eye : May be irritating to eye tissue.

Skin : May irritate skin tissue with prolonged contact.

Inhaled : Not considered a hazard with normal laboratory use.

Chronic Effects : No data available

First Aid :

Swallowed : If conscious wash out mouth with water. Seek medical advice. Show this MSDS to medical practitioner.

Eye : Immediately hold eyelids open and flood with water for at least 15 minutes. Obtain medical aid. Show this MSDS to medical practitioner.

Skin : Remove contaminated clothing. Immediately wash skin thoroughly with water and mild soap. Seek medical advice if irritation persists. Show this MSDS to medical practitioner.

Launder clothing before reuse.

Inhaled : Remove from contaminated air. Maintain breathing with artificial respiration if necessary. Seek medical assistance. Show this MSDS to a doctor.

Advice to Doctor :
Treat symptomatically

PRECAUTIONS FOR USE

Exposure Limits : Worksafe : No specific exposure standards apply.

Engineering Controls : Not usually required with normal use.

Personal Protection : Not required with normal use.

Flammability : Not flammable.

TPS Pty Ltd
A.B.N. No 30 009 773 371
4 Jamberoo Street
Springwood, Brisbane,
AUSTRALIA, 4127
Phone Australia (07) 32 900 400
International 61 7 32 900 400
Email tps@tps.com.au
Fax Australia (07) 3808 4871
International 61 7 3808 4871
Web www.tps.com.au

SAFE HANDLING INFORMATION

Storage & Transport : Store sealed in original container in a cool well ventilated situation away from foods and other chemicals. Observe good hygiene and housekeeping practices.

No special transport requirements apply.

Spills & Disposal : Mop up spills and flush to waste if local regulations permit.

Fire/Explosion Hazard : Fire fighters should wear self contained breathing apparatus and impervious clothing if exposure to fumes is likely. Use water spray, foam or dry chemical to control fire situation if compatible with other chemical products in the vicinity.

Other :

References :

Lenga, R.E. (Ed.) *Safety The Sigma Aldrich Library of Chemical Safety Data* Sigma Aldrich Corporation 1985
National Institute for Occupational Safety & Health *NIOSH Pocket Guide to Chemical Hazards* 1990.
Merck & Co Inc. *The Merck Index 11th Ed.* Merck & Co 1989.
International Labour Office *Encyclopaedia of Occupational Health & Safety* Vol 1 & 2 International Labour Office 1983
National Occupational Health & Safety Commission *Exposure Standards for Atmospheric Contaminants in the Occupational Environment* AGPS 1995
National Occupational Health & Safety Commission *List of Designated Hazardous Substances* [NOHSC:10005(1994)] AGPS 1994

All information given by the Company is offered in good faith and is believed to the best of our knowledge to be accurate. However this information is offered without warranty representation inducement or licence and the Company does not assume legal responsibility for reliance upon the same.

Every person dealing with the materials referred to herein does so at his or her own risk absolutely and must make independent determinations of suitability and completeness of information from all sources to ensure their proper use.

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AUSTRALIA, 4127
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International 61 7 32 900 400
Email tps@tps.com.au
Fax Australia (07) 3808 4871
International 61 7 3808 4871
Web www.tps.com.au

MSDS

Material Safety Data Sheet

From: Vinquiry, Inc.
7795 Bell Road
Windsor, CA 95492

VINQUIRY

24 hour Emergency Telephone:
Chemtrec: 1-800-424-9300

Outside U.S. and Canada Chemtrec: 202-483-7616

NOTE: CHEMTREC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All Non-emergency questions should be directed to Customer Service (1-707-838-6312) for assistance.

Buffer pH7, Colorless

Buffer Solution (Phosphate), pH 7

MSDS Number: BS032 --- ***Effective Date: 08/10/04***

1. Product Identification

Synonyms: None
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Vinquiry Product Codes: 10-032-0000, 10-032-0237, 10-032-0473, 10-032-0946

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Potassium Phosphate Monobasic	7778-77-0	< 1%	No
Sodium Phosphate, Dibasic	7558-79-4	< 1%	No
Water	7732-18-5	> 99%	No

3. Hazards Identification

Emergency Overview

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

Vinquiry Inc. Safety Ratings (Provided here for your convenience)

Health Rating: 0 - None
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 0 - None
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
No adverse health effects via inhalation.
Ingestion:
Not expected to be a health hazard via ingestion. Large oral doses may cause irritation to the gastrointestinal tract.
Skin Contact:
Not expected to be a health hazard from skin exposure.
Eye Contact:
No adverse effects expected.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

---

4. First Aid Measures

Not expected to require first aid measures.
Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.

Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Wash thoroughly with running water. Get medical advice if irritation develops.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
Use protective clothing and breathing equipment appropriate for the surrounding fire.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust.

---

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.

Ventilation System:
In general, dilution ventilation is a satisfactory health hazard control for this substance. However, if conditions of use create discomfort to the worker, a local exhaust system should be considered.
Personal Respirators (NIOSH Approved):
Not expected to require personal respirator usage.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Odorless.
Solubility:
Complete (100%)
Specific Gravity:
No information found.
pH:
7
% Volatiles by volume @ 21C (70F):
ca. 99
Boiling Point:
No information found.
Melting Point:
No information found.
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
No information found.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
Heat.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Potassium Phosphate Monobasic (7778-77-0)	No	No	None
Sodium Phosphate, Dibasic (7558-79-4)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Dilute with water and flush to sewer if local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

---

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------    ----  ---  -----  ---------
Potassium Phosphate Monobasic (7778-77-0)          Yes  Yes   Yes      Yes
Sodium Phosphate, Dibasic (7558-79-4)              Yes  Yes   Yes      Yes
Water (7732-18-5)                                  Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                          --Canada--
Ingredient                                        Korea  DSL   NDSL  Phil.
----------------------------------------------    -----  ---   ----  -----
Potassium Phosphate Monobasic (7778-77-0)          Yes   Yes   No     Yes
Sodium Phosphate, Dibasic (7558-79-4)              Yes   Yes   No     Yes
Water (7732-18-5)                                  Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                          -SARA 302-    ------SARA 313------
Ingredient                                RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Potassium Phosphate Monobasic (7778-77-0) No    No      No         No
Sodium Phosphate, Dibasic (7558-79-4)     No    No      No         No
Water (7732-18-5)                         No    No      No         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                         -RCRA-    -TSCA-
Ingredient                                CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Potassium Phosphate Monobasic             No         No         No
(7778-77-0)
Sodium Phosphate, Dibasic (7558-79-4)     5000       No         No
Water (7732-18-5)                         No         No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: No       Chronic: No   Fire: No  Pressure: No
Reactivity: No          (Mixture / Liquid)
```

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations

(CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.
Label Precautions:
None.
Label First Aid:
Not applicable.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.

Disclaimer

Vinquiry Inc. provides this information in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to laboratory use of this material by a properly trained person. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose. Vinquiry Inc. will not be responsible for damages resulting from use or reliance upon this information.

Materials Safety Data Sheet

Part No. 025-162, 9.225pH Buffer Solution (500ml)

1.0 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY UNDERTAKING

Product details: pH buffer 500ml

Product name: **Buffer Solution 9.225pH ± 0.01 @ 20°C**
Part number: 025 162
Supplier:

Jenway
Gransmore Green
Felsted
Dunmow
Essex
CM6 3LB
England

Telephone: + 44 (0)1371 820122
Fax: + 44 (0)1371 821083
Email: health.safety@jenway.com

Further information obtainable from: Health & Safety.

2.0 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Characterisation:
Description: Mixture of the substances listed below with non-hazardous additions.

Description	Identification Number(s)
Purified Water	**EINECS Number**: 231-791-2

Dangerous Components: Void
Additional information: For the wording of the listed risk phrases refer to section 16.

3.0 HAZARDS IDENTIFICATION

Hazard Description: Not applicable
Information pertaining to particular hazards to man and environment:
The product does not have to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
Classification system:
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.

4.0 FIRST AID MEASURES

General Information:
No special measures required.
After inhalation:
Supply fresh air; consult doctor in case of symptoms.
After skin contact:
Generally the product does not irritate the skin.
After eye contact:
Rinse opened eye for several minutes under running water.
After swallowing:
If symptoms persist consult doctor.

5.0 FIRE FIGHTING MEASURES

Suitable extinguishing agents:
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
Protective equipment:
No special measures required.

6.0 ACCIDENTAL RELEASE MEASURES

Person-related safety precautions:
Not required.
Measures for environmental protection:
Dilute with plenty of water.
Do not allow to enter sewers/surface or ground water.
Measures for cleaning/collecting:
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Additional information:
No dangerous materials are released.

7.0 HANDLING AND STORAGE

Handling: PPE to be worn. See section 8
Information for safe handling:
No special measures required.
Information about fire and explosion protection:
No special measures required.
Storage:
Requirements to be met by storerooms and receptacles:
No special requirements.
Information about storage in one common facility:
Not required.
Further information about storage conditions:
None.

8.0 EXPOSURE CONTROLS/PERSONAL PROTECTION

Additional information about design of technical facilities:
No further data; see section 7.
Ingredients with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that that have to be monitored at the workplace.
Additional information:
The lists that were valid during the compilation were used as basis.
Personal protective equipment:
General protective and hygienic measures:
The usual precautionary measures should be adhered to general rules for handling chemicals.
Respiratory protection:
Not required.
Protection of hands:
The glove material has to be impermeable and resistant to the product/the substance/the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/the preparation/the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
Material of gloves:
The selection of suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.
Penetration time of glove material:
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection:
Goggles recommended during refilling.

9.0 PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid
Colour: Colourless
Odour: Characteristic

Melting point/Melting range:	$0^{o}C$
Boiling point/Boiling range:	100°C
Flash point:	Not applicable.
Self-inflammability:	Product is not selfigniting.
Danger of explosion:	Product is not explosive.
Density at 20°C	$1.0 g/cm^3$
Solubility in/Miscibility with Water:	Fully miscible.
Solvent content:	
Organic solvents:	0.0 %

10.0 STABILITY AND REACTIVITY

Thermal decomposition/conditions to be avoided:
No decomposition if used according to specifications.
Dangerous reactions:
No dangerous reactions known.
Dangerous products of decomposition:
No dangerous decomposition products known.

11.0 TOXICOLOGICAL INFORMATION

Acute toxicity:
Primary irritant effect on the skin:
No irritant effect.
Primary irritant effect on the eye:
No irritant effect.
Sensitisation:
No sensitising effect known.
Additional toxicological information:
The product is not subject to classification according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: *When used and handled according to specifications, the product does not have any harmful effects according to our experience and the information provided to us.*

12.0 ECOLOGICAL INFORMATION

General notes:
Water hazard class 1 (German Regulation) (Self assessment): slightly hazardous for water
Do not allow undiluted product or large quantities to reach ground water, water course or sewage system.

13.0 DISPOSAL CONSIDERATIONS

Product:
Recommendation:
Smaller quantities can be disposed of with household waste.
Uncleaned packaging:
Recommendation:
Disposal must be made according to official regulations.
Recommended cleansing agents:
Water, if necessary together with cleansing agents.

14.0 TRANSPORT INFORMATION

Land transport ADR/RID (cross-border)
ADR/RID-GGVS/E class: -

Maritime transport IMDG:
IMDG Class: -
Marine pollutant: No

Air transport ICAO-TI and IATA-DGR:
ICAO/IATA Class: -

Transport/ Additional information:
Not dangerous according to the above specifications.

15.0 REGULATORY INFORMATION

Labelling according to EU guidelines:
Observe the normal safety regulations when handling chemicals. The product is not subject to identification regulations under EC Directives/Ordinance on Hazardous Materials (German GefStoffV).

National regulations
Water hazard class:
Water hazard class 1 (Self assessment) : slightly hazardous for water.

16.0 OTHER INFORMATION

This MSDS should be forwarded immediately to all users of this product within your organisation. If this product is to be re-consigned to another organisation then it is your responsibility to ensure that this MSDS is sent or copied to that organisation. This data sheet must not be construed to be a risk assessment for operations involving this substance. As with any other substance, the user is advised to carry out a risk assessment when working with it. This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship. No responsibility can be assumed by Jenway for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices.
Department issuing MSDS: Health & Safety

MSDS Number: **S4034** * * * * * *Effective Date:* ***08/02/01*** * * * * * *Supercedes:* ***08/20/98***

MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SODIUM HYDROXIDE

1. Product Identification

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH
Product Codes:
J.T. Baker: 3717, 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565
Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:
Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.
Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days after exposure.
Skin Contact:
Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.
Eye Contact:
Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water.
Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
- ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to

50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:

White, deliquescent pellets or flakes.

Odor:

Odorless.

Solubility:

111 g/100 g of water.

Specific Gravity:

2.13

pH:

13 - 14 (0.5% soln.)

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1390C (2534F)

Melting Point:

318C (604F)

Vapor Density (Air=1):

> 1.0

Vapor Pressure (mm Hg):

Negligible.

Evaporation Rate (BuAc=1):

No information found.

---

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly

pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

Hazardous Decomposition Products:

Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.

Conditions to Avoid:

Moisture, dusting and incompatibles.

11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

```
--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
------------------------------------    -----    -----------    -------------
Sodium Hydroxide (1310-73-2)             No          No            None
```

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as

hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------  ----  ---  -----  ---------
Sodium Hydroxide (1310-73-2)                     Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                         --Canada--
Ingredient                                        Korea  DSL   NDSL  Phil.
----------------------------------------------  -----  ---   ----  -----
Sodium Hydroxide (1310-73-2)                     Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-    ------SARA 313------
Ingredient                                  RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Sodium Hydroxide (1310-73-2)              No    No      No         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                       -RCRA-    -TSCA-
Ingredient                                  CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
```

```
  Sodium Hydroxide (1310-73-2)               1000       No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
Reactivity: Yes         (Pure / Solid)
```

Australian Hazchem Code: 2R
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
****

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate

precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **S8237** * * * * * *Effective Date:* ***05/08/03*** * * * * * *Supercedes:* ***09/14/00***

MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SULFURIC ACID, 10 - 51%

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid
CAS No.: 7664-93-9
Molecular Weight: 98.07
Chemical Formula: H2SO4 in H2O
Product Codes:
J.T. Baker: 0331, 4700, 4701, 5253, 5691, 5951, 9696, S8237
Mallinckrodt: H378, H379, H390, V011, V029, V487, V581

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	10 - 51%	Yes
Water	7732-18-5	49 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Water Reactive)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.
Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.
Eye Contact:
Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Chronic Exposure:
Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.
Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.
Ingestion:
DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.
Eye Contact:
Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

5. Fire Fighting Measures

Fire:
Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.
Explosion:
Contact with most metals causes formation of flammable and explosive hydrogen gas.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as

specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Sulfuric Acid:
- OSHA Permissible Exposure Limit (PEL) -
1 mg/m3 (TWA)
- ACGIH Threshold Limit Value (TLV) -
1 mg/m3(TWA), 3 mg/m3 (STEL), A2 - suspected human carcinogen for sulfuric acid contained in strong inorganic acid mists.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full

facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:

Clear oily liquid.

Odor:

Odorless.

Solubility:

Miscible with water, liberates much heat.

Specific Gravity:

1.40 (50%), 1.07 (10%)

pH:

1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

ca. 290C (ca. 554F) (decomposes at 340C)

Melting Point:

3C (100%), -32C (93%), -38C (78%), -64C (65%).

Vapor Density (Air=1):

3.4

Vapor Pressure (mm Hg):

1 @ 145.8C (295F)

Evaporation Rate (BuAc=1):

No information found.

---

10. Stability and Reactivity

Stability:
Concentrated solutions react violently with water, spattering and liberating heat.
Hazardous Decomposition Products:
Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.
Conditions to Avoid:
Heat, moisture, incompatibles.

11. Toxicological Information

Toxicological Data:
Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m3/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.
Carcinogenicity:
Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a

moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.
Environmental Toxicity:
LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified; LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.
This material may be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SULFURIC ACID (WITH NOT MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN2796
Packing Group: II
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: SULPHURIC ACID (WITH NOT MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN2796
Packing Group: II
Information reported for product/size: 20L

International (Air, I.C.A.O.)

Proper Shipping Name: SULPHURIC ACID (WITH NOT MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN2796
Packing Group: II

Information reported for product/size: 20L

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                          TSCA  EC   Japan  Australia
----------------------------------------------      ----  ---  -----  ---------
Sulfuric Acid (7664-93-9)                            Yes  Yes   Yes      Yes
Water (7732-18-5)                                    Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                            --Canada--
Ingredient                                          Korea  DSL   NDSL  Phil.
----------------------------------------------      -----  ---   ----  -----
Sulfuric Acid (7664-93-9)                            Yes   Yes   No     Yes
Water (7732-18-5)                                    Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                              -SARA 302-    ------SARA 313------
Ingredient                                    RQ    TPQ     List  Chemical Catg.
----------------------------------------      ---   -----   ----  --------------
Sulfuric Acid (7664-93-9)                     1000  1000    Yes        No
Water (7732-18-5)                             No    No      No         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                        -RCRA-    -TSCA-
Ingredient                                    CERCLA    261.33     8(d)
----------------------------------------      ------    ------    ------
Sulfuric Acid (7664-93-9)                     1000      No         No
Water (7732-18-5)                             No        No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  Yes
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: Yes         (Pure / Liquid)
```

Australian Hazchem Code: 2P
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **2** Other: **Water reactive**
Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not contact with water.

Label First Aid:

In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 14.

Disclaimer:

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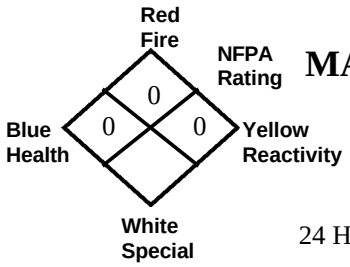
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Alconox ®



MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

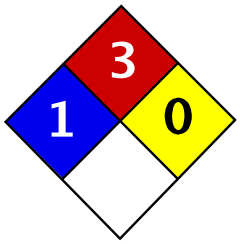
VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.



Health	2
Fire	3
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Hexanes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hexanes

Catalog Codes: SLH2335, SLH2032

CAS#: 110-54-3

RTECS: MN9275000

TSCA: TSCA 8(b) inventory: Hexane

CI#: Not applicable.

Synonym:

Chemical Name: Hexane

Chemical Formula: C6-H14

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hexanes	110-54-3	98.5-99.9

Toxicological Data on Ingredients: Hexane: ORAL (LD50): Acute: 25000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to peripheral nervous system, skin, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 225°C (437°F)

Flash Points: CLOSED CUP: -22.5°C (-8.5°F). (TAG)

Flammable Limits: LOWER: 1.15% UPPER: 7.5%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor.
Vapor may cause flash fire.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid, insoluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 (ppm) from OSHA (PEL) [United States] Inhalation
TWA: 1800 (mg/m3) from OSHA (PEL) [United States] Inhalation
TWA: 176 (mg/m3) from ACGIH (TLV) [United States] SKIN
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [United States] Inhalation
TWA: 1760 STEL: 3500 (mg/m3) from ACGIH (TLV) [United States] Inhalation
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Gasoline-like or petroleum-like (Slight.)

Taste: Not available.

Molecular Weight: 86.18g/mole

Color: Clear Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 68°C (154.4°F)

Melting Point: -95°C (-139°F)

Critical Temperature: Not available.

Specific Gravity: 0.66 (Water = 1)

Vapor Pressure: 17.3 kPa (@ 20°C)

Vapor Density: 2.97 (Air = 1)

Volatility: Not available.

Odor Threshold: 130 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.9

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not available.

Special Remarks on Reactivity: Hexane can react vigorously with strong oxidizers (e.g. chlorine, bromine, fluorine)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 25000 mg/kg [Rat].
Acute toxicity of the gas (LC50): 48000 ppm 4 hours [Rat].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: peripheral nervous system, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of ingestion, of inhalation.
Hazardous in case of skin contact (permeator).
Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects based on animal data.
May be tumorigenic based on animal data.
May affect genetic material.
Passes through the placental barrier in animal.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause mild skin irritation. It can be absorbed through the skin in harmful amounts.
Eyes: May cause mild eye irritation.
Inhalation: May be harmful if inhaled. Inhalation of vapors may cause respiratory tract irritation. Overexposure may affect, brain, spinal cord, behavior/central and peripheral nervous systems (lightheadness, dizziness, hallucinations, paralysis, blurred vision, memory loss, headache, euphoria, general anesthetic, muscle weakness, numbness of the extremeties, asphyxia, unconciousness and possible death), metabolism, respiration, blood, cardiovascular system, gastrointestinal system (nausea)
Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation with abdominal pain and nausea. May also affect the liver, blood, brain, peripheral and central nervous systems. Symptoms of over exposure by ingestion are similar to that of overexposure by inhalation.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Hexane UNNA: 1208 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hexanes

Illinois toxic substances disclosure to employee act: Hexanes
Illinois chemical safety act: Hexanes
New York release reporting list: Hexanes
Rhode Island RTK hazardous substances: Hexanes
Pennsylvania RTK: Hexanes
Florida: Hexanes
Minnesota: Hexanes
Massachusetts RTK: Hexanes
Massachusetts spill list: Hexanes
New Jersey: Hexanes
New Jersey spill list: Hexanes
Louisiana spill reporting: Hexanes
TSCA 8(b) inventory: Hexanes
SARA 313 toxic chemical notification and release reporting: Hexanes
CERCLA: Hazardous substances.: Hexanes: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
R38- Irritating to skin.
R51/53- Toxic to aquatic organisms,
may cause long-term adverse effects
in the aquatic environment.
R62- Possible risk of impaired fertility.
R65- Harmful: may cause lung
damage if swallowed.
R67- Vapors may cause drowsiness or
dizziness.
S9- Keep container in a well-ventilated place.
S16- Keep away from sources of ignition - No
smoking.
S29- Do not empty into drains.
S33- Take precautionary measures against
static discharges.
S36/37- Wear suitable protective clothing and
gloves.
S61- Avoid release to the environment. Refer to
special instructions/Safety data sheets.
S62- If swallowed, do not induce vomiting: seek
medical advice immediately and show this

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves (impervious).
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:19 PM

Last Updated: 10/10/2005 08:19 PM

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MSDS Number: **H3880** * * * * * *Effective Date:* ***05/07/03*** * * * * * *Supercedes:* ***05/10/01***

MSDS **Material Safety Data Sheet**

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID, 33 - 40%

1. Product Identification

Synonyms: Muriatic acid; hydrogen chloride, aqueous
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl
Product Codes:
J.T. Baker: 5367, 5537, 5575, 5800, 5814, 5821, 5839, 5894, 5962, 5972, 5994, 6900, 7831, 9529, 9530, 9534, 9535, 9536, 9537, 9538, 9539, 9540, 9544, 9548
Mallinckrodt: 2062, 2515, 2612, 2624, 2626, 3861, 5587, H611, H613, H987, H992, H999, V078, V628

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	33 - 40%	Yes
Water	7732-18-5	60 - 67%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea. Swallowing may be fatal.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Extreme heat or contact with metals can release flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
If involved in a fire, use water spray. Neutralize with soda ash or slaked lime.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National

Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator.
WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Colorless, fuming liquid.
Odor:
Pungent odor of hydrogen chloride.
Solubility:
Infinite in water with slight evolution of heat.
Density:
1.18
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
53C (127F) Azeotrope (20.2%) boils at 109C (228F)
Melting Point:
-74C (-101F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
190 @ 25C (77F)
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.

Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

11. Toxicological Information

Inhalation rat LC50: 3124 ppm/1H; oral rabbit LD50: 900 mg/kg (Hydrochloric acid concentrated); investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

```
Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  Yes
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Mixture / Liquid)
```

Australian Hazchem Code: 2R
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
****

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: ISOBUTYLENE

1. Chemical Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER: CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: ISOBUTYLENE
CHEMICAL NAME: Isobutylene
COMMON NAMES/SYNONYMS: 2-Methylpropene, Isobutene
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/1/99

2. Composition, Information on Ingredients

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Isobutylene FORMULA: C_4H_8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	None Established	Simple Asphyxiant	No Data

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1998-1999 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Flammable colorless gas with unpleasant odor. Dangerous fire and explosion hazard. Avoid heat, sparks, and flames. This product does not contain oxygen and may cause asphyxia if released in a confined area. Simple hydrocarbons can cause irritation and central nervous system depression at high concentrations. Contents under pressure. Use and store below 125 °F.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	No	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
No	Yes	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
High concentrations may cause minor irritation.

SKIN EFFECTS:
None anticipated.

INGESTION EFFECTS:
Ingestion is unlikely.

INHALATION EFFECTS:
Product is relatively nontoxic. May cause minor eye, mucous membrane and respiratory irritation at high concentrations.

Inhalation of high concentrations may cause dizziness, disorientation, incoordination, narcosis, nausea or narcotic effects.

This product may displace oxygen if released in a confined space. Maintain oxygen levels above 19.5% at sea level to prevent asphyxiation.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 2	Health: 1	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Instability: 1	Reactivity: 1	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures

EYES:
None normally required. If irritation occurs, flush eyes with water for 15 minutes. If irritation persists, seek medical attention.

SKIN:
None normally required. If irritation occurs, remove contaminated clothing and wash affected area with soap and water. If irritation persists, seek medical attention.

INGESTION:
Not normally required. Seek immediate medical attention.

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted (artificial) respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: -105 ^{o}F (-76 ^{o}C)	Method: Closed Cup	Autoignition Temperature: 869 ^{o}F (465 ^{o}C)
LEL(%): 1.8	UEL(%): 9.6	
Hazardous combustion products: Carbon monoxide, Carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Isobutylene is heavier than air and may travel a considerable distance along the ground to an ignition source and flash back. Isobutylene is a flammable gas! Keep away from open flame and other sources of ignition. Do not allow smoking in storage areas or when handling. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:
Water, carbon dioxide, dry chemical.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop the flow of gas. Inerting the atmosphere to reduce oxygen levels may extinguish flame, allowing capping of leaking container. Do not attempt this unless specifically trained. Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. Do not extinguish the fire until the supply is shut off as otherwise an explosive re-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Use non-sparking tools to close container valves.

Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above liquid level with remote monitors. Limit the number of personnel in proximity of fire and evacuate surrounding areas in all directions.

Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Extinguish all ignition sources. No smoking, flames, flares or sparks in hazard area. Evacuate all personnel from affected area. Use appropriate protective equipment. Increase ventilation to prevent build up of a flammable/explosive atmosphere. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical classification:
Not available.

Earth bond and ground all lines and equipment associated with the product system. **All** equipment should be non-sparking and explosion proof.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas, emergency exits, flammables and combustibles. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time.

Post "No Smoking" signs in storage or use areas. There should be no sources of ignition in storage and use areas. Outside or detached storage preferred.

For additional recommendations consult Compressed Gas Association Pamphlet P-1 and Safety Bulletin SB-2.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:
Use local exhaust to prevent accumulation. Use general ventilation to prevent build up of flammable concentrations. May use hood with forced ventilation when handling small quantities. If product is handled routinely where the potential for leaks exists, all electrical equipment must be rated for use in potentially flammable atmospheres. Consult the National Electrical Code for details.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Protective gloves made of plastic or rubber.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure at 70°F	: 39	psia
Vapor density at STP (Air = 1)	: 1.98	
Evaporation point	: Not Available	
Boiling point	: 19.5	°F
	: -6.9	°C
Freezing point	: -220.6	°F
	: -140.3	°C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H_20)	: Insoluble	
Odor threshold	: Not Available	
Odor and appearance	: A colorless gas with an unpleasant odor similar to that of burning coal.	

10. Stability and Reactivity

STABILITY:
Stable

INCOMPATIBLE MATERIALS:
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide

11. Toxicological Information

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Isobutylene	Isobutylene
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1055	UN 1055
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Isbutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION
SARA TITLE III - HAZARD CLASSES:
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: METHANE

1. Chemical Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER: CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: METHANE
CHEMICAL NAME: CH4
COMMON NAMES/SYNONYMS: Methyl Hydride
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/1/99

2. Composition, Information on Ingredients

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Methane FORMULA: CH_4 CAS: 74-82-8 RTECS #: PA1490000	100	None Established	Simple Asphyxiant	Not Available

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1998-1999 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Odorless, colorless flammable gas. Dangerous fire and explosion hazard. Avoid heat, sparks and flames. Simple Asphyxiant – This product does not contain oxygen and may cause asphyxia if released in a confined area. Maintain oxygen levels above 19.5%. Contents under pressure. Use and store below 125 °F.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	No	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
No	No	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects None reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
None anticipated.

SKIN EFFECTS:
None anticipated.

INGESTION EFFECTS:
None known. Ingestion is unlikely.

INHALATION EFFECTS:
Methane and nitrogen are simple asphyxiants. Exposure to high concentrations of this gas mixture may exclude an adequate supply of oxygen. Oxygen levels should be maintained at greater than 19.5% at normal atmospheric pressure.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 2	Health: 0	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Instability: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures

EYES:
None required.

SKIN:
None required.

INGESTION:
Not normally required.

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO THIS PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive. Keep victim warm and quiet.

5. Fire Fighting Measures

Conditions of Flammability: Flammable gas		
Flash point: -306°F (-188°C)	Method: Closed cup	Autoignition Temperature: 1076°F (580°C)
LEL(%): 5	UEL(%): 15	
Hazardous combustion products: Carbon dioxide, Carbon monoxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Flammable gas. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:
Carbon dioxide, dry chemical or water spray.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop the flow of gas. Inerting the atmosphere to reduce oxygen levels may extinguish flame, allowing capping of leaking container. Do not attempt this unless specifically trained. Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. Do not extinguish the fire until the supply is shut off as otherwise an explosive re-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Use non-sparking tools to close container valves.

Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above liquid level with remote monitors. Limit the number of personnel in proximity of fire and evacuate surrounding areas in all directions.

Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Immediately extinguish all ignition sources. No smoking, flames, sparks or flares in hazard area. Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classification:
Not Available

Earth ground and bond all lines and equipment associated with the system. All equipment should be non sparking or explosion-proof.

Methane is non-corrosive and may be used with any common structural material.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Post "NO SMOKING" signs in use or storage areas. There should be no sources of ignition in areas where this product is being used or stored. Outside or detached storage is preferred.

For additional storage recommendations, consult Compressed Gas Association's Pamphlets P-1, P-14, and Safety Bulletin SB-2.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:
Hood with forced ventilation. Local exhaust to prevent dilution of oxygen levels below 19.5%. Mechanical in accordance with electrical codes.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Plastic or rubber gloves. Protective gloves made of any suitable material.

RESPIRATORY PROTECTION:
Positive pressure air line with mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not Available	
Vapor density (Air = 1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: -285.7	^oF
	: -161.5	^oC
Freezing point	: -296.5	^oF
	: -182.5	^oC
pH	: Not Applicable	
Specific gravity	: 0.55	
Oil/water partition coefficient	: Not Available	
Solubility (H_20)	: Negligible	
Odor threshold	: Not Applicable	
Odor and appearance	: Odorless, colorless gas	

10. Stability and Reactivity

STABILITY:
Stable

INCOMPATIBLE MATERIALS:
Oxidizers

HAZARDOUS POLYMERIZATION:
Will not occur.

11. Toxicological Information

No data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Methane, compressed	Methane, compressed
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1971	UN 1971
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Methane is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
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Material Safety Data Sheet

Methyl Alcohol, Reagent ACS, 99.8% (GC)

ACC# 95294

Section 1 - Chemical Product and Company Identification

MSDS Name: Methyl Alcohol, Reagent ACS, 99.8% (GC)
Catalog Numbers: AC423950000, AC423950010, AC423950020, AC423955000, AC9541632, AC423952
Synonyms: Carbinol; Methanol; Methyl hydroxide; Monohydroxymethane; Pyroxylic spirit; Wood alcohol; Wood naptha; Wood spirit; Monohydroxymethane; Methyl hydrate.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
67-56-1	Methyl alcohol	99+	200-659-6

Hazard Symbols: T F
Risk Phrases: 11 23/24/25 39/23/24/25

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless. Flash Point: 11 deg C. Poison! Cannot be made non-poisonous. Causes eye and skin irritation. May be absorbed through intact skin. This substance has caused adverse reproductive and fetal effects in animals. **Danger! Flammable liquid and vapor.** Harmful if inhaled. May be fatal or cause blindness if swallowed. May cause central nervous system depression. May cause digestive tract irritation with nausea, vomiting, and diarrhea. Causes respiratory tract irritation. May cause liver, kidney and heart damage.
Target Organs: Kidneys, heart, central nervous system, liver, eyes.

Potential Health Effects

Eye: Produces irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. May cause painful sensitization to light.
Skin: Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
Ingestion: May be fatal or cause blindness if swallowed. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systemic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause cardiopulmonary system effects.
Inhalation: Harmful if inhaled. May cause adverse central nervous system effects including

headache, convulsions, and possible death. May cause visual impairment and possible permanent blindness. Causes irritation of the mucous membrane.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. Chronic exposure may cause reproductive disorders and teratogenic effects. Laboratory experiments have resulted in mutagenic effects. Prolonged exposure may cause liver, kidney, and heart damage.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Induce vomiting by giving one teaspoon of Syrup of Ipecac.
Inhalation: Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: Effects may be delayed. Ethanol may inhibit methanol metabolism.

Section 5 - Fire Fighting Measures

General Information: Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Vapors can travel to a source of ignition and flash back. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Flammable Liquid. Can release vapors that form explosive mixtures at temperatures above the flashpoint. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. May be ignited by heat, sparks, and flame.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Scoop up with a nonsparking tool, then place into a suitable container for disposal. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as saw dust. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Do not ingest or inhale. Use only in a chemical fume hood. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed. Do not store in aluminum or lead containers.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use only under a chemical fume hood.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Methyl alcohol	200 ppm TWA; 250 ppm STEL; skin - potential for cutaneous absorption	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA

OSHA Vacated PELs: Methyl alcohol: 200 ppm TWA; 260 mg/m3 TWA; 250 ppm STEL; 325 mg/m3 STEL
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR ?1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: alcohol-like - weak odor
pH: Not available.
Vapor Pressure: 128 mm Hg @ 20 deg C
Vapor Density: 1.11 (Air=1)
Evaporation Rate:5.2 (Ether=1)
Viscosity: 0.55 cP 20 deg C
Boiling Point: 64.7 deg C @ 760.00mm Hg
Freezing/Melting Point:-98 deg C
Autoignition Temperature: 464 deg C (867.20 deg F)
Flash Point: 11 deg C (51.80 deg F)

Decomposition Temperature: Not available.
NFPA Rating: (estimated) Health: 1; Flammability: 3; Reactivity: 0
Explosion Limits, Lower:6.0 vol %
Upper: 36.00 vol %
Solubility: miscible
Specific Gravity/Density:.7910g/cm3
Molecular Formula:CH4O
Molecular Weight:32.04

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, incompatible materials, ignition sources, oxidizers.
Incompatibilities with Other Materials: Acids (mineral, non-oxidizing, e.g. hydrochloric acid, hydrofluoric acid, muriatic acid, phosphoric acid), acids (mineral, oxidizing, e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic, e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), azo, diazo, and hydrazines (e.g. dimethyl hydrazine, hydrazine, methyl hydrazine), isocyanates (e.g. methyl isocyanate), nitrides (e.g. potassium nitride, sodium nitride), peroxides and hydroperoxides (organic, e.g. acetyl peroxide, benzoyl peroxide, butyl peroxide, methyl ethyl ketone peroxide), epoxides (e.g. butyl glycidyl ether), Oxidants (such as barium perchlorate, bromine, chlorine, hydrogen peroxide, lead perchlorate, perchloric acid, sodium hypochlorite)., Active metals (such as potassium and magnesium)., acetyl bromide, alkyl aluminum salts, beryllium dihydride, carbontetrachloride, carbon tetrachloride + metals, chloroform + heat, chloroform + sodium hydroxide, cyanuric chloride, diethyl zinc, nitric acid, potassium-tert-butoxide, chloroform + hydroxide, water reactive substances (e.g. acetic anyhdride, alkyl aluminum chloride, calcium carbide, ethyl dichlorosilane).
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 67-56-1: PC1400000
LD50/LC50:
CAS# 67-56-1:
Draize test, rabbit, eye: 40 mg Moderate;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, rat: LC50 = 64000 ppm/4H;
Oral, mouse: LD50 = 7300 mg/kg;
Oral, rabbit: LD50 = 14200 mg/kg;
Oral, rat: LD50 = 5628 mg/kg;
Skin, rabbit: LD50 = 15800 mg/kg;
Carcinogenicity:
CAS# 67-56-1: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology: Methanol has been shown to produce fetotoxicity in the embr yo or fetus of laboratory animals. Specific developmenta l abnormalities include cardiovascular, musculoskeletal, and urogenital systems.
Teratogenicity: Effects on Newborn: Behaviorial, Oral, rat: TDLo=7500 mg/kg (female 17-19 days after conception). Effects on Embryo or Fetus: Fetotoxicity, Inhalation, rat: TCLo=10000

ppm/7H (female 7-15 days after conception). Specific Developmental Abnormalities: Cardiovascular, Musculoskeletal, Urogenital, Inhalation, rat: TCLo=20000 ppm/7H (7-14 days after conception).
Reproductive Effects: Paternal Effects: Spermatogenesis: Intraperitoneal, mouse TDLo=5 g/kg (male 5 days pre-mating). Fertility: Oral, rat: TDLo = 35295 mg/kg (female 1-15 days after conception). Paternal Effects: Testes, Epididymis, Sperm duct: Oral, rat: TDLo = 200 ppm/20H (male 78 weeks pre-mating).
Neurotoxicity: No information available.
Mutagenicity: DNA inhibition: Human Lymphocyte = 300 mmol/L. DNA damage: Oral, rat = 10 umol/kg. Mutation in microorganisms: Mouse Lymphocyte = 7900 mg/L. Cytogenetic analysis: Oral, mouse = 1 gm/kg.
Other Studies: Standard Draize Test(Skin, rabbit) = 20 mg/24H (Moderate) S tandard Draize Test: Administration into the eye (rabbit) = 40 mg (Moderate). Standard Draize test: Administration int o the eye (rabbit) = 100 mg/24H (Moderate).

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 29.4 g/L; 96 Hr; LC50 (unspecified) Goldfish: 250 ppm; 11 Hr; resulted in death Rainbow trout: 8000 mg/L; 48 Hr; LC50 (unspecified) Rainbow trout: LC50 = 13-68 mg/L; 96 Hr.; 12 degrees C Fathead Minnow: LC50 = 29400 mg/L; 96 Hr.; 25 degrees C, pH 7.63 Rainbow trout: LC50 = 8000 mg/L; 48 Hr.; Unspecified ria: Phytobacterium phosphoreum: EC50 = 51,000-320,000 mg/L; 30 minutes; Microtox test No data available.
Environmental: Dangerous to aquatic life in high concentrations. Aquatic toxicity rating: TLm 96>1000 ppm. May be dangerous if it enters water intakes. Methyl alcohol is expected to biodegrade in soil and water very rapidly. This product will show high soil mobility and will be degraded from the ambient atmosphere by the reaction with photochemically produced hyroxyl radicals with an estimated half-life of 17.8 days. Bioconcentration factor for fish (golden ide) < 10. Based on a log Kow of -0.77, the BCF value for methanol can be estimated to be 0.2.
Physical: No information available.
Other: None.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 67-56-1: waste number U154; (Ignitable waste).

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	METHANOL				METHANOL
Hazard Class:	3				3(6.1)
UN Number:	UN1230				UN1230
Packing Group:	II				II
Additional Info:					FLASHPOINT

		11 C

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 67-56-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA

Section 302 (RQ)
CAS# 67-56-1: final RQ = 5000 pounds (2270 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 67-56-1: acute, flammable.
Section 313
This material contains Methyl alcohol (CAS# 67-56-1, 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 67-56-1 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 67-56-1 can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T F
Risk Phrases:
R 11 Highly flammable.
R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

Safety Phrases:
S 16 Keep away from sources of ignition - No

smoking.
S 36/37 Wear suitable protective clothing and gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 7 Keep container tightly closed.

WGK (Water Danger/Protection)
CAS# 67-56-1: 1
Canada
CAS# 67-56-1 is listed on Canada's DSL List. CAS# 67-56-1 is listed on Canada's DSL List.
This product has a WHMIS classification of B2, D1A, D2B.
CAS# 67-56-1 is listed on Canada's Ingredient Disclosure List.
Exposure Limits
CAS# 67-56-1: OEL-ARAB Republic of Egypt:TWA 200 ppm (260 mg/m3);Skin OEL-AUSTRALIA:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL-BELGIUM:TWA 200 ppm (262 mg/m3);STEL 250 ppm;Skin OEL-CZECHOSLOVAKIA:TWA 100 mg/m3;STEL 500 mg/m3 OEL-DENMARK:TWA 200 ppm (260 mg/m3);Skin OEL-FINLAND:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL-FRANCE:TWA 200 ppm (260 mg/m3);STEL 1000 ppm (1300 mg/m3) OEL-GERMANY:TWA 200 ppm (260 mg/m3);Skin OEL-HUNGARY:TWA 50 mg/m3;STEL 100 mg/m3;Skin JAN9 OEL-JAPAN:TWA 200 ppm (260 mg/m3);Skin OEL-THE NETHERLANDS:TWA 200 ppm (260 mg/m3);Skin OEL-THE PHILIPPINES:TWA 200 ppm (260 mg/m3) OEL-POLAND:TWA 100 mg/m3 OEL-RUSSIA:TWA 200 ppm;STEL 5 mg/m3;Skin OEL-SWEDEN:TWA 200 ppm (250 mg/m3);STEL 250 ppm (350 mg/m3);Skin OEL-SWITZERLAND:TWA 200 ppm (260 mg/m3);STEL 400 ppm;Skin OEL-THAILAND:TWA 200 ppm (260 mg/m3) OEL-TURKEY:TWA 200 ppm (260 mg/m3) OEL-UNITED KINGDOM:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 7/21/1999
Revision #4 Date: 3/14/2001
The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Material Safety Data Sheet

[Home] [Manufacturer] [Part Number] [NSN] [Help]

SECTION I - Material Identity

Item Name..... SANITIZER-DETERGENT,GENERAL PURPOSE
Part Number/Trade Name..... CM-34337,MSA CLEANER-SANITIZER
National Stock Number..... 6840005705299
CAGE Code..... 40912
Part Number Indicator..... A
MSDS Number..... 5986
HAZ Code..... B

SECTION II - Manufacturer's Information

Manufacturer Name..... MINE SAFETY APPLIANCES COMPANY
P.O. Box..... 430
Street..... 201 N.BRADDOCK AVENUE
City..... PITTSBURGH
State..... PA
Country..... US
Zip Code..... 15230
Emergency Phone..... 412-273-5500

MSDS Preparer's Information

MSDS Preparer Name..... N/K
Date MSDS Prepared/Revised..... N/K
Date of Technical Review..... 25JAN88
Active Indicator..... N
Item Manager..... CX

Alternate Vendors

Vendor #5 CAGE..... BFFPN

SECTION III - Physical/Chemical Characteristics

Specification Number..... N/K
Specification Type/Grade/Class..... N/K
Hazard Storage Compatibility Code..... N1-L1
NRC License Number..... N/R
Net Propellant Weight (Ammo)..... N/R
Appearance/Odor..... WHITE,FREE-FLOWING GRANULAR SOLID
Boiling Point..... N/A
Melting Point..... N/K

Vapor Pressure..... N/R
Vapor Density..... N/R
Specific Gravity..... N/K
Decomposition Temperature..... N/K
Evaporation Rate..... N/K
Solubility in Water..... COMPLETE
Percent Volatiles by Volume..... N/K
Chemical pH..... N/K
Corrosion Rate..... N/K
Container Type..... R
Container Pressure Code..... 4
Temperature Code..... 8
Product State Code..... U

SECTION IV - Fire and Explosion Hazard Data

Flash Point Method..... UNK
Lower Explosion Limit..... N/R
Upper Explosion Limit..... N/R
Extinguishing Media..... NONE NOTED;USE SUITABLE MEDIA FOR SURROUNDING FIRE.
Special Fire Fighting Procedures..... NONE NOTED:USE NIOSH/MSHA APPROVED SCBA IN AN ENCLOSED AREA IN CASE OF FIRES.
Unusual Fire/Explosion Hazards..... NONE

SECTION V - Reactivity Data

Stability..... YES
Materials to Avoid..... OXIDIZING AGENTS
Hazardous Decomposition Products..... NONE
Hazardous Polymerization..... NO
LD50 - LD50 Mixture..... N/K

SECTION VI - Health Hazard Data

Route of Entry: Skin..... N/K
Route of Entry: Ingestion..... YES
Route of Entry: Inhalation..... YES
Health Hazards - Acute and Chronic..... ACUTE:CAUSES BURNS OF EYES AND SKIN:INGESTION OF POWDER IS HARMFUL OR FATAL CHRONIC:NO DATA AVAILABLE.
Carcinogenity: NTP..... N/K
Carcinogenity: IARC..... N/K
Carcinogenity: OSHA..... N/K
Explanation of Carcinogenity..... N/K
Medical Cond. Aggrevated by Exposure.... PRE-EXISTING CONDITIONS MAY BE WORSEN
Emergency/First Aid Procedures..... EYES:FLUSH WITH WATER FOR 15 MINS.HOLDING EYELID OPEN;INGESTION:DRINK MILK,RAW EGG WHITE,OR LARGE QUANTITIES OF WATER.AVOID

ALCOHOL.CONSULT PLHYSICIAN AS SOON AS POSSIBLE.

SECTION VII - Precautions for Safe Handling and Use

Steps if Material Released/Spilled.....	SWEEP UP.WASH RESIDUE DOWN WITH COPIOUS AMOUNTS OF WATER.
Waste Disposal Method.....	DISPOSE OF WITH ORDINARY TRASH. REMOVE TO SANITARY LANDFILL.
Handling and Storage Precautions.....	N/
Other Precautions.....	N/A

SECTION VIII - Control Measures

Respiratory Protection.....	USE NIOSH/MSHA APPROVED RESPIRATOR FOR DUST (MIST , IF THERE IS NO VENTILATION.
Ventilation.....	NORMAL ROOM VENTILATION.
Protective Gloves.....	AS REQUIRED
Eye Protection.....	SAFETY GLASSES
Other Protective Equipment.....	AS REQUIRED
Work Hygenic Practices.....	AVOID CONTACT WITH SKIN AND EYES;DO NOT TAKE INTERNALLY OR BREATHE DUST.
Supplemental Health/Safety Data.....	MSDS RECEIVED BY THE DGSC-SLM:JAN08,1988
Disposal Code.....	O

SECTION IX - Label Data

Protect Eye.....	NO
Protect Skin.....	NO
Protect Respiratory.....	NO
Chronic Indicator.....	UNKNOWN
Contact Code.....	UNKNOWN
Fire Code.....	UNKNOWN
Health Code.....	UNKNOWN
React Code.....	UNKNOWN

SECTION X - Transportation Data

Container Quantity.....	2
Unit of Measure.....	OZN

SECTION XI - Site Specific/Reporting Information

Volatile Organic Compounds (P/G).....	0
Volatile Organic Compounds (G/L).....	0

SECTION XII - Ingredients/Identity Information

Ingredient #.....	01

Ingredient Name..... TRISODIUM PHOSPHATE
CAS Number..... 7601549
NIOSH Number..... TC4940000
Proprietary..... NO
Percent..... 10.0
OSHA PEL..... N/K
ACGIH TLV..... N/K
Recommended Limit..... N/K
Ingredient #..... 02
Ingredient Name..... SODIUM CARBONATE
CAS Number..... 497198
NIOSH Number..... VZ4050000
Proprietary..... NO
Percent..... 42.2
OSHA PEL..... N/K
ACGIH TLV..... N/K
Recommended Limit..... N/K
Ingredient #..... 03
Ingredient Name..... METHYL DODECYL TRIMETHYL AMMONIUM CHLORIDE AND METHYL DODECYXYLENE BIS (TRIMETHYL AMMONIUM CHLORIDE
CAS Number..... 1003
NIOSH Number..... 1000850MD
Proprietary..... NO
Percent..... 3.0
OSHA PEL..... N/K
ACGIH TLV..... N/K
Recommended Limit..... N/K
Ingredient #..... 04
Ingredient Name..... *PENTASODIUM SALT OF DIETHYLENE TRIANIME PENTA ACETIC ACID
CAS Number..... 140012
NIOSH Number..... 1000851PS
Proprietary..... NO
Percent..... 2.0
OSHA PEL..... N/K
ACGIH TLV..... N/K
Recommended Limit..... N/K
Ingredient #..... 05
Ingredient Name..... SODIUM TRIPOLYPHOSPHATE
CAS Number..... 13573187
NIOSH Number..... YK4900000
Proprietary..... NO
Percent..... 20.0
OSHA PEL..... N/K
ACGIH TLV..... N/K
Recommended Limit..... N/K
Ingredient #..... 06

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Ingredient Name........................ OCTYL PHENOXY POLYETHOXY ETHANOL
CAS Number............................ 9002931
NIOSH Number........................... 1001068OE
Proprietary............................ NO
Percent................................ 1.0
OSHA PEL............................... N/K
ACGIH TLV.............................. N/K
Recommended Limit...................... N/K
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NOTICE: For additional information, contact BIOENVIRONMENTAL/7-4551

HMMS Intranet - 30 Oct 2007 09:55 - web_msds.display - Visit the Official HMMS Website at www.hmms.com

MSDS Number: **N3666** * * * * * *Effective Date:* ***05/25/01*** * * * * * *Supercedes:* ***11/17/99***

MSDS **Material Safety Data Sheet**

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID 10% R. S.

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3 (10% solution)
Product Codes: Product Codes: H262

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	10%	Yes
Water	7732-18-5	90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH

DAMAGE.

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! May cause irritation of the nose, throat, and respiratory tract including coughing and choking. Higher concentrations or prolonged exposure to vapors of nitric acid may lead to pneumonia or pulmonary edema.
Ingestion:
Corrosive. May cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! May cause redness, pain, and severe skin burns.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

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4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
May react explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

Fire Extinguishing Media:
Water or water spray.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Increases the flammability of combustible, organic and readily oxidizable materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from combustible, organic, or any other readily oxidizable materials. Protect from freezing.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Nitric Acid:
OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA)
ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear to pale yellow solution.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Density:
1.054
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
ca. 101C (ca. 214F)
Melting Point:
ca. -3C (ca. 27F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.
Conditions to Avoid:
Heat and incompatibles.

11. Toxicological Information

For Nitric Acid: Investigated as a mutagen and reproductive effector.

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--------\Cancer Lists\-----------------------------------------------------
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Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID (WITH 10% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID (WITH 10% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 20L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia

```
  ----------------------------------------------  ----  ---  -----  ---------
  Nitric Acid (7697-37-2)                          Yes  Yes   Yes      Yes
  Water (7732-18-5)                                Yes  Yes   Yes      Yes

  --------\Chemical Inventory Status - Part 2\---------------------------------
                                                          --Canada--
  Ingredient                                     Korea  DSL   NDSL  Phil.
  ----------------------------------------------  -----  ---   ----  -----
  Nitric Acid (7697-37-2)                          Yes   Yes   No     Yes
  Water (7732-18-5)                                Yes   Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\----------------
                                              -SARA 302-    ------SARA 313------
  Ingredient                                  RQ    TPQ     List  Chemical Catg.
  ----------------------------------------  ---   -----   ----  --------------
  Nitric Acid (7697-37-2)                     1000  1000    Yes        No
  Water (7732-18-5)                           No    No      No         No

  --------\Federal, State & International Regulations - Part 2\----------------
                                                         -RCRA-    -TSCA-
  Ingredient                                  CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Nitric Acid (7697-37-2)                     1000       No         No
  Water (7732-18-5)                           No         No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: Yes         (Mixture / Liquid)
```

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If

breathing is difficult, give oxygen. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 9, 16.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: PENTANE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: PENTANE
CHEMICAL NAME: Pentane
COMMON NAMES/SYNONYMS: Amyl hydride
TDG (Canada) CLASSIFICATION: 3
WHMIS CLASSIFICATION: B2, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Pentane FORMULA: C_5H_{12} CAS: 1096-65-0 RTECS #: RZ9450000	100	1000 ppm TWA	600 ppm TWA 750 ppm STEL	LC_{50} 364 gm/m^3/4H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

Vapors irritating to the eyes and respiratory system. Skin contact may cause irritation and dermatitis. Inhalation of vapors may cause dizziness, headache and nausea. High concentrations paralyze the central nervous system, causing loss of consciousness and respiratory paralysis. Vapors and liquid extremely flammable.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	Yes

HEALTH EFFECTS:

Exposure Limits Yes	Irritant Yes	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen No
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Vapors may cause mild irritation of the eyes.

SKIN EFFECTS:
Vapors may cause mild irritation and dermatits to the skin.

INGESTION EFFECTS:
None expected.

INHALATION EFFECTS:
Inhalation of vapors may cause dizziness, headache and nausea. High concentrations paralyze the central nervous system, causing loss of consciousness and respiratory paralysis.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 1	Health: 1	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Reactivity: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures

EYES:
Not specified. Seek medical attention.

SKIN:
Remove contaminated clothing as rapidly as possible. Flush affected areas with lukewarm water. DO NOT USE HOT WATER!

INGESTION:
Not normally required.

INHALATION:
Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area and given artificial resuscitation an supplemental oxygen. Further treatment should be symptomatic and supportive.

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PENTANE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: - 40 ^{o}F (-40 ^{o}C)	Method: Not Available	Autoignition Temperature: Not Available
LEL(%): 1.5	UEL(%): 7.8	
Hazardous combustion products: Carbon monoxide, carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS:
Flammable liquid and vapor.

EXTINGUISHING MEDIA:
Water (foam), dry chemical, carbon dioxide.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop flow of pentane. Use water spray to cool surrounding containers.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classifications:
Class 1, Group not specified.

Earth-ground and bond all lines and equipment associated with the system. All electrical equIpment should be non-sparking or explosion proof.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in the storage area or use area. There should be no sources of ignition in the storage or use area.

For additional recommendations, consult Compressed Gas Association's Pamphlet P-1.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Pentane FORMULA: C_5H_{12} CAS: 1096-65-0 RTECS #: RZ9450000	100	1000 ppm TWA	600 ppm TWA 750 ppm STEL	LC_{50} 364 gm/m^3/4H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

ENGINEERING CONTROLS:
Use a laboratory hood with forced ventilation. Use local exhaust to prevent accumulation above the TWA.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Use butyl rubber, PVC or polyethylene gloves.

RESPIRATORY PROTECTION:
Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes, safety shower, eyewash "fountain"

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Liquid	
Vapor pressure at 100 ^{o}F	: 15	psia
Vapor density (Air = 1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: 97	^{o}F
	: 36	^{o}C
Freezing point	: Not Available	
	: Not Available	
pH	: Not Available	
Specific gravity @ 70 ^{o}F	: 2.48	1 atm
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Negligible	
Odor threshold	: Not Available	
Odor and appearance	: Colorless liquid and vapor with mild paraffinic odor.	

10. Stability and Reactivity

STABILITY:
Stable

INCOMPATIBLE MATERIALS:
Oxygen, other oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS:
None.

HAZARDOUS POLYMERIZATION:
Will not occur.

11. Toxicological Information

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	N-pentane or Isopentane	N-pentane or Isopentane
HAZARD CLASS:	3	3
IDENTIFICATION NUMBER:	UN 1265	UN 1265
SHIPPING LABEL:	FLAMMABLE LIQUID	FLAMMABLE LIQUID

Packing Group: I

15. Regulatory Information

No data given.

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

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