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Final

Site Specific Work Plan Addendum Preliminary Assessment/Site Inspection Site UXO-05 Former Miniature Anti-tank Range and the Former B-3 Gas Chamber

Marine Corps Base Camp Lejeune Jacksonville, North Carolina

Contract Task Order 168

May 2008

Prepared for

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

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Chantilly, Virginia

QC Review Page

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CH2M HILL

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Acronyms and Abbreviations

AEC	Areas of Environmental Concern
AHA	Activity Hazard Analysis
ASR	Archival Records Search Report
bgs	below ground surface
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CN	Chloroacetophenone
COC	Chain-of-Custody
CS	0-chlorobenzylidenemaloonitrile
DGM	Digital Geophysical Mapping
DPT	Direct Push Technology
ESV	Ecological Screening Value
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
kg	kilogram
m	meter
MC	Munitions Constituent
MCB	Marine Corps Base
MEC	Munitions and Explosives of Concern
MI	Multi-increment
MRP	Munitions Response Program
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAVFAC	Naval Facilities Engineering Command
NCDENR	North Carolina Department of Environment and Natural Resources
NFA	No Further Action
OD	Outer Diameter
PA/SI	Preliminary Assessment/Site Inspection

PM	Project Manager
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QCP	Quality Control Plan
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SVOC	Semi-volatile Organic Compound
TCL	Target Compound List
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WP	Work Plan
WWII	World War II

SECTION 1

Introduction

1.1 Background and Project Objectives

Marine Corps Base (MCB) Camp Lejeune is in the process of investigating closed ranges at the Base following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. Due to historic activities at Site Unexploded Ordnance (UXO)-05, Former Miniature Anti-tank Range, and the Former B-3 Gas Chamber site, a Munitions Response Program (MRP) Preliminary Assessment/Site Inspection (PA/SI) is being conducted.

The Former Miniature Anti-tank Range, also known as Archive Search Report (ASR) Site 2.7, and the Former B-3 Gas Chamber, also known as ASR 2.79 are located in the same general area of MCB Camp Lejeune. Portions of the Former Miniature Anti-tank Range and the Former B-3 Gas Chamber sites overlap, and will both be evaluated during this investigation.

The PA/SI for the Former Miniature Anti-tank Range and the Former B-3 Gas Chamber is being conducted to accomplish the following objectives:

1. Identify historical activities at the Former Miniature Anti-Tank Range and the Former B-3 Gas Chamber that may have resulted in environmental contamination with munitions and explosives of concern (MEC) or munitions constituents (MC) by researching archival records and interviewing current and previous installation personnel.
2. Evaluate the presence and nature of MC contamination that may exist at the Former Miniature Anti-tank Range and the Former B-3 Gas Chamber by conducting an investigation of soil, groundwater, surface water, and sediment. The Former B-3 Gas Chamber areas will also be evaluated for chemical compounds related to historic gas chamber operations.
3. Conduct ecological and human health risk screenings using analytical data collected at the Former Miniature Anti-tank Range and the Former B-3 Gas Chamber area.
4. Estimate the number and density of geophysical anomalies that may represent subsurface MEC by conducting digital geophysical mapping (DGM) within the Former B-3 Gas Chamber areas of the site. The Former Miniature Anti-tank Range was a small arms range, and therefore MEC is not a concern at this site.

1.2 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, 2007) (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-05 and the Former B-3 Gas Chamber 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, soil, surface water, and sediment.
- Perform DGM over the area associated with the Former B-3 Gas Chamber.
- 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 detail 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-05 and the Former B-3 Gas Chamber, summarizes the history of the sites, 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 the field investigation activities, including mobilization and demobilization, land surveying, vegetation clearing, temporary well installation, sampling of environmental media, and DGM.
- **Section 4, Quality Control Plan (QCP),** provides details of the approach, methods, and operational procedures to be employed for quality control (QC) of the PA/SI at Site UXO-05 and the Former B-3 Gas Chamber site.
- **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-05 and the Former B-3 Gas Chamber site.
- **Section 6, References,** lists the references cited in the preceding sections.
- **Appendix A, Archival Records Search,** presents the results of the records search and personnel interviews that were conducted to identify historical activities that may have resulted in environmental contamination of the project areas.
- **Appendix B, Geophysical Prove-out (GPO) Plan**, details the activities to be performed for validating DGM systems to be utilized at the Former B-3 Gas Chamber site.
- **Appendix C, Geophysical Investigation Plan (GIP)**, details the approach, methods, and operational procedures that will be used in performing geophysical investigations at the Former B-3 Gas Chamber site.

- **Appendix D, Health and Safety Plan (HSP),** provides an interface with CH2M HILL's overall health and safety program and 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 these sites.

1.3 Site Location and Description

Site UXO-05 and the Former B-3 Gas Chamber site are approximately 74 acres in size and are composed of the Former Miniature Anti-tank Range (Archive Search Report [ASR] # 2.7a, 2.7b, and 2.7c) and Former B-3 Gas Chamber (ASR# 2.79a, 2.79b, and 2.79c). The range areas are identified in Figure 1-1.

The southern portion of Site UXO-05 consists of overlapping Range Areas 2.7a and 2.7b, is located east of US Route 17, and is bisected by Robert L. Wilson Boulevard, Agerholm Street, and Bordelon Street. Areas 2.7a and 2.7b cover an area of approximately 59 acres. The majority of this area is heavily wooded and the remaining portion consists of developed areas with buildings, parking lots, and paved roads. It was reported that .22 caliber ammunition was used at these areas of the site from a period of 1942 to 1944, and no history of high explosives was reported (USACE, 2001).

The northwest portion of Site UXO-05 (ASR 2.7c) overlaps a portion of the Former B-3 Gas Chamber (ASR 2.79b) site and is located to the west of 7th Street. Areas 2.7c and 2.79b cover an area of approximately 10 acres. The area is primarily wooded, and picnic areas are located within the site. It was reported that .22 caliber ammunition was used at the site from a period of 1942 to 1944 (USACE, 2001). In addition, a chemical warfare training agent (tear gas) gas chamber was also reportedly located at this site from 1953 to 1958 (USACE, 2001).

Additional areas associated with the Former B-3 Gas Chamber, include ASRs 2.79a and 2.79c (USACE, 2001). Area 2.79a is located between 6th Street and 7th Street and covers an area of approximately 2.5 acres. This area is undeveloped and primarily wooded. Area 2.79c is located south of 7th Street and west of Church Street and covers an area of approximately 2 acres. This area is undeveloped and consists primarily of jurisdictional wetlands.

1.4 Site History

Site UXO-05 is located in the Camp Geiger area of Camp Lejeune. As reported in the Archival Records Search Report (Appendix A), between 1941 and 1942, the area to the northeast of UXO-05 was known as the "Tent Camps" and consisted of approximately 2,000 tents. By the end of World War II (WWII), corrugated steel Quonset huts replaced most of the tents. All tents and huts were removed by the early 1950s.

The Former Miniature Anti-tank Range was used between 1942 and 1944. During operation, .22 caliber small arms were used to fire at a moving target car located on a transverse track according to the *Final Range Identification and Preliminary Range Assessment* (USACE, 2001). The explosive hazards for this range exist with complete rounds, which would be found at or near the firing line. Complete rounds would be located at the surface, but over the years, construction and other ground movement may have caused the rounds to become buried to

an unknown depth. The area was also used extensively during WWII for blank fire and non-firing events (Lowder, 2005). Areas 2.7a and 2.7b were used as a trailer park in the 1960s. There was also an underground storage tank (UST) and four associated monitoring wells (USTCG1-MW01 through USTCG1-MW04) associated with Building CG1 (Base Game Warden and Archery Club Offices), which is located within Area 2.7a (Appendix A). The CG1 UST was a 500-gallon, used oil tank, which was removed in February 1994. The site was issued No Further Action (NFA) status by NCDENR in July 2000. The four monitoring wells were subsequently abandoned in accordance with North Carolina well abandonment standards. Due to the NFA status of the CG1 UST, the constituents associated with this site will not be analyzed for during the PA/SI.

The Former B-3 Gas Chamber was used between 1953 and 1958 (USACE, 2001). During operation, chemical warfare training agents, such as tear gas, would have been used at this training facility. There is no evidence that chemical warfare material munitions would have been used during training activities, however, the area surrounding gas chambers is often used for other chemical training. Therefore, war gas identification sets and riot control hand grenades may have been used in the Site 2.7 area (USACE, 2001)). Materials potentially present in the surface soils at the site include tear gas canisters and degradation byproducts of chloroacetophenone (CN) and 0-chlorobenzylidenemaloonitrile (CS).

A detailed investigative review of existing information about UXO-05 and the Former B-3 Gas Chamber Facility, and interviews with site personnel was conducted by CH2M HILL in May and August 2007. The review emphasized obtaining information that might indicate historical activities that may have resulted in environmental contamination of the project area. Information obtained by this effort is in the Archival Records Research Report presented in Appendix A.

Site UXO-05, Former Miniature Anti-tank Range, and the Former B-3 Gas Chamber Facility were both used for military troop training; the area is not associated with an active impact area, range, range fan, safety danger zone, or the disposal of military munitions. Site UXO-05 does have a WWII history of military troop maneuvering and reports of small arms ammunition in the area. Disposal of munitions and or burial of munitions is not reported or suspected. The area is undeveloped with access restricted to military personnel. The general public is precluded form entry to the area.

The munitions and explosives of concern risk model (Figure 1-3) was used to determine the risk due to the potential presence of MEC at the site. Based on the available information, the probability of encountering munitions with a severity of critical or above, is unlikely; resulting in an initial risk evaluation of IV E or LOW.

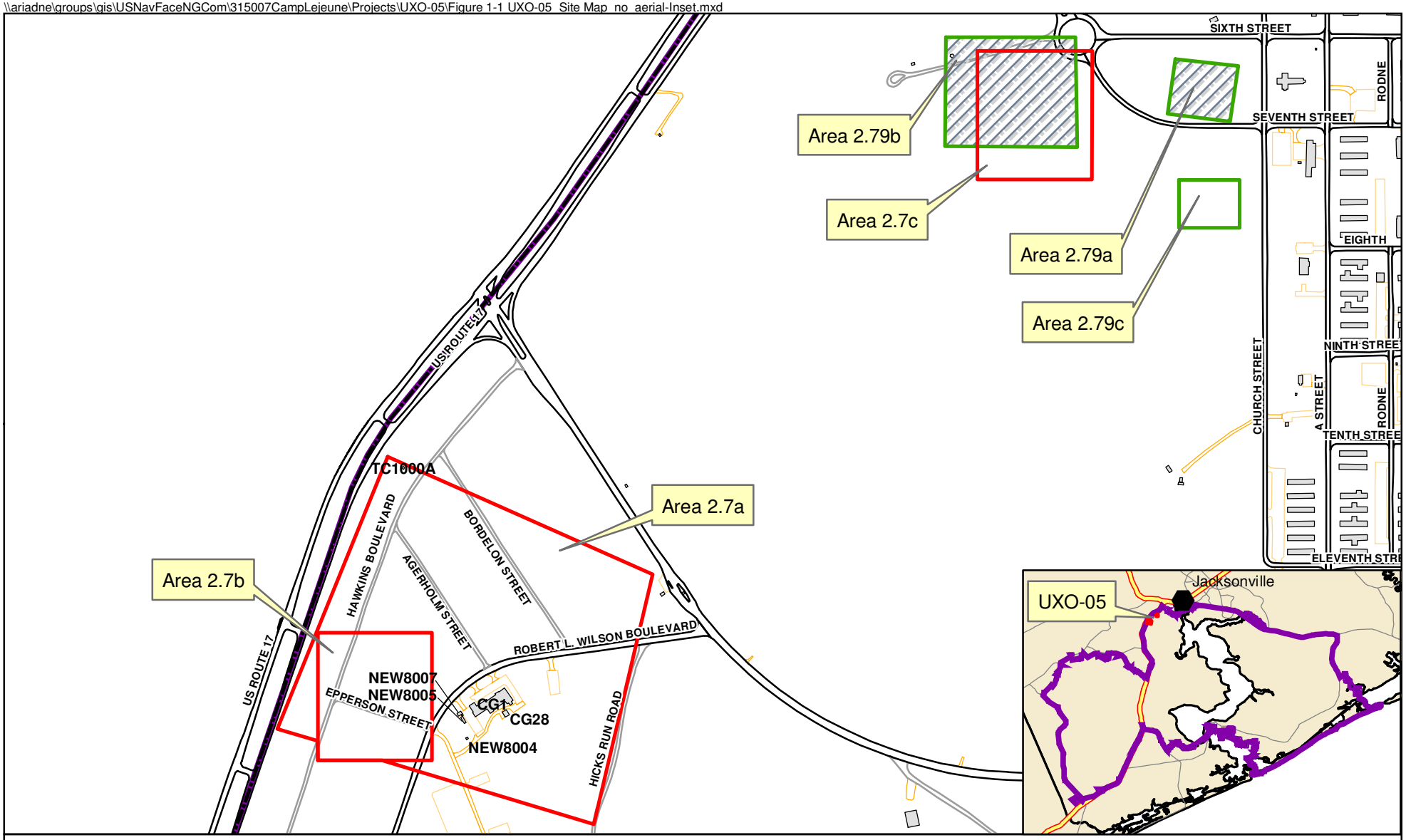
1.5 Climate

The climate in the MCB Camp Lejeune area is discussed in Section 1.4 of the MRP Master Project Plans (CH2M HILL, 2007).

1.6 Geology and Hydrology

The regional geology and hydrogeology at MCB Camp Lejeune is discussed in Section 1.6 and 1.7 of the MRP Master Project Plans (CH2M HILL, 2007). Site-specific geologic and hydrogeologic data will be collected during the PA/SI and presented in the PA/SI Report. Based on hydrogeologic conditions elsewhere on the installation, groundwater is expected to be encountered at approximately 5 ft or less bgs at the site. Site lithology is likely composed of sands with thin, discontinuous lenses of silt and clay.

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure 1-1_UXO-05_Site Map_no_aerial-Inset.mxd



Legend

- Former B-3 Gas Chamber
- UXO-05 Boundary
- DGM Area
- Buildings
- Paved Road
- Unpaved Road
- Vehicle Parking
- Installation Area

N W E S

0 375 750 1,500 Feet

0 30 60 120 180 240 300 Meters

Figure 1-1
Site Location Map
Site UXO-05 Former Miniature Anti-Tank Range
and Former B-3 Gas Chamber Site
MCB Camp Lejeune
North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure 1-2 aerial_photograph.mxd

Legend

- Former B-3 Gas Chamber
- UXO-05 Boundary
- Paved Road
- Unpaved Road

N
W E
S

0 375 750 1,500 Feet

0 30 60 120 180 240 300 Meters

Figure 1-2
Aerial Photograph
Site UXO-05 Former Miniature Anti-Tank Range
and Former B-3 Gas Chamber Site
MCB Camp Lejeune
North Carolina

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Figure 1-3
Munitions and Explosives of Concern Risk Model
Site UXO-05 (Former Miniature Anti-Tank Range) and the Former B-3 Gas Chamber
Camp Lejeune, North Carolina

SEVERITY		PROBABILITY				
		Frequent "A"	Likely "B"	Occasional "C"	Seldom "D"	Unlikely "E"
I	Catastrophic	Extremely High		HIGH		Moderate
II	Critical					
III	Marginal					
IV	Negligible		LOW			

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 Naval Facilities Engineering Command (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, vegetation clearing, direct push 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 the key personnel are discussed in Section 2.4 of the MRP Master Project Plans. Contact information for key project personnel is shown in Table 2-1. The project team organizational structure is shown 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 under this task. A draft WP will be submitted electronically for NAVFAC and MCB Camp Lejeune review. The draft WP will be revised to incorporate NAVFAC and MCB Camp Lejeune comments before being submitted to

USEPA and NCDENR for review. A final WP will be prepared that will address USEPA and NCDENR comments on the draft document.

Subcontractor procurement is also included under this task. Anticipated subcontractor services include MEC support, DGM, utility locating, land surveying, vegetation clearing, direct push soil sampling and direct push 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 are the following:

- Surveying and vegetation clearance
- Surface clearance of MEC anomalies along work routes
- MEC support
- DGM (Former B-3 Gas Chamber only)
- 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 the samples are collected until the validated data is received and incorporated into the 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 DGM data will be collected in preparation for the creation of a geographical information system (GIS) tailored for the investigative needs of the Former B-3 Gas Chamber site. All digital data will be created using a software platform that will allow it to be loaded directly into the MEC GIS system. The main purpose of the GIS is to assemble all the 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 include ArcView project and shape files that best delineate the area on the basis of uses, site conditions, and other information gathered during the study.

2.2.6 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 the 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 any 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: data will be compared to USEPA Region 9 residential soil Preliminary Remediation Goals (PRGs) (USEPA, 2004) and NCDENR Soil Screening Levels (NCDENR, 2000)
- Groundwater: data will be compared to USEPA Region 9 tap water PRGs (USEPA, 2004) and NCDENR 2L Standards (NCDENR, 2006)
- Surface water: data will be compared to both North Carolina surface water standards and USEPA national recommended water quality criteria (NCDENR, 2007; USEPA, 2006)
- Sediment: data will be compared to USEPA Region 9 residential soil PRGs (USEPA, 2004)

If newer toxicity values are available for a constituent, a new PRG will be calculated using the equations from the USEPA Region 9 PRG table and the updated toxicity values. The soil and groundwater data will also be compared to the Camp Lejeune background soil and groundwater data from Baker (2001). The background values used will be twice the average site background soil concentration.

TABLE 2-1
Project Personnel Contact Information

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
Bill Schmithorst , P.G. Project Manager CH2M HILL	3201 Beechleaf Court Suite 300 Raleigh, NC 27604	919-875-4311 (office) 919-272-7001 (cell) 919-875-8491 (fax) Bill.Schmithorst@ch2m.com
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
Thomas M. Roth, P.E. Senior Consultant CH2M HILL	2607 Lavista Road Decatur, GA 30033-1725	404-474-7640 (office) 404-259-6674 (cell) 770-604-9183 (fax) Tom.Roth@ch2m.com
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) 256-527-5662 (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		

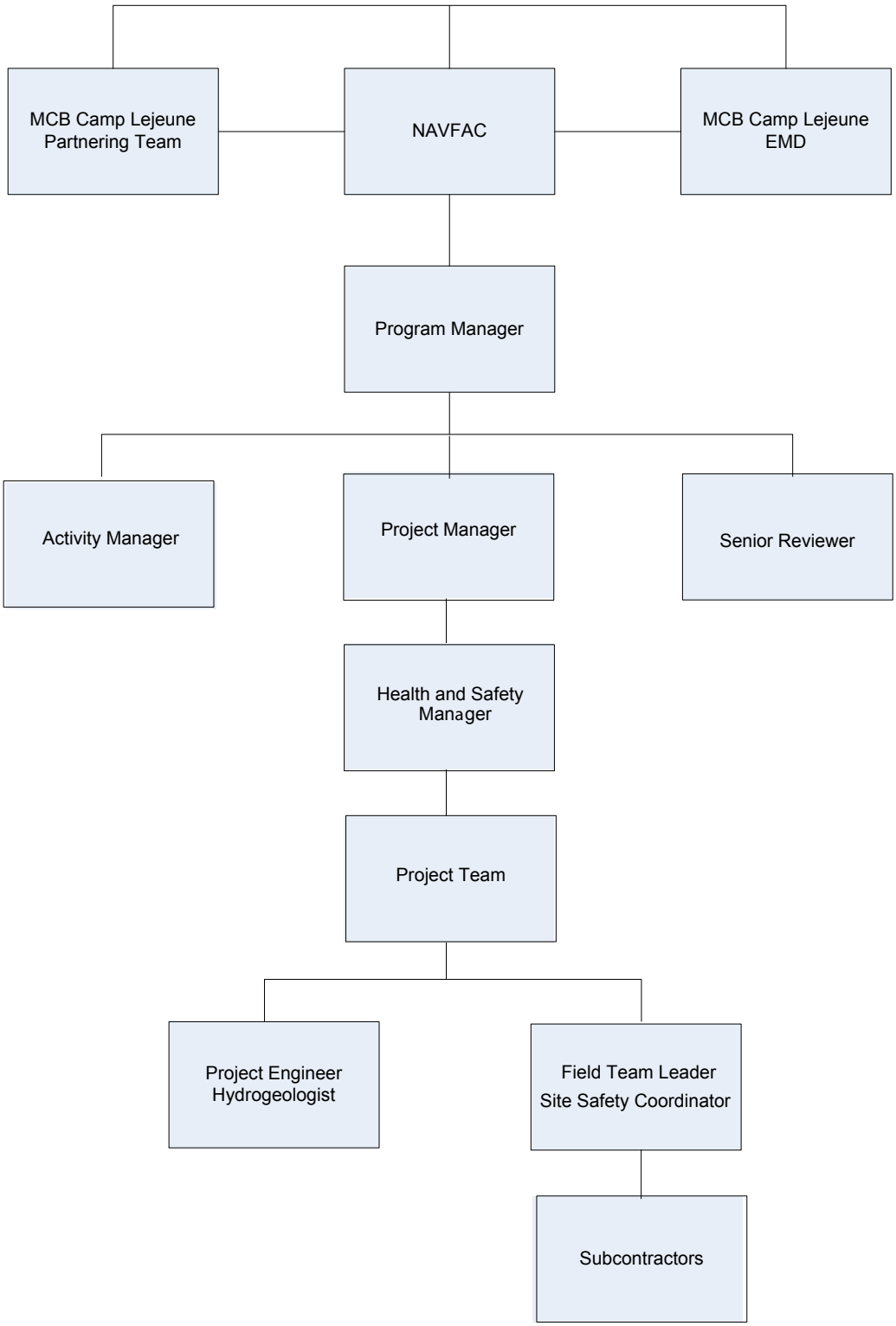

Figure 2-1
Project Team Organization Structure
PA/SI at MRP Site UXO-05 and Former B-3 Gas Chamber Site
Camp Lejeune, North Carolina

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ID	Task Name	Duration	Start	Finish
1	**PA/SI for UXO-05**	**461 days**	**Fri 4/13/07**	**Fri 1/16/09**
2	**Work Plan**	**207 days**	**Fri 4/13/07**	**Mon 1/28/08**
3	Archives Search	40 days	Fri 4/13/07	Thu 6/7/07
4	Draft Work Plan	121 days	Fri 4/13/07	Fri 9/28/07
5	Navy Review of Draft Work Plan	39 days	Tue 10/9/07	Fri 11/30/07
6	Revise and Submit for Regulatory Review	15 days	Mon 12/3/07	Fri 12/21/07
7	Regulatory Review of Work Plan	14 days	Wed 1/2/08	Mon 1/21/08
8	Revise and Submit Final Work Plan	5 days	Tue 1/22/08	Mon 1/28/08
9	**Field Activities**	**242 days**	**Thu 11/1/07**	**Fri 10/3/08**
10	Mobilization, Procurement	67 days	Thu 11/1/07	Fri 2/1/08
11	Surveying	35 days	Mon 11/26/07	Fri 1/11/08
12	DGM Grid Layout/Brush Clearing	23 days	Wed 12/19/07	Fri 1/18/08
13	Geophysical Proveout	1 day	Mon 1/21/08	Mon 1/21/08
14	Digital Geophysical Mapping	5 days	Fri 1/25/08	Thu 1/31/08
15	Environmental Sampling	40 days	Mon 6/16/08	Fri 8/8/08
16	Sample Analysis	20 days	Mon 8/11/08	Fri 9/5/08
17	Data Validation and Review	20 days	Mon 9/8/08	Fri 10/3/08
18	**Reporting**	**95 days**	**Mon 9/8/08**	**Fri 1/16/09**
19	Draft PA/SI Report	60 days	Mon 9/8/08	Fri 11/28/08
20	Navy Review of Draft PA/SI Report	10 days	Mon 12/1/08	Fri 12/12/08
21	Revise and Submit for Regulatory Review	10 days	Mon 12/15/08	Fri 12/26/08
22	Regulatory Review of PA/SI Report	10 days	Mon 12/29/08	Fri 1/9/09
23	Submit Final PA/SI Report	5 days	Mon 1/12/09	Fri 1/16/09

Project: Figure 2-2
Date: Wed 5/28/08

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

Figure 2-2
Project Schedule
Site UXO-05 and Former B-3 Gas Chamber

SECTION 3

Field Investigation Plan

3.1 Overall Approach

A PA/SI is being conducted at the MRP Site UXO-05, Former Miniature Anti-tank Range, and Former B-3 Gas Chamber following the CERCLA investigation process. The objectives for this field investigation are to:

- In accordance with the scope of work, identify the presence and nature of MC contamination that may exist in the project area
- Identify the presence of tear gas constituents that may exist in the Former B-3 Gas Chamber area
- Evaluate the nature, number, and density of anomalies that could potentially represent surface and subsurface MEC within Former B-3 Gas Chamber area
- Provide geophysical data for 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 (CH2M HILL, 2007):

- Collect 18 composite surface soil samples from six Decision Units using the Multi-increment (MI) sampling approach as detailed in Appendix C of the MRP Master Project Plans (CH2M HILL, 2007)
- Collect composite surface soil sampling from 32 locations using the TR-02-1 sampling approach as detailed in Appendix C of the MRP Master Project Plans (CH2M HILL, 2007)
- Collect subsurface soil samples from 15 locations using direct-push technology (DPT)
- Collect 10 shallow depth groundwater samples from temporary wells installed using DPT
- Collect surface water and sediment samples from two locations
- Perform DGM over approximately 10 percent of the Former B-3 Gas Chamber area

The field investigation activities are detailed below and reference the MRP Master Project Plans (CH2M HILL, 2007).

3.2 Site Preparation and Restoration

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

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, and vegetation clearance equipment
- Coordinate with local agencies, including the Marines, Range Control, 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
- Prior to initiating subsurface intrusive activities, subsurface utilities near subsurface sampling locations will be identified by a subcontract utility locating service
- Verify that 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 a 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 Boundary Survey and Decision Unit Layout

Land surveying services will be conducted in accordance with the MRP Master Project Plans (CH2M HILL, 2007). The surveying at Site UXO-05 and the Former B-3 Gas Chamber will consist of two phases.

- **Phase 1** will be a survey of the site boundary (Figure 1-1), DGM area layout, and Decision Unit layout (Figure 3-1). Work routes will be cleared for surface MEC by a UXO Technician in advance of subcontractors and project team. The site boundary survey will delineate the extent of the area of Site UXO-05 and the Former B-3 Gas Chamber, while the DGM area layout will delineate the extent of the area that will be subjected to vegetation clearing for the DGM effort. After vegetation clearing, the Decision Units Layout survey will delineate the extent of the decisions units shown on Figure 3-1.

- **Phase 2** of the land surveying will occur after environmental-sampling activities have concluded at the site and will entail surveying of the coordinates and elevations of temporary monitoring wells and soil sampling locations. .

3.2.3 Vegetation Clearing

The Base will coordinate with Camp Lejeune's Environmental Management Division office to identify federally protected species or archeological sites that may be encountered during vegetation clearing activities. Federally listed plant species will be identified and left in place in accordance with the Environmental Protection Plan (refer to Section 5).

Vegetation less than three inches in diameter will be removed from approximately 2 acres of the 12-acre investigation area located in the Former B-3 Gas Chamber area. Vegetation clearing will be accomplished using a combination of non-intrusive mechanical and manual methods.

MEC technicians will conduct surface MEC avoidance activities in the vegetation removal areas according to the MEC avoidance procedures included in the HSP (Appendix D). The brush and trees will be mulched and left in place. Trees greater than 3 inches in diameter will not be removed unless absolutely necessary. Vegetation clearing will be conducted in approximately 1.2-meter (m)-wide (4-foot [ft]) paths in order that a 1-m-wide instrument may traverse the path.

3.2.4 Site Restoration and Demobilization

Site Restoration

Restoration of the site to an appropriate level (e.g., repair deep ruts) will be verified by the CH2M HILL field team leader. MEC anomaly avoidance procedures, described in the HSP (Appendix D), will be observed if restoration is required.

Demobilization

Full demobilization will occur when the project is completed and appropriate quality assurance/quality control (QA/QC) checks have been performed. Personnel who are 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:

- All areas to be geophysically mapped will be verified as completed
- Chain-of-custody (COC) records will be reviewed to ensure that all samples were collected as planned and were submitted for appropriate analyses
- Restoration of the site 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 (refer to Appendix B) provides details of the equipment, approach, methods, operational procedures and QC to be used in performing the GPO at the Former B-3 Gas Chamber.

3.4 Geophysical Investigation Plan

DGM will be conducted over approximately 2 acres of the Former B-3 Gas Chamber site using single-coil, manually towed methods. The Former B-3 Gas Chamber site will be subjected to DGM surveys using regularly spaced (approximately 10 m) transects across the site. DGM activities will not be conducted in Former Miniature Anti-tank Range because only small caliber munitions were used in this area. The locations and actual acreages surveyed will be based on field conditions, including presence of utilities, buildings, fences, and other cultural features that may interfere with the collection of DGM data. The approximate areas where DGM will be conducted are identified in Figure 1-1.

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 the Former B-3 Gas Chamber site.

3.5 Geospatial Information and Electronic Submittals

Methods, equipment, accuracy, and submittal requirements for location surveys and mapping are described in Section 7.4 of the MRP Master Project Plans (CH2M HILL, 2007).

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 areas, the project team will investigate groundwater, surface water, sediment, and soil in the project areas. This will include collecting groundwater samples from temporary wells and collecting DPT soil samples. Soil and groundwater sample locations are distributed across the site (as conditions permit) due to a lack of available historical information indicating specific areas within the site with a high potential for MEC and associated munitions constituents (MC) to be present. 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 signatures. QA/QC samples will be collected per Section 3.6.2. MEC anomaly avoidance procedures, described in the HSP (Appendix D), will be observed during field sampling and well installation activities.

Surface Soil Multi-increment Sampling

Three soil composite samples will be collected from each of six Decision Units (MR05-DU01-SSxx through MR05-DU06-SSxx) for a total of 18 surface soil composite samples (Figure 3-1).

MEC anomaly avoidance will be practiced as described in Section 2.3 of the HSP (Appendix D). The Decision Unit dimensions include four Decision Units at 30m × 30 m and two Decision Units at 60 m x 60 m. The soil samples will be collected using the systematic random MI sampling SOP in Appendix C of the MRP Master Project Plans. The samples will be collected from 0 to 2 inches below ground surface (bgs). A minimum of 3 kilograms (kg) of soil will be collected from each Decision Unit. Samples will be analyzed by a fixed base laboratory for the following parameters (see Tables 3-1 through 3-3):

- Explosives residue (SW-846 USEPA Method 8330)
- Perchlorate (USEPA Method 6850)
- Total metals (ILM05)

Surface Soil TR-02-1 Sampling

In some areas of Site UXO-05 and the Former B-3 Gas Chamber there is heavy undergrowth present, so MI sampling is not feasible. In these areas, a total of 32 surface soil sampling (MR05-SS01 through MR05-SS32) will be collected using the TR-02-1 approach. MEC anomaly avoidance will be practiced as described in Section 2.3 of the HSP (Appendix D). The TR-02-1 approach is summarized below and described in United States Army Corps of Engineers (USACE) Technical Report ERDC/CRREL TR-02-1, *Guide for Characterization of Sites Contaminated with Energetic Materials* (Thiboutot, Ampleman, and Hewitt, 2002).

Each sampling location will be defined as an area 1 m × 1 m in size. Coordinates of the sampling locations will be based on the center of the sampling area (Figure 3-1). Soil samples will be collected by compositing a minimum of ten sample increments from random locations within each 1m × 1m sampling location. The sample increments will be approximately equal in the amount of soil, which will be collected from depths from 0 to 2 inches. The sample increments at each location will be composited into a single sample following the procedures in Appendix C of the MRP Master Project Plans, *Homogenization of Soil and Sediment Samples*, prior to being transferred to the appropriate sample containers.

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

- Explosives residue (SW-846 USEPA Method 8330)
- Perchlorate (USEPA Method 6850)
- Total metals (ILM05)

Discrete Surface Soil Samples

Ten discrete surface soil samples (MR05-SS01 through MR05-SS07 and MR05-SS33 through MR05-SS35) will be collected from 0 to 2 ft bgs from areas of the site associated with the Former B-3 Gas Chamber (refer to Figure 3-1). Actual sample location coordinates will be determined using a GPS unit in the field.

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

- Tear gas constituents (CN, CS, and breakdown products) (SW-846 USEPA Method 8270C)

Direct Push Subsurface Soil Sampling

A DPT rig will be used to collect soil samples above the water table in accordance with Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) SOPs, CH2M HILL SOPs, and the MRP Master Project Plans. Fifteen subsurface soil samples (MR05-IS01 through –IS15) will be collected from just above the water table at the locations shown in Figure 3-2. Actual sample locations will be surveyed by professional land surveyor at the conclusion of sampling activities.

MEC anomaly avoidance will be practiced during DPT subsurface soil sampling as described in Section 2.3 of the HSP (Appendix D). At the start of each borehole, a UXO technician will hand auger to five feet checking the borehole with a down hole magnetometer at one foot increments.

Samples will be analyzed by a fixed base laboratory for select parameters listed below (refer to tables 3-1 through 3-3):

- Site UXO-05, Former Miniature Anti-tank Range
  - Explosives residues (SW-846 USEPA Method 8330)
  - Perchlorate (USEPA Method 6850)
  - Total metals (ILM05)
- Former B-3 Gas Chamber
  - Explosives residues (SW-846 USEPA Method 8330)
  - Perchlorate (USEPA Method 6850)
  - Total metals (ILM05)
  - Tear gas constituents (CN, CS, and breakdown products) (SW-846 USEPA Method 8270C)

The water table in each boring will be observed in the field by visual identification of saturated conditions in the soil cores removed from the boreholes. The water table is expected to occur at approximately 5 ft or less bgs throughout the site.

DPT Temporary Well Installation and Sampling

CH2M HILL will collect 10 shallow depth groundwater grab samples from 1-inch outer-diameter (OD) polyvinyl chloride (PVC) temporary monitoring wells installed by a DPT rig in accordance with the *Temporary Well Installation* SOP in Appendix C of the MRP Master Project Plans. Proposed temporary monitoring well locations are shown in Figure 3-3. Samples will be collected near the water table.

MEC anomaly avoidance will be practiced during DPT temporary well installation as described in Section 2.3 of the HSP (Appendix D). At the start of each borehole, a UXO technician will hand auger to five feet checking the borehole with a down hole magnetometer at one foot increments.

The groundwater grab samples from each temporary well will be collected using low-flow purge rates in accordance with the low-flow groundwater sampling from monitoring wells SOP in Appendix C of the MRP Master Project Plans.

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

- Site UXO-05, Former Miniature Anti-tank Range
  - Explosives residues (SW-846 USEPA Method 8330)
  - Perchlorate (USEPA Method 6850)
  - Total and dissolved metals (ILM05)
- Former B-3 Gas Chamber
  - Explosives residues (SW-846 USEPA Method 8330)
  - Perchlorate (USEPA Method 6850)
  - Total and dissolved metals (ILM05)
  - Tear gas constituents (CN, CS, and breakdown products) (SW-846 USEPA Method 8270C)

Following sampling and surveying, all temporary wells will be removed from the boreholes and the boreholes will be abandoned by the drilling subcontractor following NCDENR guidelines by grouting from the bottom of the boring to the ground surface. Boreholes within asphalt or concrete slab will be patched at the surface.

This phase of the investigation will provide site-specific lithologic and hydrogeologic information. The depths of the groundwater zones discussed above are based on the geology of other sites at MCB Camp Lejeune.

Surface Water and Sediment Sampling

Two surface water and two sediment samples will also be collected at the locations shown in Figure 3-3 in accordance with the surface water sampling and sediment sampling SOPs in Appendix C of the MRP Master Project Plans.

Surface water 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)
- Perchlorate (USEPA Method 6850)
- Total and dissolved metals (ILM05)
- Tear gas constituents (CN, CS, and breakdown products) (USEPA Method 8270C)

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)
- Perchlorate (USEPA Method 6850)
- Total metals (ILM05)
- Tear gas constituents (CN, CS, and breakdown products) (USEPA Method 8270C)

Samples will be collected from downstream to upstream to avoid cross-contamination by sediment suspension. The surface water and sediment samples will be co-located at the locations shown in Figure 3-3. Actual sample location coordinates will be determined using a GPS unit in the field.

3.6.2 Analytical Requirements and Sample Handling

Sample Preservation and Handling

Sample preservation occurs in the field immediately after collection. The containers supplied by the laboratory will contain applicable 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 shown in Table 3-2.

Quality Assurance and Quality Control

QA/QC requirements for environmental sampling, handling, and management are detailed in Section 4 of the MRP Master Project Plans (CH2M HILL, 2007). 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

Table 3-4 presents the anticipated number of field samples and their associated QA/QC samples for PA/SI sampling activities at Site UXO-05 and the Former B-3 Gas Chamber.

Sample Identification System

The following is a general guide for sample identification; an electronic sample-tracking program will be used to manage the flow of information from the field sampling team to the laboratory and to internal and external data users. The tracking program is used to produce sample labels and COC forms and to manage the entry of sampling-related data, such as station locations and field measurements. The method of sample identification used depends on the type of sample collected and the sample container.

The field analysis data are recorded in field logbooks, along with sample identity information, while in the custody of the sampling team.

Labels for samples sent to a laboratory for analysis will be produced electronically. If they cannot be produced electronically, they 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-05 under the Munitions Response Program. Therefore, the prefix "MR05" will be used

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

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
ER = Equipment rinsate
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:

"07" = year 2007
"A" = samples collected in the first 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, "MR05-TW01-07A" would mean the following:

MR05-TW01-07A	MRP Site UXO-05
MR05-TW01-07A	Groundwater sample from Temporary Well #1
MR05-TW01-07A	Samples collected in the 1st quarter 2007

"MR05-TB1-07A" would mean the following:

MR05-TB1-07A	MRP Site UXO-05
MR05-TB1-07A	Trip Blank #1
MR05-TB1-07A	Samples collected in the 1st quarter 2007

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

Sample Packaging and Shipping

Samples will be tightly packed in a cooler with bubble wrap packaging material and ice. The samples will be either picked up at the site by the analytical laboratory or shipped to the

laboratory via overnight courier. The field team leader (FTL) is responsible for completion of the following forms:

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

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

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, 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, laboratory data, and investigation results will be completed in accordance with the 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
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
MCB Camp Lejeune
Jacksonville, North Carolina

			Analysis				
Sample Media	**Sample ID Number**	**Sample Depth/Location and Rationale**	**Explosives Residues**	**Perchlorate**	**Total Metals**	**Dissolved Metals**	**Tear Gas Constituents**
Direct Push Soil	MR05-IS01-T-B through MR05-IS05-T-B	Collected from a 2 ft interval just above the water table at each location shown on Figure 3-2. Will allow for characterization of soil across site.	X	X	X		X
Direct Push Soil	MR05-IS06-T-B through MR05-IS15-T-B	Collected from a 2 ft interval just above the water table at each location shown on Figure 3-2. Will allow for characterization of soil across site.	X	X	X		
Multi-Increment Surface Soil	MR05-DU01-SS(01,02,03) through MR05-DU06-SS(01,02,03)	Collected from an interval of 0 - 2 inches bgs. Will allow for characterization of MC and metals in surface soil across the site.	X	X	X		
TR-02-1 Surface Soil	MR05-SS01 through MR05-SS32	Collected from an interval of 0 - 2 inches bgs. Will allow for characterization of MC and metals in surface soil across the site.	X	X	X		
Discrete Surface Soil	MR05-SS01 through MR05-SS07 and MR05-SS33 through MR05-SS35	Collected from a 0 – 2 feet bgs at each location shown on Figure 3-1. Will allow for characterization of surface soil across the site.					X

TABLE 3-1
Summary of Sampling Program
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
MCB Camp Lejeune
Jacksonville, North Carolina

			Analysis				
Sample Media	**Sample ID Number**	**Sample Depth/Location and Rationale**	**Explosives Residues**	**Perchlorate**	**Total Metals**	**Dissolved Metals**	**Tear Gas Constituents**
Temporary Well Groundwater	MR05-TW01 through MR05-TW04	Samples from TW-01 through TW-04 will be collected just above the water table as shown on Figure 3-3. Will allow for characterization of groundwater across site, including upgradient and downgradient locations.	X	X	X	X	X
Temporary Well Groundwater	MR05-TW05 through MR05-TW10	Samples from TW-05 through TW-10 will be collected just above the water table as shown on Figure 3-3. Will allow for characterization of groundwater across site, including upgradient and downgradient locations.	X	X	X	X	
Sediment	MR05-SD01 through MR05-SD02	Collected from an interval of 0 - 2 inches bgs. Will allow for characterization of sediment across the site.	X	X	X		X
Surface Water	MR05-SW01 through MR05-SW02	Collected from an interval of 0 - .5 inches below the surface of the water body. Will allow for characterization of surface water across the site.	X	X	X	X	X

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

TABLE 3-2
Analyses, Bottleware, Preservation, and Holding Time Requirements
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
MCB Camp Lejeune
Jacksonville, North Carolina

Media	Analysis	Method	Container	Preservation & Storage	Holding Times
Soil and Sediment	Explosive Residues	SW-846 8330	1x8-oz bottle, Teflon cap(8330) or 2x16 oz wide mouth glass jars (8330B)	4ºC	7 days to extraction, 40 days from extraction to analysis
	Perchlorate	USEPA 6850	1x8-oz bottle, Teflon cap	4ºC	14 days to extraction, 40 days from extraction to analysis
	Total Metals	ILM05	1x4-oz bottle, Teflon cap	4ºC	6 months, Mercury: 28 days
	CN/CS Gas Constituents	SW-846 8270C	1x8-oz bottle, Teflon cap	4ºC	14 days to extraction, 40 days from extraction to analysis
Groundwater and Surface Water	Explosive Residues	SW-846 USEPA Method 8330	2x1-L amber jar	4ºC	7 days to extraction, 40 days from extraction to analysis
	Perchlorate	USEPA 6850	1x1-L Poly bottle	4ºC	7 days to extraction, 40 days from extraction to analysis
	Total and Dissolved Metals	ILM05	1x1-L Poly bottle	HNO_3 to pH <2 and cool to 4ºC	6 months, Mercury: 28 days
	CN/CS Gas Constituents	SW-846 8270C	2x1-L amber jar	4ºC	7 days to extraction, 40 days from extraction to analysis

Notes:
L = Liter; oz = ounce; HNO_3 = nitric acid

TABLE 3-3
Required QA/QC Samples
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
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
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
MCB Camp Lejeune
Jacksonville, North Carolina

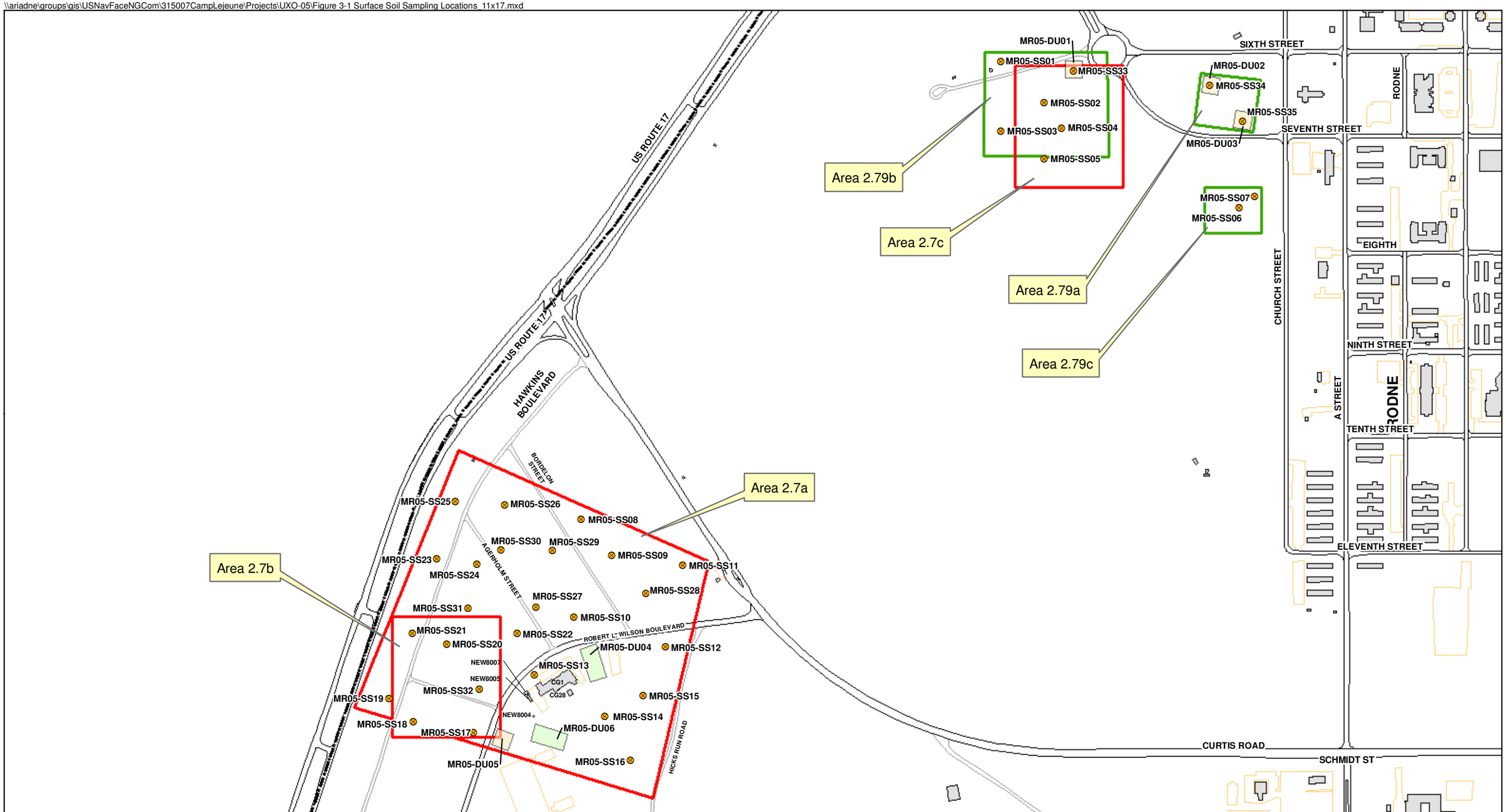
Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Direct Push Subsurface Soil Samples						
Explosives Residues	Solid	15	2	2	2	1
Perchlorate		15	2	2	2	1
Total Metals		15	2	2	2	1
Tear Gas Constituents		5	1	1	1	1
Surface Soil Samples						
Explosives Residues	Solid	50	5	2	2	3
Perchlorate		50	5	2	2	3
Total Metals		50	5	2	2	3
Tear Gas Constituents		10	1	1	1	1
Sediment Samples						
Explosives Residue	Solid	2	1	1	1	1
Perchlorate		2	1	1	1	1
Total Metals		2	1	1	1	1
Tear Gas Constituents		2	1	1	1	1
Surface Water Samples						
Explosives Residues	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
Tear Gas Constituents		2	1	1	1	1

TABLE 3-4
Sample Collection Frequencies
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
MCB Camp Lejeune
Jacksonville, North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Temporary Well Groundwater Samples						
Explosives Residues	Aqueous	10	1	2	1	1
Perchlorate		10	1	2	1	1
Total Metals		10	1	2	1	1
Dissolved Metals		10	1	2	1	1
Tear Gas Constituents		4	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

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure 3-1 Surface Soil Sampling Locations_11x17.mxd



Legend

- Surface Soil Samples
- 30m x 30m Decision Units
- 30m x 60m Decision Units
- Former B-3 Gas Chamber
- UXO-05 Boundary
- Buildings
- Paved Road
- Unpaved Road
- Vehicle Parking

N
W E
S

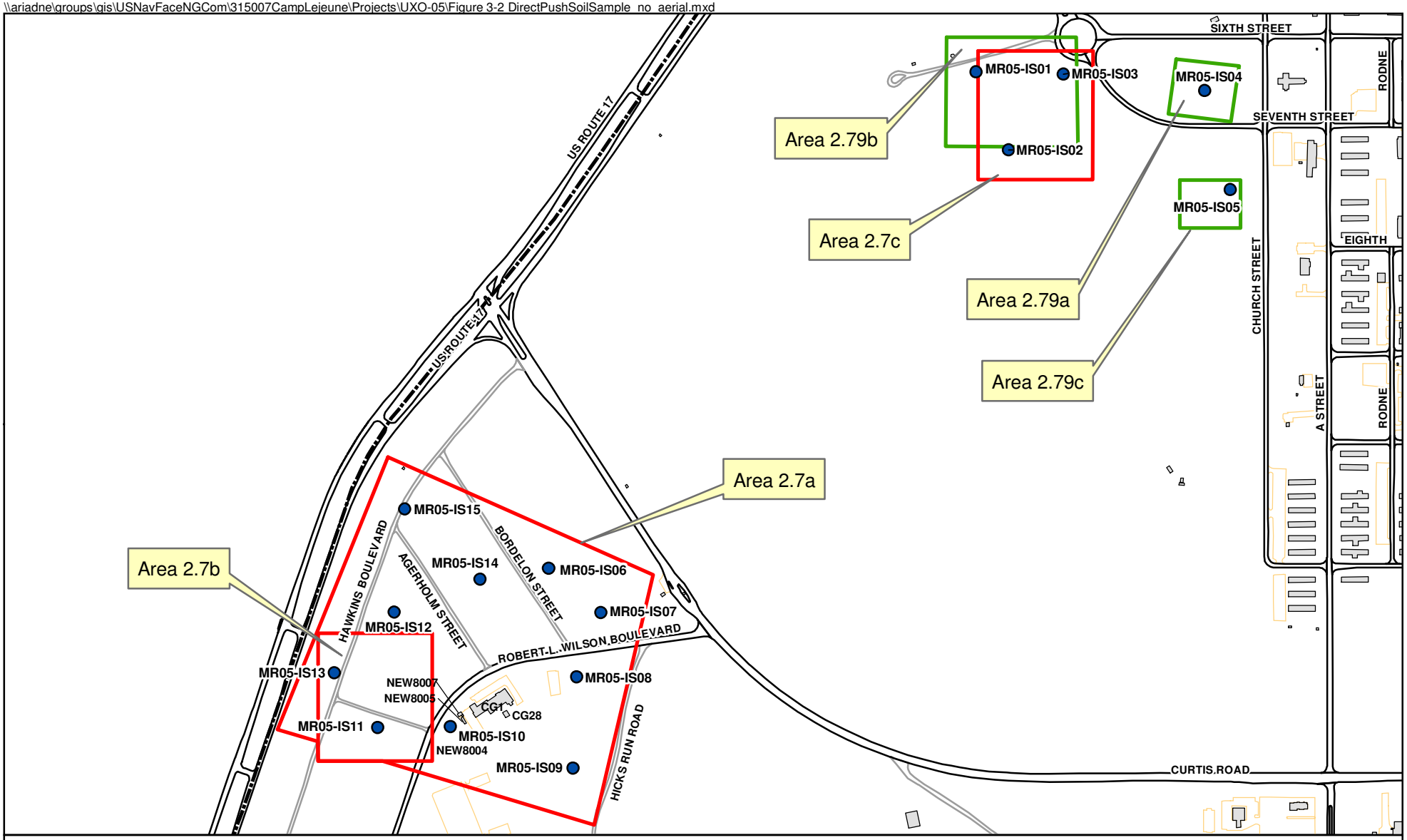
0 275 550 1,100 Feet

0 125 250 Meters

Figure 3-1
Surface Soil Sampling Locations
Site UXO-05 Former Miniature Anti-Tank Range
and Former B-3 Gas Chamber Site
MCB Camp Lejeune
North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure 3-2 DirectPushSoilSample_no_aerial.mxd



Legend

- Direct Push Soil Sample Locations
- Former B-3 Gas Chamber
- UXO-05 Boundary
- Buildings
- Paved Road
- Unpaved Road
- Vehicle Parking

N
W E
S

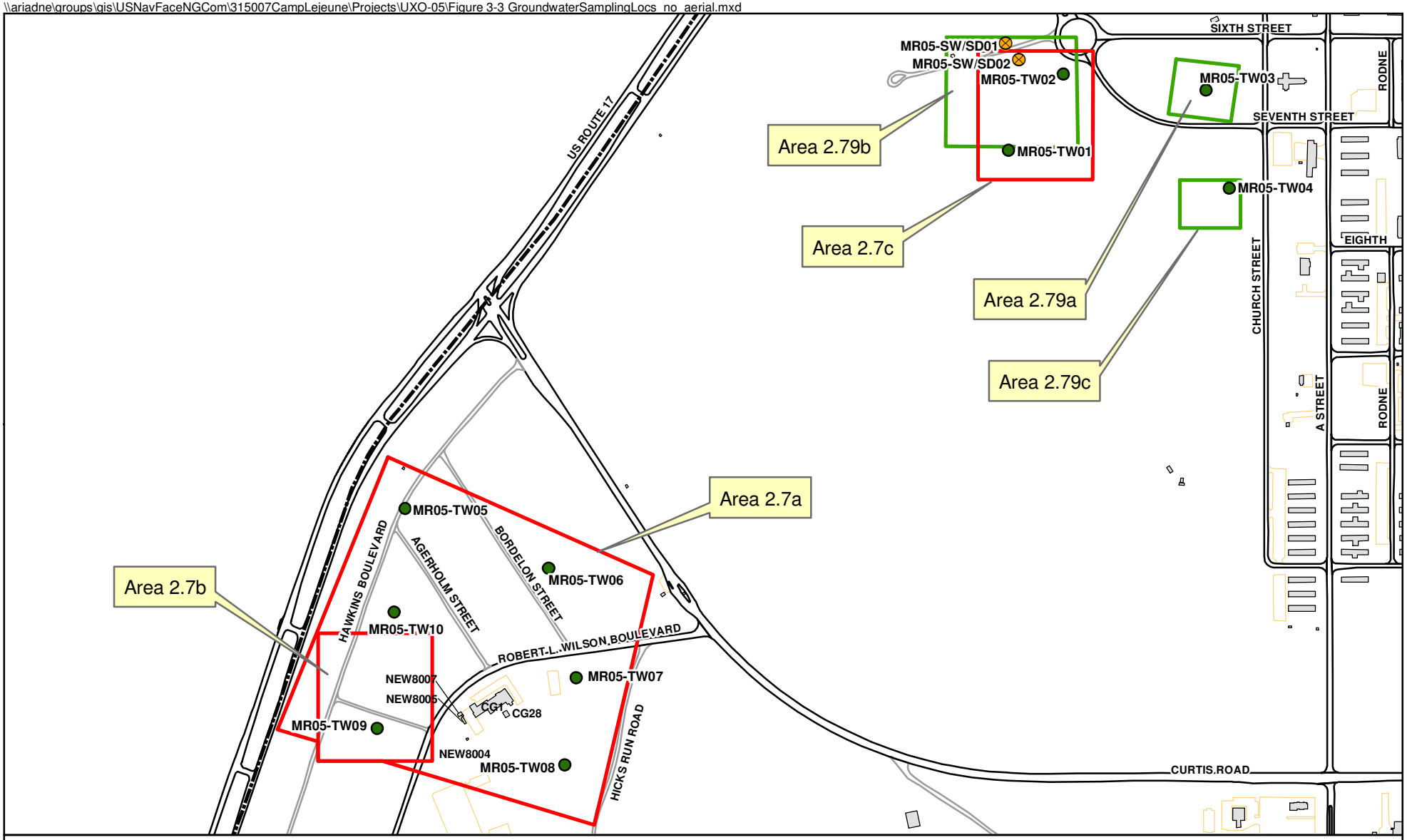
0 375 750 1,500 Feet

0 30 60 120 180 240 300 Meters

Figure 3-2
Direct Push Soil Sampling Locations
Site UXO-05 Former Miniature Anti-Tank Range
and Former B-3 Gas Chamber Site
MCB Camp Lejeune
North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure 3-3 GroundwaterSamplingLocs_no_aerial.mxd



Legend

- Surface Water/Sediment Sample Locations
- Shallow Temporary Well
- Former B-3 Gas Chamber
- UXO-05 Boundary
- Buildings
- Paved Road
- Unpaved Road
- Vehicle Parking

N W E S

0 375 750 1,500 Feet

0 30 60 120 180 240 300 Meters

Figure 3-3
Groundwater, Surface Water, and Sediment Sampling Locations
Site UXO-05 Former Miniature Anti-Tank Range
and Former B-3 Gas Chamber Site
MCB Camp Lejeune
North Carolina

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SECTION 4

Quality Control Plan

All applicable work performed by CH2M HILL and its subcontractors at Site UXO-05 and the Former B-3 Gas Chamber will be done in accordance with the QCP in Section 8 of the MRP Master Project Plans. This QCP describes the QC approach and procedures for UXO-05 and references the MCB Camp Lejeune Master Quality Assurance Project Plan (CH2M HILL, 2005b). 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 to be employed at Site UXO-05 and the Former B-3 Gas Chamber, including the phase during which it is performed, the frequency of performance, the pass/fail criteria, and actions to take if failure occurs, are presented in Table 4-1.

TABLE 4-1
Definable Features of Work Auditing Procedures
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
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	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	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.
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.
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.
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	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	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	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	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)	MEC QCS, 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)	MEC QCS, Project Manager	Hold pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.	PP/IP	O	Project plans are reviewed and acknowledged by team members.	Do not proceed with field activities until criterion is passed.
Site preparation (Site Survey)	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 grids have been established.	PP/IP	O	Site boundaries and grids have been established.	Do not proceed with dependent field activities until criterion is passed.

TABLE 4-1
Definable Features of Work Auditing Procedures
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
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
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.
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 and approval	Project Manager, Project Geophysicist	Verify all dig sheets where geophysical mapping and investigation performed are accurate and complete.	FP	O	All dig sheets where geophysical mapping and investigation performed are accurate and complete.	Ensure all dig sheets where geophysical mapping and investigation performed are accurate and complete
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 ecological 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, the bald eagle seabeach amaranth, and the rough-leaf loosestrife (USMC, 2006). Species that could occur in or adjacent to 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.

Camp Lejeune has active programs in place to protect the three federally protected avian species (American bald eagle, piping plover, and red cockaded woodpecker) that are known to occur on the base. 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]*, 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). 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-05 and the Former B-3 Gas Chamber (project area) are not within the vicinity of any of the red-cockaded woodpecker management areas.

A bald eagle's nest is documented on Camp Lejeune. The nest is located at the junction of Sneads Creek and the New River, 9 miles from the project area. 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. The project area is not within any of these buffer zones. Non-nesting eagles may use the project area for foraging habitat. However, the proposed work is not expected to impact any special habitat where eagles are concentrating.

Suitable habitat for the piping plover does not exist in the project area. 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 nest 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 the project area. Since project area is not located along the Atlantic Ocean coastline and does not contain suitable

habitat, piping plovers are not expected to be present at the site for any reason (feeding, breeding, nesting).

The project area 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 in the project area. The project area 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. SI work activities are not likely to impact these species.

The eastern cougar is the only federally listed mammal species that could occur in Onslow County. The only extant population of eastern cougar is located in south Florida and the species has not been observed in North Carolina in over 50 years. Suitable habitat for the eastern cougar does not exist in the project area 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 the project area, it is very unlikely that the eastern cougar would occur on the site and no impacts are 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 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 the project area.

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

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 the project area. Project design features have been developed to prevent impacts to listed species.

5.3 Wetlands within the Project Site

Jurisdictional wetland areas are known to be located at Site UXO-05 and the Former B-3 Gas Chamber site (Figure 5-1). In order to install groundwater monitoring wells, collect samples, and conduct DGM activities, some vegetation removal will be necessary. Work in wetland areas will be avoided to the extent practical. However, if work in areas determined to be jurisdictional wetlands is unavoidable the USACE Wilmington District will be contacted to obtain any necessary permit or authorization. No significant soil disturbance is anticipated from planned site work as described in this WP. No wetlands on or downstream of the project area are expected to be impacted by the project. Due to the size of the project area, Site UXO-05 and the B-3 Gas Chamber are below the threshold for requiring a stormwater

pollution prevention plan. However if the potential for runoff to jurisdictional wetlands exist, appropriate protection measures will be put in place.

5.4 Cultural and Archaeological Resources within the Project Site

The environmental sampling and DGM activities proposed to support this WP involve only 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 archaeologist confirms no cultural or archaeological resources are known o be within the project area. If new 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

As shown in Figures 1-1 and 1-2, Site UXO-05 and the Former B-3 Gas Chamber do not encompass nor are bounded or bordered by surface water sources other than some small surface water drainage features. No water resources are expected to be impacted by the project. There is adequate vegetation buffer surrounding the sites to protect surface water from additional runoff. Should clearing of vegetation be required in areas adjacent to a water body, appropriate silt barriers or other best management practices 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). The CAMA requires permits for development in Areas of Environmental Concern (AEC) if it meets all of the following conditions:

- It is in one of the 20 counties covered by CAMA
- It is considered "development" under CAMA
- It is in, or it affects, an AEC established by the Coastal Resources Commission
- It does not qualify for an exemption

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

The PA/SI at Site UXO-05 and the Former B-3 Gas Chamber site will include surface investigations and the collection of subsurface soil and groundwater samples using DPT. These activities do not fit the definition of “development” under CAMA; therefore, a CAMA permit is not necessary for this project.

5.7 Vegetation to be removed within the Project Site

Some vegetation removal is anticipated in association with the field investigations described in this WP. Vegetation will primarily be removed for geophysical transects and monitoring well installation. It is estimated that approximately 13 percent of wooded areas in the B-3 Gas Chamber site will be cut to allow for the use of DGM equipment. Only vegetation up to 3 inches in diameter will be cut. 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-05 or the Former B-3 Gas Chamber site.

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 have been determined to be 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 a 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 Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
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.

TABLE 5-1
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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.

TABLE 5-1
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Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
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.
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	Quillwort 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

TABLE 5-1
Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS
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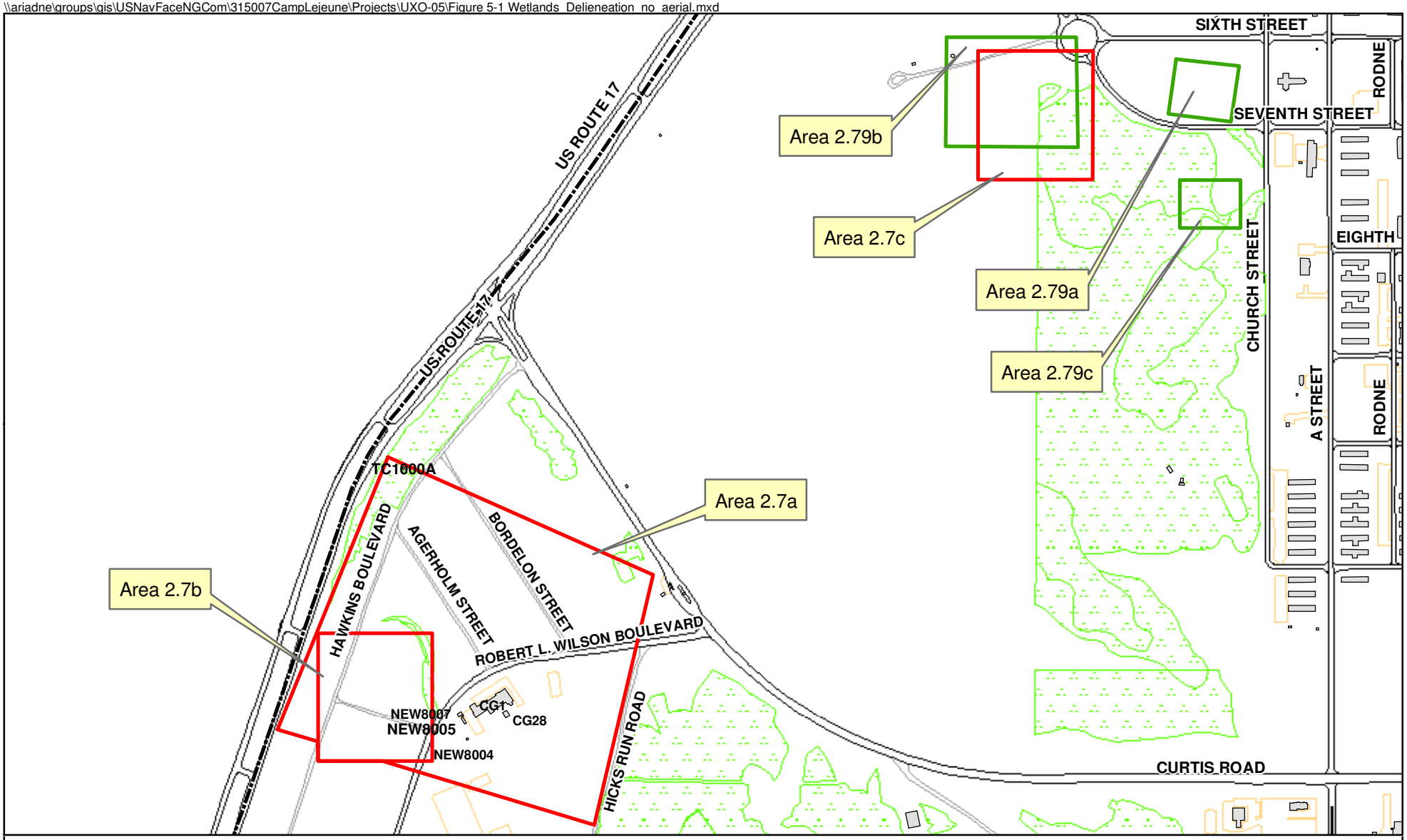
Scientific Name	Common Name	Federal Status	Habitat
Asplenium heteroresiliens	Carolina (wagner) spleenwort	FSC	Rock outcrops
Rhynchospora pleiantha	Coastal beaksedge	FSC	Extremely rare, found at fewer than 25 sites throughout its North Carolina-to-Alabama range
Solidago villosicarpa	Coastal Goldenrod	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.
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.

TABLE 5-1
Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS
Work Plan for the Preliminary Assessment/Site Inspection, Site UXO-05, Former Miniature Anti-Tank Range and Former B-3 Gas Chamber
MCB Camp Lejeune
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
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*)
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

Notes:
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.

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure 5-1 Wetlands_Delieneation_no_aerial.mxd



Legend

- Former B-3 Gas Chamber
- UXO-05 Boundary
- Buildings
- Wetland Area
- Paved Road
- Unpaved Road
- Vehicle Parking

N
W E
S

0 375 750 1,500 Feet

0 30 60 120 180 240 300 Meters

Figure 5-1
Wetlands Delineation
Site UXO-05 Former Miniature Anti-Tank Range
and Former B-3 Gas Chamber Site
MCB Camp Lejeune
North Carolina

CH2MHILL

SECTION 6

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Appendix A
Archival Records Search Report

Draft

Archival Records Search Report
Site UXO-05 (Former Miniature Anti-Tank Range) and the Former B-3 Gas Chamber

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 168

December 2007

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Chantilly, Virginia

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2.2 Ownership and Operational History 2-1

2.2.1 MCB Camp Lejeune Ownership History 2-1

2.2.2 Site UXO-05 (Former Miniature Anti-Tank Range And Former B-3 Gas Chamber) 2-1

3 References **3-1**

Attachments

1 Resource Review Summary

Figures

A-1 Site UXO-05 and Former B-3 Gas Chamber, Tent Camps Nos 1 & 2 and Vicinity, Camp Lejeune, NC, June 30, 1951

A-2 Site UXO-05 and Former B-3 Gas Chamber, Master Shore Station Development Plan, Geiger Area "B", Camp Lejeune, NC, May 5, 1961

A-3 Site UXO-05 and Former B-3 Gas Chamber, Geiger Area-MCAF, New River and Vicinity, Camp Lejeune, NC, June 30, 1964

A-4 Site UXO-05 and Former B-3 Gas Chamber, Geiger Area-MCAF, New River and Vicinity-2, Camp Lejeune, NC, June 30, 1964

A-5 Site UXO-05 and Former B-3 Gas Chamber, Geiger Area "A", Camp Lejeune, NC, June 30, 1979

A-6 Site UXO-05 and Former B-3 Gas Chamber, Geiger Area "A"-2, Camp Lejeune, NC June 30, 1979

A-7 Site UXO-05 and Former B-3 Gas Chamber, Camp Geiger Trailer Park and New River Air Station Gate, Camp Lejeune, NC, June 30, 1984

Acronyms and Abbreviations

amsl	above mean sea level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTO	Contract Task Order
°F	degrees Fahrenheit
DGM	digital geophysical mapping
ft	foot/feet
HTW	hazardous and toxic wastes
LANTDIV	Naval Facilities Engineering Command, Atlantic Division
MC	Munitions Constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
MRP	Munitions Response Program
NARA	National Archives and Records Administration
NARA II	National Archives II
NAVFAC	Naval Facilities Engineering Command
PA/SI	Preliminary Assessment/Site Inspection
Rte	Route
UXO	unexploded ordnance
WWII	World War II

SECTION 1

Introduction, Purpose, and Scope

Marine Corps Base (MCB) Camp Lejeune is in the process of investigating closed ranges at the Base following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. The work is being conducted under the Navy CLEAN III Contract N62470-02-D-3052, Contract Task Order (CTO) 168, for the Naval Facilities Engineering Command (NAVFAC), Atlantic Division (LANTDIV). Due to historic activities at Site Unexploded Ordnance (UXO)-05, Former Miniature Anti-Tank Range, and the Former B-3 Gas Chamber, a munitions response program (MRP) Preliminary Assessment/ Site Inspection (PA/SI) is being conducted to accomplish the following objectives:

- Identify historical activities at Site UXO-05 and the Former B-3 Gas Chamber that may have resulted in environmental contamination with munitions and explosives of concern (MEC) or munition constituents (MC) by researching archival records and interviewing current and previous installation personnel
- Evaluate the presence and nature of MC contamination that may exist at the Former Miniature Anti-tank Range and the Former B-3 Gas Chamber by conducting an investigation of soil, groundwater, surface water, and sediment. The Former B-3 Gas Chamber areas will also be evaluated for chemical compounds related to historic gas chamber operations.
- Conduct ecological and human health risk screenings using analytical data collected at the Former Miniature Anti-tank Range and the Former B-3 Gas Chamber area.
- Estimate the number and density of geophysical anomalies that may represent subsurface MEC by conducting digital geophysical mapping (DGM) within the Former B-3 Gas Chamber areas of the site. The Former Miniature Anti-tank Range was a small arms range, and therefore MEC is not a concern at this site.

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, specifically MEC or MC. 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 Marine Corps Library at Quantico, National Archives and Records Administration (NARA) map and text files, and MCB Camp Lejeune base files.

SECTION 2

Background 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 Marine Expeditionary Force units and includes six major Marine Corps commands, two Navy commands, one Coast Guard command, and is home to several Marine Corps schools. MCB Camp Lejeune supports a total population of approximately 150,000, including active duty military and dependants, retirees, and civilian employees (Global Security, 2007).

2.2 Ownership and Operational History

2.2.1 MCB 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 (WWII), 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 the Marines occupation, 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, 2007).

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-05 (Former Miniature Anti-Tank Range) and the Former B-3 Gas Chamber

Site UXO-05 and the Former B-3 Gas Chamber are both located in the Camp Geiger area of Camp Lejeune and consist of Sites 2.7a, b, and c (Former Miniature Anti-Tank Range) and Site 2.79a, b and c (Former B-3 Gas Chamber). Sites 2.7a and 2.7b are located in the area of the former Geiger Trailer Park, east of US 17 and south of Curtis Road. Site 2.7c is located east of US Route 17 and south of the Camp Geiger's Monument Circle. Site 2.79b is the area of the Former B-3 Gas Chamber and overlaps the area of Site 2.7c. Site 2.79a is located north

of Seventh Street and south of 6th Street. Site 2.79c is located south of Seventh Street and west of Church Street.

Camp Geiger is separate from Camp Lejeune and contains the School of Infantry (formerly known as Infantry Training Regiment (ITR)), which is composed of two training battalions - the Infantry Training Battalion (ITB) and the Marine Combat Training Battalion (MCTBn). Marines are trained in the following: Military Occupational Specialties; Marine Rifleman; Machine Gunner; Mortarman; Assaultman; or *Antitank Guided Missileman*. (Louis Berger Group, 2002)

The Camp Geiger area was originally used during World War II (WWII) to house the 1st Marine Division. During that time period (1941-1942), the area was known as the Tent Camps and consisted of approximately 2,000 tents. The Tent Camps were located in the area northeast of Site UXO-05. The Tent Camps consisted of 6-man canvas tents, 20 feet square, arranged in blocks on a grid like street pattern, and 14-man "huts" made from sheets of compressed cellulose called Homosote.[1] By the end of the WWII, corrugated steel Quonset huts replaced most of the tents, but the Homosote huts remained until the early 1950's when all huts were removed (Figure A-1 and A-2).[2] The area of Sites 2.7a and 2.7b were used as a trailer park in the 1960's. The 1964 Camp Lejeune Existing Conditions map provides the layout of the trailer park, including streets and sleeper trailer numbers (Figures A-3 and A-4). The 1979 Camp Lejeune Existing Conditions map shows the footprint of the former trailer park in the area of Sites 2.7a and 2.7b and various small buildings on the site that were/are used for classrooms, storage, a sewer pump station and pump houses for wells (Figures A-5 and A-6). The 1984 Camp Lejeune Existing Conditions map shows an "Open Storage Area" located east of the sewer pump station house (Figure A-7). No additional information on the Open Storage Area was located during the archive research.

The miniature antitank range was used between 1942 and 1944. According to the 2000 Range Identification and Preliminary Range Assessment, a 1000-Inch Miniature Antitank Range that involved firing at a moving target car on a transverse track was identified as being in the location of Site UXO-05. The explosive hazards for this range exist with complete rounds, which would be found at or near the firing line (USACE, 2001). Complete rounds would be located at the surface, but over the years, construction and other ground movement may have caused the rounds to become buried to an unknown depth (USACE, 2001). The Base Range Safety Officer noted that the area was used extensively during World War II for blank fire and non-firing events (Richardson, 2007). He also noted that the form of firing was from .22 caliber small arms, which was restricted to the site.

An underground storage tank (UST) and four associated monitoring wells (USTCG1-MW01 through USTCG1-MW04) associated with Building CG1 (Base Game Warden and Archery Club Offices), were located within Area 2.7a. The CG1 UST was a 500-gallon, used oil tank, which was removed in February 1994. The site was issued No Further Action (NFA) status by NCDENR in July 2000. The four monitoring wells were subsequently abandoned in accordance with North Carolina well abandonment standards.

[1] Global Security.org. Camp Geiger. http://www.globalsecurity.org/military/facility/camp-geiger.htm. Accessed May 23, 2007.
[2] Ibid.

The Former B-3 Gas Chamber operated between 1953 and 1961. Based on review of current maps for the Site UXO-05 and Former B-3 Gas Chamber area, no buildings are located in the area of the former gas chamber. The August 1953 Range Overlay Map shows the location of the Former B-3 Gas Chamber west and southwest of Seventh and Church Street (USACE, 2001). On the 1951 Existing Conditions map for Camp Geiger, two former buildings, TC505 (school building) and TCS507 (mockup building), are shown to be located within Sites 2.79b and 2.7c (Figure A-1). The 1961 Master Shore Development map for Camp Geiger shows two class room buildings, S-OC-1-C and S-OC-15-C, located within Sites 2.79b and 2.7c, and one building, BG-1, located within Site 2.79a (Figure A-2). The use of Building BG-1 was not identified during the archive research. This building does not appear in subsequent 1964 or 1979 existing conditions maps for the Camp Geiger area. The two classroom buildings shown on the 1961 map and building TCS652 appear within Sites 2.79b and 2.7c on the 1964 existing conditions map for the Camp Geiger area. The use of building TCS652 was not located during the archive research.

According to the Base Safety Range Officer, Mr. Duane Richardson, Camp Lejeune does not have any records for gas chambers that operated between 1953 and 1961 in the Camp Geiger area (Richardson, 2007). However, he provided a description of the typical gas chambers used at Camp Lejeune. He noted that most likely the former gas chamber was a wood/metal building with a concrete floor, with several windows and doors. The building may not have had any ventilation system other than a fan. The type of gas most likely used in the gas chamber was chlorobenzylidene malonitrile, or CS gas. The general practice of gas chambers is to test the proper fit of the gas masks, and is still a general practice today. Common practice was to use CS gas capsules and an open flame to burn the CS (Richardson, 2007).

Another range (B-012) is located immediately to the east of Area 2.7b, but is not associated with Site UXO-05 and the Former B-3 Gas Chamber. The B-012 range was shown on the 1961 Master Shore Station Development Plan and was identified as a rifle and pistol range. Authorized firing at this range consisted of .22 caliber rifles, service pistols, and revolvers. The range has remained in service from approximately 1961 to the present time. The Base Range Safety Officer indicated that the range is currently used for pistol training with 9mm and 0.45 caliber pistols (Richardson, 2007).

SECTION 3

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Figures

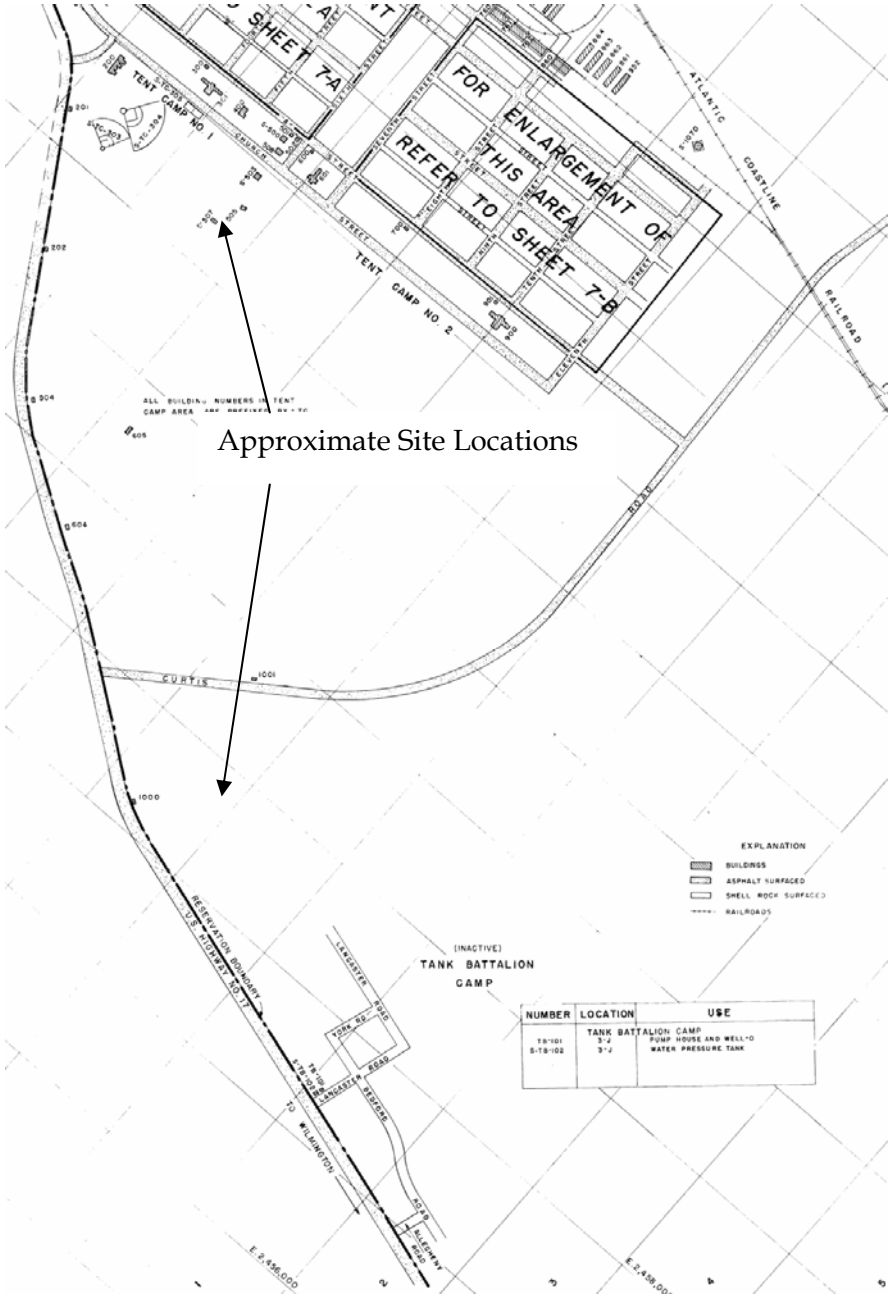

Figure A-1
Site UXO-05 and Former
B-3 Gas Chamber
Tent Camps Nos 1 & 2
and Vicinity
Camp Lejeune, NC
June 30, 1951

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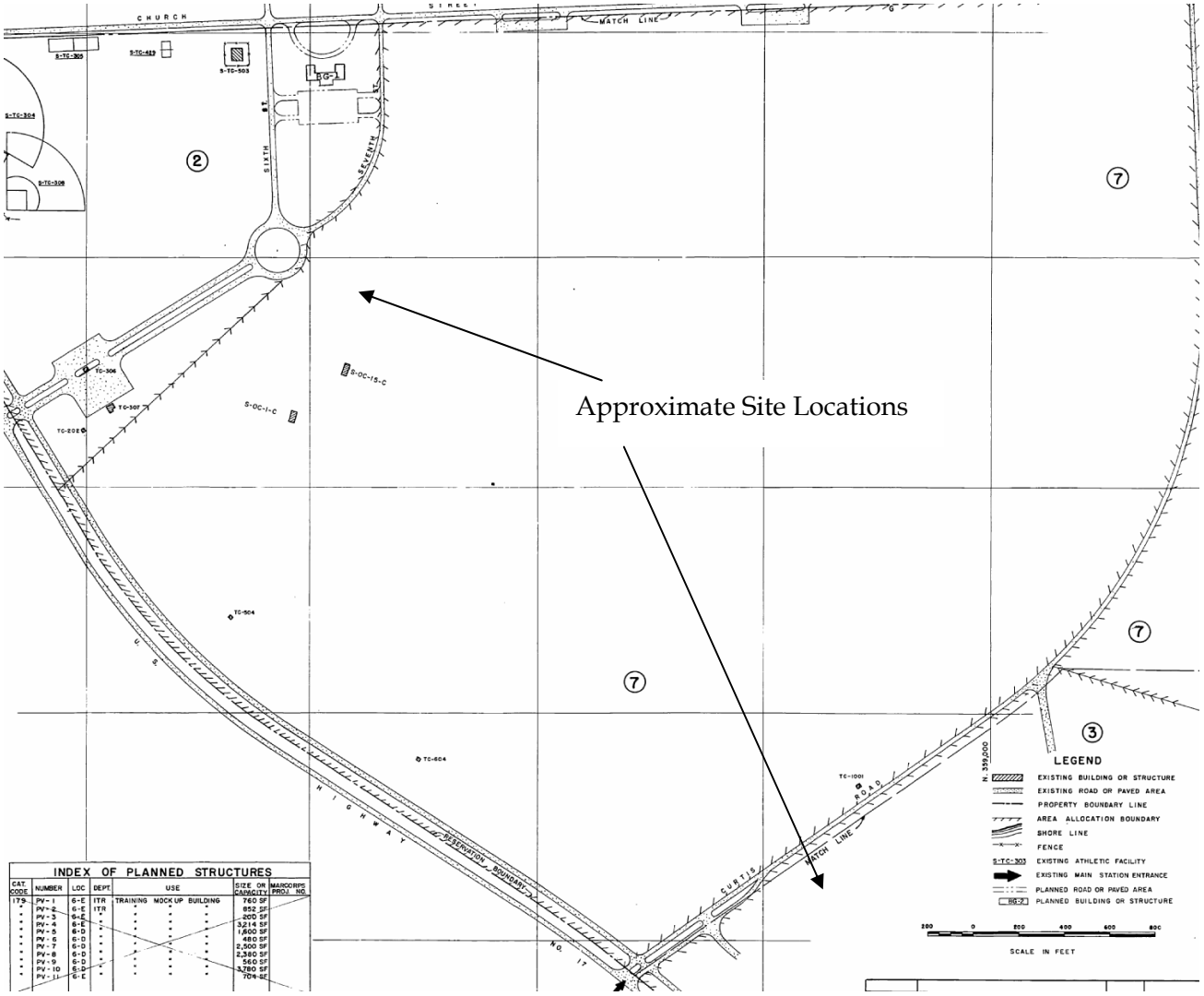

Figure A-2
Site UXO-05 and Former
B-3 Gas Chamber
Master Shore Station
Development Plan
Geiger Area "B"
Camp Lejeune, NC
May 5, 1961

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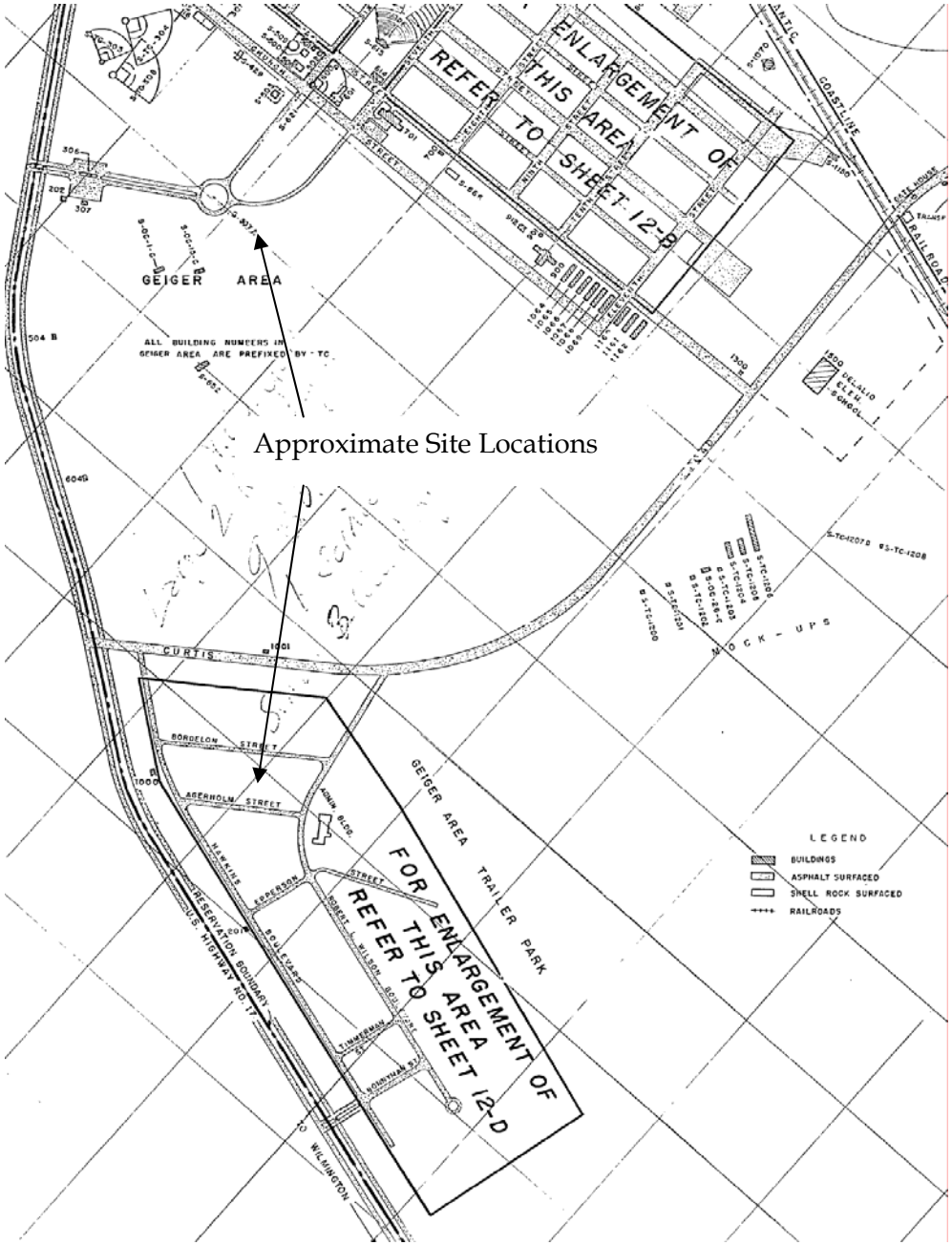

Figure A-3
Site UXO-05 and Former
B-3 Gas Chamber
Geiger Area – MCAF,
New River and Vicinity
Camp Lejeune, NC

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Figure A-4
Site UXO-05 and Former
B-3 Gas Chamber
Geiger Area – MCAF,
New River and Vicinity - 2
Camp Lejeune, NC
June 30, 1964

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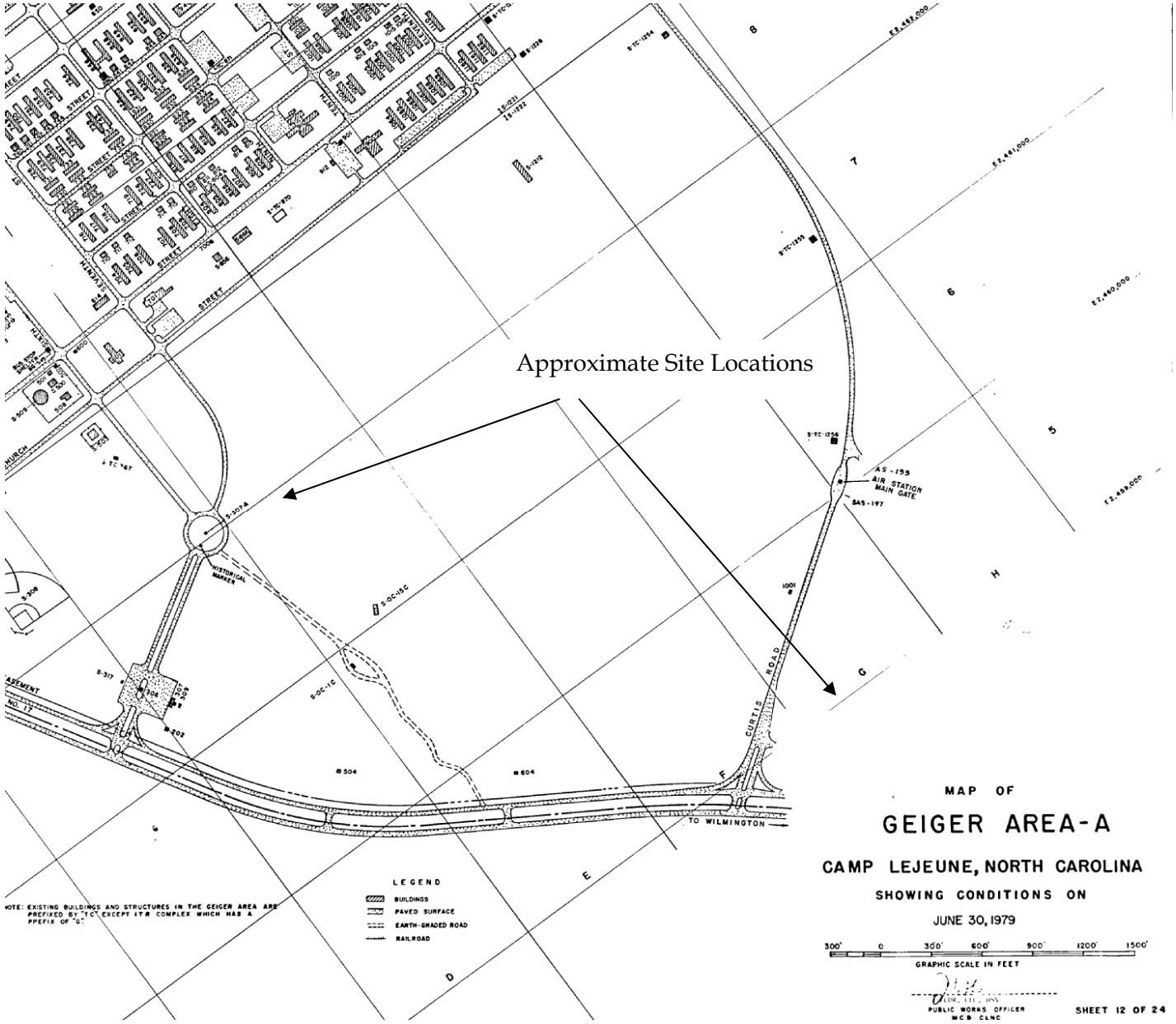

Figure A-5
Site UXO-05 and
Former B-3 Gas
Chamber
Geiger Area A
Camp Lejeune, NC
June 30, 1979

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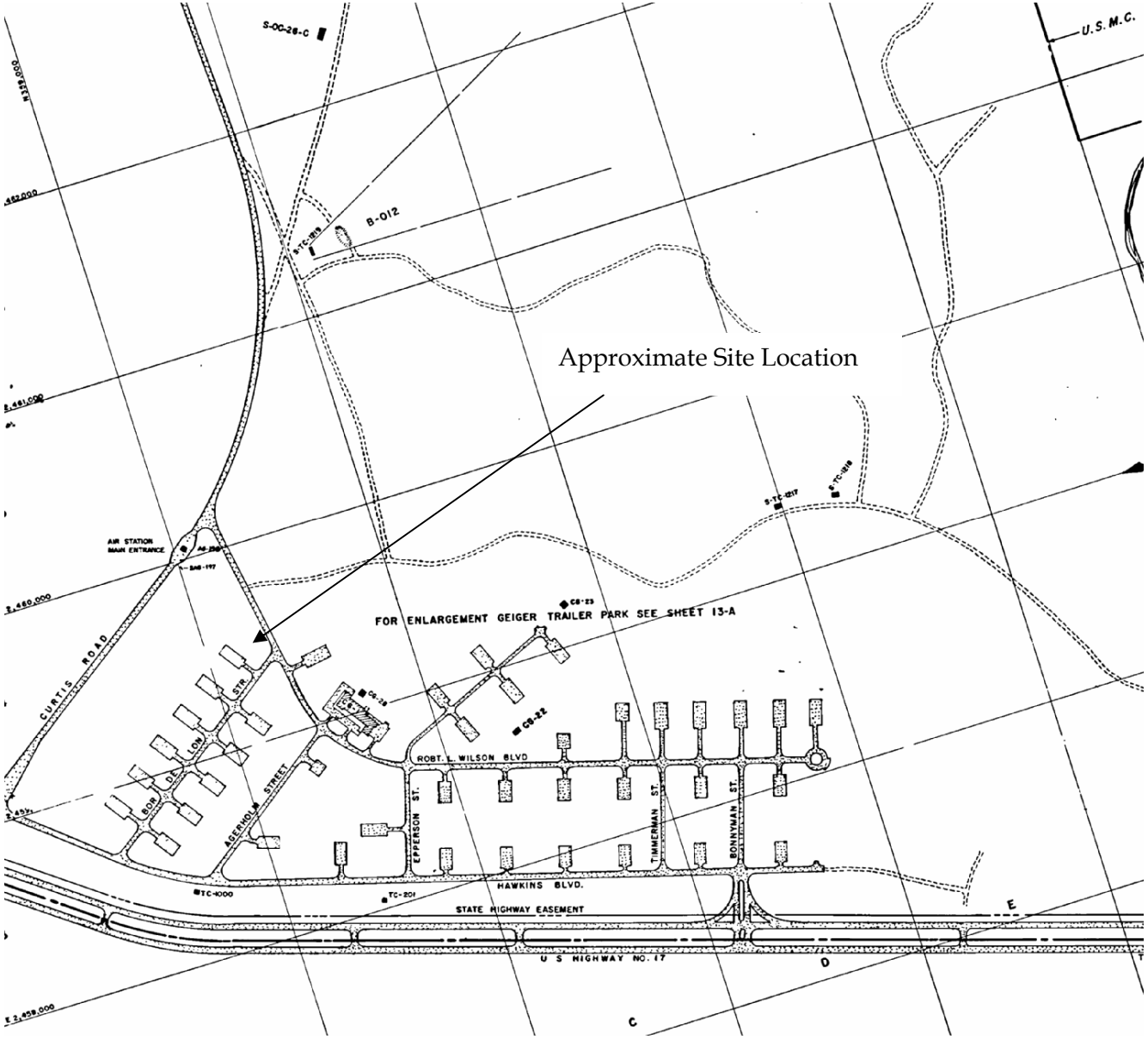

Figure A-6
Site UXO-05
Geiger Area A - 2
Camp Lejeune, NC
June 30, 1979

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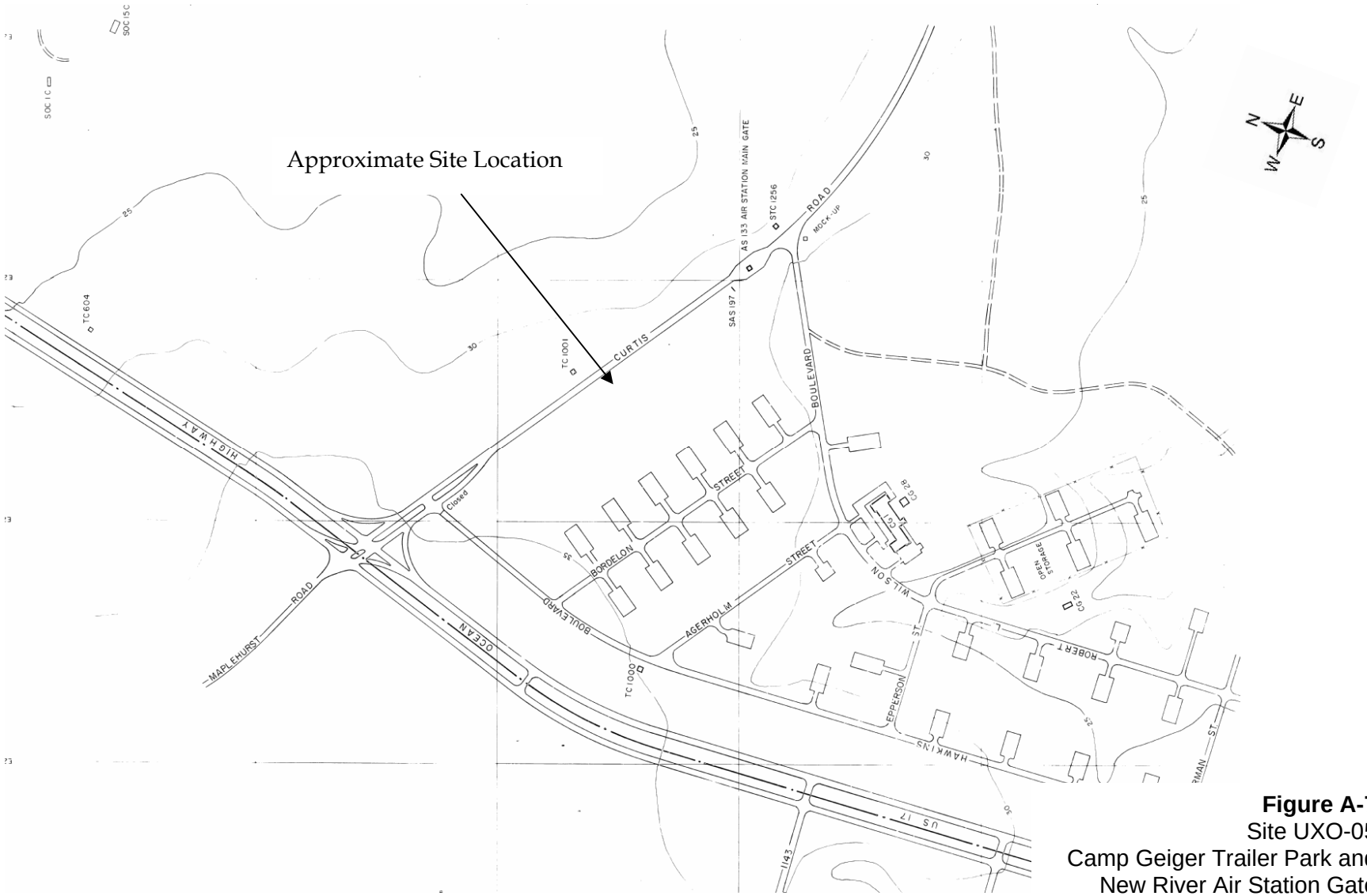

Figure A-7
Site UXO-05
Camp Geiger Trailer Park and
New River Air Station Gate
Camp Lejeune, NC
June 30, 1984

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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 Corps Library Gray Research Center (Alisa Johnson)	Reviewed all available file folders related to Camp Lejeune and copied relevant reports and figures/maps.
Quantico, Virginia, Marine Corp Base, Dunlap Hall, Audio Visual Repository	Reviewed all available file photos related to Camp Lejeune – No relevant photos to copy
US National Archives (NARA II) Historical Files	Reviewed text and drawing files from Text Division and Cartographic Division and Still Photographs Research Division.
Barry Zirby/National Archives Text File	See US National Archives Files Review
Camp Lejeune Library files	Reviewed and copied all relevant documents related to historical land use for each site.
Camp Lejeune Real Estate files	Reviewed and copied all relevant documents related to historical land use for each site.
Camp Lejeune Website	Reviewed and copied all relevant documents related to historical land use for each site.
Camp Lejeune Personnel	
Bob Lowder/Environmental	Contacted and interviewed
Linda Futrell/ Real Estate Expert	Contacted and interviewed
Glenn Pappas/MCB Camp Lejeune Military Historian	Contacted and interviewed
Michael Singhas/MCB Camp Lejeune Skeet Range Manager	Contacted and interviewed
Duane Richardson/ Base Range Safety Officer	Contacted and interviewed

Marine Corp Library Review

Text Division

Contact: Alisa Johnson

Site Visit: May 1, 2007

File review at Marine Corps Base, Quantico, Virginia, Gray Research Center, Marine Corps Archives and Special Collections.

Review files from Box #61, Camp Lejeune 1941-1984 (files copied)

- Live Minefield Site - Correspondence and map
- Regulations Governing Use of Firing Range 5, Field Training and Facilities and Maneuver Areas, BO P11102.1F, Apr 1966 - Relevant site information and maps of ranges
- Department of Navy Candidate Environmental Impact Statement (CEIS), Construction of FY 76-77 Family Housing, United States Marine Corp Base Camp Lejeune, NC, Feb 1975 - Figure, Existing Explosives text
- Combat Training Chart (topographic map) 1987
- Approaches to New River (topographic map) 1978

National Archives and Records Administration Review

Text Division

Contact: Mr. Barry Zirby, 301-713-7250 x285
Site visits on May 2 and 3, 2007

Reviewed 18 boxes of files associated with the Marine Corps, 1939-1950

- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-800 (10/45-1/47) to 1275/70-727 (1/44-12/47), Box 218.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-800 (10/44-1/45) to 1275/70-800 (7/45-9/45), Box 219.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-10 (1/48-12/48) to 2000-10 (5/24-12/36), Box 1201.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-10 (6/45-4/46) to 2000-10 (5/44), Box 1202.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20 (1/49-10/49) to 2000-10 (1/45-6/45), Box 1203.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20 (1/44-6/47) to 2000-20 (5/48-12/48), Box 1204.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-5 (6/46-12/47) to 2000-20 (6/43), Box 1205.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-10 (7/48-10/47) to 2000-20-5 (4/45-6/46), Box 1206.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-10 (7/41-11/42) to 2000-20-10 (1/45-6/45), Box 1207.

- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-10 (7/39-2/40) to 2000-20-10 (2/40-6/41), Box 1208.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-20 (1/48-12/48) to 2000-20-15 (1/49-6/50), Box 1209.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-20 (1/44-11/46) to 2000-20-20 (11/46-12/47), Box 1210.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-20 (2/33-8/36) to 2000-20-20 (6/42), Box 1211.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2015 (3/43) to 2000-80 (1/44-12/47), Box 1241.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Brooklyn to 2285-10 Camp Lejuene, Box 1570.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejuene to 2285-10 Camp Lejuene, Box 1571.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejuene to 2285-10 Camp Lejuene, Box 1572.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejuene to 2285-10 Camp Lejuene, Box 1573.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejuene to 2285-10 Camp Lejuene, Box 1574.

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.

Cartographic Division

The cartographic division did not contain any relevant information pertaining to historical ordnance use at any of the sites. Information for Camp Lejuene 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 Lejuene was for Subject Area 19- Water Systems. Subject Areas 44 is Rifle ranges, machine gun ranges, sighting ranges, bombing targets; however, no materials were located under this Subject Area.

List of Documents Obtained from National Archives

- "Aerial Photo of Football Field, 300 ft. 24 Sept 49" - aerial photograph of area north of Site UXO-08.
- Commandant Letter, dated October 21, 1947 – Subject – "Recommendation for annual allowance of blank ammunition".

- Letter of Instruction Number 1567, dated April 19, 1948 – Subject – "Handling, Storing, and Destruction of Ammunition and Explosives".
- Bureau of Ordnance Letter to Commanding Officer, Naval Ammunition Depot, Hawthorne, Nevada, dated October 23, 1947 – Subject – "Grenades, Rifle, M8, M9, A1C-S4NAA-6, Disposition of".
- Commandant Letter, dated February 26, 1945 – Subject – "Miniature Practice Bombs".
- Memorandum for the Director, Marine Corps Reserve, dated August 5, 1940, Subject – "List of property for Reserve Battalion".
- Commandant Letter, dated May 10, 1941, Subject – "Procurement of Ordnance Material".
- Bureau of Ordnance Letter – "Memorandum to Accompany Report of Deliveries of Marine Corps Ordnance Equipment for the Month of December 1942".
- "Camp General Order: Training Facilities, Regulations Governing Use of", dated December 9, 1946.
- Record Drawing - Public Works Department, Camp Lejeune, North Carolina, Fleet Marine Force, 2nd Marine Division, Shop Area, April 28, 1950.
- Map - US Marine Corps Topographic Map, Camp Lejeune North Carolina, 1947.
- Map – Camp Lejeune General Area Map, March 1947.

MCB Camp Lejeune Base Site Visit and Records Review

Base Contact: Mr. Bob Lowder, Environmental Management Division, 910-451-9607

File reviews of records in the base Real Estate office, base library, and EOD office were conducted during the site visit. Additionally, interviews were conducted with Bob Lowder/Environmental Manager, Glenn Pappas/Military Historian, Linda Futrell/Real Estate expert, Duane Richardson/EOD Base Range Safety Officer, and Michael Singhas/Camp Lejeune Skeet Range Manager.

List of Documents Obtained from Camp Lejeune

Base Real Estate Office

- "Combined Arms Training Ranges, Areas "D" & "G", 1950. Public Works Drawing 3456, Tube 20.
- "Combat Training Chart 15.042-50-01, Appendix D-1 to B.O. P11102.1F, April 9, 1969, Campwide." Public Works Drawing 12826.
- "Proposed Grenade Range, F-6 Range,"November 5, 1958. (2 drawings)
- "Replace F-6 Hand Grenade Range," July 16, 2003. (11 drawings)
- Master Shore Station Development Plan – May 1961

- 8th Communication Battalion Operations/Maintenance/Storage Facility – November 2000
- Hobby Shop Complex, Hadnot Point Phase II – June 1997
- Gottschalk Marina, Borings – August 1998
- Combat Vehicle Maintenance Shops – June 1984
  - Site Layout
  - Site Location/Vicinity
- Medical/Dental Clinic - Vicinity/Location Map – 1987
- Barracks Force Troops Complex – Location Plan & Details – 1967/1968
- Force Troops Complex Site Plan (Grading and Storm Drainage) – 1966
- Existing Conditions – 1984
  - Camp Geiger Trailer Park and New River Air Station Gate - 14599
  - New Hospital Area and Midway Park Housing Area - 14605
  - Camp Geiger Trailer Park Area - 14607
  - Paradise Point Housing Area – 14624
  - Hadnot Point Regimental Areas (100-200) – 14628
  - Hadnot Point Industrial Area – 14629
  - Hadnot Point Industrial Area and Lyman Road – 14630
- Parachute and Survival Equipment Shop – Force Troops Complex – December 1973
  - Text Boring Logs – 401374
  - Vicinity Plan - 1973 – 4013789
- Master Shore Station Development Plan – December 1960
  - Index Existing Training Facilities – 567027
  - Hadnot Point Area "A" – 567005
  - Enlargement Hadnot Point – 765508, 765509, 765510
  - Hadnot Point Area "B" – 765511
  - Geiger Area B – 567016
- Existing Conditions – 1964
  - Index Sheet
  - Midway Park Housing Area
  - Open Storage Area
  - Officers' Quarters, Paradise Point Area
  - Hadnot Point Area
  - Legend Sheet for Hadnot Point Area
  - Magazine Area
  - Geiger Area – MCAF, New River and Vicinity
  - Geiger Area Trailer Park

- Existing Conditions – 1946
  - Index Sheet
  - Midway Park Defense Housing Project
  - Officers' Quarters, Paradise Park Area
  - Division Training Area
  - Legend Sheet for Division Training Area
  - Magazine Area
- Existing Conditions – 1951
  - Index Sheet
  - Midway Park Defense Housing Project
  - Officers' Quarters Paradise Point Area
  - Division Training Area
  - Legend Sheet for Division Training Area
  - Magazine Area
  - Tent Camps No 1 & 2 and Vicinity
  - Open Storage Area
  - Enlargement of Trailer Park
- Exiting Conditions – 1979 (All areas)

Base Library

- Louis Berger Group, Inc. Under USCOE, Wilmington District Contract DACWS4-99-C-0004, *Semper Fidelis: A Brief History of Onslow County, North Carolina and MCB, Camp Lejeune, 2002, United States Marine Corps*, Lt. Col Lynn J. Kimball (USMC, Retired) Consulting Historian.
- 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*.
- Camp Lejeune Marines, On Land, On Sea, In the Air. 1943 (Pamphlet)
- United States Marine Corps 1966, *The 191st Year of Faithful Service. US Government Printing Office*. 1967, O-260-782. (Pamphlet)
- "Unofficial Directory and Guide, The Coast of North Carolina Salutes Camp Lejeune". Boone Publications, Inc., 1967.
- Carraway, Gertrude S. *Camp Lejeune Leathernecks, United States Marine Corps Training Center, Camp Lejeune, North Carolina*. October 1946.
- Review/Copied existing conditions maps for 1964 and 1977.

EOD Office

- United States Marine Corps, Marine Corps Base, Camp Lejeune. Standard Operating Procedures for Range Control, Range and Training Regulation, BO P3570.1B. 17 October 2006.

Environmental Office

- EnSafe. RCRA Facility Assessment Report for Marine Corps Base, Camp Lejeune, North Carolina, Final Submittal. July 25, 1996.
- J.A. Jones Environmental Services. Site Characterization Summary, UST PT-5, Camp Lejeune Marine Corps Base, North Carolina.
- CH2M HILL, Inc. and Baker Environmental, Inc. Final SWMU 43 Corrective Measures Study, RCRA Program, Marine Corps Base, Camp Lejeune, North Carolina. November 2006.
- Catlin Engineers and Scientists. Leaking Underground Storage Tank (LUST) Soil Assessment Report and Request for "No Further Action" Status for Building PT-37, Marine Corps Base, Camp Lejeune, North Carolina. December 28, 2000.
- Baker Environmental, Inc. Revised Final, Phase I SWMU Confirmatory Sampling Report, Text – Volume I of II, MCB Camp Lejeune, North Carolina. Contract Task Order 0371. November 2001.

Appendix B
Geophysical Prove-Out Plan

Geophysical Prove Out Work Plan

Preliminary Assessment/ Site Inspection at the Former B-3 Gas Chamber

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0168

December 2007

Prepared for

Department of the Navy
Naval Facilities Engineering Command

Under the

CLEAN III Program
Contract No. N62470-02-D-3052

Prepared by

CH2MHILL

Chantilly, Virginia

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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 MCB Camp Lejeune Munitions Response Master Project Plan (CH2M HILL, 2007) (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 the Former B-3 Gas Chamber site, MCB Camp Lejeune, North Carolina. Only additional detail, modifications or additions to the information provided in the Master GPO WP from the MRP Master Project Plan (CH2M HILL, 2007) are discussed herein.

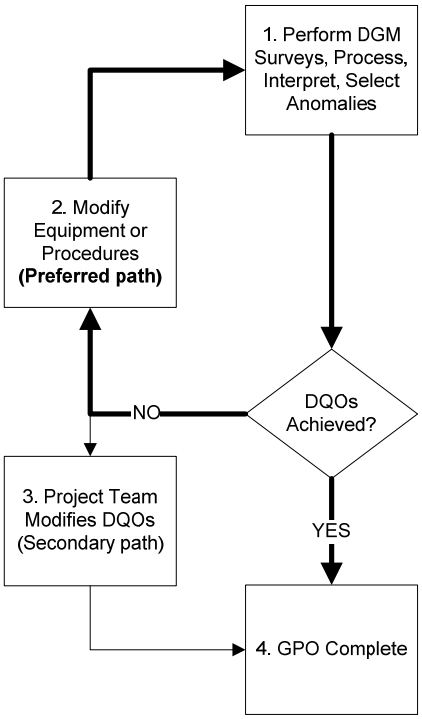
B.1 Project Data Quality Objectives

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 4.0) 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. 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	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 with the appropriate type of simulated items (MK2 hand grenade simulants) buried to represent the smallest MEC items of interest at the subject sites.

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 (CH2M HILL, 2007).

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

Because the area to be surveyed transects through both heavily vegetated woods as well as some open areas, 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 (CH2M HILL, 2007).

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 (a pipe of similar size to a hand grenade) 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, 2007. *Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July 2007.

Appendix C
Geophysical Investigation Plan

Geophysical Investigation Plan

Preliminary Assessment/ Site Inspection at the Former B-3 Gas Chamber Site

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0168

December 2007

Prepared for

Department of the Navy
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Chantilly, Virginia

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C-1 Former B-3 Gas Chamber Generalized Transect Layout

This Geophysical Investigation Plan (GIP) is a supplement to the 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, 2007) and provides additional site specific details related to the digital geophysical mapping (DGM) operations at the Former B-3 Gas Chamber site, MCB Camp Lejeune, North Carolina. Only additional detail, modifications or additions to the information provided in the Master GIP from the MRP Master Project Plan (CH2M HILL, 2007) are discussed herein.

C.1 Areas to be Investigated

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

C.1.1 Former B-3 Gas Chamber

The Former B-3 Gas Chamber project area is approximately 12.5 acres in size and is identified in the Range Identification and Preliminary Assessment as being composed of the areas 2.79a, 2.79b, and 2.79c. The former gas chamber areas are identified in **Figure 1-1**(refer to PA/SI Work plan).

The northwest portion of the Former B-3 Gas Chamber (ASR 2.79b) site and is located to the west of 7th Street. Area 2.79b covers an area of approximately 10 acres. The area is primarily wooded, and picnic areas are located within the site. It was reported that small caliber munitions were used at the site from a period of 1942 to 1944 (USACE, 2001). In addition, a chemical warfare training agent (tear gas) gas chamber was also reportedly located at this site from 1953 to 1958 (USACE, 2001).

Additional areas associated with the Former B-3 Gas Chamber, include ASRs 2.79a and 2.79c (USACE, 2001). Area 2.79a is located between 6th Street and 7th Street and covers an area of approximately 2.5 acres. This area is undeveloped and primarily wooded. Area 2.79c is located south of 7th Street and west of Church Street and covers an area of approximately 2 acres. This area is undeveloped and consists primarily of jurisdictional wetlands.

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

The types of MEC and munitions debris (MD) potentially present in the areas to be surveyed are summarized in **Table C-1**. The maximum depths anticipated are also shown in **Table C-1** with the prevailing assumption pits and trenches are not present.

C.3 Vegetation and Topography

The investigation area has a gently sloping terrain and is currently heavily vegetated with trees and thick undergrowth. Prior to commencement of DGM activities, transects with a nominal width of 4 feet (ft) will be clear cut to remove only vegetation and trees 3 inches or less in diameter to a height of no more than 6 inches above ground surface. (Transects will need to be wide enough to allow an EM61-MK2, which is approximately 1.2 meters wide with the wheels on the outside, to pass through.)

C.4 Geologic Conditions

Based on investigations at other areas of 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 Camp Lejeune indicate that the sands will likely have a relative density of loose to dense. Field observations in other areas of 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.

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 sites 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 10 feet of ground surface. However, the MEC items potentially present at the Former B-3 Gas Chamber site are likely to be within one to two feet of the ground surface (see **Table C-1**).

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 Former B-3 Gas Chamber site.

C.8 Manmade Features Potentially Affecting Geophysical Operations

Roadways at the site may be constructed of materials that have an effect on the geophysical results of surveys performed directly over the roadbeds. Automobile traffic along the road may potentially affect geophysical data collected adjacent to the road. All efforts will be made to halt data collection while automobiles pass (assuming traffic is not extremely heavy.)

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. Vegetation will be cleared to within six inches of ground surface along transects within the work areas prior to commencement of geophysical operations.

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 (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 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 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 (a pipe of similar size to a hand grenade) 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 the Former B-3 Gas Chamber site.

C.16 References

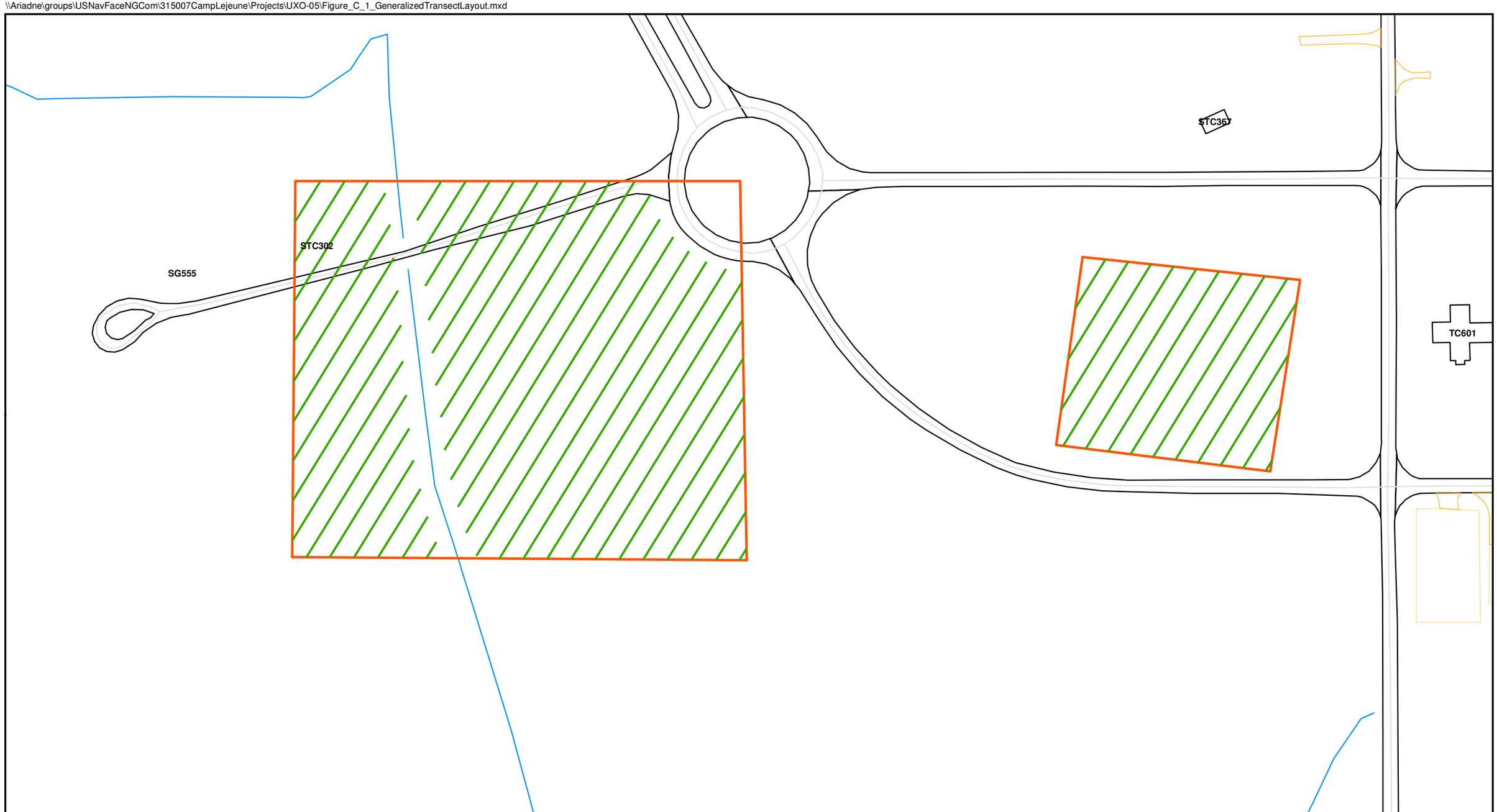
CH2M HILL. 2007. *Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July.

TABLE C-1
Anticipated Types of MEC and MD

Site	MEC Type(s)	MD	Composition	Quantities	Maximum Depths Anticipated1
Former B-3 Gas Chamber	Specific nomenclature unknown, but potential types include: Riot control hand grenade (tear gas)	Small arms	Ferrous metal components	Unknown	1.7 ft

[1] Maximum depth anticipated is either 1 ft or the depth for the deepest penetrating item from Table 7.3 (Ordnance Penetration/Detection) in U.S. Army Corps of Engineers Engineering Manual 1110-1-4009 (June 2000). The 1 ft depth is deeper than some of the items will penetrate but assumes that vegetation cover over time has buried the items below the ground surface.

\\Ariadne\groups\USNavFaceNGCom\315007CampLejeune\Projects\UXO-05\Figure_C_1_GeneralizedTransectLayout.mxd



Legend

- DGM Transect
- Surface Water Course Centerline
- Road Centerline
- Road Area
- UXO-05 Boundary

N
W E
S

0 150 300
Feet

Figure C-1
Former B-3 Gas Chamber Generalized Transect Layout
MCB Camp Lejeune
North Carolina

CH2MHILL

Appendix D
Health and Safety Plan

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 Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Safety Coordinator- Haz Waste (SC-HW) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 358852

CLIENT: US Navy

PROJECT/SITE NAME: CLEAN III CTO-0168 / MCB Camp Lejeune, MRP Preliminary Assessment/Site Investigation (PA/SI), Unexploded Ordnance (UXO) Site UXO-05-Former Miniature Anti-Tank Range and Former B-3 Gas Chamber.

SITE ADDRESS: Jacksonville, North Carolina

CH2M HILL PROJECT MANAGER: Bill Schmithorst/RDU

CH2M HILL OFFICE: Raleigh

DATE HEALTH AND SAFETY PLAN PREPARED: May 09, 2007

DATE(S) OF SITE WORK: October 2007 through March 2008

SITE ACCESS: Access to the site is restricted. The site is located within the Marine Corps Air Station (MCAS), New River section of the MCB Camp Lejeune military base. The site may be accessed through the MCAS New River Main Gate or the Contractor's entrance.

SITE SIZE: MCB, Camp Lejeune is approximately 236 square miles. Site UXO-05, subject of the Preliminary Assessment/Site Investigation, is located on approximately 74 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. All the aforementioned PA/SI work area is a relatively flat area with surface elevation at 25 feet above 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 UXO-05- Former Miniature Anti-Tank Range and Former B-3 Gas Chamber

Site UXO-05 and the Former B-3 Gas Chamber are approximately 74 acres in size and is identified in the Range Identification and Preliminary Assessment as being composed of the Former Miniature Anti-Tank Range (ASR # 2.7a, 2.7b, and 2.7c) and Former B-3 Gas Chamber (ASR# 2.79a, 2.79b, and 2.79c). The range areas are identified in Figure 1-1.

The southern portion of UXO-05 consists of overlapping range areas 2.7a and 2.7b, is located east of US Route 17, and is bisected by Robert L. Wilson Boulevard, Agerholm Street, and Bordelon Street. Areas 2.7a and 2.7b cover an area of approximately 59 acres. The majority of this area is heavily wooded and the remaining portion consists of developed areas with buildings, parking lots, and paved roads. It was reported that small caliber munitions were used at these areas of the site from a period of 1942 to 1944.

The northwest portion of UXO-05 consists of overlapping range areas 2.7c and 2.79b and is located to the west of 7th Street. Areas 2.7c and 2.79b cover an area of approximately 10 acres. The area is primarily wooded, and picnic areas are located within the site. It was reported that small caliber munitions were used at the site from a period of 1942 to 1944. In addition, this area was also reportedly used from 1953 to 1958 as Chemical Warfare Training Agent (tear gas) B-3 Gas Chamber.

Area, 2.79a is located between 6th Street and 7th Street and covers an area of approximately 2.5 acres. This area is undeveloped and primarily wooded. It was reported that this area was associated with the Former B-3 Gas Chamber.

Area 2.79c is located north south of 7th Street and west of Church Street and covers an area of approximately 2 acres. This area is undeveloped and consists primarily of jurisdictional wetlands. It was reported that this area was associated with the Former B-3 Gas Chamber.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

The aforementioned munitions response program (MRP) site has the potential to include hazardous or toxic waste (HTW) and/or munitions and explosives of concern (MEC). Due to historical activities within the project area, a PA/SI is being conducted to accomplish the following objectives:

1. Identify historical activities at Site UXO-05 and the Former B-3 Gas Chamber that may have resulted in environmental contamination with HTW or MEC by researching archival records and interviewing current and previous installation personnel;
2. Identify the presence and nature of any HTW contamination that may exist at Site UXO-05 and the Former B-3 Gas Chamber by conducting an investigation of groundwater and soil in and immediately surrounding the sites; and
3. Evaluate the nature, number, and density of anomalies that could potentially represent subsurface MEC, and provide geophysical data for future MEC intrusive investigation, by geophysically mapping the Former B-3 Gas Chamber site.

Site Map

This page is reserved for a Site Map.

(Refer to attached Figures 1-1 and 1-2)

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CH2M HILL HEALTH AND SAFETY PLAN I

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1 Tasks to be performed under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

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

1.1.1 Hazwoper-Regulated Tasks

- Direct-push technology (DPT) soil boring
- Groundwater sampling
- Surface and subsurface soil sampling
- Geophysical mapping
- MEC Avoidance

1.1.2 Non-HAZWOPER-Regulated Tasks

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

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS				
	DPT Soil Boring	Soil Sampling	Groundwater Sampling	Brush Clearing	Geophysical Mapping
Flying debris/objects	X			X	X
Noise > 85dBA	X			X	X
Electrical	X	X	X		X
Suspended loads	X				
Buried utilities, drums, tanks	X				X
Slip, trip, fall	X	X	X	X	X
Back injury	X	X	X	X	X
Confined space entry					
Trenches / excavations					
Visible lightning	X	X	X	X	X
Vehicle traffic	X	X	X		X
Elevated work areas/falls	X				
Fires					X
MEC	X	X	X	X	X
Entanglement	X				X
Drilling	X				
Heavy equipment	X				X
Working near water					
Working from boat					
IDW Drum Sampling					

2 Hazard Controls

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

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

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

2.1 General Hazards

2.1.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-209, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness requires enough illumination intensity to read a newspaper without difficulty.
- 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.

2.1.2 Hazard Communication

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

The SSC 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.

2.1.3 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 HSM or the Equipment Coordinator for additional information.

2.1.4 Lifting

(Reference CH2M HILL SOP HS-112, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
  - Plan storage and staging to minimize lifting or carrying distances.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.1.5 Fire Prevention

(Reference CH2M HILL SOP HS-208, *Fire Prevention*)

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

2.1.6 Electrical

(Reference CH2M HILL SOP HS-206 *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.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- 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.
- 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.

2.1.7 Heat Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold 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 consult the SSC/DSC to avoid progression of heat-related illness.

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.

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

2.1.8 Cold Stress

(Reference CH2M HILL SOP HS-211, *Heat and 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 consult the SSC/DSC to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

2.1.9 Procedures for Locating Buried Utilities

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).

2.2 Biological Hazards and Controls

2.2.1 Snakes

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

2.2.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in 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.

2.2.3 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.

2.2.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.2.5 Bloodborne Pathogens

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

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.2.6 Mosquito Bites

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

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

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

Symptoms of Exposure to the West Nile Virus

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

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

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

2.2.7 Fire Ant Bites

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

2.3 MEC

MEC Avoidance Procedures. MEC avoidance operations will be required during sampling operations at the Former B-3 Gas Chamber site. Avoidance operations will consist of a team composed of one or more UXO Technicians. A single-person team will consist of a UXO Technician III. Additional personnel will be UXO Technician III or less. **Contact with MEC is prohibited.** The UXO Team will not destroy any MEC encountered. All MEC contacts and suspected MEC anomalies will be reported to the site manager who will in turn notify MCB Camp Lejeune personnel in accordance with contractual requirements.

Access routes to sampling locations. Prior to sampling, the UXO Technicians will conduct a reconnaissance of the sampling area. The reconnaissance will include locating the designated sampling or drilling location(s) and

insuring that they are free of surface MEC. If surface MEC is detected the point will be relocated as directed. Once the designated point has been cleared, an access route for the sampling crew's vehicles and equipment will be cleared for surface MEC. The access route, at a minimum will be twice the width of the widest vehicle and the boundaries will be clearly marked to prevent personnel from straying into non cleared areas. If surface MEC is encountered, the UXO Team will mark and report the item and divert the approach path around the MEC.

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

Borehole Sampling. If surface samples are required they will be obtained prior to the start of boring. The borehole procedures will be completed using direct push technology (DPT) equipment. Prior to DPT sampling of Site UXO-05, an UXO Technician will advance a borehole using a hand auger, and check the borehole with a down hole magnetometer a minimum of every one foot, to the deepest sampling depth or a maximum of 5feet to ensure that smaller items of MEC, undetectable from the surface will be detected. The anticipated depth of potential MEC items is anywhere from near-surface to < 1 ft, based on penetration calculations for the .22 caliber small arms. Should any other MEC item other than the .22 caliber munitions be identified on-site, work will stop and the depth of down hole will be re-evaluated.

2.4 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
PNAs (Limits as Coal Tar Pitch)	GW: SB: SS:	02 mg/m^3	80 Ca	Dermatitis and bronchitis	9.24
2,4,6-trinitrotoluene (TNT) and	GW: SB: SS:	1.5 mg/m^3	500 mg/m^3	Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irregularities	UK
1,3-dinitrobenzene (DNB)	GW: SB: SS:	1 mg/m^3	50 mg/m^3	Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage	UK

Footnotes:

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

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

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

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

Potential Routes of Exposure		
Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.		

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

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

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

Employee Name	Office	Responsibility	SC-HW/FA-CPR
Bill Schmithorst	RDU	Project Manager	Level D SC-HW: FA-CPR
Paul Weber	RDU	Task Manager	Level D SC-HW: FA-CPR
Dan Hockett	CLT	Task Manager	FA-CPR
Erin Must	RDU	Field Team Member	Level D SC-HW: FA-CPR
David Seed	RDU	Field Team Leader	Level D SC-HW: FA-CPR
Rachel Zajac	RDU	Field Team Member	Level D SC-HW: FA-CPR
Tom Konopka	RDU	Field Team Member	Level D SC-HW: FA-CPR
Jeff Albano	CLT	Field Team Member	Level D SC-HW: FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact
Gary Tysor
NAVFAC Atlantic
Code: OPCEV
6506 Hampton Blvd
Norfolk, Virginia 23508-1278
757-322-4851
757-322-4805 fax
gary.tysor@navy.mil

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

3.2.2 CH2M HILL

Project Manager: Bill Schmithorst/RDU
ESBG Munitions Response Safety Officer: Dan Young/NVR
Health and Safety Manager: Michael Goldman/ATL
Munitions Response Senior Advisor: Tom Roth/ATL

Field Team Leader: James Frank/RDU
Safety Coordinator- Hazardous Waste (SC-HW): Various
UXO Site Safety and Health Officer: TBD

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

UXO TECHNICIAN III

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

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

UXO TECHNICIANS

All UXO Technicians are required to comply with the provisions of this Avoidance Plan, the SSHP, the WP and all applicable Federal, State and local regulations. They will report to the UXO Technician III.

3.2.3 CH2M HILL Subcontractors

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

Subcontractor: To be determined
Subcontractor Contact Name:
Telephone:

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

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SC-HW is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-

assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SC-HW to review subcontractor performance.

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

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

3.2.4 Contractors

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

Contractor: To be determined
Contractor Contact Name:
Telephone:

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (e.g., advising on H&S issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6 are to be used by the SC-HW to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative
  - Request that the contractor determine and implement corrective actions
  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

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

PPE Specifications [a]

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

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• 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 decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SC-HW.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SC-HW qualified at that level is present.

5 Air Monitoring/Sampling

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

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
FID: OVA model 128 or equivalent	Soil sampling, drilling and other intrusive work.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
PID: OVM with 10.6eV lamp or equivalent	Soil sampling, drilling and other intrusive work.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
CGI: MSA model 260 or 261 or equivalent	Soil sampling, drilling and other intrusive work.	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily
O_2Meter: MSA model 260 or 261 or equivalent	Soil sampling, drilling and other intrusive work.	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	Continuous during advancement of boring or trench	Daily

[a] Action levels apply to sustained breathing-zone measurements above background.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SC-HW; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

[c] If the measured percent of 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
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing
FID: OVA	100 ppm methane	3.0 ± 1.5	100 ppm	1.5 lpm reg T-tubing
FID: TVA 1000	100 ppm methane	NA	100 ppm	2.5 lpm reg T-tubing
Dust Monitor: Miniram-PDM3	Dust-free air	Not applicable	0.00 mg/m^3 in "Measure" mode	Dust-free area OR Z-bag with HEPA filter
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL ± 5% LEL	1.5 lpm reg direct tubing

5.3 Air Sampling

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

Method Description

None anticipated.

Personnel and Areas

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

HSM: Michael Goldman/ATL
MRSO: Dan Young/NVR

6 Decontamination

(Reference CH2M HILL SOP HS-506, *Decontamination*)

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

6.1 Decontamination Specifications

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

6.2 Diagram of Personnel-Decontamination Line

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

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

7 Spill-Containment Procedures

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

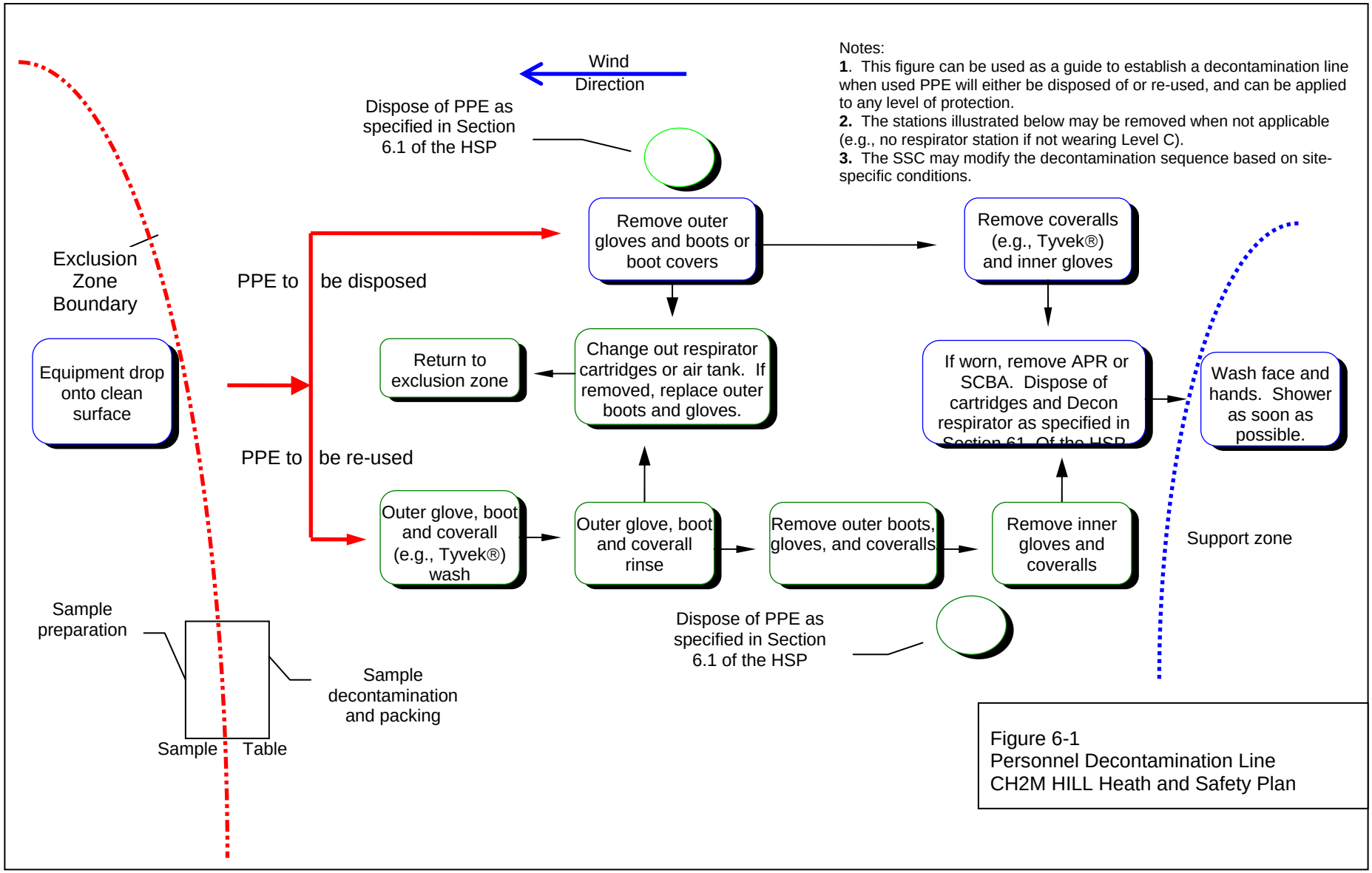


Figure 6-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-510, *Site Control)*

- The SC-HW will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SC-HW records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-116, *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 SSC in appropriate level of protection.
- The SC-HW is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 Munitions Response Site Control

The UXO Technician III coordinates access control and security at the B-3 Gas Chamber site. Strict MEC avoidance procedures will be practiced during field investigation activities. An instrument-assisted visual site survey will be completed prior to commencing field sampling activities. Due to the hazardous nature of MEC work, only authorized personnel will be allowed within 200 ft of work operations. Authorized personnel are those that have completed the required training, meet medical requirements and are essential to the ongoing operation. This 200 ft buffer is an area large enough to prevent personnel injuries from fragmentation and overpressure resulting from either an unintentional or intentional detonation of MEC.

During duty hours, personnel will provide security at the site. All work will stop if any unauthorized personnel approach within 200 feet of work operations. This will ensure the field team's safety and the safety of those approaching the work site. Equipment will be returned to a designated area and secured at the end of each work day. Future site control measures to ensure safety are as follows;

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

8.3 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-220, *Site-Specific Written Safety Plans)*

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

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

9 Emergency Response Plan

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

9.1 Pre-Emergency Planning

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

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

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

9.2 Emergency Equipment and Supplies

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

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

9.3 Incident Response

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

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

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

9.4 Emergency Medical Treatment

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

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

9.5 Evacuation

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

9.6 Evacuation Signals

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

9.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

10 Approval

This site-specific Health and Safety Plan 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.

10.1 Original Plan

Written By: David Seed/RDU **Date:** May 09, 2007

Approved By: Michael Goldman/ATL **Date:** May 14, 2007

Approved By: Dan Young/NVR **Date:**

10.2 Revisions

Revisions Made By: Michael Goldman **Date:** June 27, 2007

Revisions to Plan: The section covering underground utilities was upgraded.

Revisions Approved By: Michael Goldman **Date:** June 27, 2007

Revisions Made By: Monica Tiburzi **Date:** August 8, 2007

Revisions to Plan: The original HSP addressing all CTO-0168 MRP sites was divided into individual, site-specific HSPs.

Revisions Approved By: **Date:**

Revisions Made By: David Seed **Date:** October 1, 2007

Revisions to Plan: Review comments from Timothy Garretson/VBO were incorporated.

Revisions Approved By: **Date:**

Revisions Made By: David Seed **Date:** May 15, 2008

Revisions to Plan: Section 3.1 table listing field team members was updated. MSDS were added for chemicals listed on the hazardous chemical products inventory table.

Revisions Approved By: **Date:**

11 Attachments

Attachment 1:	Employee Signoff Form – Field Safety Instructions
Attachment 2:	Project-Specific Chemical Product Hazard Communication Form
Attachment 3:	Chemical-Specific Training Form
Attachment 4:	Emergency Contacts
Attachment 5:	Project H&S Forms/Permits
Attachment 6:	Project Activity Self-Assessment Checklists
Attachment 7:	Applicable Material Safety Data Sheets

CH2MHILL

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: CLEAN III CTO-168 / MCB Camp Lejeune, Site UXO-05 **Project Number:** 358852

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

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

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

Project Name: CLEAN III CTO-0168 / MCB Camp Lejeune, MRP Preliminary Assessment/Site Investigation (PA/SI), Unexploded Ordnance (UXO) Sites: UXO-05-Former Miniature Anti-Tank Range and Former B-3 Gas Chamber

Project Number: 358852

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

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Methane	1 liter, compressed	Support Zone			
Isobutylene	1 liter, compressed	Support Zone			
Pentane	1 liter, compressed	Support Zone			
Hydrochloric acid	< 500 ml	Support Zone / sample bottles			
Nitric acid	< 500 ml	Support Zone / sample bottles			
Sulfuric Acid	< 500 ml	Support Zone / sample bottles			
Sodium hydroxide	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
pH buffers	< 500 ml	Support Zone			
MSA Sanitizer	< 1 liter	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

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

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 358852
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.

EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification MUST be made within 24 hours of the injury.

24-hour CH2M HILL Emergency

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
800/756-1130
(After hours calls will be returned within 20 minutes)

Fire/Spill Emergency – 911 or
Base Fire Response #: (910) 451-9111

Local Occupational Physician
Occupational Medicine Specialists
4815 Oleander Dr.
Wilmington, NC 28403
910 452-1111

Security & Police – 911 or
Base Security #: (910) 451-2555

Corporate Director Health and Safety
Name: Mollie Netherland/SEA
Phone: 206/453-5005
24-hour emergency beeper: 888-444-1226

On-Scene Coordinator
Name: Fire Chief
Phone: (910) 451-5815

Environmental Management Division (EMD)
Names: Bob Lowder
Phone: (910) 451-9607

Utilities Emergency
Water:
Gas: Contact Base EMD
Electric:

Health and Safety Manager (HSM)
Name: Michael Goldman/ATL
Phone: (770) 604-9095

Designated Safety Coordinator (DSC)
Name:
Phone:

Regional Human Resources Department
Name: Carol Miscoe/SAN
Phone: 210/377-3085 x291

Project Manager see Site-Specific HSP
Name: Bill Schmithorst / RDU
Phone: 919-875-4311 x41

Corporate Human Resources Department
Name: Pete Hannon/DEN
Phone: 720/286-3077 x60337
Cell: 303/886-1229

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

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

Worker's Compensation and Auto Claims
Zurich Insurance Company
Phone: 800/382-2150

Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: TBD

Evacuation Assembly Area(s): TBD by the SC-HW; will probably be the local hotel where the field team is staying

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

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

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

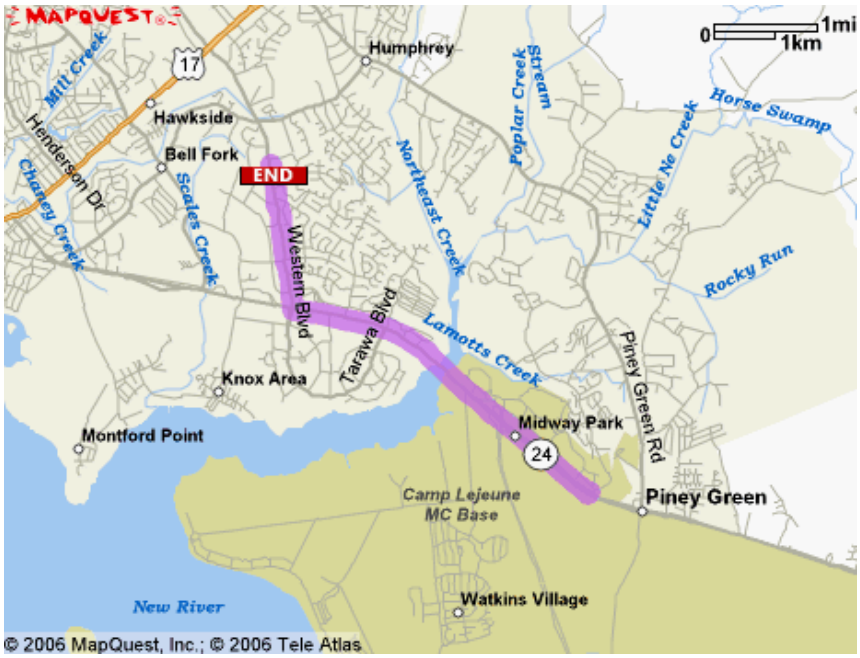
Local ambulance service:
Base Ambulance: (910) 451-3004, (910) 451-3005
Public Ambulance: (910) 451-9111

From MCB Camp Lejeune

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

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

Directions to Onslow County Memorial Hospital:
1. 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.



CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

To be completed as needed for task specific operations.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists

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)

	Yes	No	N/A	N/O
WASTE MANAGEMENT (4.2.3)				
13. Drill cuttings and purge water managed and disposed properly	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	☐	☐	☐	☐
15. Appropriate decontamination procedures being followed, per project's written safety plan	☐	☐	☐	☐
DRILLING AT MUNITIONS RESPONSE 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

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Applicable 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.

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

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.

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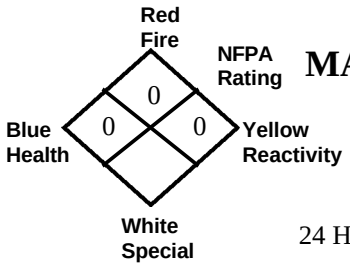
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

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.

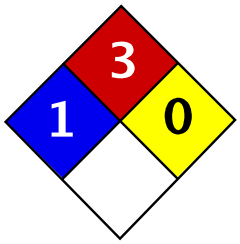
VII. PRECAUTIONS FOR SAFE HANDLING AND USE

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.

---

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

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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)
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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.

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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:
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).

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
```

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

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  ----------------------------------------------  ----  ---  -----  ---------
  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)
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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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