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FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT MMRP SITE UXO-14  
FORMER INDOOR PISTOL RANGE AND GAS CHAMBER RIFLE RANGE AREA MCB CAMP  
LEJEUNE NC  
04/01/2011  
CH2M HILL

Final

**Preliminary Assessment/Site Inspection Report  
MMRP Site UXO-14 Former Indoor Pistol Range  
(ASR #2.199) and Gas Chamber (ASR #2.200)  
(Rifle Range Area)**

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

**Contract Task Order 0014**

**April 2011  
Prepared for**

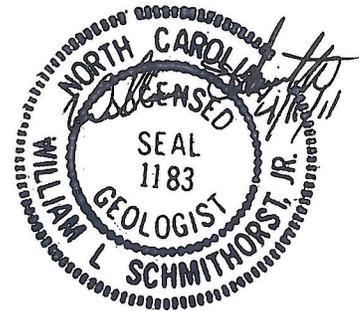
**Department of the Navy  
Naval Facilities Engineering Command  
Mid-Atlantic**

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

**Prepared by**



**CH2MHILL**



**Raleigh, North Carolina**

# QC Review Page

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Final

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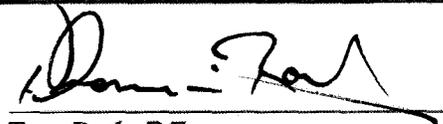
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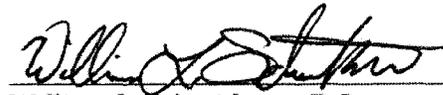


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# Acronyms and Abbreviations

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ASR	Archive Search Report
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action – Navy
COPC	constituent of potential concern
CSM	conceptual site model
CTO	contract task order
°F	degrees Fahrenheit
DDESB	Department of Defense Explosives Safety Board
DGM	digital geophysical mapping
DO	dissolved oxygen
DPT	direct push technology
DQO	data quality objective
EM	electromagnetic
EM61	EM61-MK2
ERS	ecological risk screening
ESS	Explosives Safety Submission
ESV	ecological screening value
FID	flame ionization detector
ft	feet, foot
ft/ft	feet per foot
GIS	geographic information system
GPO	geophysical prove-out
GPS	Global Positioning System
HHRS	human health risk screening
HI	hazard index
HQ	hazard quotient
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
m	meter
MC	munitions constituents
MCB	Marine Corps Base
MCL	maximum contaminant level
MEC	munitions and explosives of concern
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram

MMRP	Military Munitions Response Program
MR	munitions response
MRP	Munitions Response Program
MRSP	Munitions Response Site Prioritization Protocol
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolt
NAD83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NAVFAC	Naval Facilities Engineering Command
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards
NC SSL	North Carolina Soil Screening Levels
ORP	oxidation-reduction potential
PA/SI	Preliminary Assessment/Site Inspection
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RSL	Regional Screening Level
SQUIRTs	Screening Quick Reference Tables
SVOC	semi volatile organic compound
TCL	Target Compound List
TGCs	tear gas constituents
TOC	top of casing
TP	technical paper
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
VOC	volatile organic compound

# Introduction

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This report documents the findings of a Preliminary Assessment/Site Inspection (PA/SI) conducted at a Military Munitions Response Program (MMRP) site located at Marine Corps Base Camp Lejeune (MCB CamLej) in Jacksonville, North Carolina (**Figure 1-1**). The site consists of two areas designated as Archive Search Report (ASR) #2.199 (former Indoor Pistol Range) and #2.200 (former Gas Chamber [Rifle Range Area]), referred to collectively as Site Unexploded ordnance (UXO)-14.

This PA/SI was conducted by CH2M HILL under the Naval Facilities Engineering Command (NAVFAC) Comprehensive Long-term Environmental Action—Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order (CTO) 0014. **Appendix A** presents the Munitions Response Site Prioritization Protocol (MRSPP) Site Summary for Site UXO-14.

## 1.1 Objectives and Approach

MCB CamLej is in the process of investigating closed ranges at the Base following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. Reported historical range activities at Site UXO-14 have prompted this PA/SI, the first investigative phase of the CERCLA investigation process.

The primary objective of this environmental investigation was to evaluate the potential presence and nature of impacts to environmental media resulting from historical munitions use at the subject site, and to evaluate whether additional investigation and/or remediation activities are necessary. Accordingly, this investigation focused on impacts to soil and groundwater from munitions constituents (MC). A secondary objective was to assess the site for the presence of anomalies that represent potential subsurface munitions and explosives of concern (MEC) at the former Gas Chamber.

This PA/SI was conducted in accordance with the *Site-specific Work Plan Addendum for Preliminary Assessment/Site Inspection at Site UXO-14, Former Indoor Pistol Range and Gas Chamber (Rifle Range Area), Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (PA/SI Work Plan Addendum) (CH2M HILL, 2009) and Munitions Response Program Master Project Plans (CH2M HILL, 2008a).

The general approach adopted during this PA/SI was as follows:

- Conduct research to identify historical activities that may have resulted in contamination with MEC at the former Gas Chamber, or MC at both locations, including review of archival records and interviews with current and former installation personnel.
- Perform a geophysical survey of 10 percent of the former gas chamber portion of Site UXO-14 to evaluate the number and density of geophysical anomalies representing potential subsurface MEC.

- Evaluate the presence and nature of MC contamination that may exist by conducting an investigation of soil and groundwater.
- Conduct ecological and human health risk screening using analytical data collected at the site.

## 1.2 Report Organization

This PA/SI report is organized as follows:

- Section 1, Introduction
- Section 2, Site Background
- Section 3, Field Investigation Activities
- Section 4, Investigation Results
- Section 5, Human Health Risk Screening
- Section 6, Ecological Risk Screening
- Section 7, Site UXO-14 Conceptual Site Model
- Section 8, Conclusions and Recommendations
- Section 9, References

# Site Background

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This section presents a summary of regional and site-specific information, including location, site setting, physical characteristics, and history.

## 2.1 MCB CamLej Location and Description

MCB CamLej encompasses approximately 236 square miles in Onslow County, North Carolina and is bisected by the New River, which flows in a southeasterly direction toward the Atlantic Ocean (**Figure 1-1**). Construction of MCB CamLej began in 1941 with the objective of developing the “World’s Most Complete Amphibious Training Base.” The mission of MCB CamLej is to maintain combat-ready units for expeditionary deployment. MCB CamLej provides housing, training facilities, logistical support, and administrative supplies for Fleet Marine Force units and other assigned units. The Base is home to an active duty, dependent, retiree, and civilian population of approximately 150,000, of whom approximately 47,000 are military personnel. Land use surrounding MCB CamLej is varied, with mainly commercial properties along the northern boundary, a mix of agricultural and residential land along the eastern and western boundaries, and the New River estuary and Atlantic Ocean comprising the southern boundary.

## 2.2 Site Setting

Site UXO-14 includes two separate areas located west of Powder Lane in the Stones Bay area of MCB CamLej (**Figures 2-1 and 2-2**). The eastern area of Site UXO-14, the former Indoor Pistol Range area, includes approximately 0.09 acres of level terrain consisting of maintained grass and a loose sandy area representing the former building footprint. Prior to the PA/SI field efforts, construction debris unrelated to the site was stockpiled within the former Indoor Pistol Range area. All debris was removed by the Base prior to sampling activities.

The western area of Site UXO-14, the former Gas Chamber area, is approximately 0.04 acres in size and is heavily wooded with thick underbrush. The land surface within the former Gas Chamber area slopes toward the south and west, toward an unnamed tributary of the New River. Scrap metal was observed and removed from the surface within the former Gas Chamber area. No surface water bodies were observed within Site UXO-14.

## 2.3 Site History

In August 2008, CH2M HILL conducted a detailed review of existing information relating to historical activities at Site UXO-14 that could have resulted in the releases of hazardous substances within the area of investigation. This review also included interviews with current and former site personnel. Information obtained from this effort is documented in the Archival Records Search Report presented in **Appendix B**, and summarized below.

The Indoor Pistol Range first appears on existing conditions maps in 1950 as Building RR-53 (Figure 2-3 of **Appendix B**). According to the *Final Range Identification and Preliminary Range Assessment*, the pistol range was present on base maps until 1996 (U.S. Army Corps of Engineers [USACE], 2001). The Indoor Pistol Range appears in the 1962 and 1989 historical aerial photographs (Figures 2-4 and 2-5 of **Appendix B**). According to Base Range Safety Officer, Duane Richardson, the Indoor Pistol Range was only used for small arms training.

The Gas Chamber first appeared on the 1950 existing conditions maps as Building RR-63 (Figure 2-3 of **Appendix B**); it was labeled as a Gas Chamber until 1954. After 1954, Building RR-63 was used for storage and was present on maps until 1965. However, on the 1962 historical aerial photograph, the area is completely overgrown and Building RR-63 is not visible (Figure 2-4 of **Appendix B**). The 1989 historical aerial photograph, Figure 2-5 of **Appendix B**, also shows the area as being heavily wooded. According to the *Final Range Identification and Preliminary Range Assessment*, it is assumed that tear gas was used at this facility (USACE, 2001).

## 2.4 Regional Climate

The climate in the Onslow County area is characterized by typically short, mild winters and long, hot, humid summers. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 degrees to 53 degrees Fahrenheit (°F) in the winter months, and from 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 begins on June 1 and continues through November 30. Storms of non-tropical origin, such as frontal passages, local thunderstorms, and tornadoes, are more frequent and can occur year-round.

## 2.5 Regional Geology and Hydrogeology

Regional geology at MCB CamLej is discussed in the *MCB CamLej MRP Master Project Plans, Marine Corps Base Camp Lejeune, North Carolina* (CH2M HILL, 2008a), referred to herein as the MRP Master Project Plans.

Surface water drainage in the project vicinity flows to the west into an unnamed tributary of the New River (**Figure 2-1**). The New River flows into the Atlantic Ocean via New River inlet (MCB Camp Lejeune, 2002).

## 2.6 Site Geology and Hydrogeology

Soil cores recovered from Site UXO-14 indicate that shallow deposits consist of discontinuous layers of fine-grained sediments consistent with the Undifferentiated formation (Cardinell et al., 1993). Particle sizes noted from soil boring logs indicate sediments ranging from clay to fine-grained sand. The predominant lithology directly underlying Site UXO-14 is poorly graded, fine-grained sand interbedded with a lesser amount of clayey sands/sandy clays. Soil boring depths at Site UXO-14 range from 10 to 15 ft below ground surface (bgs).

Site-specific hydrogeologic information was derived from the installation of four shallow temporary monitoring wells as detailed in **Section 3.3.3**. The temporary well depths for Site UXO-14 ranged from 15 to 18 ft bgs. The temporary wells were screened above the Castle Hayne confining unit in the surficial aquifer. **Figure 2-3** depicts the potentiometric surface of the water table on December 8, 2009 and indicates that groundwater flow in the surficial aquifer mimics topography and generally flows toward the southwest. The horizontal hydraulic gradient, calculated from temporary monitoring wells TW-03 and TW-04 (**Table 2-1**), is approximately 0.04 feet per foot (ft/ft).

# Field Investigation Activities

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The initial site reconnaissance, surveying, vegetation clearing, and digital geophysical mapping (DGM) field activities were performed in May 2009. Environmental sampling activities were conducted in November and December 2009.

Field activities were conducted in accordance with the PA/SI Work Plan Addendum (CH2M HILL, 2009). The technical approach included in the PA/SI Work Plan Addendum was developed by the MCB CamLej Tier I Partnering Team, which includes representatives from the United States Navy, MCB CamLej, United States Environmental Protection Agency (USEPA) Region 4, and North Carolina Department of Environment and Natural Resources (NCDENR).

## 3.1 Site Preparation and Support

### 3.1.1 MEC Avoidance

Due to the potential presence of MEC, avoidance measures were implemented in accordance with the Explosives Safety Submission (ESS) Determination (MARCORSYSCOM, 2009). UXO technicians qualified in accordance with Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18 (DDESB, 2004) provided MEC escort and avoidance services to the surveying, vegetation clearing, utility locate, geophysical services, and drilling subcontractors. MEC items were not encountered during this project.

### 3.1.2 Site Survey

Land surveying was conducted in accordance with the Munitions Response Program Master Project Plans (CH2M HILL, 2008a). SEPI Engineering, a North Carolina-licensed surveyor from Raleigh, North Carolina, conducted the site surveying activities in two phases, as described below.

Phase 1 consisted of delineating the site boundary and DGM area layout. The surveyor prominently marked the perimeter of the project area using flagging tape and wooden stakes and provided all survey results to CH2M HILL. The site boundary was provided by MCB CamLej Geographical Information Systems (GIS) using the site boundary shown in the 1951 Range Overlay Map (Figure 2-2 in **Appendix A**). The surveyor also facilitated preparation of the site for DGM by establishing transects for DGM surveys and provided the survey results for incorporation into the DGM subcontractor's GIS.

Phase 2 consisted of surveying the temporary monitoring well locations and subsurface soil sample locations after the completion of environmental sampling activities.

## 3.2 Digital Geophysical Mapping

DGM was performed within the former Gas Chamber area of Site UXO-14 to evaluate the frequency and distribution of geophysical anomalies that potentially represent subsurface MEC. DGM was not performed at the former indoor pistol range due to the lack of historical UXO activities at this portion of the site (Richardson, 2008). The DGM was performed by subcontractor NAEVA Geophysics from Charlottesville, VA, with quality control (QC) being performed by both NAEVA and CH2M HILL's Munitions Response (MR) QC Geophysicist. A summary of the work performed is provided below; the Geophysical Investigation Report is provided in **Appendix C**.

### 3.2.1 Digital Geophysical Mapping Survey

Prior to the DGM survey at Site UXO-14, Sepi Engineering installed survey stakes along two DGM transects. The survey information for these stakes was incorporated into the DGM data collected during the DGM survey.

The DGM data were collected using a Geonics EM61-MK2 (EM61) Electromagnetic (EM) System in wheel mode configuration. The locations of the DGM transects were based on specific site conditions (e.g., avoidance of surface debris). Two DGM transects spaced 5 meters apart were completed and covered approximately 20 percent of the total former Gas Chamber area (0.008 acre). Due to the small size of the former Gas Chamber area more than the desired 10 percent of the total area was subject to DGM in order to obtain better spatial distribution of the DGM transects. The areas of the site covered by the survey are shown in **Figure 3-1**.

### 3.2.2 Geophysical Prove-out

Prior to the start of DGM activities, a Geophysical Prove-Out (GPO) was conducted to assess whether the selected geophysical equipment met project data quality objectives (DQOs). This GPO was conducted at the existing GPO plot set up and seeded by CH2MHILL at the former Knox Trailer Park (Site UXO-04). A threshold of 3 millivolts (mV) in Channel 2 was chosen for the selection of geophysical anomalies because this value represents the threshold where a metallic item can be positively distinguished from signal noise. The GPO was conducted in accordance with Appendix B of the PA/SI Work Plan Addendum (CH2M HILL, 2009). The Geophysical Investigation Report presented in **Appendix C** details the results of the GPO.

### 3.2.3 Data Quality Objectives

All DQOs outlined in the PA/SI Work Plan Addendum (CH2M HILL, 2009) were met during the DGM survey.

### 3.2.4 Quality Control

An extensive QC program was applied to the DGM operations at the site. **Figure 3-2** shows an overall chart of the QC steps.

The geophysical system was field-tested as specified in the PA/SI Work Plan Addendum (CH2M HILL, 2009). A summary of the tests performed is presented in **Table 3-1**. Both

NAEVA and CH2M HILL performed QC of geophysical data and data deliverables at each step of the processing path.

All tests outlined in the PA/SI Work Plan Addendum (CH2M HILL, 2009) were performed on the DGM instruments at the appropriate intervals (e.g., daily, weekly, at start of project). Results were checked by NAEVA's QC Geophysicist prior to delivery to CH2M HILL and subsequently checked by the CH2M HILL QC Geophysicist. All QC test were within the acceptance criteria outlined in the PA/SI Work Plan Addendum (CH2M HILL, 2009)

### 3.3 Environmental Investigation Activities

During the development of the PA/SI Work Plan Addendum (CH2M HILL, 2009), historical records were reviewed to identify potential areas of concern at Site UXO-14. However, historical records did not provide evidence to bias the sampling; therefore, sample locations were distributed evenly across accessible areas of the site. **Figures 3-3** and **3-4** illustrate the environmental sampling locations utilized during the PA/SI. Environmental samples were collected in accordance with the PA/SI Work Plan Addendum (CH2M HILL, 2009). Within the former Gas Chamber area of Site UXO 14, MEC avoidance procedures were observed and a UXO technician was present at all times during sampling.

The constituents of concern at the former gas chamber area were 2-chlorobenzalmalonitrile (CS) and 2-chloroacetophenone (CN), compounds normally found in tear gas. Because these 2 constituents (referred to herein as tear gas constituents [TGC]) are semi-volatile organic compounds (SVOCs), the environmental media at this area were analyzed under the USEPA Method 8270C, which includes all SVOCs. Additionally, the constituents of concern at the former indoor pistol range were metals because of the usage of small arms at the range. The environmental media in this area were analyzed under the USEPA Method 6010B.

#### 3.3.1 Surface Soil Sampling

Surface soil sampling was conducted at Site UXO-14 on November 6, 2009, and consisted of the collection of 20 surface soil samples (designated MR14-SS01 through MR14-SS20) using the TR-02-1 approach as described in the PA/SI Work Plan Addendum (CH2M HILL, 2009). Soil samples were collected by compositing a minimum of 30 sample aliquots from random locations within each 1-m by 1-m sampling location at depths from 0 to 2 inches bgs, in accordance with the USACE Technical Report ERDC/CRREL TR-02-1, *Guide for Characterization of Sites Contaminated with Energetic Materials* (Thiboutot, Ampleman, and Hewitt, 2002). Surface soil sampling locations are shown on **Figure 3-3**.

Samples were analyzed for the following parameters:

- Target Analyte List (TAL) metals (SW-846 USEPA Method 6010B) within the former Indoor Pistol Range area of Site UXO-14 only
- SVOCs (SW 846 USEPA Method 8270C) within the former Gas Chamber area of Site UXO-14 only

The analytical data were validated by Environmental Data Services, Inc. of Williamsburg, Virginia under subcontract to CH2M HILL. Data validation reports are provided in **Appendix D**.

### 3.3.2 Subsurface Soil Sampling

On December 4, 2009, four soil borings were advanced to depths of up to 15 ft bgs at the locations shown on **Figure 3-4**, using a direct push technology (DPT) drill rig operated by Probe Technologies Inc. of Concord, North Carolina. The DPT sampling method utilized an open core barrel sampling device along with disposable acetate liners. Down-hole sampling equipment was decontaminated between borings and new liners were used to retrieve each successive soil core. The continuous soil cores retrieved from these borings were examined and logged by a CH2M HILL geologist. In addition, the soil cores were field-screened for the presence of volatile organic compounds (VOCs) using a flame-ionization detector (FID). Soil boring logs are provided in **Appendix E**.

Following completion of each soil boring, a discrete soil sample was collected from an unsaturated portion of the soil core located immediately above the estimated water table. Soil samples ranged in depth from 2 to 5 ft bgs. Four subsurface soil samples, designated MR14-IS01 through MR14-IS04, were collected from the locations shown on **Figure 3-4**.

Subsurface soil samples were submitted to Empirical Laboratories and analyzed for the following analytes:

- TAL metals (SW-846 USEPA Method 6010B) within the former Indoor Pistol Range area of Site UXO-14 only
- SVOCs (SW 846 USEPA Method 8270C) within the former Gas Chamber area of Site UXO-14 only

The results of the analytical data were validated by Environmental Data Services, Inc. under subcontract to CH2M HILL. Data validation reports are provided in **Appendix D**.

### 3.3.3 Temporary Well Installation

On December 4, 2009, four temporary groundwater monitoring wells were installed at the site (designated MR14-TW01 through MR14-TW04) to depths ranging from 15 to 18 ft bgs. **Figure 3-4** shows the temporary well locations, and **Table 2-1** summarizes the well construction details. Due to the small size of the area inside the site boundary at the former indoor pistol range, temporary well MR-14-TW02 was located approximately 20 ft south and down-gradient of the site boundary in order to effectively assess the shallow groundwater hydraulic gradient.

Each temporary well was constructed using 1-inch inside diameter Schedule 40 polyvinyl screen (PVC) screen and riser. The well screens consisted of a 10-ft length of 0.010-inch machine slotted Schedule 40 PVC and were placed to bracket the water table. Each well was also equipped with a pre-packed sand filter pre-attached to the screened interval and containing 120 mesh sand. If heaving sands did not collapse into the annulus, additional silica filter sand (#2) was placed in the remaining annular space between the pre-packed sand filter and borehole wall, extending roughly 2 ft above the top of the screen. A layer of bentonite granules was placed above the top of the sand pack extending to the ground surface. A locking watertight cap was placed on the PVC pipe and the wells were clearly labeled. Well completion diagrams are presented in **Appendix E**.

The temporary wells were developed using disposable bailers and a peristaltic pump. Development continued until the water was visually clear and water quality parameters had stabilized. Following well development, the wells were allowed to equilibrate for at least 24 hours before sampling.

### 3.3.4 Groundwater Sampling

Prior to well purging and sampling, water level measurements were recorded in each temporary well (**Table 2-1**). Water level measurements were converted to water level elevations using the top of casing (TOC) elevation survey data, and were used to construct a potentiometric surface map of the water table (**Figure 2-3**).

All groundwater samples were collected using a peristaltic pump with disposable polyethylene tubing and low-flow purging and sampling techniques in accordance with the PA/SI Work Plan Addendum (CH2M HILL, 2009). Water quality parameters (specific conductance, pH, turbidity, temperature, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured and recorded during the purging phase using a YSI 556® multi-probe water quality meter and Hanna 98703® portable turbidity meter. Field parameters are summarized in **Table 3-2**. Groundwater sampling data sheets are provided in **Appendix F**. Groundwater samples were collected only after all field parameters had become stable over three successive readings and at least one well volume had been purged. If field parameters did not stabilize, samples were collected after at least three well volumes had been purged. Parameters were considered stabilized over three successive readings when successive measurements agreed as follows:

- pH within 0.1 standard unit
- Temperature is constant
- Conductivity within 10 percent
- Turbidity less than 10 NTU, or as low as practicable given sampling conditions

Prior to sample collection, the water quality meter flow-through cell was disconnected from the peristaltic pump so that the pump discharge flowed directly into the laboratory-supplied sample bottles. New pump tubing was used for the purging and sampling of each well. Groundwater samples collected for TGC analysis were collected using a vacuum container in accordance with the 2007 USEPA Region IV Modified Groundwater Sampling SOP (USEPA, 2007).

Once sample collection was complete, the sample bottles were placed in iced coolers and prepared for shipment under chain-of-custody control to Empirical Laboratories. Samples were analyzed for the following analytes:

- Total and dissolved metals (SW-846 USEPA Method 6010B) within the former Indoor Pistol Range area of Site UXO-14 only
- SVOCs (SW 846 USEPA Method 8270C) within the former Gas Chamber area of Site UXO-14 only

The results of the analytical data were validated by Environmental Data Services, Inc. under subcontract to CH2M HILL. Data validation reports are provided in **Appendix D**. Sampling results are presented in **Section 4**.

On December 10, 2009, following sampling and surveying, all temporary wells were abandoned by the drilling subcontractor in accordance with North Carolina Well Construction Standards.

### 3.3.5 Quality Assurance/Quality Control Sampling

Appropriate quality assurance (QA)/QC sampling was performed in accordance with Navy CLEAN and CH2M HILL protocols, including field blanks, equipment blanks, duplicates, and matrix spike/matrix spike duplicates (MS/MSDs). Required QA/QC samples and the frequency of collection are shown in **Table 3-3**.

## 3.4 Investigation-derived Waste Management

Investigation-derived waste (IDW) was disposed of in accordance with the Base Waste Management Plan (CH2M HILL, 2008c). IDW generated during field events consisted of well development and purge water, decontamination fluids, disposable equipment, and personal protective equipment (PPE). Soil from the borings was spread around the borehole. The purge water and decontamination fluids were placed in labeled 55-gallon drums and staged at the storage facility on Parachute Tower Road. Disposable equipment, including PPE, poly sheeting, paper towels, and aluminum foil, was placed in black contractors' trash bags and disposed of in an on-base trash receptacle.

## 3.5 Site Survey

Following completion of sampling activities, SEPI Engineering surveyed horizontal coordinates for all subsurface soil sampling locations, as well as horizontal coordinates, casing elevations and ground elevations for the four temporary wells (**Table 2-1**). Elevations were accurate to the nearest 0.01 ft (0.1 ft for unpaved ground surface), and tied to the nearest North American Datum of 1988 (NAVD 88) benchmark. Horizontal controls were based on the metric system and referenced to the North American Datum of 1983 (NAD83) and the Universal Transverse Mercator (UTM) grid system.

# Investigation Results

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This section presents the results of the investigation activities conducted at Site UXO-14 during May and December 2009.

## 4.1 Digital Geophysical Mapping Results

The DGM survey was conducted in accordance with the approved PA/SI Work Plan Addendum (CH2M HILL, 2009) and covered approximately 20 percent (approximately 0.008 acre) of the former Gas Chamber portion of Site UXO-14. The DGM survey yielded a total of 17 geophysical anomalies with a signal greater than 3 mV and representing potential subsurface MEC, primarily concentrated in the eastern half of the site. **Figure 3-1** shows the DGM area and the distribution of anomalies representing potential subsurface MEC. **Appendix C** contains the Geophysical Investigation Report.

## 4.2 Environmental Investigation Results

The following subsections present and summarize the laboratory data from analysis of soil and groundwater samples collected at Site UXO-14. Laboratory analytical data are presented in **Appendix G**.

### 4.2.1 Soil

Following the third-party data validation of the laboratory analytical data, surface and subsurface soil samples were screened against the NCDENR Federal Remediation Branch Target Soil Screening Levels (NC SSLs) (NCDENR, 2010a), the Adjusted USEPA Regional Screening Levels (RSLs) for Chemical Contaminant Tables (USEPA, 2010), and MCB CamLej background surface and subsurface soil concentrations (two times the mean base background surface soil concentration), which were available for inorganic analytes only (Baker, 2001).

The RSLs for non-carcinogenic compounds were adjusted by dividing by 10 to conservatively account for exposure to multiple analytes. The methodology for calculating NC SSLs for contaminant migration from soil to groundwater was developed to identify chemical concentrations in soil that have the potential to impact groundwater. The NC SSLs are back-calculated from acceptable groundwater concentrations and take into consideration fate and transport parameters (NCDENR, 2010a).

**Figure 4-1** shows the locations of the surface soil sample exceedances and **Figure 4-2** depicts the locations of subsurface soil sample exceedances. Exceedances are shown only if the concentration exceeded two times the mean base background concentration (if available) and at least one of the screening levels (NC SSLs or the Adjusted RSLs). The detected concentrations of specific target analytes are listed in **Tables 4-1** and **4-2**. Laboratory analytical data is presented in **Appendix G**.

## Surface Soil Samples

- **SVOCs** -- Pentachlorophenol was detected above the NC SSL (31 micrograms per kilogram [ $\mu\text{g}/\text{kg}$ ]) in sample MR14-SS17 (630 J  $\mu\text{g}/\text{kg}$ ). However, this concentration did not exceed the USEPA Adjusted Residential or Industrial Soil RSL. Neither of the two TGCs were detected in surface soil samples.
- **Total Metals**

Analyte	Frequency of Detection (# detected / # sampled)	Maximum Concentration (mg/kg)	Minimum Concentration (mg/kg)	Screening Criteria (mg/kg)		Frequency of Exceedances
Antimony	9/13	387	UD	2X Mean BBG	0.447	8
				Residential RSL	3.1	6
				Industrial RSL	41	2
Arsenic	12/13	2.7	UD	2X Mean BBG	0.626	5
				Residential RSL	0.39	7
				Industrial RSL	1.6	1
Chromium	13/13	3.76	0.882	Residential RSL	0.29	13
Iron	13/13	1,470	243	NC SSLs	150	13
Lead	13/13	35,500	132	2X Mean BBG	12.3	13
				Residential RSL	400	7
				Industrial RSL	800	7
				NC SSLs	270	10
Mercury	9/13	1.08	UD	2X Mean BBG	0.081	1
				NC SSLs	1	1

- Seven additional metals (cobalt, copper, manganese, nickel, silver, sodium, and zinc) were detected at concentrations greater than twice the mean base background concentration in at least one surface soil sample, but concentrations did not exceed USEPA Adjusted Soil RSLs or NC SSLs.

## Subsurface Soil Samples

- **SVOCs** -- Benzaldehyde and naphthalene were detected in sample MR14-IS04 at a concentration below the surface soil screening criteria. Neither of the two TGCs were detected in subsurface soil.
- **Total Metals**

Analyte	Frequency of Detection (# detected / # sampled)	Maximum Concentration (mg/kg)	Minimum Concentration (mg/kg)	Screening Criteria (mg/kg)		Frequency of Exceedances
Chromium	3/3	1.06	.74 J	Residential RSL	0.29	3
Iron	3/3	370	183	NC SSLs	150	3
Lead	3/3	290	1.34	2X Mean BBG	8.49	1
				NC SSLs	270	1
Antimony	1/3	2.62	2.62	2X Mean BBG	0.36	1
Zinc	2/3	9.98	3.3	2X Mean BBG	6.59	1

- Eight metals (aluminum, arsenic, barium, copper, manganese, mercury, nickel, and vanadium) were detected at concentrations below the surface soil screening criteria in at least one sample.

## 4.2.2 Groundwater

This section presents the results for laboratory analysis of groundwater samples collected from the four shallow temporary monitoring wells. Groundwater results were screened against the North Carolina Groundwater Quality Standards (NCGWQS) (NCDENR, 2010b), USEPA Tap Water RSLs (USEPA, 2010), and MCB CamLej background groundwater concentrations (two times the mean base background groundwater concentration), which were available for inorganic analytes only (Baker, 2002). The NCGWQS are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state that may be tolerated without creating a threat to human health or otherwise rendering the groundwater unsuitable for its intended purpose.

The detections and exceedances of NCGWQS, USEPA RSLs, and/or two times the mean base background levels are shown on **Table 4-3**. Laboratory analytical data is presented in **Appendix G**. **Figure 4-3** depicts the locations of groundwater samples with concentrations that exceeded two times the mean base background concentration (if available) and at least one of the other screening levels (NCGWQS or USEPA Tap Water RSLs).

- **SVOCs-** Neither of the two TGCs were detected in groundwater.

Analyte	Frequency of Detection (# detected / # sampled)	Maximum Concentration (µg/L)	Minimum Concentration (µg/L)	Screening Criteria (µg/L)		Frequency of Exceedances
Benzo(a)pyrene	1/1	0.07	0.07	USEPA Adjusted Tap Water RSL	0.003	1
				NCGWQS	0.005	1
Dibenz(a,h)anthracene	1/1	.078 J	.078 J	USEPA Adjusted Tap Water RSL	0.003	1
				NCGWQS	0.005	1
Indo (1,2,3-cd) pyrene	1/1	.069 J	.069 J	USEPA Adjusted Tap Water RSL	0.003	1
				NCGWQS	0.05	1

- **Total Metals**

Analyte	Frequency of Detection (# detected / # sampled)	Maximum Concentration (µg/L)	Minimum Concentration (µg/L)	Screening Criteria (µg/L)		Frequency of Exceedances
Arsenic	2/3	4.09	1.03 J	USEPA Adjusted Tap Water RSL	0.045	2
Chromium	3/3	2	1.14 J	USEPA Adjusted Tap Water RSL	0.043	3
Iron	3/3	2910	518	NCGWQS	300	3
				USEPA Adjusted Tap Water RSL	2600	1
Copper	2/3	103	1.49 J	2X Mean BBG	2.76	1

• **Dissolved Metals**

Analyte	Frequency of Detection (# detected / # sampled)	Maximum Concentration (µg/L)	Minimum Concentration (µg/L)	Screening Criteria (µg/L)		Frequency of Exceedances
Dissolved Arsenic	1/3	3.29	3.29	USEPA Adjusted Tap Water RSL	0.045	1
Dissolved Chromium	3/3	1.51	.86 J	USEPA Adjusted Tap Water RSL	0.043	3
Dissolved Iron	3/3	2670	398	NCGWQS	300	3
				USEPA Adjusted Tap Water RSL	2600	1

# Human Health Risk Screening

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A conservative preliminary human health risk screening (HHRS) was performed to assess the potential for human health risks associated with exposure to site media (soil and groundwater). The results of the HHRS provide a preliminary indication of potential risks from constituents of potential concern (COPCs), and are used to help evaluate whether future residential use of the site is acceptable based on human health risks or if the site requires further evaluation (such as a baseline risk assessment or additional data collection).

The data included in the risk screening were all validated. The validated data were evaluated to determine their reliability for use in the HHRS. A review of the data identified the following criteria for data usability:

- Estimated values flagged with a J qualifier were treated as detected concentrations.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.
- Unfiltered groundwater samples were analyzed in the risk evaluations following USEPA Region IV guidance (USEPA, 2000).

## 5.1 Human Health Conceptual Site Model

The human health conceptual site model (CSM) presents an overview of site conditions, potential contaminant migration pathways, and exposure pathways to potential receptors. The human health CSM for soil and groundwater is presented on **Figure 5-1**. **Section 2** presents the site history and setting, which are summarized below.

Site UXO-14 includes two separate areas located west of Powder Lane in the Stones Bay area of MCB CamLej (**Figure 2-1**). For the purposes of the HHRS, both areas were evaluated as one exposure unit. The former Indoor Pistol Range area encompasses approximately 0.09 acres of level terrain. This area is clear of dense vegetation, consisting primarily of maintained grass and a loose sandy area representing the former building footprint. Prior to the PA/SI field efforts, construction debris was stockpiled within the former Indoor Pistol Range area. All debris was removed by the Base prior to sampling activities. The former Gas Chamber area is approximately 0.04 acre in size and consists mainly of dense vegetation. The topography at the former Gas Chamber area slopes toward the west and an unnamed tributary of the New River. Storage of scrap metal has been observed at the site.

Potential current receptors include visitors, trespassers, Base/industrial workers, and maintenance workers. The current receptors may come in contact with surface soil. Exposure routes may include incidental ingestion of and dermal contact with the surface soil and inhalation of volatile and particulate emissions from the surface soil.

Future site use is not expected to change significantly from current site use; therefore, potential future receptors include current receptors and construction workers who perform

any future construction projects at the site. Additionally, although unlikely, future residents are included as a worst-case scenario, to evaluate unrestricted future site use. Future receptors could be exposed to surface and subsurface soil if future construction at the site were to result in re-working the soil and exposing the subsurface soil. Exposure routes for future exposure to the surface and subsurface soil are the same as those for current surface soil: incidental ingestion of and dermal contact with the soil, and inhalation of volatile and particulate emissions from the soil.

Potable water supplies for MCB CamLej and the surrounding residential area are provided by water supply wells that pump groundwater from the Castle Hayne aquifer; as a result, there is no current exposure to shallow groundwater at Site UXO-14. There are no active water supply wells within a 1,500-ft radius of Site UXO-14. The groundwater use patterns are already established for the Base and the area around Site UXO-14, so use of shallow groundwater from Site UXO-14 for industrial or residential purposes is unlikely. Additionally, the surficial aquifer at MCB CamLej is not suitable for potable water use due to high dissolved solids, hardness, and fluctuating water levels that negatively affect water yields. However, state and federal governing policies assume that underground freshwater resources are potable, and should be maintained as such; therefore, a potable use scenario was evaluated in this HHRS. It was conservatively assumed that if future residential development of the site occurs, the residents could potentially use the groundwater as a potable water supply. The residents could be exposed through ingestion or dermal contact while bathing. Additionally, due to the groundwater depth (from 4 to 8 ft bgs), construction workers could be exposed to the groundwater through dermal contact from an open excavation during construction activities.

The vapor intrusion pathway was not evaluated because the target analytes are not volatile.

## 5.2 Human Health Risk-Based Screening and Risk Ratio Evaluation Methodology

The HHRS was conducted in three steps using a risk ratio technique (Department of the Navy, 2000). If COPCs were identified after Step 1, they were evaluated in Step 2. If COPCs were identified after Step 2, they were evaluated in Step 3. The three-step screening process is described below.

### 5.2.1 Step 1

The maximum detected analyte concentrations for each medium were compared to USEPA risk-based screening levels (RSLs; USEPA, 2010), other human health risk screening levels (if appropriate), and two times the mean background concentration (for inorganic constituents in soil and groundwater). RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents (i.e., were adjusted to a hazard quotient [HQ] of 0.1, from the HQ of 1.0 used in the RSL table). RSLs based on carcinogenic endpoints were used as presented in the RSL table and are based on a carcinogenic risk of  $1 \times 10^{-6}$ .

The soil data were compared to Residential Soil RSLs. Residential Soil RSLs are more conservative (i.e., lower) than Industrial Soil RSLs and are therefore protective of all potential receptors (e.g., residents, industrial workers, construction workers).

The groundwater data were compared to Tap Water RSLs. Groundwater data were also compared to maximum contaminant levels (MCLs) and NCGWQS; however, these comparisons were not used to identify the groundwater COPCs to carry forward to Step 2.

If the maximum detected concentration in soil or groundwater exceeded the appropriate screening value and background concentration, the screening level risk evaluation proceeded to Step 2.

Lead is not evaluated in the same manner as the other COPCs, but is regulated by USEPA based on blood-lead uptake using a physiologically based pharmacokinetic model called the Integrated Exposure Uptake Biokinetic (IEUBK) Model. As a screening tool, the maximum detected concentration of lead is screened at 400 mg/kg in soil based on residential exposure. However, the model uses the average lead concentration, not the maximum detected lead concentration. Therefore, if the average lead concentration was greater than the soil screening level, it was retained as a COPC. For groundwater, the maximum detected concentration of lead was first screened against the federal action level for lead in groundwater of 15 µg/L (USEPA, 2009a). The average lead concentration was then used, and lead was retained as a COPC if this concentration was greater than the action level.

In addition to comparing the detected concentrations to the screening levels, the detection limits for non-detected analytes were compared to the screening levels. Non-detected analytes with detection limits exceeding the screening level were not identified as COPCs to carry forward to Step 2, but are discussed below to evaluate the potential for underestimating the total risks.

### 5.2.2 Step 2

For analytes identified as COPCs in Step 1, a corresponding risk level was calculated using the following equation:

$$\text{corresponding risk level} = \frac{\text{concentration} \times \text{acceptable risk level}}{\text{RSL}}$$

The concentration is the maximum detected concentration (the same as used in Step 1). The acceptable risk level is 1 for noncarcinogens and 10<sup>-6</sup> for carcinogens. RSLs for noncarcinogenic effects were not adjusted by 10 as was done in Step 1; rather, they were used as presented in the RSL table.

All of the corresponding risk levels for each analyte within a medium were summed to calculate the cumulative corresponding hazard index (HI) (for noncarcinogens) and cumulative corresponding carcinogenic risk (for carcinogens). A cumulative corresponding HI was also calculated for each target organ/effect. If the cumulative corresponding HI for a target organ/effect was greater than 0.5, or the cumulative corresponding carcinogenic risk was greater than 5×10<sup>-5</sup>, the analytes contributing to these values were retained as COPCs and carried forward to Step 3.

### 5.2.3 Step 3

A corresponding risk level was calculated as discussed above for Step 2; however, the 95 percent upper confidence limit (UCL) was used in place of the maximum detected concentration if more than five samples were available for that medium, to obtain a more

site-specific risk ratio. If the cumulative corresponding HI by target organ/effect was greater than 0.5, or the cumulative corresponding carcinogenic risk was greater than  $5 \times 10^{-5}$ , then constituents contributing to these values were retained as COPCs.

ProUCL Version 4.00.04 (USEPA, 2009b) was used to test the data distribution and calculate the 95 percent UCL used for the Step 3 risk ratio calculations (**Appendix H**).

## 5.3 Human Health Conceptual Site Model

The human health risk-based screening (comparison to risk-based criteria and background levels, Step 1) and risk ratio evaluation (Steps 2 and 3) were performed for surface soil, subsurface soil, and groundwater.

### 5.3.1 Surface Soil Risk Screening

Tables H-1 through H-3 of **Appendix H** present the risk-based screening and risk ratio evaluation for surface soil. The samples collected from the former Indoor Pistol Range area were analyzed for metals, and the samples collected from the former Gas Chamber area were analyzed for TGCs. As shown in Table H-1, three metals (antimony, arsenic, and lead) were identified as COPCs (and are associated with the former Indoor Pistol Range area). Based on Step 2 of the screening process (Table H-2), antimony was identified as a COPC. In Step 3 (Table H-3), the HI of antimony was 3.4, which is greater than 0.5. Therefore, antimony was retained as a COPC.

The average lead concentration in the surface soil was 4,603 mg/kg, which is higher than the lead screening level of 400 mg/kg in soil. Therefore, lead is considered to be present at a concentration of potential concern, and lead was identified as a COPC in the HHRS.

Further evaluation of surface soil at the former Indoor Pistol Range area is necessary based on human health risks. Further evaluation of surface soil at the former Gas Chamber area is not necessary based on human health risks.

### 5.3.2 Subsurface Soil Risk Screening

Tables H-4 through H-6 of **Appendix H** present the risk-based screening and risk ratio evaluation for the subsurface soil. The samples collected from the former Indoor Pistol Range area were analyzed for metals, and the samples collected from the former Gas Chamber area were analyzed for TGCs. As shown on Table H-4, three metals (antimony, arsenic, and lead) were identified as COPCs associated with the former Indoor Pistol Range area. Based on Step 2 of the screening process (Table H-5), antimony was identified as a COPC. In Step 3 (Table H-6), the HI of antimony was 2.8, which is greater than 0.5.

The average lead concentration in the subsurface soil is 3,702 mg/kg, which is higher than the lead screening level of 400 mg/kg in soil. Therefore, lead is considered to be present at a concentration of potential concern, and lead was identified as a COPC in the HHRS.

Further evaluation of subsurface soil at the former Indoor Pistol Range area based on human health risks is necessary. Further evaluation of subsurface soil at the former Gas Chamber area is not necessary based on human health risks.

### 5.3.3 Groundwater Risk Screening

The risk-based screening and risk ratio evaluation for groundwater data are presented in Tables H-7 and H-8 of **Appendix H**. As shown on Table H-7, three TGCs ([benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene]) associated with the former Gas Chamber area exceeded the first step of the screening and were identified as COPCs for evaluation in Step 2. Based on Step 2 (Table H-8), the three TGCs were eliminated from consideration as COPCs. Therefore, no potential unacceptable risks are associated with exposure to the groundwater, and further evaluation of the groundwater based on human health exposure and risk is not necessary.

### 5.3.4 Non-detected Analytes

In a few cases, laboratory detection limits were above the screening level for a certain constituent, so it is not known whether these constituents are present in exceedance of screening criteria. For surface soil and subsurface soil, only one TGC (4,6-dinitro-2-methylphenol) was not detected in surface soil but had detection limits above the screening level. However, the detection limits for this analyte in surface and subsurface soil were only slightly above the screening level (were within one order of magnitude of the non-carcinogenic Adjusted RSL). There were several TGCs and metals in groundwater that were not detected but had detection limits above the screening level. In some cases, detection limits were only slightly above the screening levels.

In addition, due to the limited amount of other TGCs and metals constituents detected in the groundwater, it is not expected that the constituents examined here are present, and if so, it is likely they would be below levels of potential concern for human health.

# Ecological Risk Screening

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An ecological risk screening (ERS) was conducted for Site UXO- 14. Results for constituents in surface soil, subsurface soil, and groundwater were screened against benchmarks intended to be protective of ecological receptors. All data considered in the screen were collected in 2009.

## 6.1 Site Ecological Setting and Available Data

Site UXO 14 includes both the former Indoor Pistol Range area and the former Gas Chamber area. The former Indoor Pistol Range area is predominantly mowed grasses, and the former Gas Chamber area is forested. Soil and groundwater samples were collected from both areas.

A total of 20 surface soil samples were collected (plus two duplicates) from 0 to 2 inches bgs. Surface soil samples MR14-SS01 through MR14-SS12 were collected in the former Indoor Pistol Range area and were analyzed for inorganics. Surface soil samples MR14-SS13 through MR14-SS20 were collected in the former Gas Chamber area and were analyzed for TGCs.

For subsurface soil, samples collected from 0 to 5 ft bgs were used for the ERS. Subsurface soil samples MR14-IS01 through MR14-IS03 were collected at the former Indoor Pistol Range area and were analyzed for TGCs. Subsurface soil sample MR14-IS04 was collected at the former Gas Chamber area and was analyzed for TGCs.

Data from four groundwater wells were available for screening (four samples plus one duplicate). The temporary groundwater monitoring wells were co-located with the subsurface soil locations. The former Indoor Pistol Range samples were analyzed for inorganics, and the former Gas Chamber samples were analyzed for TGCs. Dissolved metals data were available for a subset of the wells.

## 6.2 Screening Methodology

For each medium (surface soil, subsurface soil, and groundwater), the maximum and average concentrations are presented along with representative ecological screening values (ESVs) intended to be protective of ecological receptors. HQs were calculated by dividing these exposure concentrations by the ESVs. It should be noted that ESVs for inorganic constituents in water are generally based on dissolved concentrations and comparing them to total metals concentrations is conservative and may over-represent risk.

For locations with multiple data points (i.e., a parent and duplicate sample were available), data were reduced to the value of the highest detected concentration or highest detection limit if there was no detection. Where average concentrations are reported, one-half of the detection limit was used for nondetects as the representative concentration when determining the average.

For soil, the USEPA Ecological Soil Screening Levels (EcoSSL) (USEPA, 2009a) were preferentially selected over Region 4 values (USEPA, 2001). When no EcoSSL was available for a constituent, the Region 4 value was selected.

A selection hierarchy was also applied to groundwater. The NRWQC was preferentially selected over the Region 4 value (USEPA, 2009b). However, when no NRWQC was available for a constituent, the Region 4 value was selected as the ESV. It is uncertain if groundwater discharges to a marine or freshwater water body, so the lowest of freshwater and marine ESVs was selected to be conservative.

A base background study was conducted at MCB CamLej in June and July 2000 (Baker, 2001). As part of the ERS, surface soil, subsurface soil, and groundwater background concentrations were compared to site-specific media concentrations. Additional lines of evidence in the evaluation included the frequency of detection, frequency of exceedance, magnitude of exceedance, and identification of potential laboratory contaminants.

Calcium, magnesium, potassium, and sodium were evaluated but not considered as COPCs in the ERS. Each is considered a macronutrient (Whitehead, 2000).

## 6.3 Screening Results

This section addresses constituents that were detected and had available ESVs based on the selection hierarchy discussed above. Constituents not detected are not expected to pose a risk to ecological receptors.

### 6.3.1 Surface Soil

As shown in Table I-1 of **Appendix I**, seven detected constituents had concentrations in surface soil samples in excess of ESVs (aluminum, antimony, iron, lead, mercury, vanadium, and zinc). The aluminum, iron, and vanadium maximum concentrations were consistent with base background levels. The maximum concentration of zinc exceeded two times the mean background but was within the background range for surface soils at MCB CamLej and is considered to be representative of background.

Antimony, lead, and mercury concentrations exceeded the ESVs (with maximum-based HQs above 10) and were above the background ranges for surface soil. The most elevated concentrations were collected from the western portion of the former Indoor Pistol Range area. Locations MR14-SS11 and MR14-SS12 contained the highest concentrations of lead and antimony, while location MR14-SS02 contained the highest concentrations of mercury. These analytes may pose a risk.

### 6.3.2 Subsurface Soil

As shown in Table I-2 of **Appendix I**, only aluminum, antimony, iron, and lead had detected concentrations in subsurface soil in excess of the ESVs. The aluminum and iron maximum concentrations were consistent with base background levels and are not considered to pose an unacceptable risk to ecological receptors.

Antimony and lead concentrations exceeded the ESVs, with respective maximum-based HQs of 9.7 and 26.4, and concentrations were well above background levels. The maximum

concentrations were collected from location MR14-IS01 in the western portion of the former Indoor Pistol Range area. These analytes may pose a risk.

### 6.3.3 Groundwater

As shown in Table I-3 of **Appendix I**, aluminum, copper, and iron were the only constituents detected in groundwater at concentrations in excess of the selected ESVs. The maximum concentrations of aluminum and iron are consistent with base background levels. Copper concentrations were consistent with background levels based on dissolved data, suggesting that copper is sorbed to soil/suspended solids and not dissolved in groundwater. Consequently, none of these constituents are expected to pose an unacceptable risk.

Of the dissolved inorganics, aluminum was the only analyte with a maximum concentration greater than the ESV. The maximum aluminum concentration, however, was consistent with background levels. Consequently, dissolved metals are not expected to pose an unacceptable risk to ecological receptors.

## 6.4 Supplemental Evaluation

This section addresses constituents that were detected but did not have an ESV based on the selection hierarchy discussed above. Supplemental values were selected as available from Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas (Texas Commission on Environmental Quality, 2006), Validation of Environmental Military Threshold Values for Explosives in Soil (National Research Council Canada, 2008), and other publications, as needed. These comparisons are discussed along with other lines of evidence such as frequency of detection and relationship to the range of background concentrations.

### 6.4.1 Surface Soil

In surface soil, hexachlorobutadiene was the only detected constituent that lacked an ESV. The maximum concentration of hexachlorobutadiene was less than the supplemental ESV. Hexachlorobutadiene is not expected to pose an unacceptable risk to ecological receptors.

To evaluate polycyclic aromatic hydrocarbons (PAHs) in surface soil, the detected concentrations of the low molecular weight PAHs were summed and compared to the EcoSSL screening value of 29,000 ug/kg. The detected concentrations for the high molecular weight PAHs were also summed and compared to the EcoSSL screening value of 1,100 ug/kg. Non-detected concentrations were not included in the totals. The totals for both low and high molecular weight PAHs were below their respective screening values, and therefore, PAHs are not expected to pose a significant risk to ecological receptors.

### 6.4.2 Subsurface Soil

None of the detected subsurface soil constituents lacked ESVs.

### 6.4.3 Groundwater

In groundwater, the following five TGCs that lacked ESVs were detected: 4-methylphenol, benzo(a)pyrene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The concentrations of all of these constituents, excluding benzo(a)pyrene, were below the designated supplemental ESVs and risk to ecological receptors is considered negligible. The benzo(a)pyrene concentration in groundwater exceeded the selected ESV; however, this constituent was not detected in any surface or subsurface soil samples. There appears to be no significant onsite source. Given this, and the likely attenuation during transport to a surface water body, risk to ecological receptors is considered negligible.

## 6.5 Summary

Antimony, lead, and mercury in the surface soil and antimony and lead in subsurface soil were detected at concentrations that exceeded one or more screening criteria. These constituents are recommended for further evaluation. The remaining constituents detected at Site UXO 14 are not expected to pose an unacceptable risk to ecological receptors.

# Site UXO-14 Conceptual Site Model

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The CSM, as shown on **Figure 7-1**, is an essential element of a results-based environmental investigation and corrective action program. It is an important assessment tool that integrates the information needed to understand how COPCs move through the environment and potentially come in contact with human and ecological receptors. Development of a CSM is an iterative process; the model is refined as new information becomes available. The CSM is an effective tool in identifying additional data needs and supporting management decisions regarding sampling strategies, project constraints, and regulatory compliance. Key elements of the CSM are grouped into major categories identifying potential sources, extent of contaminant migration, fate and transport, and potential exposure pathways and receptors.

## 7.1 Source

Site UXO-14 was investigated to evaluate potential impacts related to the operations of the former Indoor Pistol Range and Gas Chamber areas during the 1950s. Three metals (antimony, lead, and mercury) were identified as COPCs in the surface and subsurface soils within the former Indoor Pistol Range area of based on the HHRS and ERS and may be associated with historical munitions-related activities conducted at the site.

## 7.2 Fate and Transport Mechanisms

Fate and transport analysis can guide assessment activities, improve understanding of the distribution of site contaminants, support risk assessments, and aid in identifying potential remedial alternatives, if necessary. A transport pathway describes the mechanisms whereby contaminants, once released, can be transported from a source to an exposure point.

### 7.2.1 Soil

Metals occurring at the ground surface could potentially release MC to surficial soils, which can be redistributed by wind and water. Detected target analytes are not volatile, and would be expected to be transported along with the soil. More soluble analytes may be dissolved and leached into groundwater.

### 7.2.2 Groundwater

Materials that adhere to soil particles or accumulate in soil pore spaces can potentially leach and migrate vertically to the groundwater as a result of infiltration of precipitation or fluctuations in the groundwater level. The rate and extent of this leaching are influenced by several factors, including:

- Depth to the water table
- Amount of precipitation

- Rate of infiltration
- Physical and chemical properties of the soil
- Physical and chemical properties of the contaminant

### 7.3 Exposure Pathways and Receptors

An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media and exposure routes. Human and ecological exposures are discussed in **Sections 5** and **6**. These risk screenings indicated that no unacceptable risks to human health or ecological receptors exposed to Site UXO-14 groundwater exist based on the results of the environmental sampling. However, the HHRS and ERS concluded that three metals (antimony, lead, and mercury) were identified as COPCs in the surface and subsurface soils within the former Indoor Pistol Range area.

# Conclusions and Recommendations

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This section provides conclusions and recommendations based on the PA/SI findings.

## 8.1 Conclusions

### 8.1.1 Digital Geophysical Mapping

A total of 17 geophysical anomalies were detected at the gas chamber area of Site UXO-14. However, intrusive investigation of the anomalies was not conducted during this phase of investigation and therefore the nature of the anomalies was not determined.

### 8.1.2 Environmental Investigation

The PA/SI involved collection of environmental media samples (i.e., surface soil, subsurface soil, and groundwater) from several locations within Site UXO-14. A summary of the detected target analytes is provided below.

#### Surface Soil

Antimony, arsenic, chromium, iron, lead, and mercury were the only target analytes detected in surface soil that exceeded one or more of the regulatory screening criteria. However arsenic, chromium, iron, and mercury have screening criteria less than two times the mean base background surface soil concentrations.

#### Subsurface Soil

Laboratory analysis of the subsurface soil samples indicated that chromium, iron, and lead were the only target analytes reported to exceed one or more regulatory screening criteria. However, concentrations of chromium and iron did not exceed two times the mean base background subsurface soil concentrations.

#### Groundwater

Three SVOCs ([benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)perylene]) and three metals (arsenic, chromium, and iron) were detected in groundwater at concentrations exceeding one or more regulatory screening criteria; however, the risk screening process indicated that the detected concentrations did not present an unacceptable risk to human health or ecological receptors. TGCs were not detected in groundwater.

### 8.1.3 Human Health and Ecological Risk Screening

Human health and ecological risk screening indicates that further investigation of Site UXO-14 is necessary to delineate the extent of elevated metals concentrations within the surface and subsurface soils at the former Indoor Pistol Range area. Antimony, mercury (ERS only), and lead were identified as COPCs in surface soils within the former Indoor Pistol Range area during the ERS and HHRS process. Antimony and lead were identified as COPCs in

subsurface soils within the former Indoor Pistol Range area. The risk screening process indicated that the detected concentrations of SVOCs and metals in Site UXO-14 groundwater did not present an unacceptable risk to human health or ecological receptors. Additionally, the human health and ecological risk screening indicates that no unacceptable risk to human health or ecological receptors were identified for exposure to soil and groundwater within the former Gas Chamber area of Site UXO-14.

## 8.2 Recommendations

Based on the DGM results, it is recommended that an intrusive investigation be performed to assess the nature of the geophysical anomalies representing potential subsurface MEC at the former gas chamber area. The need for additional sampling of MC will be re-evaluated based on the results of the intrusive anomaly investigation. Additional investigation should be conducted to delineate extent of the identified impacts to surface and subsurface soil at the former Indoor Pistol Range area.

# References

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Tables

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TABLE 2-1

Groundwater Elevation and Well Construction Information

Site UXO-14 Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)

MCB CamLej, North Carolina

Well ID	Date Installed (mm/dd/yy)	Screened Interval (ft bgs)	Bottom of Well (ft bgs)	Surveyed Top of Casing Elevation (ft msl)	Surveyed Ground Surface (ft msl)	Depth to Water December 8, 2009 (ft bTOC)	Groundwater Elevation December 8, 2009 (ft msl)
MR14-TW01	12/04/09	8-18	19.85	43.36	41.56	6.60	36.76
MR14-TW02	12/04/09	8-18	19.92	44.36	42.00	8.12	36.24
MR14-TW03	12/04/09	8-18	19.85	45.08	42.01	7.93	37.15
MR14-TW04	12/04/09	5-15	14.89	32.64	32.04	4.4*	28.42*

**Notes:**

ft bgs = feet below ground surface

ft bTOC = feet below top-of-casing

ft msl = feet above mean sea level

\* measured 12/9/2009 at 0930

Prepared by: David Seed

Checked by: Simon Kline

TABLE 3-1  
DGM Instruments Standardization Tests and Acceptance Criteria  
Site UXO-14 Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)  
MCB CamLej, North Carolina

Test	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning and End of Day	First Time Instr. Used	2% of Total Area Surveyed
1	Equipment Warm-up	Equipment specific (typically 5 min)	x	x			
2	Personnel Test	Based on instrument used. Personnel, clothing, etc. should have no effect on instrument response. <2 mV		x			
3	Vibration Test (Cable Shake)	Data profile does not exhibit data spikes. <2 mV		x			
4	Static Background & Static Spike	+/- 20% of standard item response, after background correction			x		
5	Latency Test	Repeatability of response amplitude +/-20%, Positional Accuracy +/- 20 cm				x	
6	Repeat Data	Repeatability of response amplitude					x
7	Sensor Positioning Test	Positional Accuracy within 10 cm		x			

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**TABLE 3-2**

Groundwater Field Parameters

*Site UXO-14 Former Indoor Pistol Range and Gas Chamber Area (Rifle Range Area)*

*MCB CamLej, North Carolina*

<b>Station ID</b>	MR14-TW01	MR14-TW02	MR14-TW03	MR14-TW04
<b>Sample Date</b>	12/8/2009	12/8/2009	12/8/2009	12/9/2009
<b>Field Parameters</b>				
Dissolved Oxygen (mg/L)	0.49	0.33	0.57	3.30
Oxidation Reduction Potential (mV)	169.8	-83.6	-117.9	-0.8
pH	5.35	4.9	5.59	5.07
Specific Conductance (mS/cm)	0.106	0.092	0.205	0.088
Temperature (°C)	18.46	18.04	17.06	17.46
Turbidity (NTU)	5.1	3.4	7.8	10

Prepared by: David Seed  
Checked by: Simon Kline

TABLE 3-3  
 QA/QC Sampling Program  
*Site UXO-14 Former Indoor Pistol Range and Gas Chamber Area (Rifle Range Area)*  
*MCB CamLej, 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 parent 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 parent sample

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Checked by: Simon Kline

TABLE 4-1  
 Surface Soil Analytical Results  
 Site UXO-14 Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)  
 PA/SI Report  
 MCB CamLej, North Carolina

Station ID Sample ID Sample Date	Camp Lejeune Background SS 2X Mean	NCPSRGs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	MR14-SS01		MR14-SS02	MR14-SS03	MR14-SS04	MR14-SS05	MR14-SS06	MR14-SS07	MR14-SS08	MR14-SS09	MR14-SS10	MR14-SS11
					MR14-SS01-09D	MR14-SS01D-09D	MR14-SS02-09D	MR14-SS03-09D	MR14-SS04-09D	MR14-SS05-09D	MR14-SS06-09D	MR14-SS07-09D	MR14-SS08-09D	MR14-SS09-09D	MR14-SS10-09D	MR14-SS11-09D
					11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09
<b>Chemical Name</b>																
<b>Semivolatile Organic Compounds (µg/kg)</b>																
2-Methylnaphthalene	--	1,600	370,000	31,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzaldehyde	--	--	1,200,000	780,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	--	180	2,100	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	600	2,100	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	--	5,900	21,000	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	--	7,200	120,000	35,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	--	330,000	2,200,000	230,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	--	56,000	2,200,000	230,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	--	8.7	22,000	6,100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	--	210	18,000	3,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	--	31	9,000	3,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	--	57,000	17,000,000	1,700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	--	220,000	1,700,000	170,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total Metals (mg/kg)</b>																
Aluminum	5,487	--	99,000	7,700	1,590	1,760	869	856	662	744	551	821	963	1,380	1,060	1,080
Antimony	0.447	--	41	3.1	<u>23.1 J</u>	<u>6.43 J</u>	<u>22.1</u>	<u>34.9</u>	0.675 J	0.744 U	0.77 U	0.347 J	0.759 U	0.776 U	0.862	<u>57.5</u>
Arsenic	0.626	5.8	1.6	0.39	<u>0.931</u>	<u>1.19</u>	<u>0.696</u>	<u>0.434</u>	0.246 J	0.204 J	0.257 U	<u>0.402</u>	0.337	0.204 J	0.33	0.335
Barium	14.5	580	19,000	1,500	13.2	10.4	6.57	6.09	3.15	2.21	2.17	6.32	2.44	2.96	2.83	5.57
Beryllium	0.103	--	200	16	0.256 U	0.266 U	0.251 U	0.247 U	0.254 U	0.248 U	0.257 U	0.302 U	0.253 U	0.259 U	0.249 U	0.269 U
Calcium	6,360	--	--	--	390	550	1,350	474	127 J	53 J	200 J	203 J	253 U	1,080	200 J	97.7 J
Chromium	6.05	3.8	5.6	0.29	<u>3.76</u>	<u>3.26</u>	<u>1.55</u>	<u>1.93</u>	<u>1.3</u>	<u>1.04</u>	<u>0.882</u>	<u>2.36</u>	<u>1.32</u>	<u>1.48</u>	<u>1.25</u>	<u>2.7</u>
Cobalt	0.294	--	30	2.3	0.267 J	0.665 U	0.627 U	<u>0.592 J</u>	0.634 U	0.62 U	0.641 U	0.754 U	0.632 U	0.646 U	0.622 U	0.375 J
Copper	4.83	700	4,100	310	4.57	<u>12.8</u>	2.68	2.78	1.39	0.962	1.08	<u>8.47</u>	1.43	1.2	1.3	4.43
Iron	3,245	150	72,000	5,500	1,470	1,150	1,080	942	683	616	243	907	537	639	598	721
Lead	12.3	270	800	400	<u>3.000</u>	<u>1.250</u>	<u>3.110</u>	<u>4.990</u>	303	145	132	<u>910</u>	271	73.9	366	<u>6.430</u>
Magnesium	238	--	--	--	77.3 J	93.6 J	251 U	68.7 J	254 U	248 U	257 U	62.2	253 U	58.8 J	249 U	141 J
Manganese	13.7	65	2,300	180	21.2	18	13.1	8.78	5.09	4.89	3.69	13.5	9.04	6.92	8.51	18
Mercury	0.081	1	31	2.4	0.0486	0.052	<u>1.08</u>	0.0399	0.017	0.033 U	0.033 U	0.0301 J	0.0135 J	0.033 U	0.033 U	0.0688
Nickel	1.21	130	2,000	160	1.83	1.78	1.42	1.91	1.01	0.592	0.404 J	1.43	0.912	0.961	0.936	1.73
Potassium	116	--	--	--	74.9 J	82.4 J	251 U	247 U	254 U	248 U	257 U	302 U	253 U	259 U	249 U	82.9 J
Silver	0.14	3.4	510	39	0.0563 J	0.266 U	0.11 J	0.0506 J	0.254 U	0.248 U	0.257 U	0.302 U	0.253 U	0.259 U	0.249 U	0.195 J
Sodium	80.9	--	--	--	256 U	266 U	251 U	247 U	254 U	248 U	257 U	302 U	253 U	259 U	249 U	225 J
Vanadium	8.9	--	520	39	7.66	7.17	7.1	8.74	3.45	1.63	1.09	6.02	3.63	2.52	3.55	5.39
Zinc	10.8	1,200	31,000	2,400	65.3	57.7	43.8	62.1	19.6	15	16.6 J	61.4 J	24.2 J	12.9 J	18.8 J	47.2 J

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSL

**Bold text indicates exceedance of Adjusted Industrial Soil RSLs**

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

TABLE 4-1

Surface Soil Analytical Results

Site UXO-14 Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)

PA/SI Report

MCB CamLej, North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCPSSRGs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	MR14-SS12	MR14-SS13		MR14-SS14	MR14-SS15	MR14-SS16	MR14-SS17	MR14-SS18	MR14-SS19	MR14-SS20
Sample ID					MR14-SS12-09D	MR14-SS13-09D	MR14-SS13D-09D	MR14-SS14-09D	MR14-SS15-09D	MR14-SS16-09D	MR14-SS17-09D	MR14-SS18-09D	MR14-SS19-09D	MR14-SS20-09D
Sample Date					11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09
Chemical Name														
<b>Semivolatile Organic Compounds (µg/kg)</b>														
2-Methylnaphthalene	--	1,600	370,000	31,000	NA	11 U	11 U	11 U	12 U	12 U	12	1.6 J	3.3 J	11 J
Benzaldehyde	--	--	1,200,000	780,000	NA	260 R	270 R	250 R	270 R	280 R	94 J	92 J	270 R	110 J
Benzo(a)anthracene	--	180	2,100	150	NA	11 UJ	11 U	11 U	12 UJ	12 UJ	12 UJ	12 UJ	2.8 J	3.2 J
Benzo(b)fluoranthene	--	600	2,100	150	NA	11 U	11 U	11 U	12 U	12 U	18	4.7	7.3 J	13 U
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	NA	11 U	11 U	11 U	12 U	12 U	7.2 J	12 U	2.6 J	13 U
Benzo(k)fluoranthene	--	5,900	21,000	1,500	NA	11 U	11 U	11 U	12 U	12 U	4.4 J	2.3	2.8 J	13 U
bis(2-Ethylhexyl)phthalate	--	7,200	120,000	35,000	NA	260 UJ	270 U	250 UJ	270 UJ	280 UJ	60 J	280 U	270 U	310 U
Fluoranthene	--	330,000	2,200,000	230,000	NA	1.8 J	2.5 J	1.5 J	4 J	6 J	11 J	4.7 J	5 J	7.2 J
Fluorene	--	56,000	2,200,000	230,000	NA	11 U	11 U	11 U	12 U	4 J				
Hexachlorobutadiene	--	8.7	22,000	6,100	NA	11 U	11 U	11 U	12 U	4.3 J				
Naphthalene	--	210	18,000	3,600	NA	11 U	11 U	11 U	12 U	12 U	10 J	12 U	12 U	11 J
Pentachlorophenol	--	31	9,000	3,000	NA	760 U	760 U	720 U	780 U	800 U	<b>630 J</b>	800 U	780 U	900 U
Phenanthrene	--	57,000	17,000,000	1,700,000	NA	11 U	11 U	11 U	12 U	12 U	20	3.3	5.3 J	9.4 J
Pyrene	--	220,000	1,700,000	170,000	NA	2 J	3 J	11 U	12 U	6.3 J	12 J	4.6 J	6.2 J	6.8 J
<b>Total Metals (mg/kg)</b>														
Aluminum	5,487	--	99,000	7,700	807	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	0.447	--	41	3.1	<b>387</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.626	5.8	1.6	0.39	<b>2.7</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	14.5	580	19,000	1,500	7.79	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.103	--	200	16	0.0503 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	6,360	--	--	--	405	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	6.05	3.8	5.6	0.29	<b>3.14</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	0.294	--	30	2.3	0.314 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	4.83	700	4,100	310	11.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	3,245	150	72,000	5,500	740	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	12.3	270	800	400	<b>35,500</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	238	--	--	--	248 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	13.7	65	2,300	180	13	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.081	1	31	2.4	0.0293 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1.21	130	2,000	160	2.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	116	--	--	--	248 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.14	3.4	510	39	0.634	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	80.9	--	--	--	248 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	8.9	--	520	39	5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	10.8	1,200	31,000	2,400	47.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

**Bold box** indicates exceedance of NC SSL

**Bold text** indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

TABLE 4-2

Subsurface Soil Analytical Results  
 Site UXO-14 Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)  
 PA/SI Report  
 MCB CamLej, North Carolina

Station ID	Camp Lejeune Background SB 2X Mean	NCPSRGs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	MR14-IS01	MR14-IS02	MR14-IS03	MR14-IS04	
Sample ID					MR14-IS01-2-3-09D	MR14-IS02-2-3-09D	MR14-IS03-2-3-09D	MR14-IS04-4-5-09D	MR14-IS04D-4-5-09D
Sample Date					12/04/09	12/04/09	12/04/09	12/04/09	12/04/09
<b>Chemical Name</b>									
<b>Semivolatile Organic Compounds (µg/kg)</b>									
Benzaldehyde	--	--	1,200,000	780,000	280 U	280 U	290 U	540 J	520 J
Naphthalene	--	210	18,000	3,600	12 U	12 U	12 U	1.8 J	13 U
<b>Total Metals (mg/kg)</b>									
Aluminum	10,369	--	99,000	7,700	1,530	881 J	793	NA	NA
Antimony	0.36	--	41	3.1	2.62	0.889 U	0.913 U	NA	NA
Arsenic	2.12	5.8	1.6	0.39	0.208 J	0.195 J	0.304 U	NA	NA
Barium	16.6	580	19,000	1,500	2.49	1.78 J	1.44 J	NA	NA
Chromium	14.5	3.8	5.6	0.29	1.06	0.74	0.748	NA	NA
Copper	2.56	700	4,100	310	1.28	0.592 U	0.609 U	NA	NA
Iron	5,439	150	72,000	5,500	370	322	183	NA	NA
Lead	8.49	270	800	400	290	1.34	1.8	NA	NA
Manganese	9.25	65	2,300	180	3.29	2.81 J	1.54	NA	NA
Mercury	0.071	1	31	2.4	0.0342 J	0.0333 U	0.041 U	NA	NA
Nickel	2.27	130	2,000	160	0.43 J	0.368 J	0.357 J	NA	NA
Vanadium	17.2	--	520	39	1.28	1.2	0.799	NA	NA
Zinc	6.59	1,200	31,000	2,400	9.98	1.18 U	3.3	NA	NA

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSL

**Bold text indicates exceedance of Adjusted**

**Industrial Soil RSLs**

Underline indicates exceedance of Adjusted

Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

TABLE 4-3

Groundwater Analytical Results  
 Site UXO-14 Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)  
 PA/SI Report  
 MCB CamLej, North Carolina

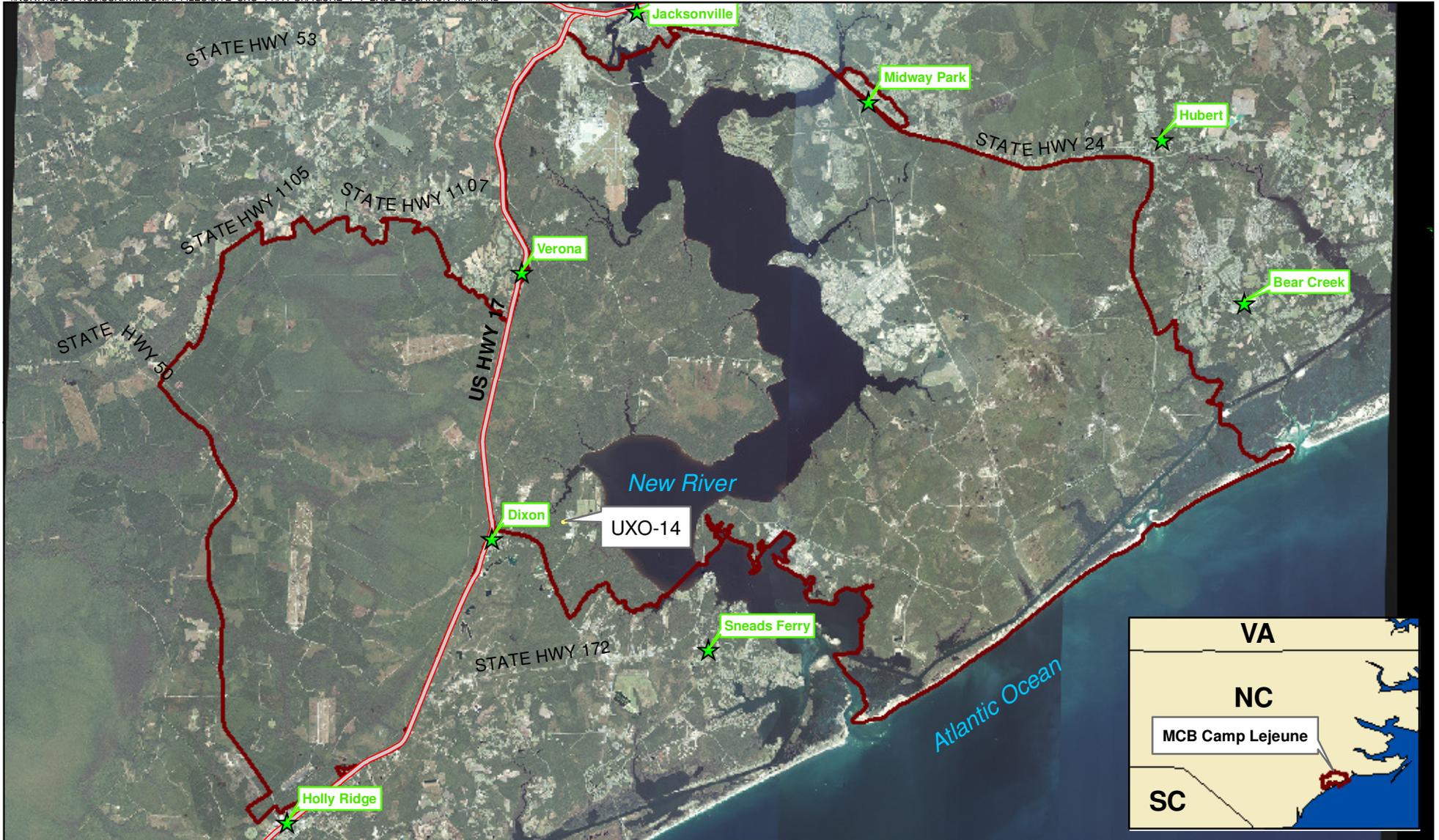
Station ID	Camp Lejeune Background GW 2X Mean	NCGWQS (January 2010) *	Adjusted Tap Water RSLs	MR14-IS01	MR14-IS02	MR14-IS03	MR14-IS04	
Sample ID				MR14-TW01-09D	MR14-TW02-09D	MR14-TW03-09D	MR14-TW04-09D	MR14-TW04D-09D
Sample Date				12/08/09	12/08/09	12/08/09	12/09/09	12/09/09
Chemical Name								
<b>Semivolatile Organic Compounds (µg/l)</b>								
4-Methylphenol	--	40	18	NA	NA	NA	1.7 J	1.6 J
Benzo(a)pyrene	--	0.005	0.003	NA	NA	NA	<b>0.07 J</b>	<b>0.07 J</b>
Benzo(g,h,i)perylene	--	200	110	NA	NA	NA	0.08 J	0.073 J
Dibenz(a,h)anthracene	--	0.005	0.003	NA	NA	NA	<b>0.078 J</b>	<b>0.074 J</b>
Indeno(1,2,3-cd)pyrene	--	0.05	0.03	NA	NA	NA	<b>0.069 J</b>	<b>0.071 J</b>
<b>Total Metals (µg/l)</b>								
Aluminum	1,886	--	3,700	246 J	175 J	293 J	NA	NA
Arsenic	5.77	10	0.045	<b>1.03 J</b>	<b>4.09</b>	1.25 U	NA	NA
Barium	86.2	700	730	8.48 J	63.6	46.9	NA	NA
Beryllium	0.308	--	7.3	1.25 U	0.254 J	1.25 U	NA	NA
Calcium	69,078	--	--	7,480	5,870	31,600	NA	NA
Chromium	3.13	10	0.043	<b>2</b>	<b>1.14 J</b>	<b>1.36</b>	NA	NA
Copper	2.76	1,000	150	1.49 J	103	2.5 U	NA	NA
Iron	5,999	300	2,600	<b>518</b>	<b>2,910</b>	<b>1,230</b>	NA	NA
Lead	2.8	15	--	0.975	0.75 U	0.75 U	NA	NA
Magnesium	6,363	--	--	437 J	1,170 J	1,500	NA	NA
Manganese	214	50	88	5.01 J	23.4 J	13.7 J	NA	NA
Nickel	7.97	100	73	0.851 J	1.23 J	2.5 U	NA	NA
Potassium	3,277	--	--	1,070 J	1,250 J	1,710 J	NA	NA
Sodium	22,508	--	--	13,600	8,000	12,100	NA	NA
Vanadium	4.72	--	18	3.12 U	1.88 J	2.2 J	NA	NA
Zinc	42.1	1,000	1,100	3.16 J	3.16 J	5 U	NA	NA
<b>Dissolved Metals (µg/l)</b>								
Aluminum, Dissolved	1,886	--	3,700	100 J	118 J	149 J	NA	NA
Arsenic, Dissolved	5.77	10	0.045	1.25 U	<b>3.29</b>	1.25 U	NA	NA
Barium, Dissolved	86.2	700	730	8.1 J	61.5	47.5	NA	NA
Calcium, Dissolved	69,078	--	--	7,220	5,550	32,600	NA	NA
Chromium, Dissolved	3.13	10	0.043	<b>1.51</b>	<b>0.86 J</b>	<b>0.98 J</b>	NA	NA
Copper, Dissolved	2.76	1,000	150	1.32 J	2.5 U	2.5 U	NA	NA
Iron, Dissolved	5,999	300	2,600	<b>398</b>	<b>2,670</b>	<b>1,160</b>	NA	NA
Lead, Dissolved	2.8	15	--	0.83	0.75 U	0.75 U	NA	NA
Magnesium, Dissolved	6,363	--	--	422 J	1,140 J	1,530	NA	NA
Manganese, Dissolved	214	50	88	5.53 J	22.8 J	13.4 J	NA	NA
Nickel, Dissolved	7.97	100	73	0.78 J	1.35 J	2.5 U	NA	NA
Potassium, Dissolved	3,277	--	--	1,060 J	1,260 J	1,750 J	NA	NA
Sodium, Dissolved	22,508	--	--	13,400	9,510	12,500	NA	NA
Vanadium, Dissolved	4.72	--	18	3.12 U	2.33 J	1.94 J	NA	NA

Notes:

- Shading indicates exceedance of two times the mean base background concentration for Groundwater
- Bold box indicates exceedance of NCGWQS or the more conservative MCL**
- Bold text indicates exceedance of Adjusted Tap Water RSLs**
- RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
- \* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative.
- NA - Not analyzed
- J - Analyte present, value may or may not be accurate or precise
- U - The material was analyzed for, but not detected
- UJ - Analyte not detected, quantitation limit may be inaccurate
- µg/l - Micrograms per liter

Figures

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- Legend**
- ★ Cities
  - Highways
  - Site UXO-14 Boundary
  - Installation Boundary

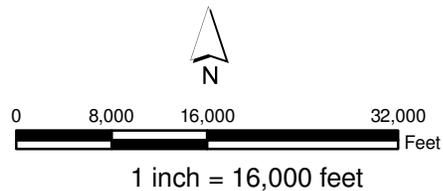


Figure 1-1  
Base Location Map  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199)  
and Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina





**Legend**

- Site UXO-14 Boundary (Former Indoor Pistol Range Area)
- Site UXO-14 Boundary (Former Gas Chamber Area)
- Installation Boundary
- Jurisdictional Wetlands

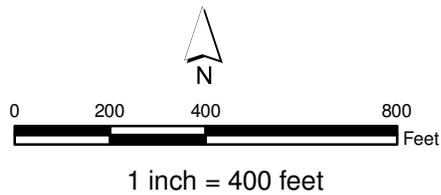


Figure 2-1  
 Site Proximity Map  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLeJ  
 North Carolina





- Legend**
-  Streams
  -  Site UXO-14 Boundary (Former Indoor Pistol Range Area)
  -  Site UXO-14 Boundary (Former Gas Chamber Area)

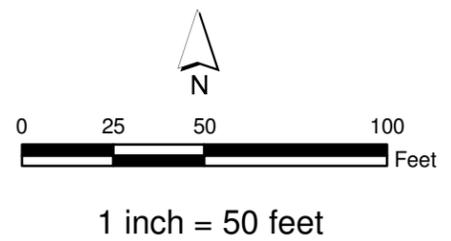


Figure 2-2  
 Site Layout Map  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLej  
 North Carolina  




**Legend**

- Temporary Wells/Subsurface Soil Sampling Location
- Groundwater Contours
- Streams
- Site UXO-14 Boundary (Former Indoor Pistol Range Area)
- Site UXO-14 Boundary (Former Gas Chamber Area)

28.42 - Groundwater Elevation  
 Note: Potentimetric surface contours have been inferred between temporary well locations. Actual conditions may differ from those shown here

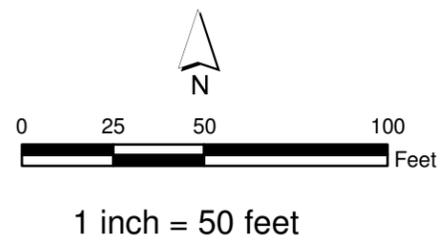


Figure 2-3  
 Groundwater Elevation Map (December 2009)  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLej  
 North Carolina



**Legend**

- Geophysical Anomaly (greater than 3 mV)
- DGM Transect
- Site UXO-14 Boundary (Former Indoor Pistol Range Area)
- Site UXO-14 Boundary (Former Gas Chamber Area)

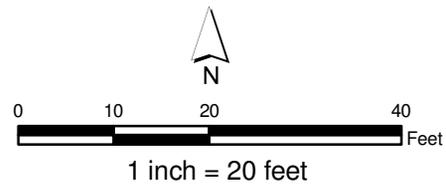
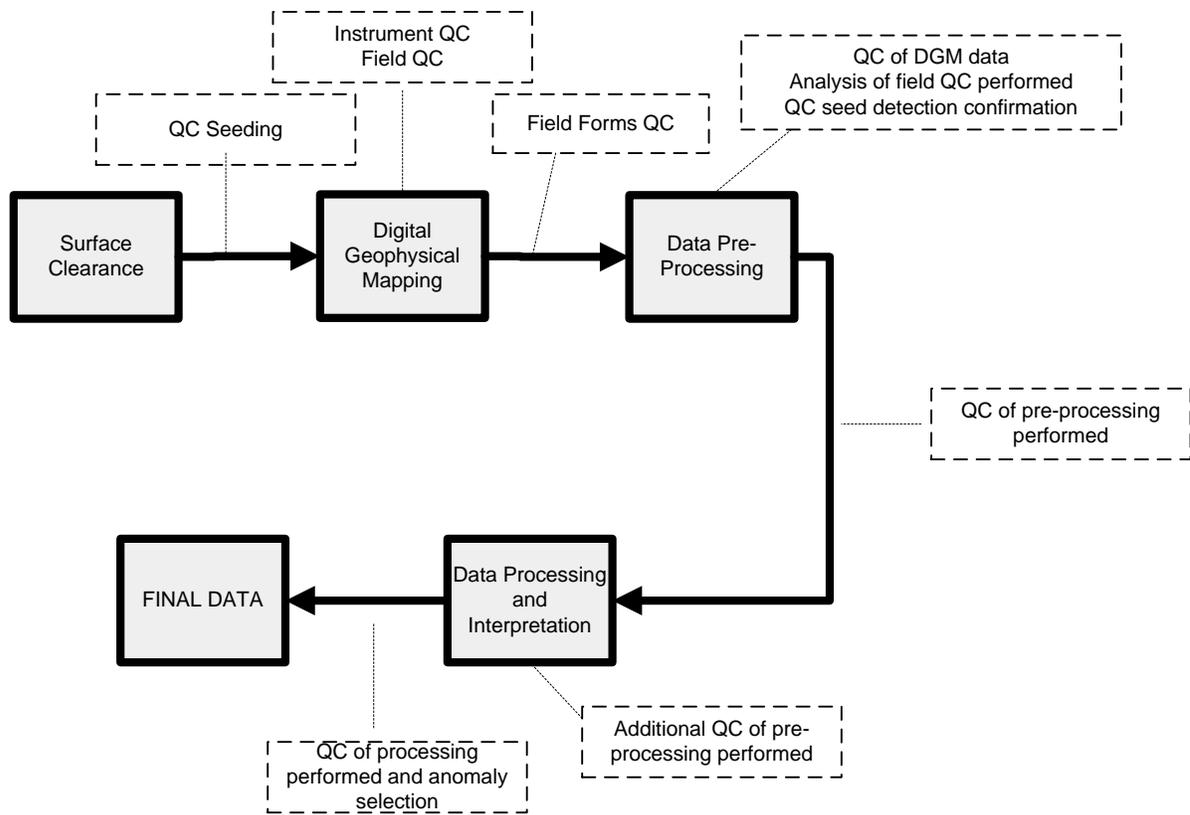


Figure 3-1  
DGM Results and Transect Locations  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina





**FIGURE 3-2**  
 Overview of DGM Process QC  
*Site UXO-14, Former Indoor Pistol Range and Gas Chamber (Rifle Range Area)*  
*PA/SI Report*  
*MCB CamLej*  
*North Carolina*  
*Generated by: David Seed Checked by: Simon Kline*



- Legend**
- Surface Soil Sampling Location
  - Streams
  - Site UXO-14 Boundary (Former Indoor Pistol Range Area)
  - Site UXO-14 Boundary (Former Gas Chamber Area)

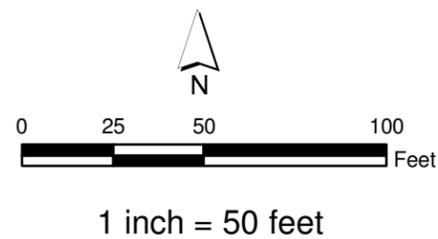


Figure 3-3  
 PA/SI Surface Soil Sampling Locations  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLej  
 North Carolina  




- Legend**
- Temporary Well/Subsurface Soil Sampling Location
  - Streams
  - Site UXO-14 Boundary (Former Indoor Pistol Range Area)
  - Site UXO-14 Boundary (Former Gas Chamber Area)

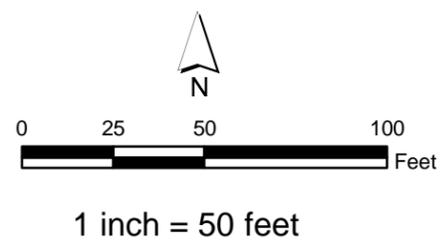
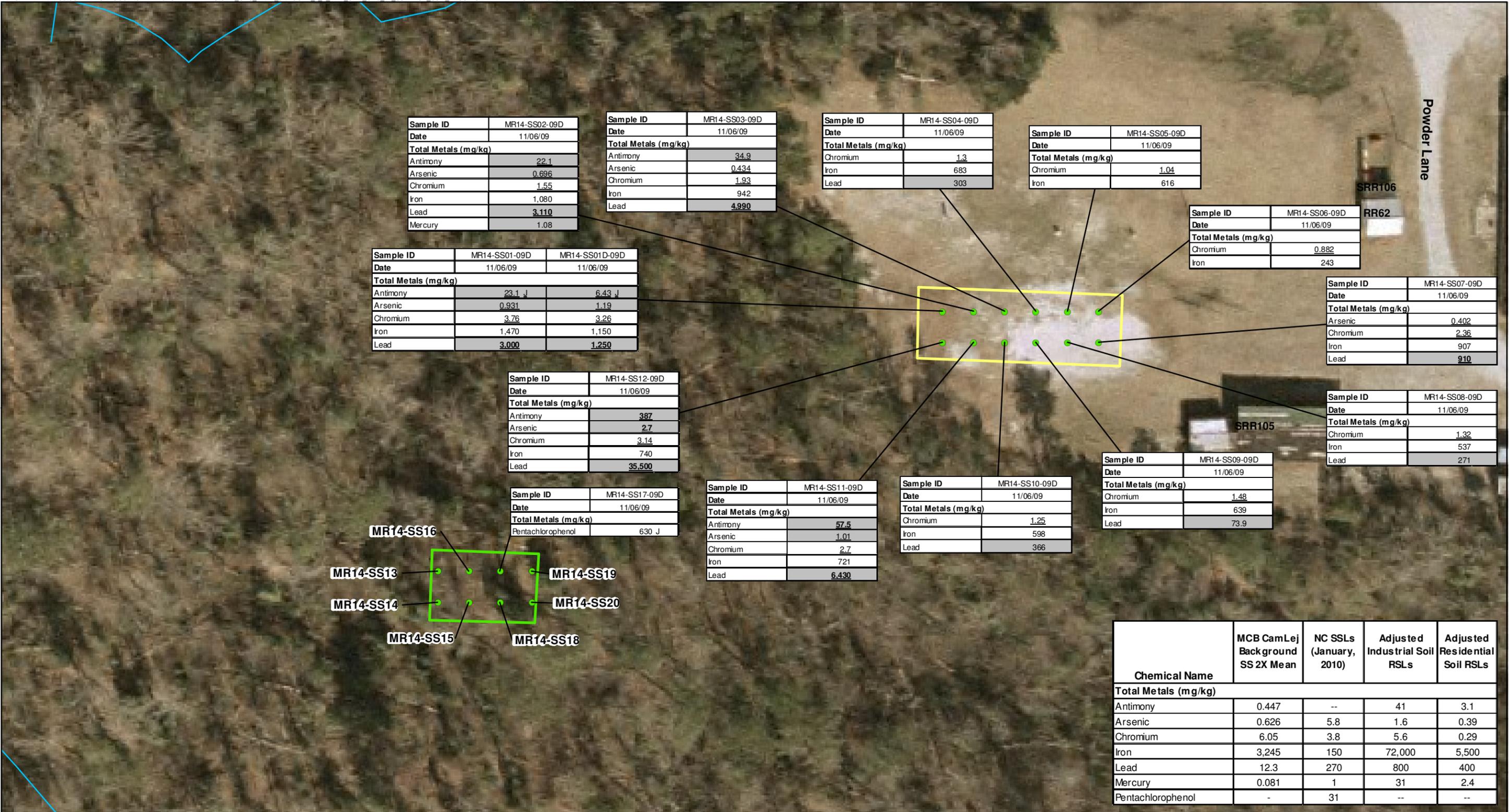


Figure 3-4  
DPT Soil and Groundwater Sampling Locations  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina





Sample ID	MR14-SS02-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Antimony	22.1
Arsenic	0.696
Chromium	1.55
Iron	1,080
Lead	<b>3,110</b>
Mercury	1.08

Sample ID	MR14-SS03-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Antimony	34.9
Arsenic	0.434
Chromium	1.93
Iron	942
Lead	<b>4,990</b>

Sample ID	MR14-SS04-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Chromium	1.3
Iron	683
Lead	303

Sample ID	MR14-SS05-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Chromium	1.04
Iron	616

Sample ID	MR14-SS06-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Chromium	0.882
Iron	243

Sample ID	MR14-SS01-09D	MR14-SS01D-09D
Date	11/06/09	11/06/09
<b>Total Metals (mg/kg)</b>		
Antimony	23.1 J	6.43 J
Arsenic	0.931	1.19
Chromium	3.76	3.26
Iron	1,470	1,150
Lead	<b>3,000</b>	<b>1,250</b>

Sample ID	MR14-SS07-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Arsenic	0.402
Chromium	2.36
Iron	907
Lead	<b>910</b>

Sample ID	MR14-SS12-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Antimony	387
Arsenic	2.7
Chromium	3.14
Iron	740
Lead	<b>35,500</b>

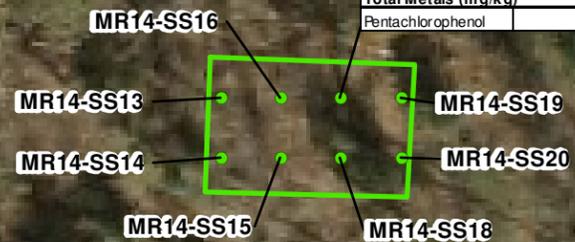
Sample ID	MR14-SS08-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Chromium	1.32
Iron	537
Lead	271

Sample ID	MR14-SS11-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Antimony	57.5
Arsenic	1.01
Chromium	2.7
Iron	721
Lead	<b>6,430</b>

Sample ID	MR14-SS10-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Chromium	1.25
Iron	598
Lead	366

Sample ID	MR14-SS09-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Chromium	1.48
Iron	639
Lead	73.9

Sample ID	MR14-SS17-09D
Date	11/06/09
<b>Total Metals (mg/kg)</b>	
Pentachlorophenol	630 J



Chemical Name	MCB CamLej Background SS 2X Mean	NC SSLs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs
<b>Total Metals (mg/kg)</b>				
Antimony	0.447	--	41	3.1
Arsenic	0.626	5.8	1.6	0.39
Chromium	6.05	3.8	5.6	0.29
Iron	3,245	150	72,000	5,500
Lead	12.3	270	800	400
Mercury	0.081	1	31	2.4
Pentachlorophenol	-	31	--	--

- Legend**
- Surface Soil Sampling Location
  - Site UXO-14 Boundary (Former Indoor Pistol Range Area)
  - Site UXO-14 Boundary (Former Gas Chamber Area)
  - Streams

- Notes:**
- Shading indicates exceedance of two times the mean base background concentration for surface soil
  - **Bold text indicates exceedance of NC SSLs**
  - **Bold text indicates exceedance of Adjusted Industrial Soil RSLs**
  - Underline indicates exceedance of Adjusted Residential Soil RSLs
  - RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
  - mg/kg - Milligrams per kilogram
  - µg/kg - Micrograms per kilogram
  - J - Analyte present, value may or may not be accurate or precise

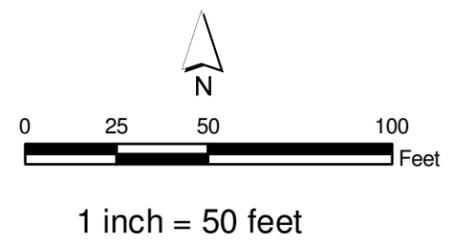
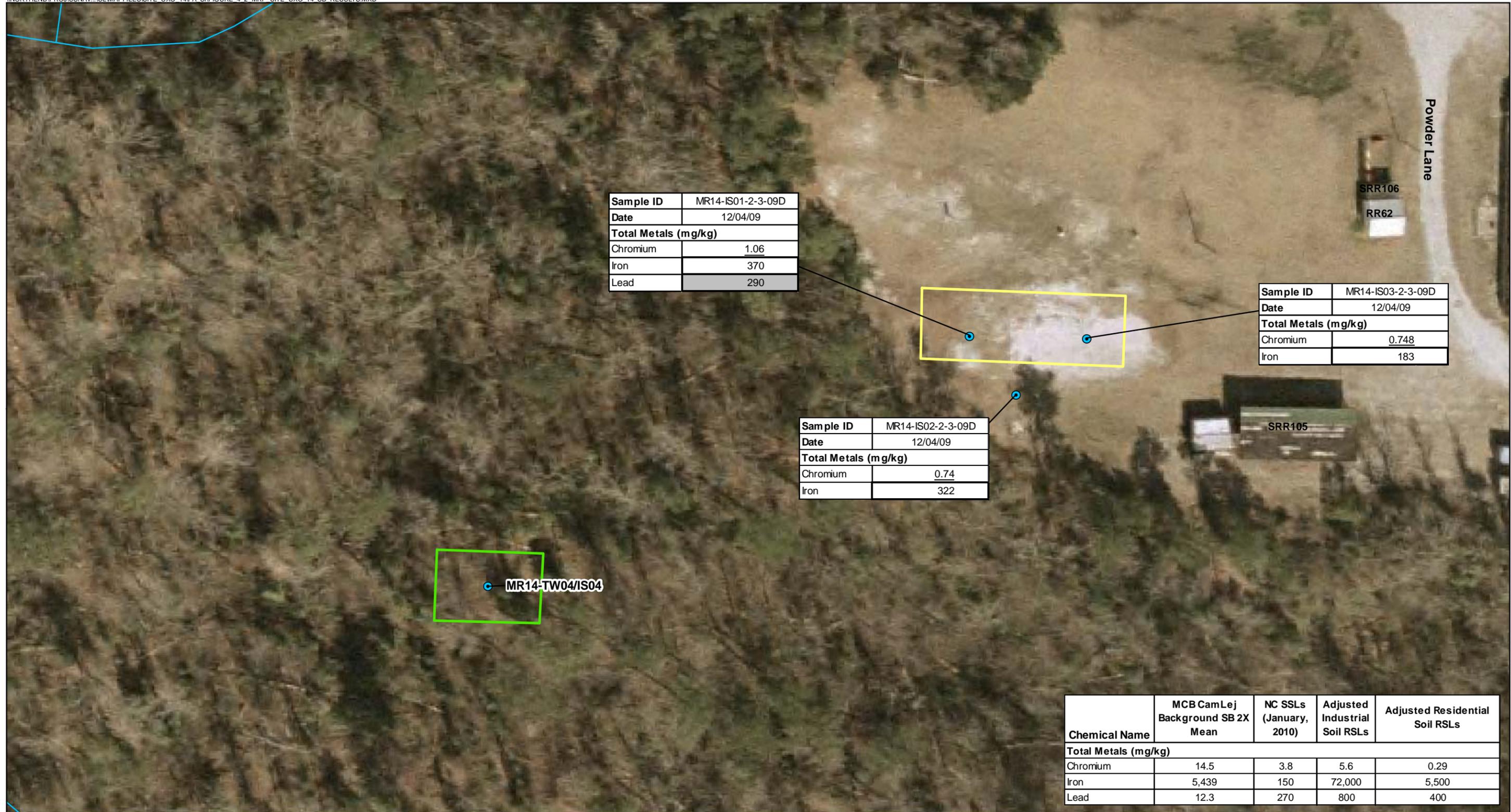


Figure 4-1  
 Surface Soil Exceedances  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLej  
 North Carolina



Sample ID	MR14-IS01-2-3-09D
Date	12/04/09
<b>Total Metals (mg/kg)</b>	
Chromium	<u>1.06</u>
Iron	370
Lead	290

Sample ID	MR14-IS03-2-3-09D
Date	12/04/09
<b>Total Metals (mg/kg)</b>	
Chromium	<u>0.748</u>
Iron	183

Sample ID	MR14-IS02-2-3-09D
Date	12/04/09
<b>Total Metals (mg/kg)</b>	
Chromium	<u>0.74</u>
Iron	322

MR14-TW04/IS04

Chemical Name	MCB CamLej Background SB 2X Mean	NC SSLs (January, 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs
<b>Total Metals (mg/kg)</b>				
Chromium	14.5	3.8	5.6	0.29
Iron	5,439	150	72,000	5,500
Lead	12.3	270	800	400

- Legend**
- Subsurface Soil Sampling Location
  - Streams
  - ▭ Site UXO-14 Boundary (Former Indoor Pistol Range Area)
  - ▭ Site UXO-14 Boundary (Former Gas Chamber Area)

Notes:

- Shading indicates exceedance of two times the mean base background concentration for surface soil
- **Bold text indicates exceedance of NC SSLs**
- **Bold text indicates exceedance of Adjusted Industrial Soil RSLs**
- Underline indicates exceedance of Adjusted Residential Soil RSLs
- RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
- mg/kg - Milligrams per kilogram

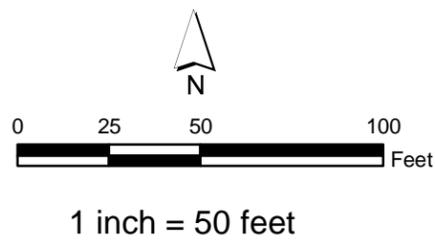
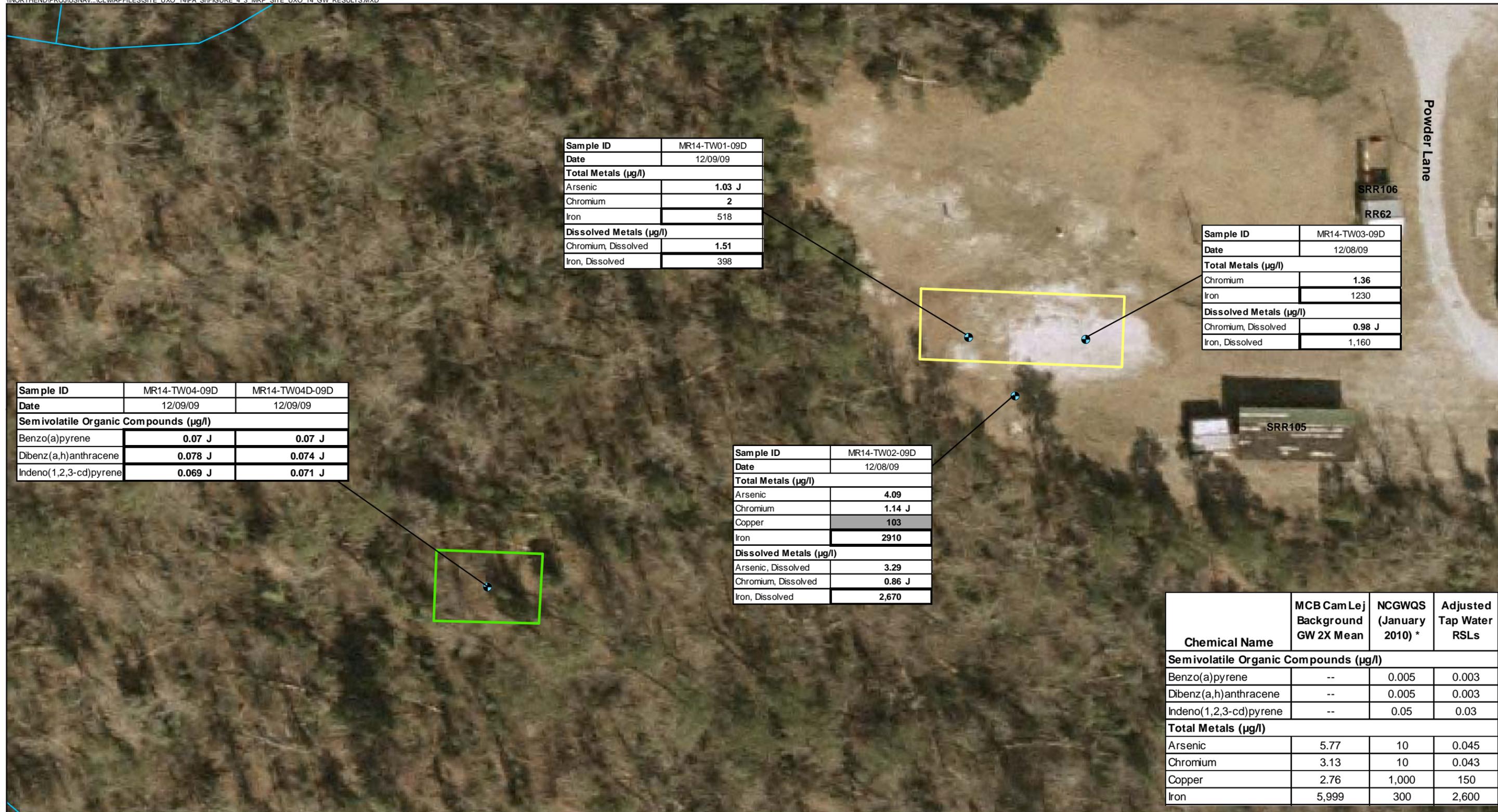


Figure 4-2  
 Subsurface Soil Exceedances  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLej  
 North Carolina



Sample ID	MR14-TW01-09D
Date	12/09/09
<b>Total Metals (µg/l)</b>	
Arsenic	<b>1.03 J</b>
Chromium	<b>2</b>
Iron	518
<b>Dissolved Metals (µg/l)</b>	
Chromium, Dissolved	<b>1.51</b>
Iron, Dissolved	398

Sample ID	MR14-TW03-09D
Date	12/08/09
<b>Total Metals (µg/l)</b>	
Chromium	<b>1.36</b>
Iron	1230
<b>Dissolved Metals (µg/l)</b>	
Chromium, Dissolved	<b>0.98 J</b>
Iron, Dissolved	1,160

Sample ID	MR14-TW04-09D	MR14-TW04D-09D
Date	12/09/09	12/09/09
<b>Semivolatile Organic Compounds (µg/l)</b>		
Benzo(a)pyrene	<b>0.07 J</b>	<b>0.07 J</b>
Dibenz(a,h)anthracene	<b>0.078 J</b>	<b>0.074 J</b>
Indeno(1,2,3-cd)pyrene	<b>0.069 J</b>	<b>0.071 J</b>

Sample ID	MR14-TW02-09D
Date	12/08/09
<b>Total Metals (µg/l)</b>	
Arsenic	<b>4.09</b>
Chromium	<b>1.14 J</b>
Copper	<b>103</b>
Iron	2910
<b>Dissolved Metals (µg/l)</b>	
Arsenic, Dissolved	<b>3.29</b>
Chromium, Dissolved	<b>0.86 J</b>
Iron, Dissolved	2,670

Chemical Name	MCB CamLej Background GW 2X Mean	NCGWQS (January 2010) *	Adjusted Tap Water RSLs
<b>Semivolatile Organic Compounds (µg/l)</b>			
Benzo(a)pyrene	--	0.005	0.003
Dibenz(a,h)anthracene	--	0.005	0.003
Indeno(1,2,3-cd)pyrene	--	0.05	0.03
<b>Total Metals (µg/l)</b>			
Arsenic	5.77	10	0.045
Chromium	3.13	10	0.043
Copper	2.76	1,000	150
Iron	5,999	300	2,600

**Legend**

- Temporary Well Location
- Streams
- Site UXO-14 Boundary (Former Indoor Pistol Range Area)
- Site UXO-14 Boundary (Former Gas Chamber Area)

- Notes:**
- Shading indicates exceedance of two times the mean base background concentration for surface soil
  - **Bold box indicates exceedance of NCGWQS or the more conservative MCL**
  - **Bold text indicates exceedance of Adjusted Tap Water RSLs**
  - RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
  - \* - The MCL-Groundwater value is reported in place of the NC2LWG where the MCL value is more conservative.
  - µg/L - Micrograms per liter
  - J - Analyte present, value may or may not be accurate or precise

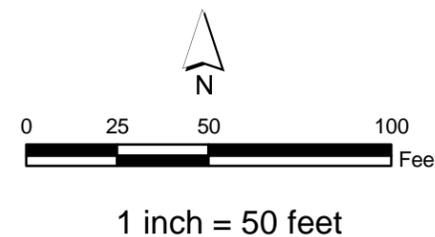
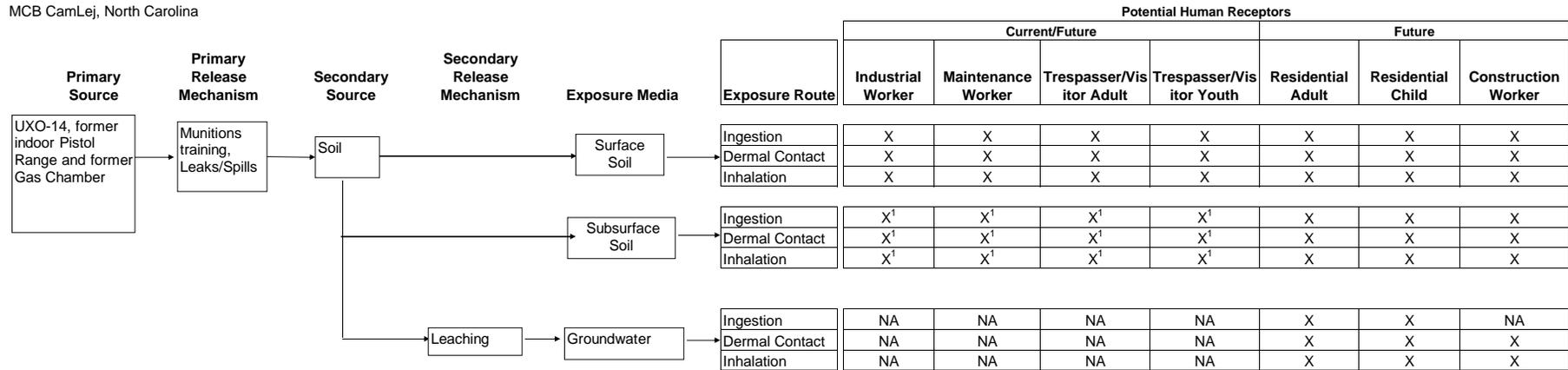


Figure 4-3  
Groundwater Exceedances  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina



**FIGURE 5-1**  
 Conceptual Site Model for HHRA  
 UXO-14, Former Indoor Pistol Range and Gas Chamber  
 MCB CamLej, North Carolina



<sup>1</sup>Current receptor populations may be exposed to surface soil. Future receptor populations may be exposed to surface and subsurface soil.

NA - Not Applicable or pathway is incomplete

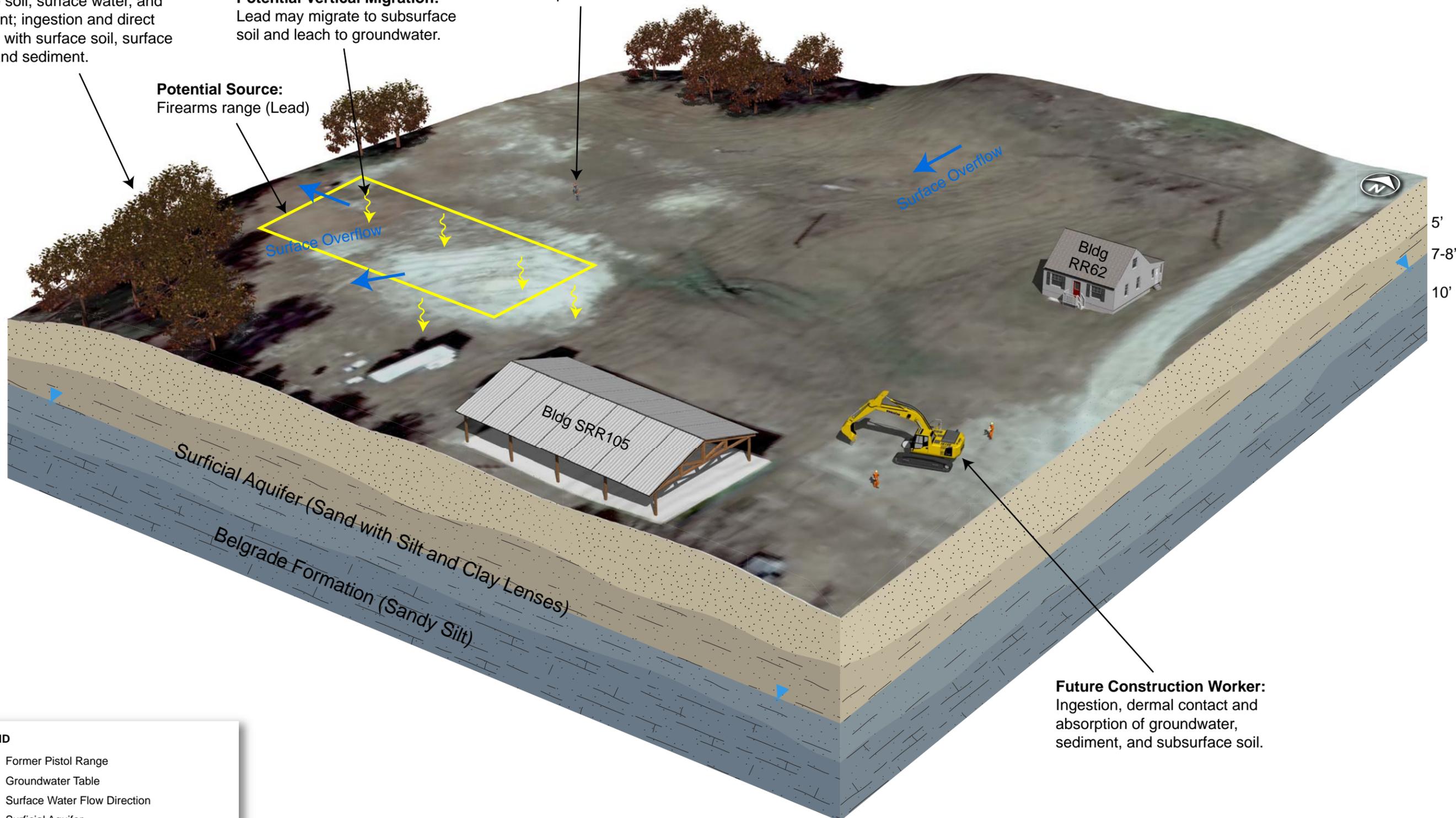
X - Potentially complete exposure pathways

**Terrestrial Flora and Invertebrates:**  
Direct contact and root uptake from surface soil, surface water, and sediment; ingestion and direct contact with surface soil, surface water and sediment.

**Potential Vertical Migration:**  
Lead may migrate to subsurface soil and leach to groundwater.

**Trespasser/Visitor:** Ingestion and dermal contact of surface water and sediment; Inhalation and dermal absorption of surface soil.

**Potential Source:**  
Firearms range (Lead)



**Future Construction Worker:**  
Ingestion, dermal contact and absorption of groundwater, sediment, and subsurface soil.

**LEGEND**

- ▬ Former Pistol Range
- ▼ Groundwater Table
- Surface Water Flow Direction
- Surficial Aquifer
- Poorly Graded Sand
- Silty-Clayey Sand
- Sand and Clay Mix

FIGURE 7-1  
3-D Conceptual Site Model  
UXO-14 Former Pistol Range  
MCB Camp Lejeune  
North Carolina

Appendix A  
MSRPP QA Report

---

# QA Panel Report

9/22/2010

**Site Name:** UXO 000014 - RIFLE RANGE  
CANTONMENT

**Site POC:** CLELAND DAVID

**Site Location:** CAMP LEJEUNE NC MCB

**Stakeholder Participation:** No

**Cognizant FEC:** MIDLANT

**Regulatory Participation:** No

**Last QA Date:**

**Last QA MRS Priority:**

## Site Description:

MRP Site UXO-14—Rifle Range (ASR# 2.199) and Gas Chamber (ASR# 2.200). The 2 acre Pistol Range (Building RR-53) is located within the Rifle Range area of the Base was reportedly utilized from 1950 to 1996. During operation of the range, small arms were used to fire at a fixed target. The Gas Chamber (Building RR-63) was reportedly in use from 1950 through 1954 and is thought to have primarily used tear gas. The Draft PA/SI is complete and metals contamination in soil identified at the former pistol range and geophysical anomalies are present at the former gas chamber. Additional investigation planned.

## Factors Affecting the Change in MRS Priority:

New data obtained through further study resulting in a revision to one or more subordinate MRSP ratings that had previously been completed

## Reason for Addressing the MRSP Site out of Sequence:

Mission-driven requirements

### Summary

<b>Overall MRS Priority:</b> 6	<b>MRS Priority Source:</b> CHE	
<b>EHE Priority:</b> 7	<b>EHE Rating:</b> F	<b>EHE Score:</b> 41
<b>CHE Priority:</b> 6	<b>CHE Rating:</b> F	<b>CHE Score:</b> 40
<b>HHE Priority:</b> EP	<b>HHE Rating:</b>	<b>HHE Priority Source:</b>

**EHE Priority:7      EHE Score: 41      EHE Rating: F**

## Explosive Hazard Factor Data Elements

*Table 1*

*EHE Module: Munitions Type Data Element Table*

Classification	Score
<i>Riot control;</i>	3
<i>Small arms;</i>	2
<b>Munitions Type</b>	<b>3</b>

### Description:

Former range and gas chamber (potential for riot control).

*Table 2*

*EHE Module: Source of Hazard Data Element Table*

Classification	Score
<i>Former range;</i>	10
<b>Source of Hazard</b>	<b>10</b>

### Description:

N/A

**Accessibility Factor Data Elements**

**Table 3**  
***EHE Module: Location of Munitions Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>Suspected (historical evidence);</i>	5
<i>Small arms (regardless of location);</i>	1
<b>Location of Munitions</b>	<b>5</b>

**Description:**

DGM conducted at gas chamber and 17 geophysical anomalies were identified.

**Table 4**  
***EHE Module: Ease of Access Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>Barrier to MRS access is incomplete;</i>	8
<b>Ease of Access</b>	<b>8</b>

**Description:**

Base is fenced but site is accessible within the Base boundary.

**Table 5**  
***EHE Module: Status of Property Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>DoD control;</i>	0
<b>Status of Property</b>	<b>0</b>

**Description:**

Base is fenced but site is accessible within the Base boundary.

**Receptor Factor Data Elements**

**Table 6**  
***EHE Module: Population Density Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>&gt; 500 persons per square mile;</i>	5
<b>Population Density</b>	<b>5</b>

**Description:**

The Base has an active duty, dependent, retiree, and civilian employee population of approximately 150,000 people. The density of the surrounding population is 196 persons per square mile within a 2-mile radius of the MRS boundary. Based on the 2008 census, the population of the City of Jacksonville is over 65,000 and Onslow County is over 165,000.

**Table 7**  
***EHE Module: Population Near Hazard Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>26 or more inhabited structures;</i>	5
<b>Population Near Hazard</b>	<b>5</b>

**Description:**

No inhabited structures located within the MRS boundary. Approximately 130 structures are located within a 2 mile radius of the MRS boundary, at least 47 of them appear to be inhabited structures.

**Table 8**  
***EHE Module: Types of Activities/Structures Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>Residential, educational, commercial, or subsistence;</i>	5
<i>Parks and recreational areas;</i>	4
<i>Agricultural, forestry;</i>	3
<i>Industrial or warehousing;</i>	2
<b>Types of Activities/Structures</b>	<b>5</b>

**Description:**

N/A

**Table 9**  
***EHE Module: Ecological and/or Cultural Resources Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>No known or recurring activities;</i>	0
<b>Ecological and/or Cultural Resources</b>	<b>0</b>

**Description:**

N/A

**CHE Priority: 6      CHE Score: 40      CHE Rating: F**

**CWM Hazard Factor Data Elements**

**Table 11**  
***CHE Module: CWM Configuration Data Element Table***

<b>Classification</b>	<b>Score</b>
<i>CAIS (chemical agent identification sets);</i>	10
<b>CWM Configuration</b>	<b>10</b>

**Description:**

Former gas chamber, because it is unknown whether CAIS sets with CWM were used, it is assumed.

**Table 12**

**CHE Module: Sources of CWM Data Element Table**

Classification	Score
<i>Former Training Facility using CWM or CAIS;</i>	2
<b>CWM Configuration</b>	<b>2</b>

**Description:**

Former gas chamber, because it is unknown whether CAIS sets with CWM were used, it is assumed.

**Accessibility Factor Data Elements**

**Table 13**  
**CHE Module: Location of CWM Data Element Table**

Classification	Score
<i>Suspected (physical evidence);</i>	10
<b>Location of CWM</b>	<b>10</b>

**Description:**

DGM conducted at gas chamber and 17 geophysical anomalies were identified.

**Table 14**  
**CHE Module: Ease of Access Data Element Table**

Classification	Score
<i>Barrier to MRS access is incomplete;</i>	8
<b>Ease of Access</b>	<b>8</b>

**Description:**

Base is fenced but site is accessible within the Base boundary.

**Table 15**  
**CHE Module: Status of Property Data Element Table**

Classification	Score
<i>DoD control;</i>	0
<b>Status of Property</b>	<b>0</b>

**Description:**

Base is fenced but site is accessible within the Base boundary.

**Receptor Factor Data Elements**

**Table 16**  
**CHE Module: Population Density Data Element Table**

Classification	Score
<i>&gt; 500 persons per square mile;</i>	5

**Population Density** **5**

**Description:**

The Base has an active duty, dependent, retiree, and civilian employee population of approximately 150,000 people. The density of the surrounding population is 196 persons per square mile within a 2-mile radius of the MRS boundary. Based on the 2008 census, the population of the City of Jacksonville is over 65,000 and Onslow County is over 165,000.

**Table 17**  
**CHE Module: Population Near Hazard Data Element Table**

Classification	Score
<i>26 or more inhabited structures;</i>	5
<b>Population Near Hazard</b>	<b>5</b>

**Description:**

No inhabited structures located within the MRS boundary. Approximately 130 structures are located within a 2 mile radius of the MRS boundary, at least 47 of them appear to be inhabited structures.

**Table 18**  
**CHE Module: Types of Activities/Structures Data Element Table**

Classification	Score
<i>Residential, educational, commercial, or subsistence;</i>	5
<i>Parks and recreational areas;</i>	4
<i>Agricultural, forestry;</i>	3
<i>Industrial or warehousing;</i>	2
<b>Types of Activities/Structure</b>	<b>5</b>

**Description:**

N/A

**Table 19**  
**CHE Module: Ecological and/or Cultural Resources Data Element Table**

Classification	Score
<i>No known or recurring activities;</i>	0
<b>Ecological and/or Cultural Resources</b>	<b>0</b>

**Description:**

N/A

HHE Priority: EP	HHE Rating:	HHE Source:
<b>Health Hazard Priority:</b>	EP	
<b>Receptor Description:</b>	Evaluation pending. Environmental media sampling and risk screenings were conducted during PA/SI and no unacceptable risks identified. Data will be loaded to the model in November 2010.	
<b>Pathway Description:</b>	Evaluation pending. Environmental media sampling and risk screenings were conducted during PA/SI and no unacceptable risks identified. Data will be loaded to the model in	



---

*Sediment Eco*

**CHF:** 0

**MPF:**

**RF:**

**Rating:** N/A

**Priority:** EP

**Migration Pathway Factor Desc:**

N/A

**Receptor Factor Desc:**

N/A

---

*Soil*

**CHF:** 101.233871

**MPF:**

**RF:**

**Rating:** N/A

**Priority:** EP

**Migration Pathway Factor Desc:**

N/A

**Receptor Factor Desc:**

N/A

**Appendix B**  
**Archival Records Search Report**

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Final

**Archival Records Search Report for the Preliminary  
Assessment/Site Inspection of Site UXO-14, Former  
Site of Indoor Pistol Range and Gas Chamber (Rifle  
Range Area) ASR #2.199 and #2.200**

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

**Contract Task Order 0014**

**June 2009**

Prepared for

**Department of the Navy  
Naval Facilities Engineering Command  
Mid-Atlantic**

Under the

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

Prepared by



**CH2MHILL**

**Raleigh, North Carolina**

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<b>2 Site Information.....</b>	<b>2-1</b>
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2.2 Ownership and Operational History .....	2-1
2.2.1 Camp Lejeune Ownership History .....	2-1
2.2.2 Site UXO-14 Former Site of Indoor Pistol Range and Gas Chamber ASR #2.199 and #2.200.....	2-1
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## Figures

1-1	Site UXO-14 Location Map
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2-2	Site UXO-14 Proximity Map- 1951
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## Attachments

1	Resource Review Summary
2	Historical Aerial Photographs
3	Ordnance Technical Sheets, Small Arms Munitions, and Gas Identifier Technical Data Sheets

# Acronyms and Abbreviations

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

## SECTION 1

# Introduction, Purpose, and Scope

---

The United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) are in the process of investigating closed ranges at Marine Corps Base (MCB) Camp Lejeune following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. A munitions response program (MRP) Preliminary Assessment/Site Inspection (PA/SI) included under Contract Task Order (CTO)-0014 will be conducted at Site Unexploded Ordnance (UXO)-14 Former Site of Indoor Pistol Range and Gas Chamber (Rifle Range Area) Archive Search Report (ASR) #2.199 and #2.200 in order to accomplish the following objectives:

- Identify historical activities at Site UXO-14 that may have resulted in environmental contamination with munitions and explosives of concern (MEC) at the former Gas Chamber or munitions constituents (MC) at both areas of investigation
- Evaluate the presence and nature of any MC contamination that may exist at Site UXO-14
- Conduct ecological and human health risk screenings on analytical data collected at Site UXO-14
- Estimate the number and density of geophysical anomalies that may represent subsurface MEC
- Provide geophysical data for future MEC intrusive investigations.

The results of the environmental investigation will determine if any impacts to soil and groundwater have occurred at Site UXO-14 due to past range activities. To support site investigation effort, this archival records search report has been prepared to provide a narrative of the historical activities at Site UXO-14 that may have resulted in environmental contamination with MEC.

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

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

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

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

# Site Information

---

## 2.1 Facility Information

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

## 2.2 Ownership and Operational History

### 2.2.1 Camp Lejeune Ownership History

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

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

### 2.2.2 Site UXO-14 Former Site of Indoor Pistol Range and Gas Chamber ASR #2.199 and #2.200

Site UXO-14 consists of two sites, the former site of Indoor Pistol Range and Gas Chamber Areas, identified in the *Range Identification and Preliminary Range Assessment* as ASR #2.199 and #2.200, approximately 0.09 acres and 0.04 acres in size respectively. Site UXO-14 is located in the Stones Bay area of MCB Camp Lejeune just west of Powder Lane (**Figure 2-1**). The former Gas Chamber area is heavily wooded and the former Indoor Pistol Range is currently cleared of heavy vegetation.

The Indoor Pistol Range and Gas Chamber appear on a 1951 range overlay map for the Rifle Range Complex (Plate 21 of USACE, 2000) as Features 6 and 5 respectively (**Figure 2-2**). Aerial photographs from 1948 and 1951 clearly depict the pistol range building and a path or road into heavily wooded area where the Gas Chamber is shown to have existed. However, no cleared area can be discerned in the aerial photos indicating the gas chamber building (**Attachment 2**).

The Indoor Pistol Range appears on existing conditions maps from 1950 through 1985 as Building RR-53. **Figure 2-3** shows the location of Building RR-53 in 1950, although the area does not change significantly throughout the years. Existing conditions maps between 1985 and 2005 are unavailable for the area, however according to the *Range Identification and Preliminary Range Assessment*, the Indoor Pistol Range was present on base maps until 1996 (USACE, 2000). The Indoor Pistol Range appears in the 1962 and 1989 historical aerial maps (**Figures 2-4** and **2-5**). According to Base Range Safety Officer, Duane Richardson, the types of munitions used at the Indoor Pistol Range were small arms. Therefore, there should not be UXO issues and most contamination should be contained within the former building areas (Richardson, 2008). Ordnance technical sheets on small arms ammunition are provided in **Attachment 3**.

The Gas Chamber first appeared on the 1950 existing conditions maps as Building RR-63 (**Figure 2-2**); it continued to be labeled as a Gas Chamber until 1954. After 1954, Building RR-63 was used as a storage building and was present on existing conditions maps until 1965. Building RR-63 does not appear on the 1962 historical aerial, the area is completely overgrown (**Figure 2-4**). The 1989 historical aerial, **Figure 2-5**, also shows the area as being heavily wooded. The specific types of munitions used in this Gas Chamber are unknown but chemical-related. It is assumed tear gas was used at this facility.

A 1944 letter to the Commandant General describes the need for chemical warfare training using actual chemical agents:

*It is considered desirable to conduct such decontamination training using actual chemical agents and requiring students to decontaminate equipment, material, and ground that has actually been contaminated. Authority is requested to use war gases in such training...* (NACP, 1944)

A training bulletin from January 1944 authorizes the use of chlorine in gas chamber training. The chlorine cylinders of 25, 50, and 75 pounds were used at that time for gas mask training (NACP, 1944). The *1951 Regimental General Order: Defense against Chemical and Radiological Warfare* describes the training: "... a minimum of two additional hours of gas mask drill will be climaxed by gas chamber training" (NACP, 1951).

General information on toxic gas identification sets that were used during the 1940's and 1950's is provided in **Attachment 3**. Chemicals used in these sets include: mustard, lewisite, mustard-lewisite, chloropicrin, phosgene, chloroacetophenone (CN) gas, and adamsite (USACE, 2000). The presence of chemical warfare training munitions may require the use of personal protective equipment (PPE).

## References

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

National Archives at College Park (NACP) at College Park, Maryland. 1944. *Text Division: Marine Corps Training Bulletin: Use of Chlorine in Training*. Record Group 127 (USMC), Office of the Commandant, General Correspondence. January 19.

NACP. 1951. *Text Division: Regimental General Order Number 39: Defense against Chemical and Radiological Warfare*. Record Group 127 (USMC), Office of the Commandant, General Correspondence. August 28.

Richardson, Duane, Camp Lejeune Range Safety Officer. 2008. Personal Communication. August 19.

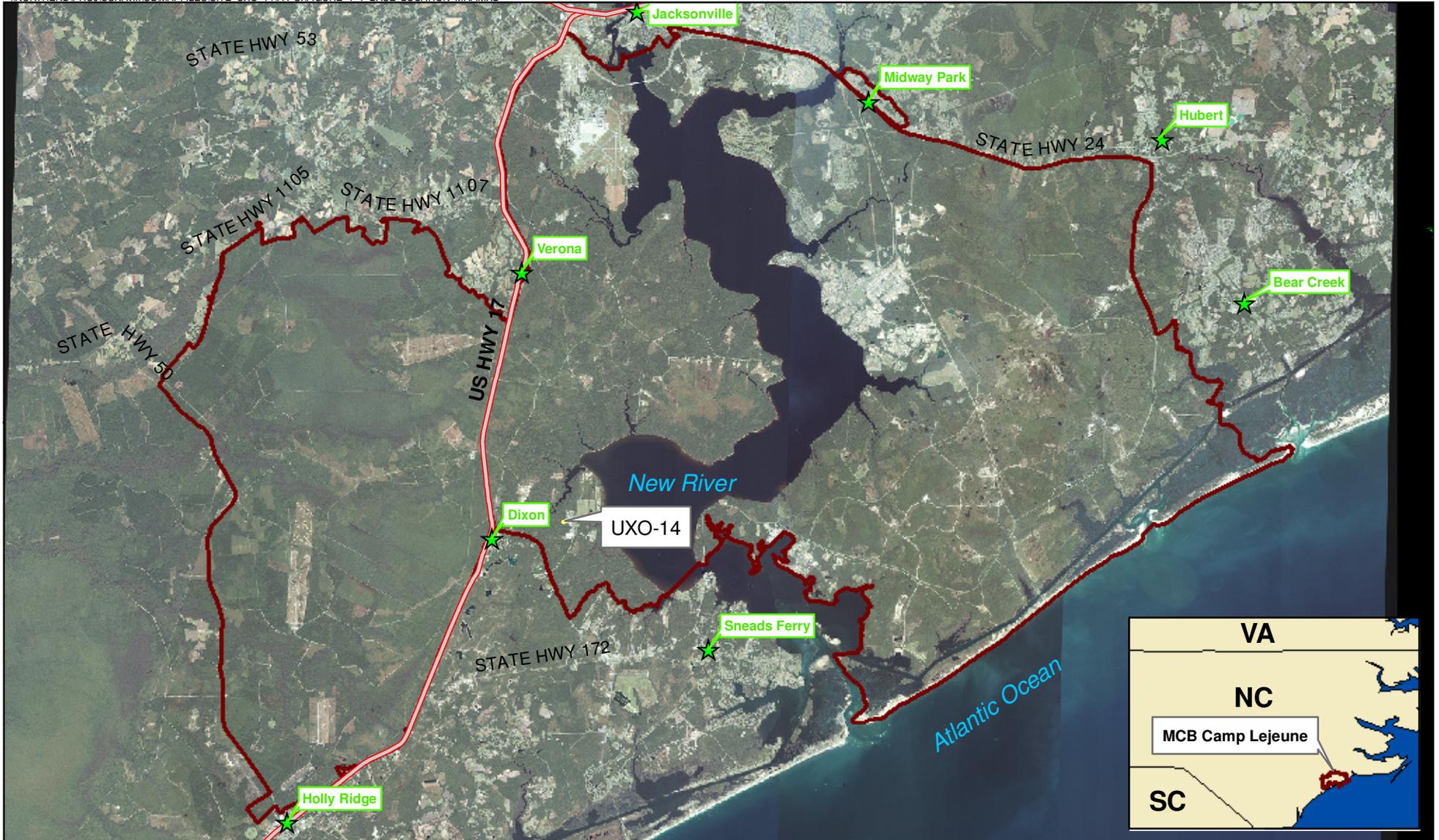
United States Army Corps of Engineers (USACE). 2000. *Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune, Onslow, North Carolina*. St. Louis District. February.

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

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

## Figures

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- Legend**
- ★ Cities
  - Highways
  - Site UXO-14 Boundary
  - Installation Boundary

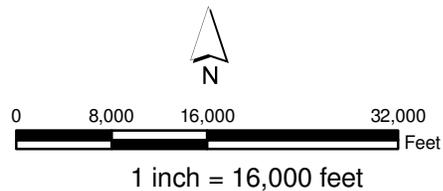


Figure 1-1  
Base Location Map  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199)  
and Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina





**Legend**

- Site UXO-14 Boundary (Former Indoor Pistol Range Area)
- Site UXO-14 Boundary (Former Gas Chamber Area)
- Installation Boundary
- Jurisdictional Wetlands

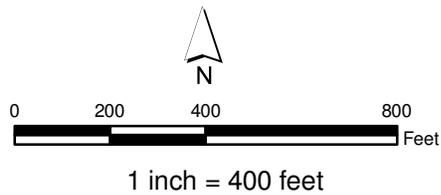
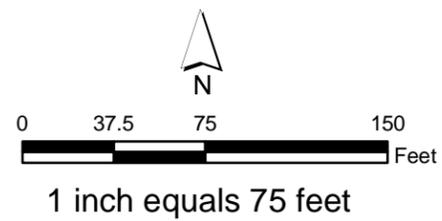


Figure 2-1  
 Site Proximity Map  
 Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
 Gas Chamber (ASR#2.200)  
 PA/SI Report  
 MCB CamLeJ  
 North Carolina





**Legend**  
[Green Box] Sites UXO-14  
[Red Box] Site



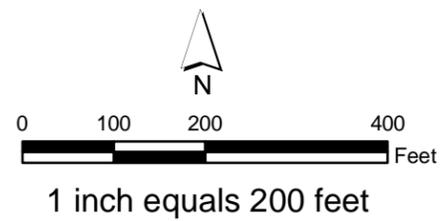
**Figure 2-2**

Site UXO-14  
Historical Aerial – 1962  
[Red Box] MCB CamLej MCB Camp Lejeune  
North Carolina





**Legend**  
Sites UXO-14  
Site



**Figure 2-3**  
Site UXO-14  
Historical Aerial – 1989  
MCB CamLej MCB Camp Lejeune  
North Carolina





**Legend**  
Site UXO-14

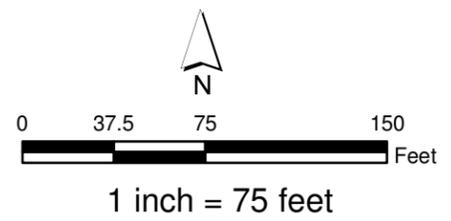


Figure 2-4  
Historical Aerial – 1962  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina





**Legend**  
Site UXO-14

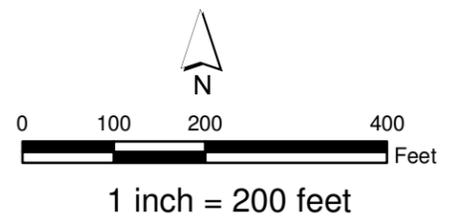


Figure 2-5  
Historical Aerial – 1989  
Site UXO-14, Former Indoor Pistol Range (ASR#2.199) and  
Gas Chamber (ASR#2.200)  
PA/SI Report  
MCB CamLej  
North Carolina  
CH2MHILL

**Attachment 1**  
**Resource Review Summary**

---

ATTACHMENT 1

# Resource Review Summary

---

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

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

## 1.1 Marine Corp Library Review

### History Division: Text

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

Site Visit: August 19, 2008

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

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

## Copied:

1. Training Areas and Facilities. February 16, 1953. Relevant site information and maps of ranges.
2. Camp Lejeune, North Carolina. February 10, 1942. Map of area.
3. Camp Lejeune: Early History. June 1942. Discusses “Miscellaneous Marine Corps Training.”
4. Brief History of Camp Lejeune, North Carolina. August 15, 1954
5. Commandant Letter dated August 25, 1951 – Subject – “Twelve quartermaster warehouses for Camp Lejeune, North Carolina; further justification for.”
6. Camp Lejeune General Map. Date unknown. Map of area.

**History Division: Photographic Division**

Contact: Lena Kaljot

Photo Historian, Historical Reference Branch  
Quantico, Virginia  
(703) 432-4873 DSN 378  
Lena.kaljot@usmc.mil

Site Visit: August 19, 2008

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

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

## Copied:

1. Aerial Photos: Camp Lejeune, NC. Various angles. May 6, 1948.
2. Aerial Photos: Tent Camp, Camp Lejeune. Various angles. June 1946.
3. Aerial Photos: Tent Camp, Camp Lejeune. Various angles. September and December 1948.
4. Aerial Photo: Tent Camp, Camp Lejeune. September 1951.
5. Aerial Photos: Division Training Area, Camp Lejeune. Looking West. September 1948.
6. Aerial Photo: Division Training Area, Camp Lejeune. Looking East. December 23, 1948.
7. Aerial Photo: Magazine Area, Camp Lejeune, NC. Looking South. September 17, 1948.
8. Aerial Photo: Officers Quarters, Camp Lejeune. October 13, 1948.
9. Aerial Photo: Officers Housing Area, Camp Lejeune, NC. September 14, 1951.
10. Aerial Photo: Montford Point, Camp Lejeune, NC. September 22, 1948.
11. Aerial Photo: Camp Knox Area, Camp Lejeune. Looking North. September 22, 1948.
12. Aerial Photo: Rifle Range Area, Camp Lejeune. Various angles. September 17, 1948.
13. Aerial Photo: Rifle Range Area, Camp Lejeune, NC. September 14, 1951.
14. Aerial Photo: Airfield, Camp Lejeune, NC. September 16, 1948.

15. Aerial Photo: New River Administration Building and Circle, Camp Lejeune. August 22, 1944.
16. Aerial Photo: MCAAF Camp Lejeune, NC. October 30, 1947.
17. Aerial Photo: USMCAF, Camp Lejeune, NC. November 5, 1951.
18. Aerial Photo: Peter Point Field, MCAAF, Camp Lejeune, NC. April, 13, 1948.
19. Aerial Photo: Peter Point Field, Camp Lejeune, NC: Building No. PP-106.
20. Seven Aerial Photos of “Unknown dates and locations”.

## Achieve and Special Collections: Maps

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

Site Visit: August 19, 2008

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

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

Copied:

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

## 1.2 National Archives and Records Administration Review

### Text Division

Site visit: August 20-22, 2008

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### List of Documents Obtained from National Archives

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

18. "Regimental General Order Number 39: Defense against Chemical and Radiological Warfare." August 28, 1951.
19. "Regimental Training Order Number 157-52: Training Schedule 4.2 Mortar Co, 16-21 June 1952." June 10, 1952.
20. "Regimental Training Order Number 180-52: Training Program 1 July to 30 September. 1952." June 30, 1952.
21. "Regimental Training Order Number 241-52: Training Program 1 October to 31 December 1952." September 29, 1952.
22. "Regimental Training Order Number 259-52: Preliminary Marksmanship Training Schedule for 6<sup>th</sup> Marines and attached Division Units from 4 to 11 October 1952." October 3, 1952.
23. "Regimental Training Order Number 9-53: Training Program 6 July-3 October 53" June 24, 1953.
24. "Change No.2 to Regimental Training Order Number 8-53: Training Facilities, Maneuver Areas and Firing Ranges" August 20, 1953.
25. "Regimental General Order 92: Interior Guard" October 20, 1953.

## Cartographic Division

Site visit: August 22, 2008

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

## 1.3 MCB Camp Lejeune Base Records Review

Contact: Andrew Smith

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

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

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

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

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

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

“ Site UXO 02 ASR Area 2.201: This one could be a hard one. Other than the list in the manual you have, I have nothing on file. It was very common to bury ammunition, ammunition dunnage, trash in those days and I would be very surprised if we don't have soil and water contamination of some type, to some degree. I am surprised it was so close to the water. This area is heavily wooded now and I am not aware of anything being done in that area after the late 1970. This area will need to be inspected in detail.

Site UXO 07 ASR Area 2.77: It was very common to have a practice hand grenade ranges close to where the Marines lived to make it easy to conduct training. Should not be any live ordnance/UXO in this area, it is in the present built up area of main side so I am sure the dirt berms, surrounding areas have been leveled out. Practice hand grenades had a small fuze (noise maker) and the steel body that was re-useable.

Site UXO 10 ASR Area 2.136: I know this site real good, because I trained there in 1975. We used Demolitions (C-4), White Smoke Grenades, White phosphorous Hand Grenades, and Flame Thrower Weapons and blank ammunition for small arms, presently it is a borrow pit for dirt, large pond, filled with water and woods all around. I would state we have no issues with UXO in that area. If anything I would say the soil in and around the site may be contaminated.

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

Site UXO 12 ASR Area 2.5: Battle Site Zero range dating back to 1942-45, Common practice to pile up a large dirt berm in the units area and set up, small targets next so the rifle sights could be set. Possible lead in the soil issue, area presently very wooded area.

Site UXO 14 ASR 1.199: Indoor Pistol Range/Gas Chamber. Can only assume that it had some type of bullet trap for the pistol range inside some type of structure and the Gas

Chamber would have been in some type of building also. No UXO issues, but we could possibly see contaminated soil issues in and around the site. Area is presently wooded.”

In reference to the 5<sup>th</sup> Area Gun Park:

“Many years ago the old 105mm and 155mm howitzers within 10th Marines (Arty Regt) would park along with the prime mover (Trucks) that pulled the heavy gun. This gun park was very large parking area with concrete pads that the gun would be parked on and gravel roads along with a small shed/metal box for each gun that would hold/store the equipment for that gun. All maintenance on the guns/howitzer would have been conducted here at this location. Training drills would also take place at the site. I would say we have a good chance of fuel/oil and other POL fluids leaking into the soil in and around this area. No ammunition or UXO would be present at this site. Just off O Street.”

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

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

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

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

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

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

### Documents Reviewed at the Base Library

Site Visit: August 20 and 21, 2008

1. Lotfield, Thomas, C. Principal Investigator. UNCW, August 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune; Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp., Vol. II, Contract No. N62470-79-C-4273.*
2. Camp Lejeune Marines, On Land, On Sea, In the Air. Pamphlet (several from 1944 – 1988).

3. Carraway, Gertrude S. Camp Lejeune Leathernecks, United States Marine Corps Training Center, Camp Lejeune, North Carolina. October 1946.
4. Baker Environmental, 1992, Administrative Record (CTO-0021) *Section 1: Site Identification- Correspondence*. May

Copies from Baker Source:

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

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

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

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

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

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

**Attachment 2**  
**Historical Aerial Photographs**

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Site UXO-14

725 2 MAW 1430Z 6" 4,000' RIFLE RANGE, CAMP LEJEUNE N.C. RESTRICTED

**Attachment 3**  
**Ordnance Technical Sheets, Small Arms**  
**Munitions, Gas Identifier Technical Data Sheets**

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# SMALL-ARMS AMMUNITION

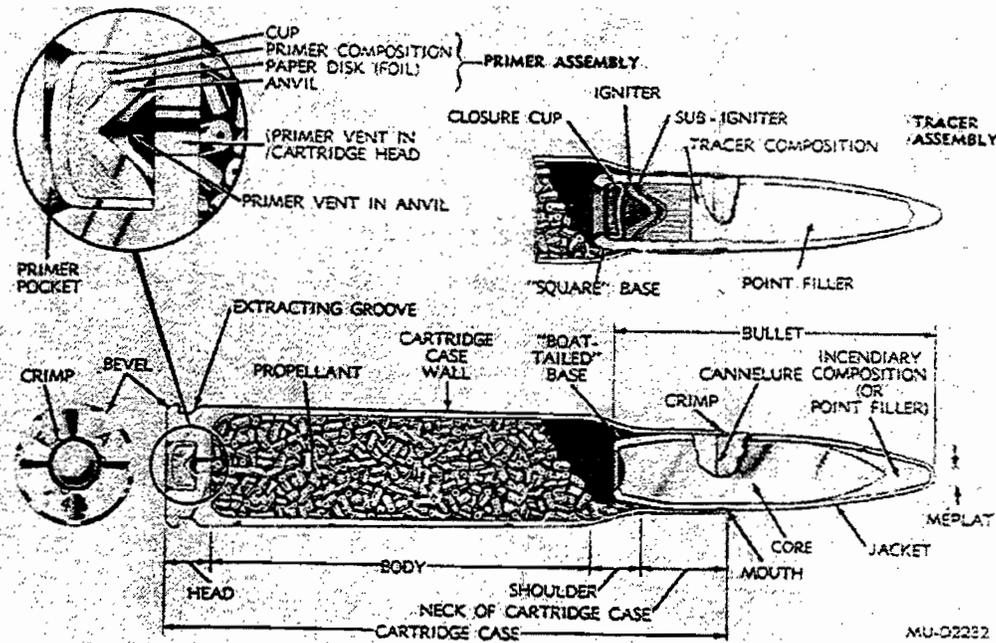
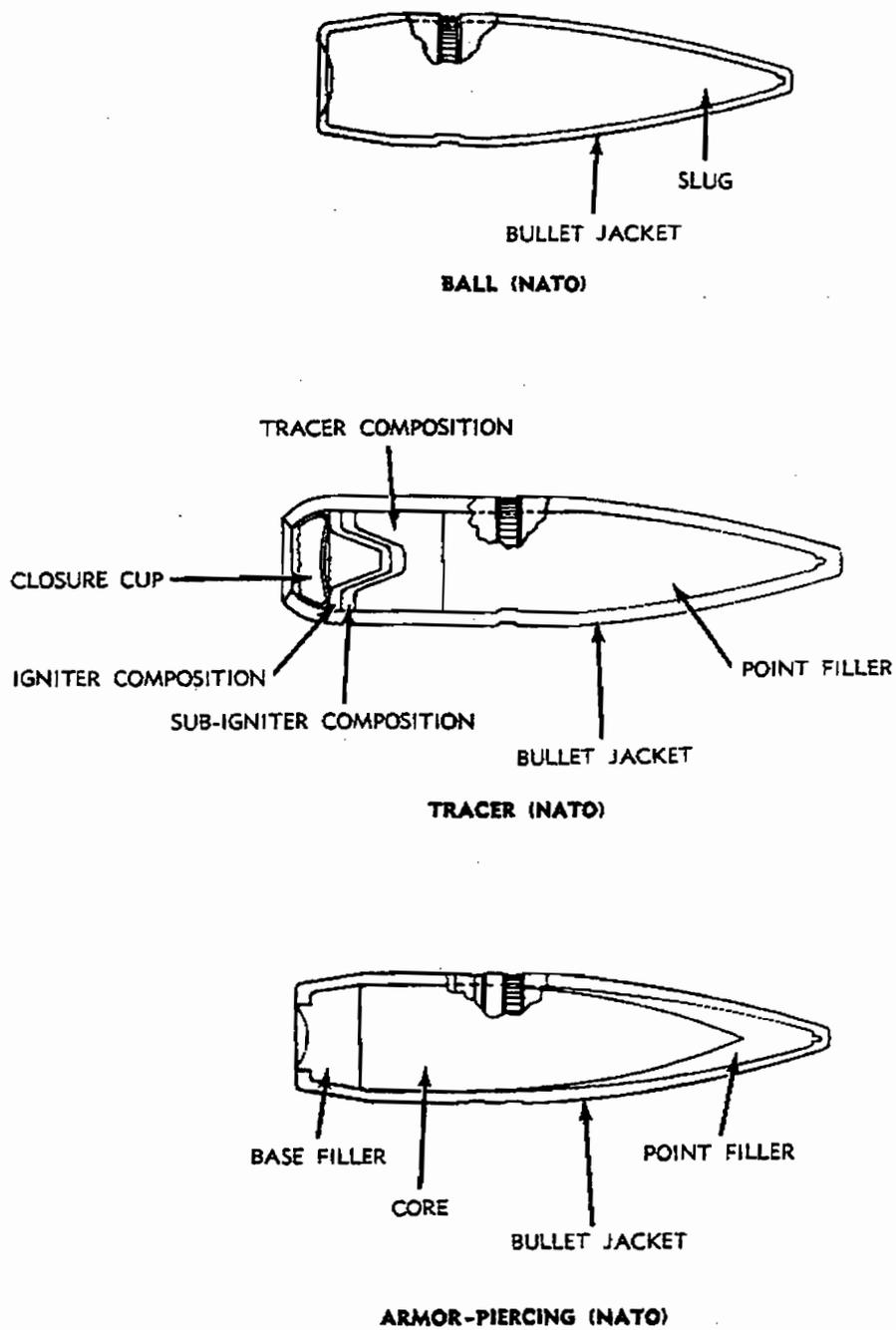


Figure 1. Typical cartridge (sectional)

**General.** Small-arms ammunition, as used herein, describes a cartridge or families of cartridges intended for use in various types of hand-held or mounted weapons through 30 millimeter. Within a caliber designation, these weapons may include one or more of the following: rifles (except recoilless), carbines, pistols, revolvers, machineguns and shotguns. For purposes of this publication, small-arms ammunition may be grouped as cartridges intended primarily for combat or training purposes (API, HEI, tracer or ball); for training purposes only (blank or dummy); or for special purposes (rifle grenade or spotter-tracer). Refer to TM 9-1306-200 for more detailed information on small-arms ammunition.

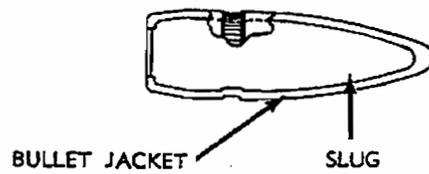
**Cartridges.** In general, a small-arms cartridge is identified as an assembly of a cartridge case, primer, a quantity of propellant within the cartridge case, and a bullet or projectile. Blank and rifle grenade cartridges are sealed with paper closure disks in lieu of bullets. Dummy cartridges are composed of a cartridge case and a bullet. Some dummy cartridges contain inert granular materials to simulate the weight and balance of live cartridges. A typical cartridge and the terminology of its components are shown in figure 1.

**Case.** Although steel, aluminum, zinc and plastic materials have been used experimentally, brass, a composition of 70 percent copper and 30 percent zinc, is the most commonly used material for cartridge cases. Steel, as well as brass, is an approved material for caliber .45 cartridge cases. Brass, paper and plastic are used for 12 gage shotshell bodies and aluminum is used for military-type .410 gage shotshell bodies.

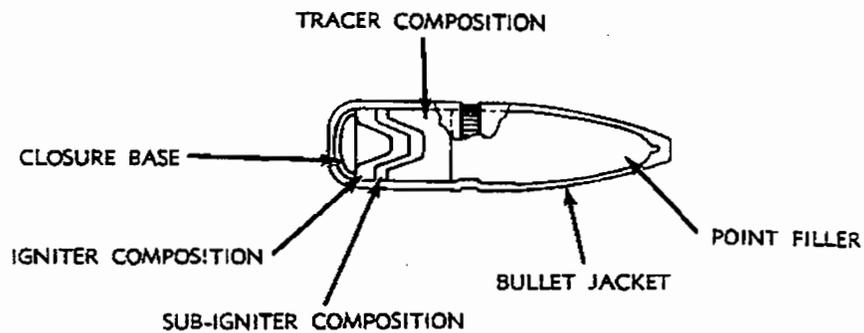


MU-D 2233

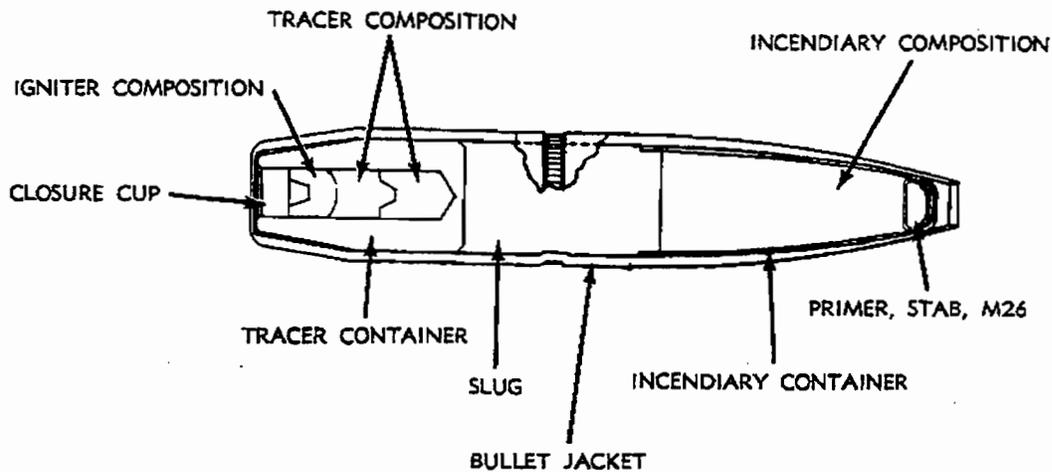
Figure 2. 7.62 mm bullets (sectional)



**5.56 MM BALL**



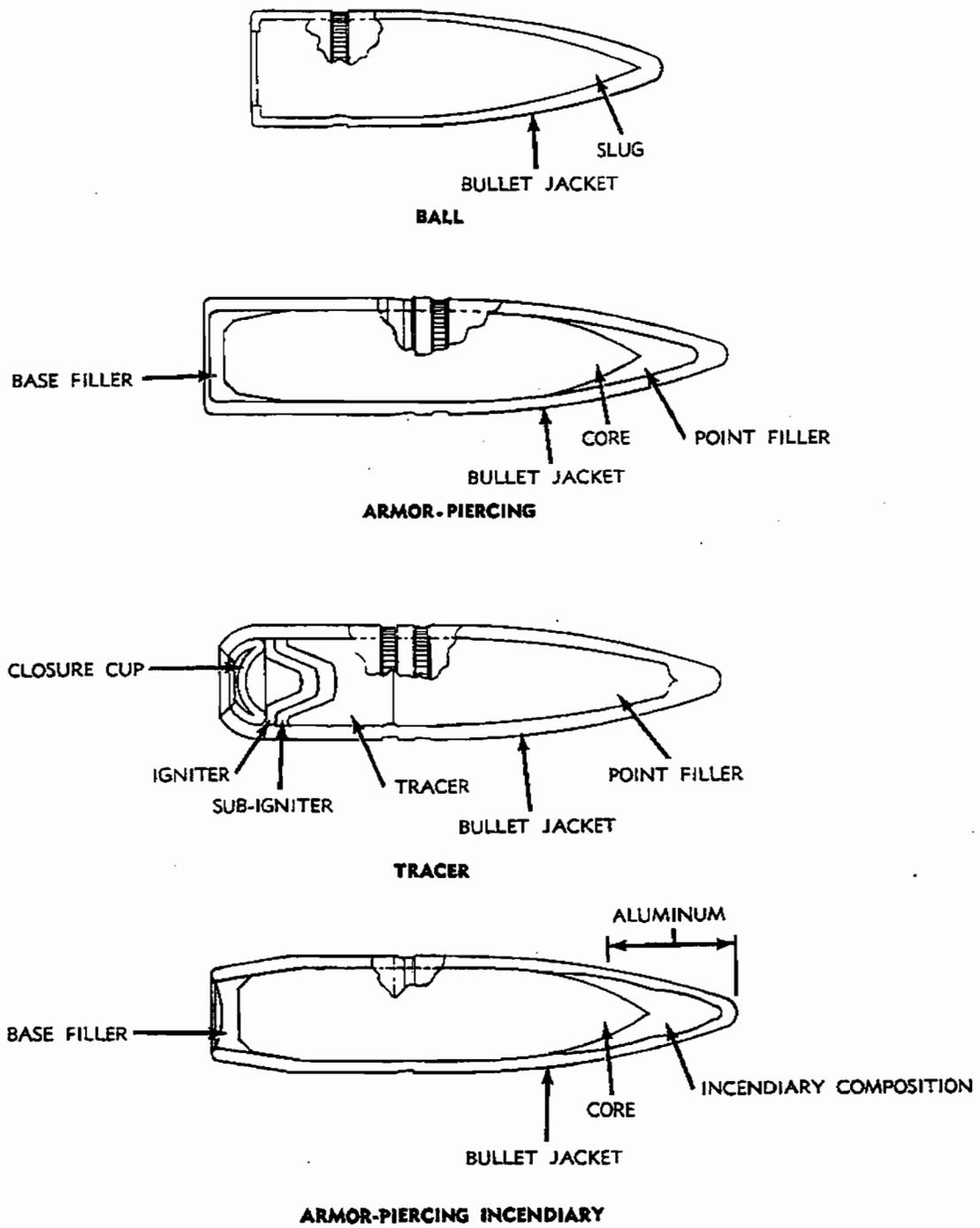
**5.56 MM TRACER**



**CALIBER .50, SPOTTER TRACER**

MU-D 2234

*Figure 3. 5.56mm and caliber .50 spotter tracer bullets (sectioned).*



MU-D 2235

Figure 4. Caliber .30 bullets (sectional).



**BALL**



**BLANK**



**HIGH-PRESSURE TEST (HPT)**



**MATCH**



**ARMOR-PIERCING (AP)**



**BALL, FRANGIBLE**



**TRACER**



**DUMMY, INERT-LOADED**



**DUMMY**



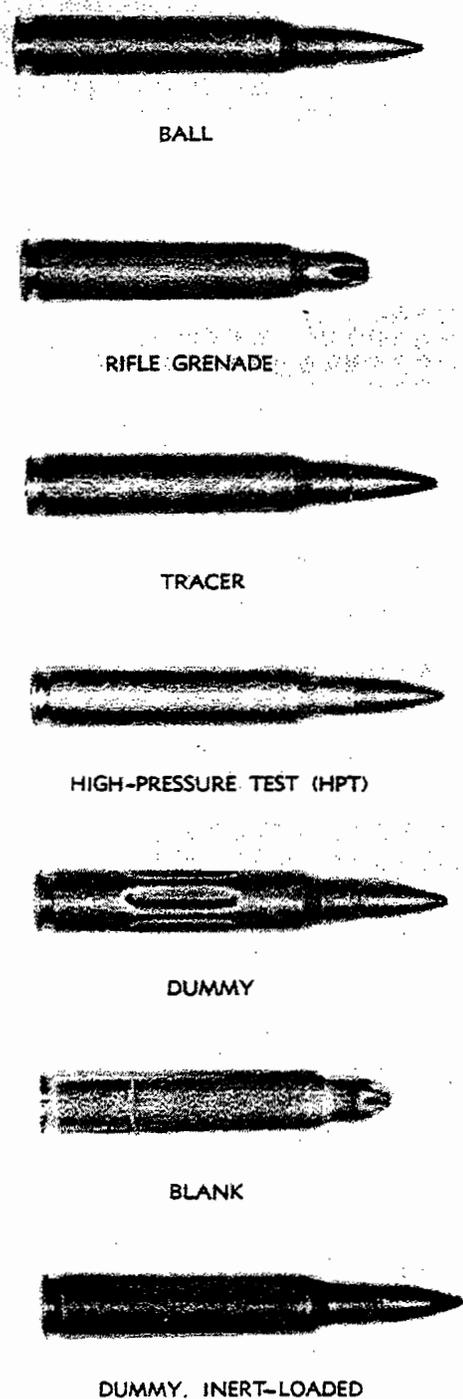
**DUPLEX**



**RIFLE GRENADE**

MU-D 2236

*Figure 5. 7.62mm cartridges*



MU-D 2237

Figure 6. 5.56mm cartridges

*Propellant.* Cartridges are loaded with varying weights of propellant. This is to impart sufficient velocity (within safe pressures) to the projectile to obtain the required ballistic performance. These propellants are either of the single-base (nitrocellulose) or double-base (nitrocellulose and nitroglycerine) type. The propellant grain configuration may be cylindrical with a single, lengthwise perforation, spheroid (ball) or flake. Most propellants are coated with a deterrent (to assist in controlling the rate of combustion) and with a final coating of graphite (to facilitate flow of propellant and eliminate static electricity in loading cartridges).

*Primer.* Small-arms cartridges contain either a percussion or electric primer. The percussion primer consists of a brass or gilding metal cup that contains a pellet of sensitive explosive material secured by a paper disk and a brass anvil. The electric primer consists of an electrode button in contact with the priming composition, a primer cup assembly and insulator. A blow from the firing pin of the weapon on the center of the percussion primer cup base compresses the primer composition between the cup and the anvil. This causes the composition to explode. The function of the electric primer is accomplished by a firing pin with electrical potential, which contacts the electrode button. This allows current to flow through the energy-sensitive priming composition to the grounded primer cup and cartridge case, exploding the priming composition. Holes or vents in the anvil or closure cup allow the flame to pass through the primer vent in the cartridge case and ignite the propellant. Rimfire ammunition, such as the caliber .22 cartridge, does not contain a primer assembly. Instead, the primer composition is spun into the rim of the cartridge case and the propellant is in intimate contact with the composition. On firing, the firing pin strikes the rim of the cartridge case, compressing the primer composition and initiating its explosion.

*Bullet.* With few exceptions, bullets through caliber .50 are assemblies of a jacket and a lead or

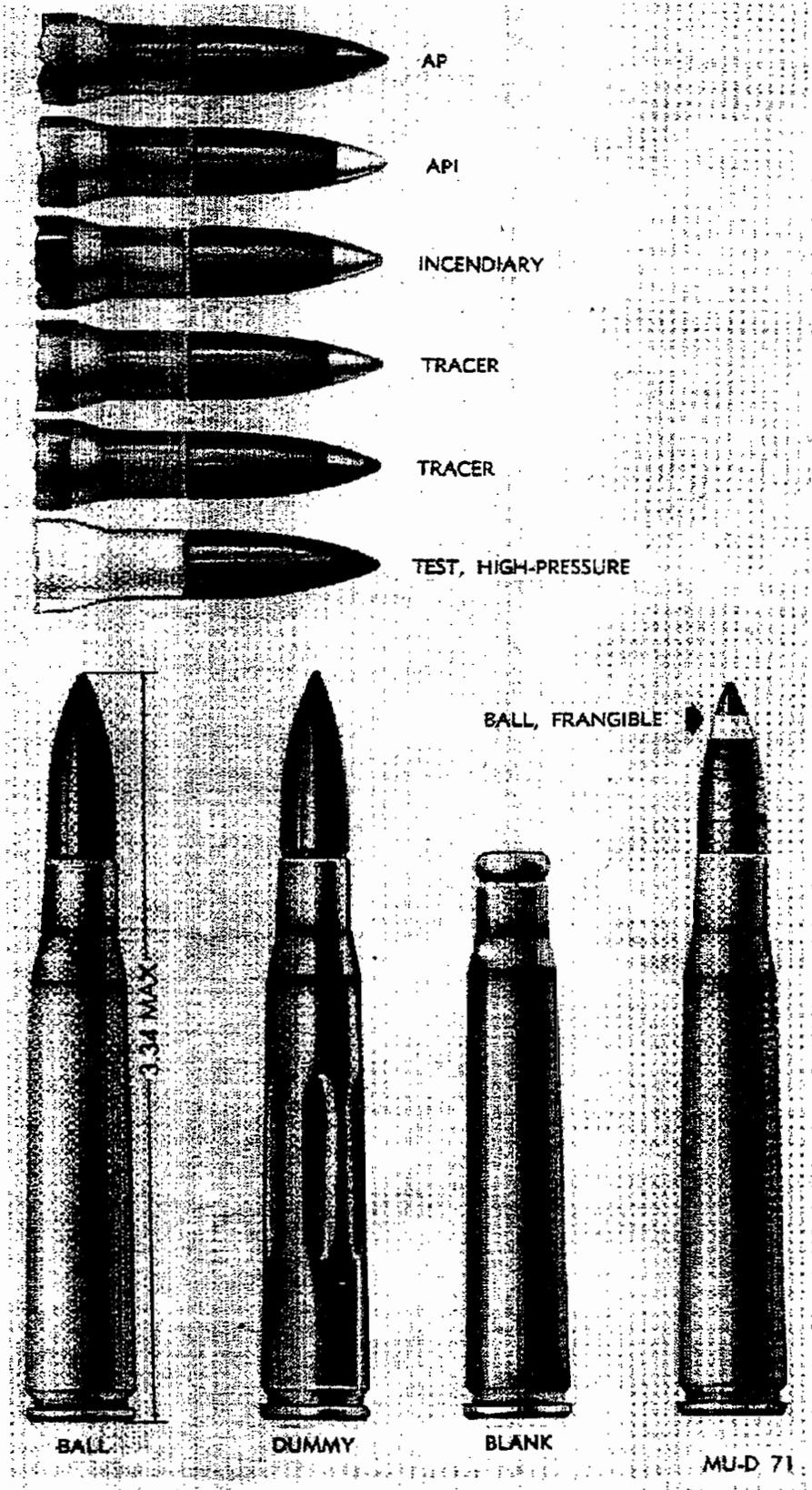


Figure 7. Caliber .30 cartridges

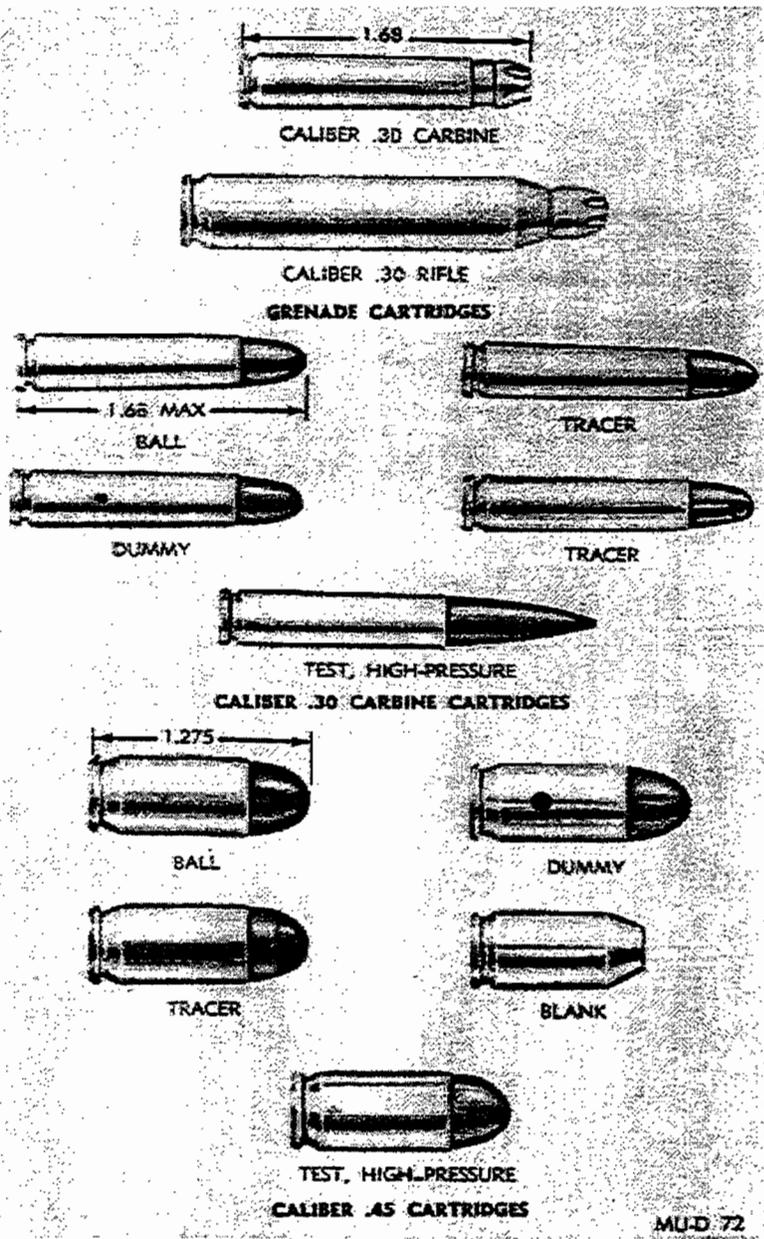


Figure 8. Caliber .30 carbine and caliber .45 cartridges

steel core. They may contain other components or chemicals which provide the terminal ballistic characteristics of the bullet type. The bullet jacket may be either gliding metal, gliding-metal clad steel, or copper plated steel. Caliber .30 and 7.62mm frangible bullets are molded of powdered lead and a friable plastic which pulverizes into dust upon impact with the target. The pellets used in the shotgun shells are spheres of lead alloys varying from 0.08 inch to 0.33 inch in diameter

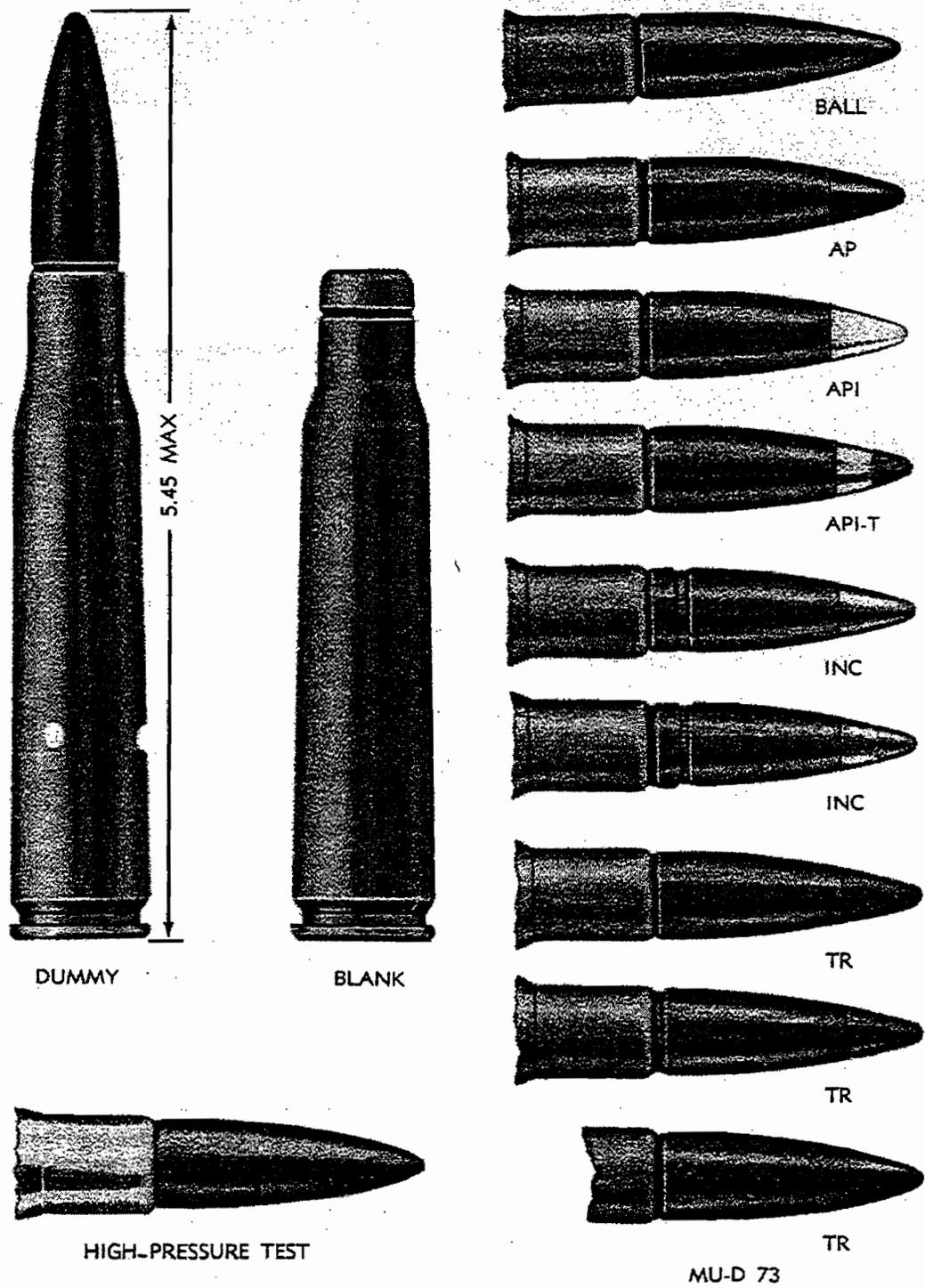


Figure 9. Caliber .50 cartridges

*Ball Cartridge.* The ball cartridge is intended for use in rifles, carbines, pistols, revolvers and/or machineguns against personnel and unarmored targets. The bullet, as designed for general purpose combat and training requirements, normally consists of a metal jacket and a lead slug. Caliber .60 ball bullet and 7.62-mm, ball M59 bullet contain soft steel cores.

*Tracer Cartridge.* By means of a trail of flame and smoke, the tracer cartridge is intended to permit visible observation of the bullet's in-flight path or trajectory and the point of impact. It is used primarily to observe the line of fire. It may also be used to pinpoint enemy targets to ignite flammable materials and for signaling purposes. The tracer element consists of a compressed, flammable, pyrotechnic composition in the base of the bullet. This composition is ignited by the propellant when the cartridge is fired. In flight, the bullet emits a bright flame which is visible to the gunner. Trace burnout occurs at a range between 400 and 1,600 yards, depending upon the caliber of ammunition.

*Match Cartridge.* The match cartridge is used in National and International Match Shooting competitions. The bullet consists of a gliding-metal jacket over a lead slug. The cartridges are identified on the head face with the designation NM (National Match) or Match.

*Armor-Piercing Cartridges.* The armor-piercing cartridge is intended for use in machine-guns or rifles against personnel and light armored and unarmored targets, concrete shelters, and similar bullet-resisting targets. The bullet consists of a metal jacket and a hardened steel-alloy core. In addition, it may have a base filler and/or a point filler of lead.

*Armor-Piercing-Incendiary Cartridge.* The armor-piercing-incendiary cartridge is used in rifles or machineguns as a single combination cartridge in lieu of separate armor-piercing and incendiary cartridges. The bullet is similar to the armor-piercing bullet, except that the point filler is incendiary mixture instead of lead. Upon impact with the target, the incendiary mixture

burst into flame and ignites flammable material.

*Armor-Piercing-Incendiary Tracer Cartridge.* The bullet of the armor-piercing-incendiary-tracer cartridge combines the features of the armor-piercing, incendiary, and tracer bullets and may be used to replace those cartridges. The bullet consists of a hard steel core with compressed pyrotechnic mixture in the cavity in the base of the core. The core is covered by a gilding-metal jacket with incendiary mixture between the core point and jacket. This cartridge is for use in caliber .50 weapons only.

*Duplex Cartridge.* The duplex cartridge contains two special ball type bullets in tandem. The front bullet is positioned partially in the case neck, similarly to a standard ball bullet. The rear bullet, positioned completely within the case, is held in position by a compressed propellant charge. The base of the rear bullet is angled so that in flight, it follows a path slightly dispersed from that of the front bullet

*Spotter-Tracer Cartridge.* The spotter-tracer cartridge is intended for use in coaxially mounted caliber .50 spotting rifles. The bullet trajectory closely approximates that of 106mm projectiles. Thus, this cartridge serves as a fire control device to verify weapon sight settings before firing 106mm weapons. The bullet contains an impact detonator and incendiary composition which identify the point of impact by flash and smoke.

*Blank Cartridge.* The blank cartridge is distinguished by absence of a bullet. It is used for simulated fire, in training maneuvers, and for saluting purposes. It is fired in rifles and machineguns equipped with blank firing attachments.

*Grenade Cartridge.* The grenade cartridge is used to propel rifle grenades and ground signals from launchers attached to rifles or carbines. All rifle grenade cartridges are distinguished by the rose petal (rosette crimp) closure of the case mouth.

*Frangible Cartridge.* The caliber .30 frangible cartridge, designed for aerial target training purposes, is also used in rifles and machineguns for target shooting. Caliber .30 and 7.62mm frangible cartridges are used in tank machineguns, firing single shot, for training in tank gunnery. At its normal velocity, the bullet, which is composed of powdered lead and friable plastic, will completely disintegrate upon striking a 3/16-inch aluminum alloy plate at 100 yards from the muzzle of the gun. These cartridges are not to be used on any but well ventilated indoor ranges to preclude buildup of toxic bullet dust. Inhalation of bullet dust may be injurious to health

*Incendiary Cartridge.* The incendiary cartridge was designed for aircraft and ground weapon use to ignite combustible targets (e.g., vehicular and aircraft fuel tanks). The bullet contains a compressed incendiary mixture which ignites upon impact with the target. The incendiary cartridge has been superseded by the API and APIT cartridges because of their improved terminal ballistic effects

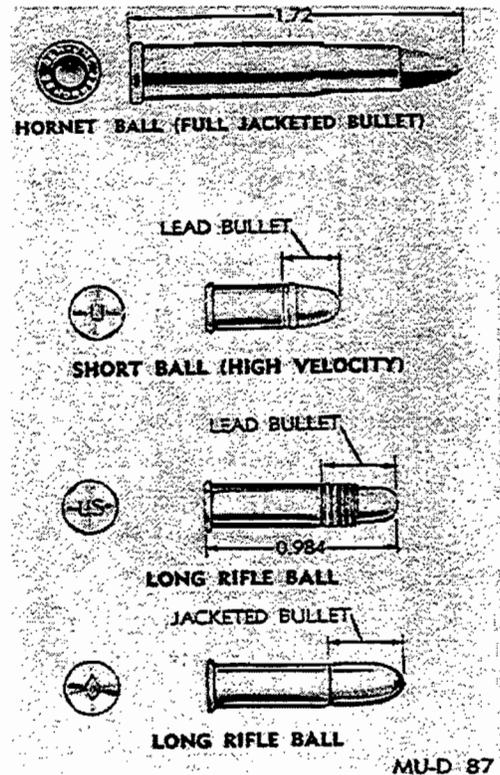


Figure 11. Caliber .22 cartridges

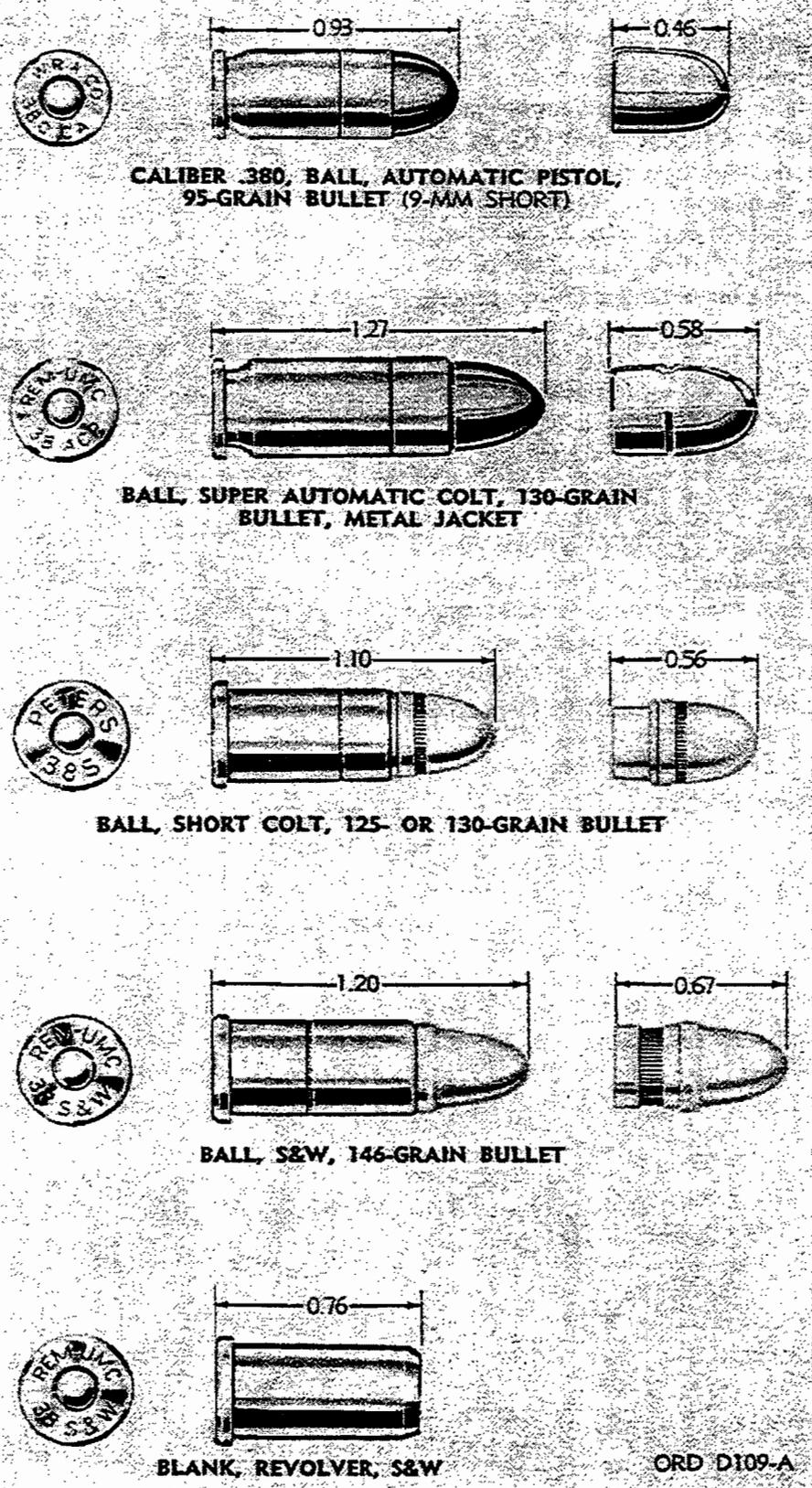


Figure 12. Caliber .38 cartridges.

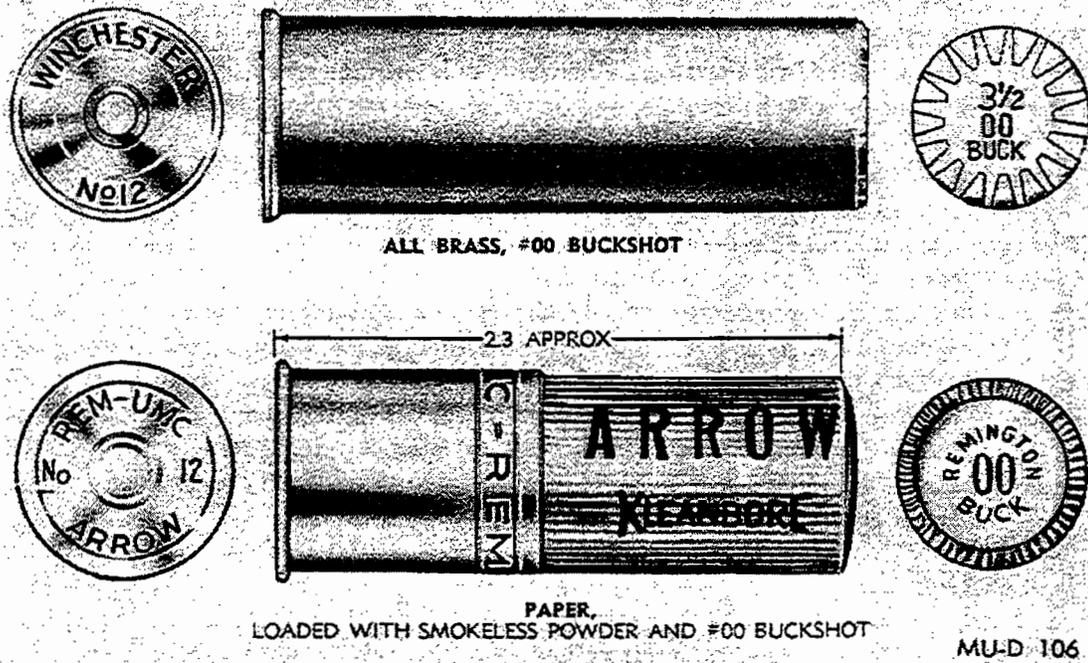


Figure 13. 12 gage shotgun shells.

**Target-Practice Cartridge.** The 20mm target-practice cartridge is the conventional steel shell with steel nose plug. It is used primarily for training purposes. This is not a combat cartridge; hence, no fuze is used in the assembly.

**Special Purpose Cartridge.**

**Cartridges of various calibers.** (fig. 11 through 13), which consist of different types of projectiles and bullets, are used for training and special purposes. They include the following:

- (1) Caliber .22 long rifle and caliber .38 and .45 wad-cutter cartridge for target shooting.
- (2) Caliber .45 blank cartridges fired in exercises to condition dogs to gun fire.
- (3) Caliber .22 hornet and .410 shotgun cartridges for firing in Air Force combination (survival) weapons for hunting purposes.
- (4) Caliber .45 line-throwing cartridges for firing in caliber .45 line-throwing rifles. The Navy uses these for throwing lines from ship-to-ship. The Army Signal Corps uses these for projecting signal wires over elevated terrain
- (5) Shotshells containing the designated shot sizes as required for the following:
  - (a) 12 gage #00 Buck for guard duty
  - (b) 12 gage #4 Buck for guerrilla purposes.
  - (c) 12 gage #6, 7½ and 8 shot for clay target shooting for training purposes.
  - (d) .410 gage #7 shot for caliber .22/.410 survival weapons maintained by aircraft.

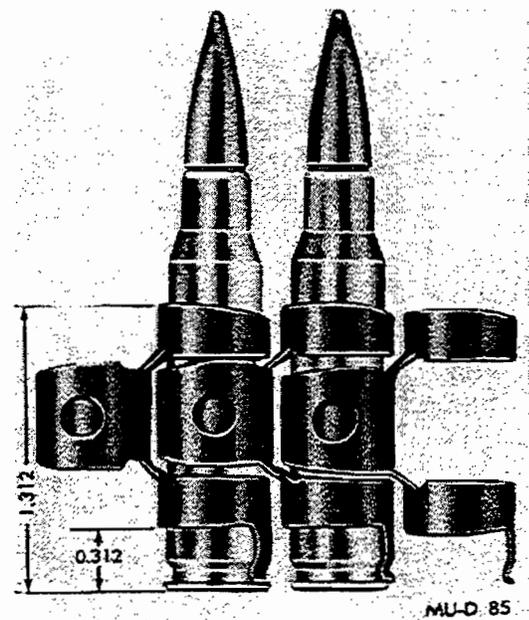


Figure 14. Linked 7.62-mm cartridge

*Special purpose cartridges.* These also include the following types of military cartridges:

(1) *Dummy.* The dummy cartridge is used for practice in loading weapons and simulated firing to detect flinching of personnel when firing weapons. It consists of a cartridge case and a ball bullet. Cartridge identification is by means of holes through the side of the case or longitudinal corrugations in the case and by the empty primer pocket.

(2) *Dummy inert-loaded.* This cartridge consists of a cartridge case, a ball bullet and inert granular material in the case simulating the weight and balance of a live cartridge. The exterior of the cartridge is identified by a black chemical finish and by the absence of a primer. This cartridge is used by installations for testing weapon function, linkage and feed chutes.

(3) *High-pressure test.* High-pressure test ammunition is specially loaded to produce pressures substantially in excess of the maximum average or individual pressures of the corresponding service cartridge. This cartridge is not for field issue. It is used only by armorers and weapons mechanics for proof firing of weapons (rifles, pistols, machine guns) at place of manufacture, test and repair. Because of excessive pressures developed by this type of ammunition, and the potential danger involved in firing, proofing of weapons is conducted only by authorized personnel from fixed and shielded rests by means of a lanyard or other remote control methods.

### *Metallic Links and Clip.*

*Metallic links.* (fig. 14 and 15) are used with caliber .30, caliber .50, 5.56mm, 7.62mm and 20mm cartridges in machine guns. The links are made of steel, surface treated for rust prevention. They are used to assemble cartridges into linked belts of 100 to 750 cartridges per belt. The links must meet specific test and dimension requirements to assure satisfactory ammunition feed and functioning in the machine gun under all training and combat service conditions.

*Different configurations of cartridge clips.* These permit unitized packages of ammunition. This facilitates transfer of cartridges to appropriate magazines for caliber .30, 7.62mm and 5.56mm rifles. The caliber .30 eight-round clip feeds eight cartridges as a unit into the receiver of the rifle. The caliber .45 clip feeds three cartridges as a unit into the revolver cylinder. Five-round and eight-round clips are used with caliber .30 cartridges; five-round clips with 7.62mm cartridges; ten-round clips with caliber .30 carbine and 5.56-mm cartridges; and three-round clips with caliber .45 cartridges

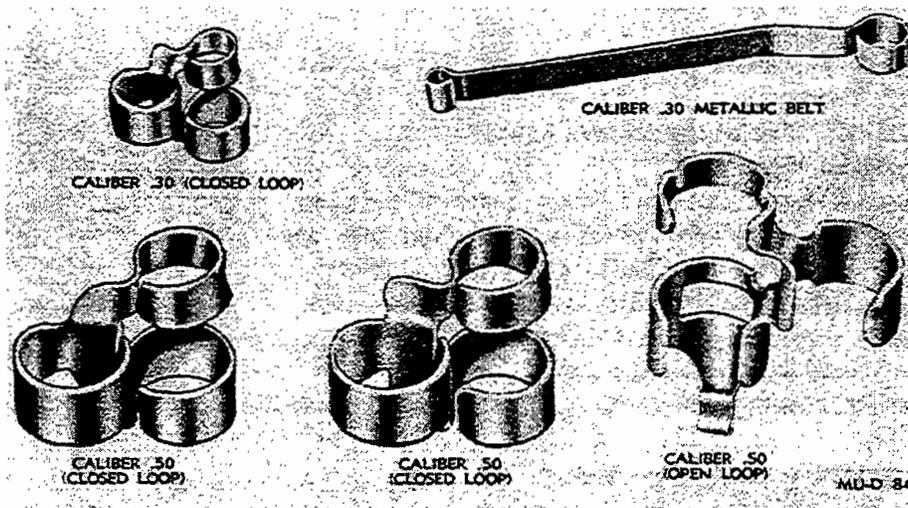


Figure 15. Links for caliber .30 and caliber .50 ammunition

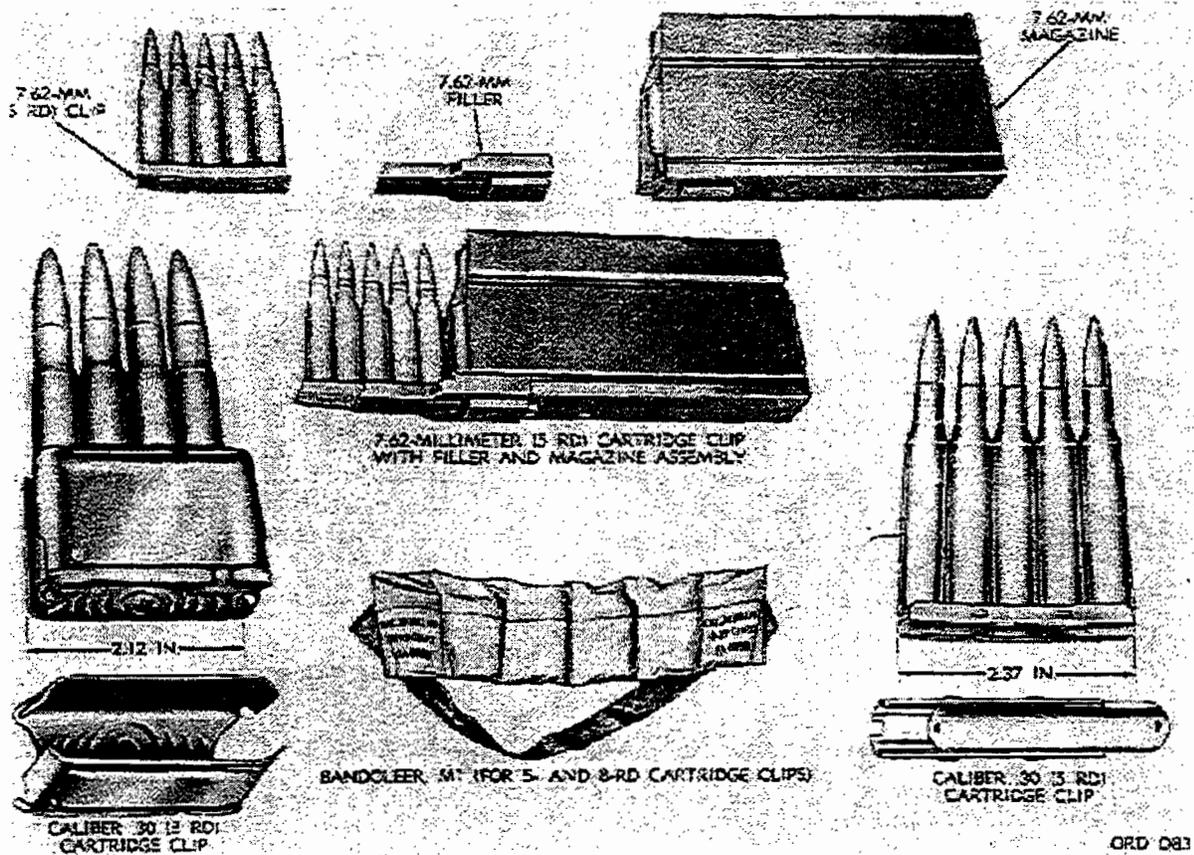


Figure 16. Cartridges in 20-round cartons in ammunition box

**Packing and Identification Marking.**

**Packing.** These containers and methods for packing military small-arms ammunition are specified in drawings, specifications or, as required, in the procurement contract. Military containers presently being manufactured have been limited to a few standard types designed to withstand all conditions commonly encountered in handling, storage and transportation of ammunition. Military cartridges, except 20mm, are packed in metallic ammunition boxes, over-packed in wooden wire-bound crates. Twenty millimeter cartridges are packed in ammunition boxes only. When commercial cartridges are not packed in a military pack, they are packed in accordance with standard commercial practices.

**Identification Markings.** Each outer shipping container and all inner containers are fully marked to identify the ammunition. Wire-bound boxes are marked in black and ammunition boxes are painted olive drab, with markings in yellow. When linked ammunition is functionally packed, component lot numbers are replaced by a functional lot number. Typical packing and identification markings are illustrated in figures 17 and 18.

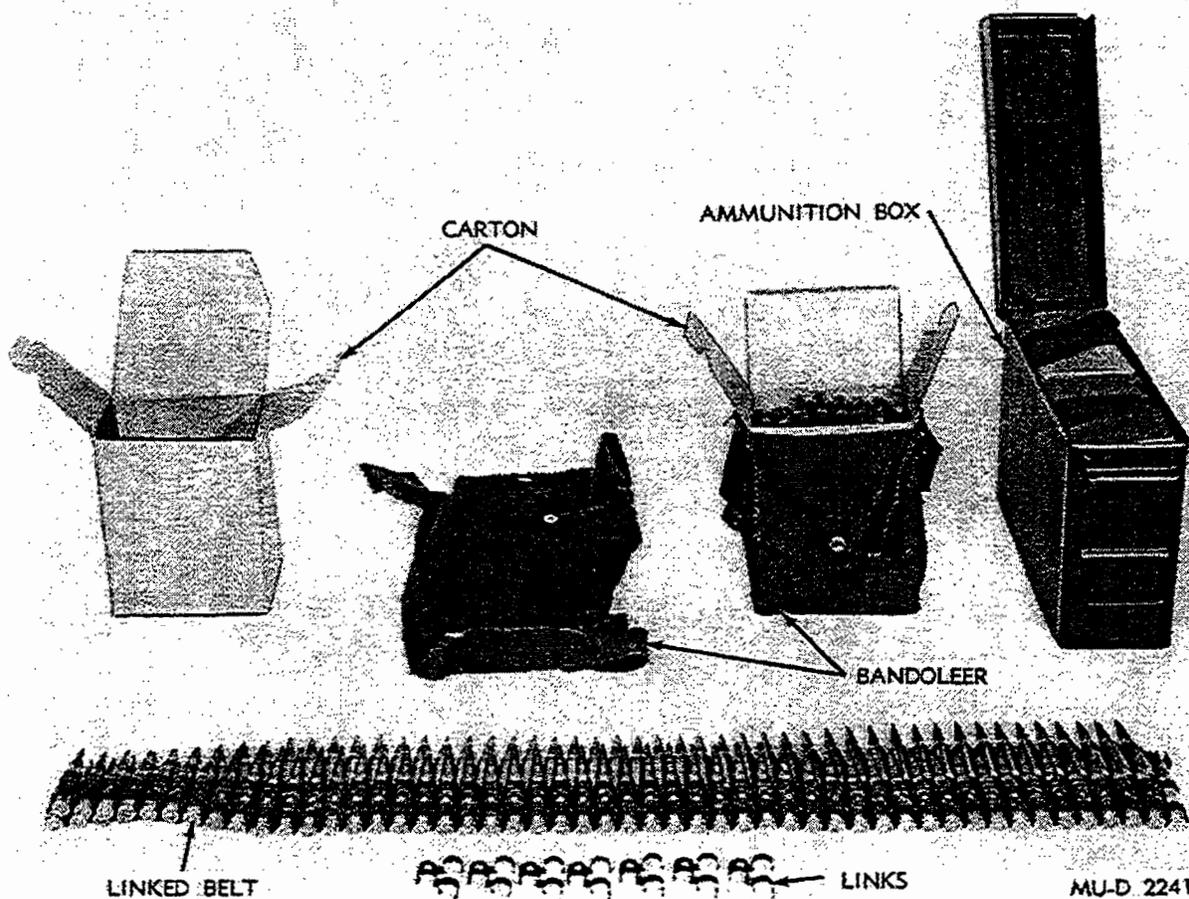


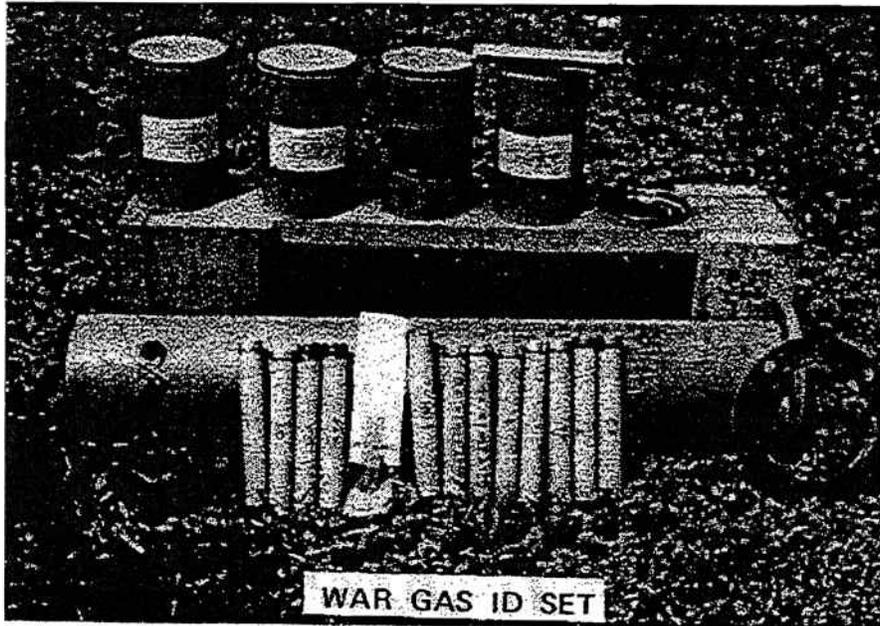
Figure 17. Cartridges, link belt, cartons, bandoleers and ammunition box.

*Care, Handling and Preservation.*

Small-arms ammunition is comparatively safe to handle. It is packed to withstand transportation, handling and storage conditions normally encountered in the field. However, consideration should be given to general handling precautions pertaining to ammunition and explosives.

**Reference:** This data is a reprint of Chapter 3, TM 9-1300-200, *Ammunition General*, October 1969, excluding information on 20mm and 30mm ammunition.

# GAS IDENTIFICATION SET, DETONATION, M1 K951/K952



*Use.* Designed to be used outdoors. The gas tubes would be detonated, creating an agent cloud. Soldiers would then try to identify the agent based on its odor and other characteristics.

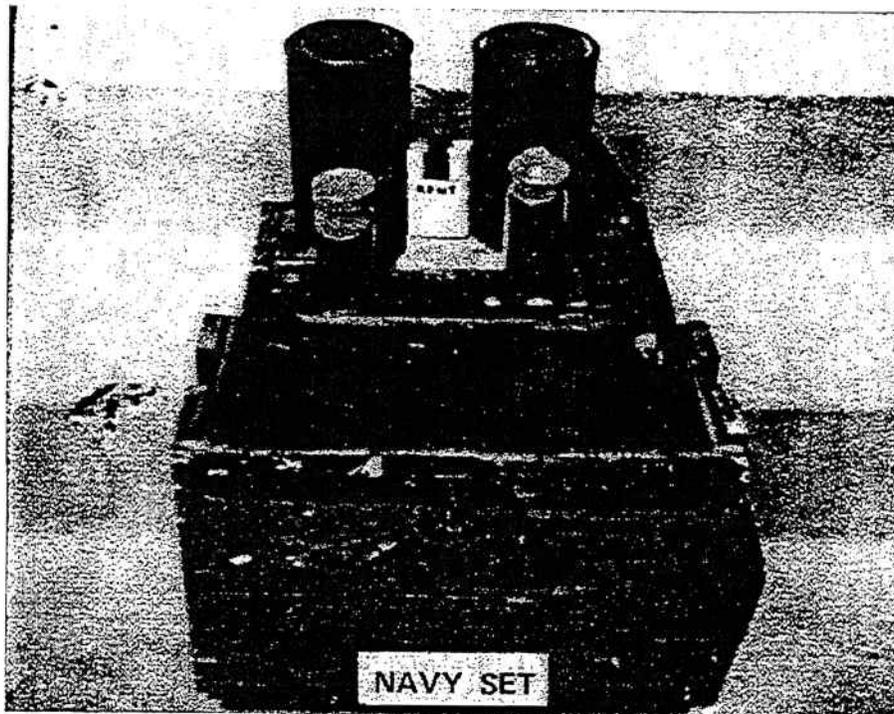
*Description.* The K951/952 Chemical Agent Identification Set (CAIS) contained 48 Pyrex, flame sealed ampoules, 12 each containing 1.4 ounce solution of Mustard (H, 5% in chloroform) Lewisite (L, 5% in chloroform), Chloropicrin (PS, 50% in chloroform), and Phosgene (CG) for a total of 26 fluid ounces (0.768 liters) of agent, less the chloroform, per set. Each ampoule is 1 inch in diameter and 7½ inches long. Each ampoule is packed in a cardboard screw cap container (mailing tube type) with agent type indicated by letters on the cardboard container. Twelve (12) cardboard containers each are packaged into 4 press fit metal cans which are 9¼ inches high. The cans are packed into a steel cylinder 6⅝ inches in diameter, approximately 38 inches long and 0.145 inches thick. The open end of the cylinder is closed by a flanged end cover which is secured by eight bolts. The only difference between the K951 and K952 is that the K951 was issued with blasting caps that were packed and shipped in a separate container.

*Time frame of use* Korean Era

*Old Stock Number* ..... FSN 1365-025-3273 (K951)  
FSN 1365-025-3783 (K952)

**Reference:** *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

# GAS IDENTIFICATION SET, INSTRUCTIONAL M1, (NAVY SET), K955



*Use.* Designed to be used indoors to instruct military personnel in recognizing the odors of chemical agent. This type of set contains only a small amount of chemical agent.

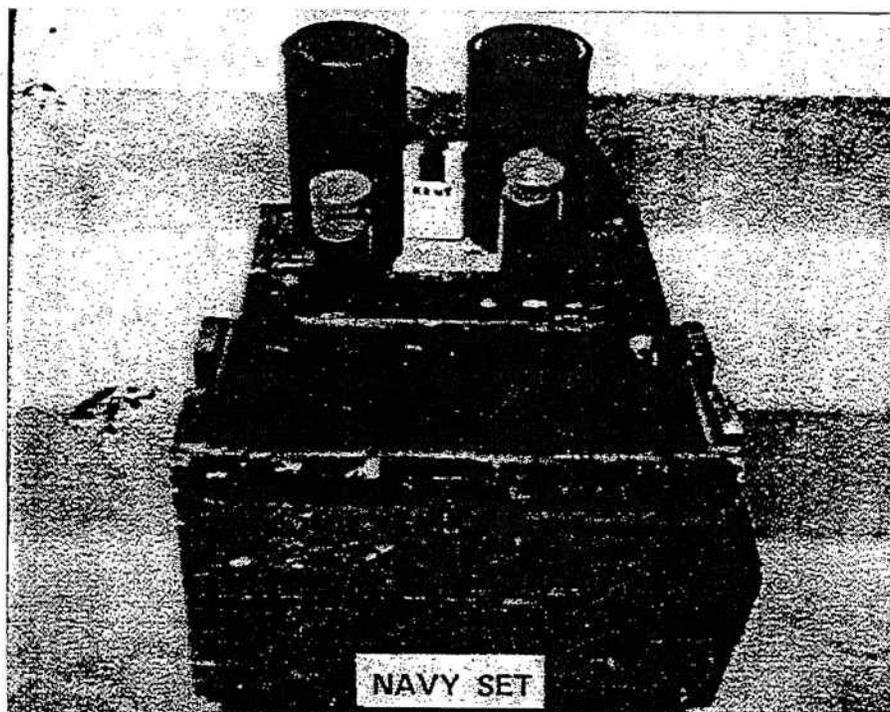
*Description.* The K955 Chemical Agent Identification Set (CAIS) contains seven glass bottles with a total of 3.5 fluid ounces (0.103 liters) of agent per CAIS. Four of the bottles contain 3 ounces (90cc) of activated charcoal on which agent is absorbed. One bottle contains Lewisite (L), one Chloropicrin (PS), and two Mustard (HS), one contains 6 grams of Triphosgene (a simulant for Phosgene (CG)), one 15 grams of Chloroacetophenone (CN), and one with 15 grams of Adamsite (DM). These sets are packed in a hinged-covered wood box that resembles a foot locker and measures 30<sup>3</sup>/<sub>8</sub> inches wide, 15<sup>1</sup>/<sub>2</sub> inches long and 11<sup>1</sup>/<sub>4</sub> inches high. The inside of the box is divided into eight sections. Seven of the sections contain sealed cans in sawdust and the eighth has instructions. The cans are 4 inches in diameter and 7 inches high and have a paint can type lid. Inside each can is one round bottle with a large screw top or glass stopper which is usually wax coated. The bottles are frequently filled with charcoal.

*Old Stock Number* ..... FSN 1365-368-6154

*Time Frame of Use:* ..... Late 1930's to World War II

**Reference:** *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

# GAS IDENTIFICATION SET, INSTRUCTIONAL M1, (NAVY SET), K955



*Use.* Designed to be used indoors to instruct military personnel in recognizing the odors of chemical agent. This type of set contains only a small amount of chemical agent.

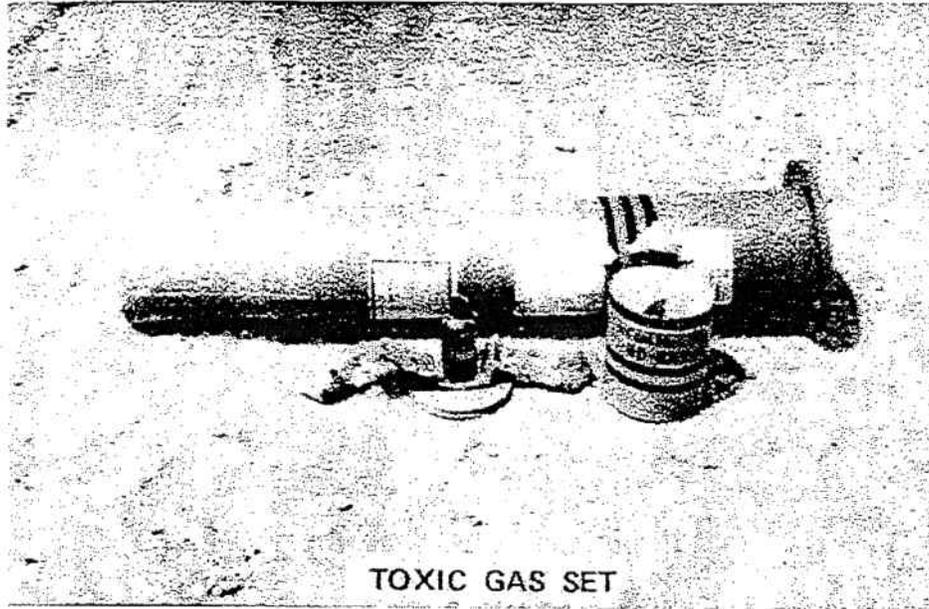
*Description.* The K955 Chemical Agent Identification Set (CAIS) contains seven glass bottles with a total of 3.5 fluid ounces (0.103 liters) of agent per CAIS. Four of the bottles contain 3 ounces (90cc) of activated charcoal on which agent is absorbed. One bottle contains Lewisite (L), one Chloropicrin (PS), and two Mustard (HS), one contains 6 grams of Triphosgene (a simulant for Phosgene (CG)), one 15 grams of Chloroacetophenone (CN), and one with 15 grams of Adamsite (DM). These sets are packed in a hinged-covered wood box that resembles a foot locker and measures 30<sup>3</sup>/<sub>8</sub> inches wide, 15<sup>1</sup>/<sub>2</sub> inches long and 11<sup>3</sup>/<sub>4</sub> inches high. The inside of the box is divided into eight sections. Seven of the sections contain sealed cans in sawdust and the eighth has instructions. The cans are 4 inches in diameter and 7 inches high and have a paint can type lid. Inside each can is one round bottle with a large screw top or glass stopper which is usually wax coated. The bottles are frequently filled with charcoal.

*Old Stock Number* ..... FSN 1365-368-6154

*Time Frame of Use:* ..... Late 1930's to World War II

**Reference:** *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

# TOXIC GAS SET, M1 K941



*Description.* The K941 CAIS contains 24 glass bottles, each containing 3½ ounces of Mustard (H) or Distilled Mustard (HD) for a total of 84 ounces (2.48 L) per set.

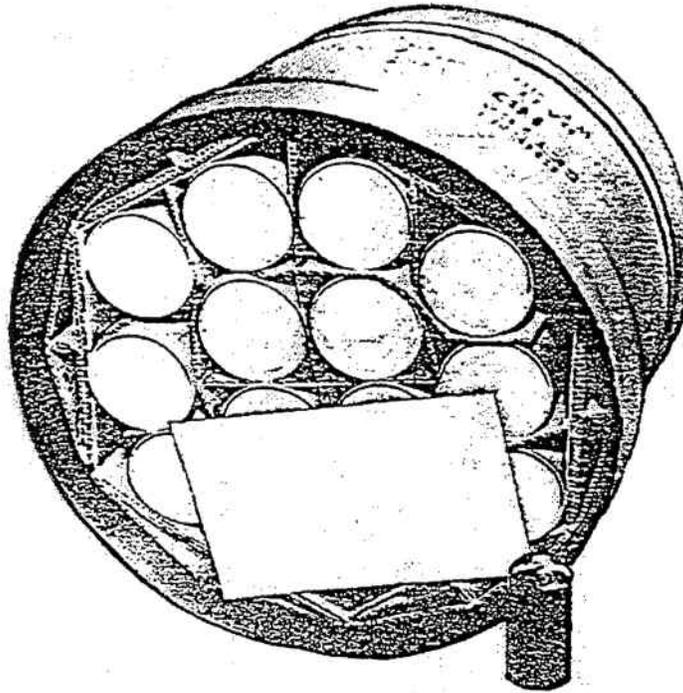
Bottles are round and have a small screw top. Heat resistant paint on the bottles indicates “H”, “HS”, or “HD”, “TOXIC GAS SET, M1”. Four bottles are packed in ½ inch layers of sawdust within a sealed metal can. The cans are pressure sealed, 6¼ inches high, and have a sardine-type key on the bottom. Six of these metal cans are fitted into a steel shipping cylinder that is 6⅝ inches in diameter, approximately 38 inches long, and 0.145 inches thick. The open end of this container is closed by a flanged end cover which is secured by eight bolts tightened over a ⅛ inch thick lead gasket.

*Time frame of use.* World War II through the late 1950s.

*Old Stock Number*..... FSN 1365-219-8574

**Reference:** *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

# TOXIC GAS SET, M2 K942



*Description.* The K942 Chemical Agent Identification Set (CAIS) contains 28 heat-sealed ampoules, each containing 3.8 ounces of Mustard (H, HD, or HS) for a total of 106.4 ounces (3.15 Liters) per set. Each ampoule is  $1\frac{7}{8}$  inches in diameter and  $4\frac{5}{8}$  inches in length and packed in its own can. Twenty eight(28) cans are packed in a cold-rolled carbon steel drum 14 inches in diameter, 14 inches high and 0.0375 inches thick (20 gauge) in 2 layers (14 cans per layer). The cans are separated into individual compartments by fiberboard packaging.

*Time frame of use.* Korean Era.

*Old Stock Number*..... FSN 1365-563-4146

**Reference:** *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

Appendix C  
Geophysical Investigation and Geophysical System Verification  
Reports

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

## **GEOPHYSICAL INVESTIGATION REPORT**

**Focused Preliminary Assessment/Site Inspection  
Sites UXO-07 and UXO-11  
Former Practice Hand Grenade Ranges,  
Site UXO-10  
Former Flame Tank and Flame Thrower Range  
&  
Site UXO-14  
Former Indoor Pistol Range and Gas Chamber  
Marine Corps Base (MCB) Camp Lejeune, North Carolina**

**Task Order 0014**

Dates of Investigation:

May 19<sup>th</sup> – May 22<sup>nd</sup>, 2009

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## APPENDICES & CD

**Appendix A:** GPO color contour maps

**Appendix B:** Example QC test results

**Contents of CD:** Project deliverables

## ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
ASR	Archive Search Report
DGM	Digital Geophysical Mapping
DQO	Data Quality Objectives
GGA	Global Positioning System Fix Data Format
GLONASS	Global Navigation Satellite System (Russian)
GPO	Geophysical Prove-Out
GPS	Global Positioning System
MCB	Marine Corps Base
MEC	Munitions and Explosives of Concern
MR	Munitions Response
MRP	Munitions Response Program
mV	Millivolts
NAD83	North American Datum of 1983
QA	Quality Assurance
QC	Quality Control
RTK	Real Time Kinematic
SI	Site Inspection
SOP	Standard Operating Procedures
SOW	Statement of Work
TO	Task Order
UTM	Universal Transverse Mercator

## **1.0 INTRODUCTION**

---

NAEVA Geophysics, Inc. (NAEVA) was contracted by CH2M HILL to conduct Digital Geophysical Mapping (DGM) at the following Munitions Response Sites in various locations at Marine Corps Base (MCB) Camp Lejeune, North Carolina: UXO-07, D-6 Practice Hand Grenade Course; UXO-10, D-11A Flame Tank and Flame Thrower Range; UXO-11, B-5 Practice Hand Grenade Course; and UXO-14 Former Indoor Pistol Range and Gas Chamber. Field operations were conducted from May 19<sup>th</sup> to May 21<sup>st</sup>, 2009.

### **1.1 BACKGROUND AND OBJECTIVES**

The purpose of this geophysical investigation was to detect and map subsurface metal potentially representing munitions and explosives of concern (MEC) in four locations. The investigation involved DGM of transects totaling to 2.12 acres and covered approximately 10 percent of each of the targeted areas of sites UXO-07, UXO-10, and UXO-11. Due to site conditions, a smaller area of coverage was attained at Site UXO-14. Prior to the commencement of mapping, a Geophysical Prove-Out (GPO) was completed for the purpose of establishing an appropriate anomaly targeting threshold and to test the effectiveness of the geophysical instrument.

### **1.2 SCOPE OF WORK**

NAEVA Geophysics provided all personnel and geophysical survey equipment to perform the DGM surveys at Camp Lejeune. A total of four separate locations were identified for DGM surveying and were completed according to the scope of work and work plan addendums. Geophysical data were collected in transect lines to provide 10% coverage of each of the targeted areas. Prior to starting the production geophysical surveying, a GPO was performed to demonstrate the capabilities of the personnel and equipment to meet the data quality objectives (DQOs) defined in the CH2M HILL project work plan. All production data were to be processed, interpreted and delivered to the CH2M HILL Project Geophysicist on the schedule and in the formats specified in the Statement of Work.

### **1.3 SITE LOCATION AND DESCRIPTION**

The four sites selected for mapping under Task Order 14 (TO-14) are Site UXO-07, D-6 Practice Hand Grenade Course (ASR Site 2.77); Site UXO-10, D11A Flame Tank and Flame Thrower Range (ASR Site 2.136); Site UXO-11, B-5 Practice Hand Grenade Course (ASR Site 2.81); and Site UXO-14 Former Indoor Pistol Range (ASR Site 2.199) and Gas Chamber (ASR Site 2.200).

### **Site UXO-07, D-6 Practice Hand Grenade Course**

The Site UXO-07, D-6 Practice Hand Grenade Course investigation area is composed of two separate areas located south of Main Service Road off of O Street on the Main Side of Camp Lejeune and is approximately seven acres in size. The northern area of the site, UXO-07\_1 contains 91 transects spaced at 10 meter intervals with the exception of the northeast transects, which are spaced at five meter intervals; the southern portion of the site, UXO-07\_2 consists of 35 transects evenly spaced at 10 meter intervals. Both portions of the site are composed primarily of cleared and developed land with active parking lots and buildings, including an Armory in the southern portion, which bound transects within each area. The topography is generally flat in both areas, with an isolated trench running southeast in the northern transects. The presence of underground and overhead utilities is confirmed on this site, and active roads run parallel to the westernmost and easternmost transects.

### **Site UXO-10, D-11A Flame Tank and Flame Thrower Range**

The Site UXO-10, D-11A Flame Tank and Flame Thrower Range investigation area is bisected by Gonzalez Boulevard and Main Service Road located just west of Sneads Ferry Road on the Main Side of Camp Lejeune and is approximately 10 acres in size. The site is predominantly developed with parking lots and paved roads and may contain underground utilities. The 43 transects spaced at 10 meter intervals north of Main Service Road are relatively flat, with some hummocky terrain and are bounded by active parking lots and Gonzalez Boulevard to the west. The area bounded to the north by Main Service Road is relatively flat, and is scattered with large sewer piping, lumber, vegetation with some larger trees and a container from a 16-wheel truck. The area south of Main Service Road was not laid out with pre-planned transects due to the conditions of the area. NAEVA, under the guidance of CH2M HILL, conducted a meandering path transect using Real Time Kinematic (RTK) Global Positioning System (GPS), attempting to cover as much area as feasible to reach the 10 percent coverage goal, while avoiding existing surface metal.

### **Site UXO-11, B-5 Practice Grenade Course**

The Site UXO-11, B-5 Practice Grenade Course investigation area is located north of Sixth Street and east of Seventh Street at the New River Air Station and is approximately one to two acres in size. The area contains 8 transects at 10 meter intervals on undeveloped, flat terrain that is primarily free of vegetation. The site is bound by the investigation boundary on all sides and is bisected by a water-filled trench on the southeast edge.

### **Site UXO-14 Former Indoor Pistol Range and Gas Chamber**

The Site UXO-14 Former Indoor Pistol Range and Gas Chamber investigation area is located west of Powder Lane in the Stones Bay Area of Camp Lejeune and is approximately one acre in size. DGM

activities were only conducted at the former Gas Chamber site, which included only two transects spaced approximately 5 meters apart. The presence of dense vegetation and minimal brush clearance prevented the use of global positioning systems (GPS) for data positioning. Data collection is bounded on all sides by the edge of cleared vegetation.

## **2.0 EQUIPMENT**

---

### **2.1 GEONICS EM61-MK2**

The geophysical instrument used for the investigation at MCB Camp Lejeune is the Geonics EM61-MK2 metal detector. The EM61-MK2 is a high resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. In comparison with other metal detectors, especially magnetometers, it is much better suited for work in close proximity to man-made structures and in areas of dense subsurface metallic debris (i.e., impact ranges). This instrument was chosen based on multiple previous investigations successfully using the EM61-MK2 at MCB Camp Lejeune.

The EM61-MK2 system consists of two 1 meter by 0.5 meter air-cored coils, a digital data recorder, batteries and processing electronics. The EM61-MK2's transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects. The receivers either measure the eddy currents at three distinct time intervals in the bottom coil and one time interval in the top coil or four intervals in the bottom coil if no top coil measurements are recorded. Four time gates from the bottom coil were recorded for the DGM surveys at MCB Camp Lejeune. Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils are measured in millivolts (mV). The arrangement of coils is such that there is a vertical separation of 40 cm from the ground to the bottom coil. Assuming accurate data positioning, target resolution of approximately 0.5 meters can be expected. The data are collected using Geomar's NAV61MK2 program and temporarily stored in a Juniper Allegro CX data logger prior to downloading to a laptop computer.

### **2.2 TRIMBLE 5700/R7/R8 REAL TIME KINEMATIC GLOBAL POSITIONING SYSTEM**

Trimble's 5700/R7/R8 RTK GPS is a 24-channel dual frequency RTK receiver that uses both L1 and L2 satellites. This system operates with a base and a rover unit; the base sends corrections to the rover via radio link, thus maintaining a 3-cm horizontal accuracy and a 5-cm vertical accuracy. For configuration with the EM61-MK2, the rover is set to output a GGA NMEA (National Marine Electronics Association) string at 1 Hz, which is captured into the NAV61MK2 program and temporarily stored on the Juniper Allegro CX. The base station utilized for this survey was a Trimble R8 GNSS. The R8 GNSS is a

multichannel, multi-frequency receiver, antenna, and data-link radio combined into one device. It uses Trimble R-Track technology to support all GPS signals, including the new L2C signal and the planned L5 signal of GPS Modernization, and also supports GLONASS (Global Navigation Satellite System).

### **3.0 METHODOLOGY**

---

#### **3.1 DGM SURVEY ACTIVITIES**

DGM surveying at MCB Camp Lejeune was accomplished using the EM61-MK2 in wheel mode configuration, with data positioning provided by RTK GPS. Wheel mode was tested in a GPO (see Section 5.1) and the generally flat terrain without many mounds or ruts allowed for its use on the two sites. In wheel mode, the EM61-MK2 bottom coil is mounted on two 40-cm wheels, and has four fiberglass spacers used to support the top coil. A tripod attached to the top coil holds the GPS antenna over the center of the EM coils. All data collected at MCB Camp Lejeune were recorded at a sample rate of 10 readings per second.

A survey transect spacing of 0.75-m was used for the GPO survey area. This spacing results in coil overlap on successive lines, reducing the likelihood of data gaps and improving the chance of detecting small MEC items. Low stretch polypropylene ropes painted with alternating bands of fluorescent orange and blue paint were placed across the GPO at 10-m intervals, perpendicular to the direction of travel. These ropes provided guidance to the geophysicist maneuvering the EM61-MK2 across the grid, to maintain parallel lines spaced 0.75-m apart.

Prior to DGM activities, licensed surveyors contracted by CH2M HILL placed color-coded stakes to mark the start and end of each transect in each of the four sites. For transects, which require only a single pass in one direction with no overlap, measuring tapes were pulled and secured as tightly and straight as possible; plastic pin flags were then placed at 10-m intervals to provide a line of sight to the geophysicist maneuvering the EM61-MK2 along the transect.

When in fiducial mode, in order to maximize control over positioning, tapes running along the transect line direction were made as straight as possible. Using the measuring tapes, fiducial points/markers and start and stop stations for each line were recorded. Using known UTM (Universal Transverse Mercator) coordinates for each stake, local coordinates recorded for each transect setup can be converted to meter coordinates in the data processing phase.

## **3.2 DATA PROCESSING AND INTERPRETATION**

### **3.2.1 Data Storage and Initial Editing**

EM61-MK2 data are temporarily stored in an Allegro CX data logger using Geomar's NAV61MK2 software and then downloaded into a laptop computer for further on-site processing using Geomar's Trackmaker and Geosoft Oasis Montaj software version 7.0.1.

Daily logs, field notes and survey report forms were input digitally into a handheld PDA while in the field each day. Initial data processing was performed by the field team, which included reviewing the data for integrity, repeatability, and data density issues, positioning the data based on the field notes and creating XYZ files for each grid and QC test for use in further processing the geophysical data. If an issue with a file was noted, such as a missing line or bad readings, the cause was investigated and corrected as necessary.

### **3.2.2 Preprocessing**

Data were transferred to NAEVA's data processor in the Charlottesville, Virginia office where converted raw data files were imported into Geosoft's Oasis Montaj to perform the following:

- Review and finalize all QC tests (cable shake, personnel, static and latency) prior to processing of the DGM data for that day
- Set projection of NAD83 UTM Zone 18 North
- Evaluate data density and RTK GPS quality
- Apply auto leveling and instrument drift corrections
- Apply default lag correction
- Generate preliminary contour map(s) from submitted data
- Generate preliminary original vs. repeat profiles by transect
- Generate formatted ASCII files containing preprocessed data by transect

### **3.2.3 Final Processing**

After completion of preprocessing, the data were further evaluated and processed to generate final processed data files. Final processing steps included:

- Evaluation and refinement of auto leveling and instrument drift corrections in the channel selected for target analysis (Channel 2)
- Evaluation and refinement of lag correction in the channel selected for target analysis (Channel 2)
- Additional digital filtering and enhancement, as necessary, in the channel selected for target analysis (Channel 2)

- Targeting of data, as described in Section 3.2.4
- Generation of formatted ASCII files containing processed data by transect
- Generation of final maps for each transect showing contoured data, target locations, and culture
- Generation of final original vs. repeat profiles by transect

### **3.2.4 Analysis and Target Selection**

The UX-Detect module within Oasis Montaj identifies peak amplitude responses associated with, but not limited to, MEC items. Data was gridded using the Kriging method, and initial targets were selected along the profiles that were produced. The data profiles corresponding to the anomalies selected by Geosoft were then analyzed by trained geophysicists, with the targets evaluated as to their validity and position, as single-source anomalies may generate multiple target designations depending on shape and orientation. Targets found to be invalid or incorrectly located were removed or adjusted. Additionally, anomalies that were not selected by the UX-Detect module, yet deemed to represent a potential MEC target, were manually selected. All target selection was performed on final processed data from Channel 2 of the bottom coil of the EM61-MK2.

Final processed XYZ (ASCII) files were created for each transect and individual geophysical maps and target lists were created for each transect. When all data at a particular site had been collected mosaic maps were created by combining color contour maps from all the transects at that site. All anomalies occurring at or above the targeting threshold of 3 mV Channel 2 were identified using a unique ID number.

Each target list provides a Target ID, Transect ID, Easting (x) and Northing (y) UTM coordinate location for each target, the recorded peak response in millivolts, and any processor comments. The target IDs were prioritized by designating the highest amplitude response as the number one target in each transect.

All raw, preprocessed, and processed data have been submitted to CH2M HILL's project geophysicist and can be found on the enclosed CD (see Contents of CD).

## **4.0 RESULTS**

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### **4.1 SUMMARY OF WORK PERFORMED**

The digital geophysical mapping of selected areas of MCB Camp Lejeune took place from May 19<sup>th</sup> to May 21<sup>st</sup>. After the majority of May 19<sup>th</sup> was spent surveying the GPO, Site UXO-14 Former Indoor Pistol Range and Gas Chamber was completed. The former gas chamber consists of two transects measuring 17 and 17.5-meters in length, respectively and is densely wooded, preventing the use of RTK GPS.

DGM was conducted in UXO-10, D-11A Flame Tank and Flame Thrower Range and UXO-11, B-5 Practice Hand Grenade Course on May 20<sup>th</sup>. UXO-10 is an area approximately 10 acres in size surrounding a developed parking lot and an adjacent field to the southwest. UXO-10 was collected in two portions: UXO-10 and UXO-10A. UXO-10 includes 43 transects and has minimal natural and cultural obstacles hindering data production and quality. UXO-10A is the area located to the southwest of Main Service Road. Although relatively flat, the area is scattered with dense vegetation and construction materials, which prevented the placement of transects prior to NAEVA's arrival. Consequently, UXO-10A was run as a continuous meandering path using RTK GPS.

Following the completion of UXO-10, collection of UXO-11, B-5 Practice Hand Grenade Course commenced. UXO-11 included eight transects and was on level ground; deep standing water in the southeast corner of the site created the only obstacle.

DGM took place at UXO-07, D-6 Practice Hand Grenade Course on May 21<sup>st</sup>. Site UXO-07 includes two separate areas – UXO-07\_1 and UXO-07\_2 – that combine for 126 transects. There are a large number of cultural items, including power lines, buildings, chain-link fence, active parking lots and roads, and vegetation that hindered production slightly.

Table 1 (at the end of the text) provides a full breakdown of acreage and targets by transect block. Plates 1 – 6 display the EM61-MK2 bottom coil mosaic maps for UXO-07\_1 and UXO-07\_2, UXO-10 and UXO-10A, UXO-11 and UXO-14, respectively.

## **4.2 MOBILIZATION AND SITE SETUP**

Prior to mobilization an Activity Hazard Analysis (AHA) and Standard Operating Procedures (SOPs) were provided to CH2M HILL, and all personnel had current 8-hour and/or 40-hour OSHA HAZWOPER training.

NAEVA mobilized one field crew to Jacksonville, North Carolina on May 18<sup>th</sup>. Color-coded survey control stakes had been installed prior to arrival on site. Work was initiated on May 19<sup>th</sup> and all specified collection activities were completed by May 21<sup>st</sup>. Site-specific health and safety briefs were given each morning by the CH2M HILL site manager. No equipment was staged on site.

## **4.3 DGM SURVEY ACTIVITIES**

### **4.3.1 Site UXO-07, D-6 Practice Hand Grenade Course**

The Former Practice Hand Grenade Course designated as UXO-07 and subdivided into UXO-07\_1 and UXO-07\_2 (Figures 1 and 2) is a former practice hand grenade range used to train troops how to use hand grenades. Since it was not an actual hand grenade range, the level of MEC present is expected to be very low. The site has since been developed into a living facility with a surrounding parking lot with an Armory

in the south west portion. The ground was generally flat which aided the data quality, however a number of cultural objects are present; buildings, parking lots, chain-link fences, moving cars and vegetation acted as obstacles and in some cases caused GPS dropout and created gaps in the transect paths.

On the seven acre site, 126 total transects were collected in two separated areas. UXO-07\_1, the larger of the two areas, consisted of 91 transects totaling .635 acres. 1105 targets were selected above the targeting threshold of 3 mV in Channel 2 in this area, giving an estimated target density of approximately 1740 targets per acre. The greatest anomaly distribution is generally located next to the buildings and roadways, possibly due to the presence of underground structures such as reinforced concrete. 196 of the 1105 selected targets – approximately 17 percent – have been designated as culture. The eastern-most area, farthest from the building and roads, were generally clear.

UXO-07\_2, located to the southwest of the first area, was considerably smaller. 35 transects, totaling 0.18 acres were collected in this region. Transects were collected on a smooth but slight hill and were bounded by a parking lot and fences. Roads, utilities, and concrete pads were observed and avoided as much as possible. Dense concentrations of short trees also caused breaks in transect paths. 328 targets were selected in this area, resulting in an estimated target density of approximately 1822 targets per acre. The general concentration of these targets located near the Armory and roads in the southwest corner. A total of 113, or approximately 34 percent, of the selected targets have been deemed as culture-related.

#### **4.3.2 Site UXO-10, D-11A Flame Tank and Flame Thrower Range**

The Flame Tank and Flame Thrower Range, also composed of two separate areas, UXO-10 and UXO-10A (Figures 3 and 4), was only used as a flame thrower range, and as such no actual munitions are expected, however hand grenades and C-4 may have been used.

The area is currently a parking lot (UXO-10) to the north and an undeveloped field (UXO-10A) to the south, transected by a service road used primarily for tank traffic. UXO-10 was generally smooth with a small ravine located parallel to Main Service Road and another parallel to Gonzalez Boulevard. Cultural items in the area included a paved parking lot with cars, active roads, culverts and light posts and overhead power lines along Gonzalez Boulevard. No MEC surface debris was noted.

43 transects were collected over 0.35 acres; with 434 targets selected, the estimated target density is approximately 1251 targets per acre. Target distribution was generally uniform increasing slightly in proximity to the roads and power lines. Culture-related items were the source of 115 targets, or 26 percent of all selected targets for the area.

UXO-10A is located across Main Service Road from the northern area and is predominately level ground. Due to a large number of closely spaced obstructions, including lumber, sewer piping, dense vegetation and a container truck, stakes were not placed by surveyors prior to NAEVA's arrival. Under the guidance of

CH2M HILL, one meandering transect was used as an alternative method of collection. The path of collection was done in sweeps generally parallel to the main service road in order to reduce the amount of data overlap, and therefore ensuring the goal of 10 percent coverage would be met.

794 targets were selected along a path that totaled 0.72 acres, giving an estimated target density of approximately 1097 targets per acre. The main concentration of targets is located along the western boundary near the overhead power lines and utility markers and along the southern portions where the construction materials were present. A small percentage (less than 10 percent) of the selected targets was considered culture-sourced.

#### **4.3.3 Site UXO-11, B-5 Practice Hand Grenade Course**

The Practice Hand Grenade Course, UXO-11 (Figure 5), was used to train troops how to use hand grenades. Since it was not an actual hand grenade range, the level of MEC present is expected to be very low. The area is now a parade/training ground used sporadically for non-munitions related work.

Work at UXO-11 was begun immediately following the completion of UXO-10. Eight transect lines, each approximately 120 meters in length, were collected over smooth ground with no cultural influences for a total of 0.23 acres. A ditch containing deep standing water created a gap in the southernmost transect and tall trees were noted on the southern boundary but caused no GPS dropouts.

In the area collected, 86 targets were selected with slightly higher concentrations of targets were in the center of the area. The approximate estimated target density observed for UXO-11 is 379 targets per acre. Approximately 18 percent of all selected targets were considered culture related; however, these 16 targets represent the surveyor nails placed at the end of each transect. No MEC-related surface debris was observed in this area.

#### **4.3.4 Site UXO-14, Former Indoor Pistol Range and Gas Chamber**

Site UXO-14 (Figure 6), Former Indoor Pistol Range and Gas Chamber, was used for small arms practice and gas training, thus no actual munitions are expected. Due to dense forest with thick underbrush and minimal vegetation clearance, steep terrain, and scrap metal, only a small portion of the Former Gas Chamber was collected. The dense vegetation of Site UXO-14 also prevented the use of RTK GPS; in lieu of GPS, wheel mode with fiducial positioning was used with the EM61-MK2.

Two transects were collected on this site for a total of 33.9 meters and .01 acres, which was a reduced area compared to the original .96 acres that were expected to be surveyed. The area designated for collection is steep on the western edge and levels out to the east. Abundant scrap metal was observed at the surface; large pieces of sheet metal were removed from the survey area prior to collection. No MEC-related surface debris was observed.

The transects were 17 and 17.5 meters long, respectively, and yielded a total of 17 targets. A more concentrated area of high-response targets is present on the east side of the surveyed transects. Only two targets were designated as culture-related for the two transects, which represent the surveyor nails placed at stake locations 10138 and 10137 (Plate 6). The target density for UXO-14, based on the number of targets detected in comparison to the area collected, is approximately 2125 targets per acre; however, since such a small area was surveyed and in an area where surface metal was abundant, this number is not statistically accurate.

#### **4.4 DATA PROCESSING AND INTERPRETATION**

All data were processed as described in-depth in Section 3.2. Part of the process included analyzing channel decay in order to identify possible noise or other false positive responses. Any anomalies suspected as originating from noise (e.g., channel readings out of phase) and not metallic objects are noted in the processing reports included on the CD. These reports list down-line data density statistics, leveling, lag, and parameters used in processing each transect. Processors examined all data prior to NAEVA demobilizing from the site.

### **5.0 QUALITY CONTROL**

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To establish confidence in the data reliability, QC tests were conducted throughout the project. Tests were conducted prior to, during, and after all data collection sessions. All QC tests for the EM61-MK2 were conducted after a minimum 15 minute warm-up period for the electronics. Sample graphical displays of QC data are included in Appendix B.

#### **5.1 SYSTEM VALIDATION - GEOPHYSICAL PROVE-OUT (GPO)**

Prior to mapping the four sites, a survey of a pre-existing GPO area was completed. The purpose of surveying the GPO is to demonstrate the effectiveness of all instrumentation, methods, and personnel prior to the initiation of fieldwork and document the site-specific capabilities of a DGM system. Serial number identifications were recorded for all instrumentation (i.e. data logger, coils, EM61-MK2 electronics), and the GPO was mapped using the same personnel, equipment, and methodologies employed for the DGM survey.

The existing GPO location in Knox Park used by NAEVA for all prior work at MCB Camp Lejeune was used for this project as well. A background survey was not conducted, as the GPO has been in place for several years and many collected datasets exist for comparison. Inert seed items were emplaced by CH2M HILL at various depths and orientations in order to test the detection capabilities of the instrument and establish a targeting threshold for geophysical anomalies. The GPO was originally established using the

North Carolina State Plane coordinate system under the NAD83 (1986) datum. Both corner stakes and corner flags were present in the ground, and noted on the contour maps (Appendix A), displaying the shift in coordinates that has occurred with the new datum.

The EM61-MK2 was used to survey the GPO twice in wheel mode, using RTK GPS and fiducial positioning. The EM61-MK2 was chosen based on its ability to detect small, near-surface ferrous and non-ferrous munitions and its high data resolution. The unconsolidated sands at MCB Camp Lejeune should not adversely affect the instrument response, however the EM61-MK2 is susceptible to interference from power lines or other objects that create an electromagnetic field (e.g., junction boxes, radios in transmit mode).

It was determined that a threshold of 3 mV in Channel 2 (the same threshold used in prior work) would detect the MEC items of interest. See Appendix A for color contour maps of the RTS- and fiducial-collected GPO.

## 5.2 QC TEST DESCRIPTIONS AND ACCEPTANCE CRITERIA

The following QC procedures were performed and documented during the data collection process and reviewed by a qualified geophysicist on a daily basis:

**GPS QC:** Positioning accuracy of the geophysical data was demonstrated by testing the GPS equipment over one or more known points. The accuracy of the data positioning was evaluated by comparing NAEVA's point coordinates provided by the professional land surveying team. The project DQO's called for the positions to be within 10-cm of the known points. The sensor position test was conducted prior to starting DGM surveying each workday. Errors noted in the positioning were less than 10-cm each day with typical errors on the order of 3-4 centimeters.

**Static Background and Static Spike:** Static tests were performed by positioning the survey equipment within or near the survey boundaries in an area free of metallic response and collecting data for a 3-minute period. During this time, the instrument was held in a fixed position through the use of a PVC pipe stand. The static tests consisted of one minute without a spike (known standard), one minute with a spike (a wood board fitted to the bottom coil with a bolt secured through the center), and then one minute without a spike. The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist, and to ensure consistent response to the spike item. The static background and static spike test were conducted at the beginning of each day and the end of each site investigation.

**Cable Shake Test:** Each morning, prior to production surveying, data were collected while the EM coil was held in a stationary position, and each of the cables were shaken, one at a time. The response was monitored in the field for immediate corrective action, transmitted back to a processor, analyzed, and checked for spikes in the data that can possibly create false anomalies. Any data spike greater than 2 mV

from the mean would constitute a QC failure. The cable shake test was conducted at the beginning of the survey operation for each workday and cables were not disconnected during the day.

**Personnel Test:** This test checks the response of instruments to personnel and their clothing/proximity to the system. Each morning, prior to survey operation, the instrument was checked for its response to the personnel operating the system. The response was observed in the field for immediate corrective action and transmitted back to a processor, and analyzed and checked for spikes in the data that can possibly create false anomalies. Any data spike greater than 2 mV from the mean would constitute a QC failure.

**Latency Test:** A 20-meter long single survey line was established near the first transect of the day with the static item placed at the center point (10-m). A line of data was collected in each direction along the test line prior to daily collection operations to demonstrate consistency in instrument performance (both response and positioning) throughout the course of the survey, with acceptance criteria of  $\pm 20\%$  response amplitude and  $\pm 20$  cm positional accuracy.

**Repeat Data:** This test is performed to verify repeatability of the data and was performed at the end of each of the four UXO sites. At least 2% of the survey lines were repeated and evaluated for consistency. Since small deviations in line path can affect the instrument response the profiles were evaluated qualitatively. The spike test is used to assess quantitative repeatability.

### 5.3 QC TEST RESULTS

QC data were evaluated using Geosoft's QA/QC software. Static, cable shake, and personnel test profiles were plotted with an acceptance criterion of  $\pm 2$  mV from the mean. Any readings outside this range were flagged on the profiles and an associated failure percentage was reported. The following provides a summary of the QC results:

**GPS QC:** All daily checks of GPS accuracy were within 10-cm of the recorded positions.

**Static Background / Spike Test:** All static and spike tests were within acceptance criteria; stable, repeatable, and without spikes.

**Cable Shake Test:** No spikes were observed in any of the tests.

**Personnel Test:** No deviation from background response was observed.

**Latency Test:** Latency tests were plotted showing the line path and gridded response. A comparison of tests shows that response amplitudes are consistent and test item positions are accurate.

**Repeat Data:** Repeat lines generally showed good repeatability. Discrepancies in repeat lines were often a result of line path deviation or noise in the data.

All QC tests were well within acceptance criteria. As QC tests were conducted in the vicinity of the

associated grids, variations in noise levels are apparent. Especially noisy tests are noted on the data plots as containing influence from power lines. Most static spike tests show an initial drop in response at the beginning of the collection period, likely due to software behavior, as readings were completely stable in monitoring mode, yet when data collection was started the recorded values dropped. This behavior was observed on multiple occasions but the effect was reduced during data leveling and did not result in any QC failures.

## 6.0 CONCLUSIONS

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Work under TO-14 was completed after one working day for the GPO and Site UXO-14 Former Indoor Pistol Range and Gas Chamber, one day for Site UXO-10, D-11A Flame Tank and Flame Thrower Range and Site UXO-11, B-5 Practice Hand Grenade Course, and one day at UXO-07, D-6 Practice Hand Grenade Course. Mapping activities were slightly slower at site UXO-07 due to its large size and increased number of obstacles including buildings, roadways/parking lots, fences and vegetation that fragmented transects. This survey serves as the initial focused SI of all aforementioned areas in which NAEVA has conducted 10 percent transect surveys.

A qualitative analysis highlights the effectiveness of the transect survey in identifying areas of higher metallic concentrations. In particular, the higher densities of targets were generally located near cultural objects such as buildings and fences. The anomaly density observed for UXO-07\_1 is more concentrated near the buildings in the southern portion of the site and near the road to the west; these areas composed more than half the targets selected. The surveyed area at Site UXO-07\_1 is currently an in-use housing complex and therefore contains many cultural structures that may have affected target detection and densities. UXO-07\_2 is similar with regards to target density array; the targets are even distributed throughout the area, but where there was a building, fence, or other structure present, anomaly density increased. Underground utilities associated with the housing complex may have been, in conjunction with aboveground influences, responsible for the increase in target density. However, since the area was not a full coverage survey, it is not possible to accurately identify the presence of underground utility lines.

MRP Site UXO-10, similar to UXO-07, shows high concentrations of targets near man-made objects. UXO-10 had a number of overhead power lines and light posts, near which target densities tended to increase. Approximately one-third of the targets were located below the overhead power lines on the western side of the site; however, the same area also included several metal culverts and light posts as features, which are also known to be responsible for increasing the target density. A saturated area is visible on the eastern portion of the site (Plate 3), but no cultural influences were apparent in the field.

UXO-10A displayed comparable target densities to UXO-10. The main concentrations of targets are

located in two areas and comprise approximately two-thirds of the selected targets. On the western edge of the collected area, a large saturated region is shown. This area is in close proximity to overhead power lines, and several cultural objects including a large utility cover, which suggests the possible existence of underground utilities. The second saturated region is located at the southern end of the collected area. Several construction items including large, metallic sewer pipes were noted on the surface here. It is possible that these large construction items, in addition to smaller discarded pieces of metal, could be the cause of the increased target density in this area.

Lacking in cultural influences, UXO-11 collection yielded a considerably decreased quantity of targets. The main concentration of the targets producing the highest mV responses is located in the center of the site, but does not exhibit saturation or any predictable cultural pattern.

UXO-14 produced a similar number of targets for each transect collected. The two transects, being only five meters apart, displayed analogous patterns of target location. Cultural influences were not noted in the dense vegetation surrounding the collected area of UXO-14; however, large pieces of sheet metal were observed upon arrival and moved prior to collection. It is possible that pieces of scrap metal that were not removed from the area are the cause of the large mV values that were recorded by the EM61-MK2.

While there are a low number of suspected noise targets, noise levels were not severe enough to adversely affect the detection of actual metallic objects, and there are no areas on the map that exhibit noise saturation. Even at the southwest boundary of UXO-10, where data collection passed directly under the lines, noise was only moderate. The overhead line location can be seen in Plate 3.

Since both UXO-07 and UXO-11 were used as training and education sites rather than live ranges or impact areas, any MEC present is expected to be quite shallow. Given that all the MRP Sites investigated during this survey have been previously redeveloped, with the exception of UXO-14, which is heavily wooded, no trenches or holes from training activities are visible. It is probable that any MEC, whether discrete objects in the top foot or so of soil, or items in burial pits, have been accurately located by this geophysical survey.

The enclosed CD contains all raw, preprocessed, and processed data, including processing reports, QC test results, color contour maps and target lists for each grid, and mosaic maps for both sites. A copy of this report may also be found in Adobe PDF and Microsoft Word formats.

## 7.0 REFERENCES

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- CH2M HILL. 2009. *Preliminary Assessment/Site Inspection at Site UXO-07, D-6 Practice Hand Grenade Course (ASR #2.77)*. Prepared for Department of the Navy Naval Facilities Engineering Command. March.
- CH2M HILL. 2009. *Preliminary Assessment/Site Inspection at Site UXO-10, D-11A Flame Tank and Flame Thrower Range (ASR #2.136)*. Prepared for Department of the Navy Naval Facilities Engineering Command. March.
- CH2M HILL. 2009. *Preliminary Assessment/Site Inspection at Site UXO-11, B-5 Practice Hand Grenade Course (ASR #2.81)*. Prepared for Department of the Navy Naval Facilities Engineering Command. March.
- CH2M HILL. 2009. *Preliminary Assessment/Site Inspection at Site UXO-14, Former Indoor Pistol Range and Gas Chamber (Rifle Range Area) ASR #2.199 and #2.200*. Prepared for Department of the Navy Naval Facilities Engineering Command. April.
- CH2M HILL. 2006. *Master Ordering Agreement*. April.
- Geonics Limited. 2005. *EM61-MK2 and EM61-MK2HP 4 Channel High Sensitivity Metal Detectors Operating Manual*. July.

**TABLE 1: TRANSECT STATISTICS**

<b>Site</b>	<b>Data Set</b>	<b>Transects</b>	<b>Distance Traveled (m)</b>	<b>Acreage</b>	<b>Targets</b>
UXO-07	UXO-07_1	91	2568.991	0.635	1105
UXO-07	UXO-07_2	35	725.990	0.180	328
UXO-10	UXO-10	43	1405.267	0.347	434
UXO-10	UXO-10A	1	2931.121	0.724	794
UXO-11	UXO-11	8	919.530	0.227	86
UXO-14	UXO-14	2	33.910	0.008	17
<b>TOTALS</b>	<b>6 Data Sets</b>	<b>180</b>	<b>8584.809</b>	<b>2.121</b>	<b>2764</b>

\* Total data sets and targets do not include GPO figures

# FIGURES



Figure 1: Proposed transect location for UXO-07\_1



Figure 2: Proposed transect locations for UXO-07\_2



**Figure 3: SE portion of UXO-10 shot from Parking lot looking to SE corner**



**Figure 4: UXO-10A looking towards the SE from a midpoint of the area**



**Figure 5: Proposed Transect locations for UXO-11**



**Figure 6: UXO-14 shot from the SW to the NE**

# **PLATES:**

**PLATE 1: EM61-MK2 MOSAIC – UXO-07\_1 PRACTICE HAND  
GRENADE COURSE**

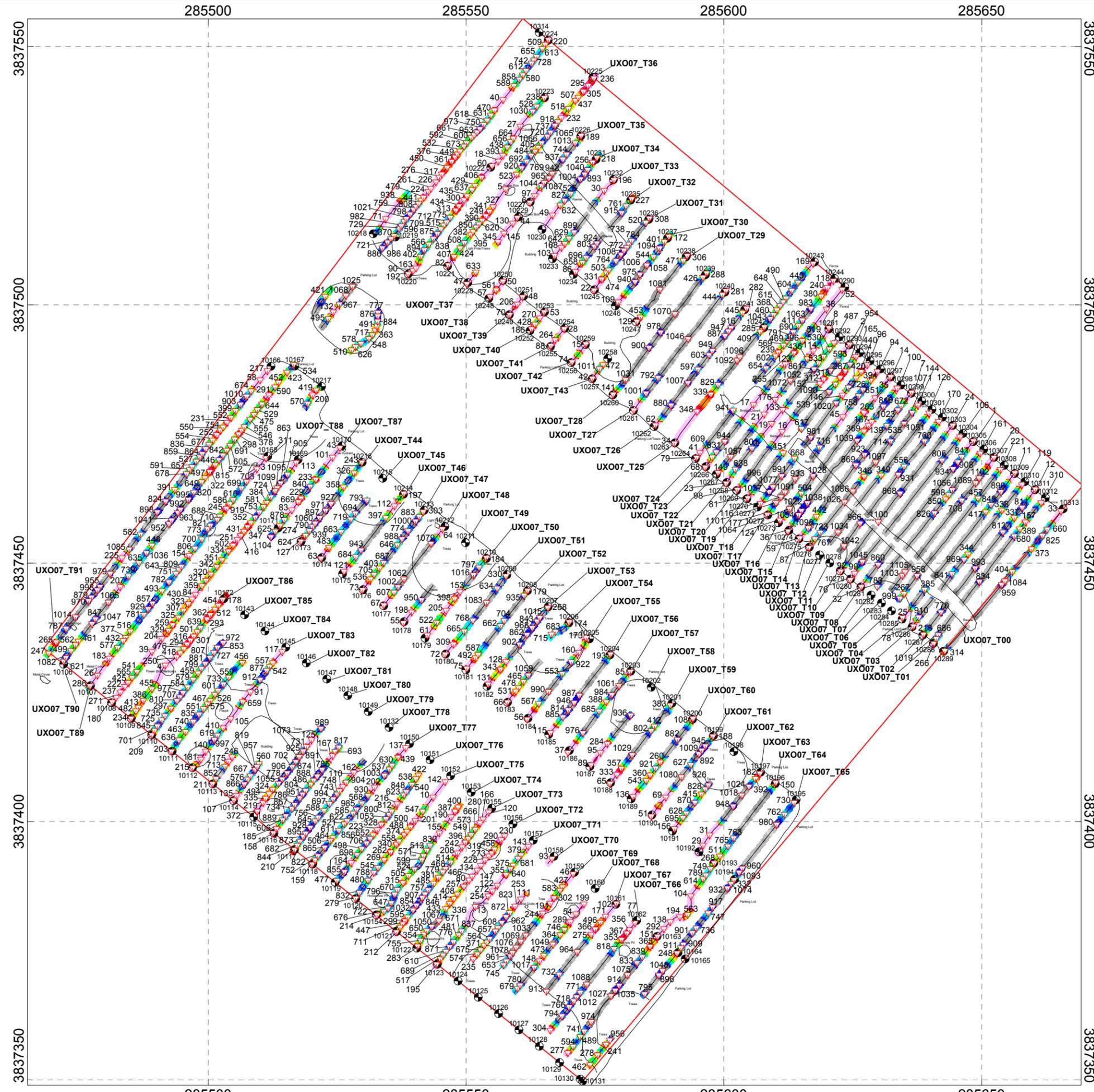
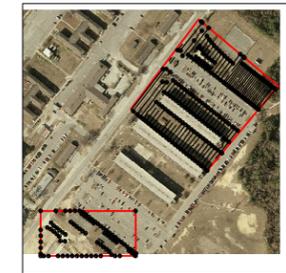
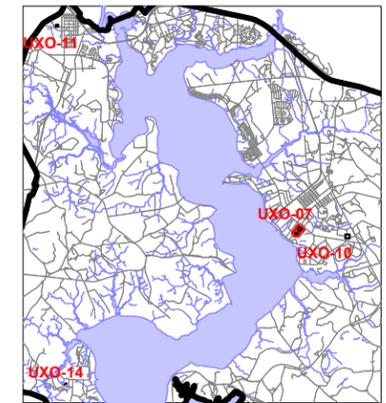
**PLATE 2: EM61-MK2 MOSAIC – UXO-07\_2 PRACTICE HAND  
GRENADE COURSE**

**PLATE 3: EM61-MK2 MOSAIC – UXO-10 FLAME TANK AND  
FLAME THROWER RANGE**

**PLATE 4: EM61-MK2 MOSAIC – UXO-10A FLAME TANK AND  
FLAME THROWER RANGE**

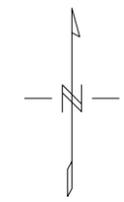
**PLATE 5: EM61-MK2 MOSAIC – UXO-11 PRACTICE HAND  
GRENADE COURSE**

**PLATE 6: EM61-MK2 MOSAIC – UXO-14 FORMER INDOOR  
PISTOL RANGE AND GAS CHAMBER**

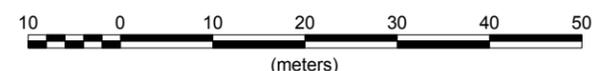


**Legend**

- Transect Path
- Surveyed Transect End Point(s)
- Thin black lines, symbols and text indicate field culture sketch (Accuracy in the range of 1-3m)
- Selected Target (See Target Pick List For Response and Location)



1:780



NAD83 / UTM zone 18N

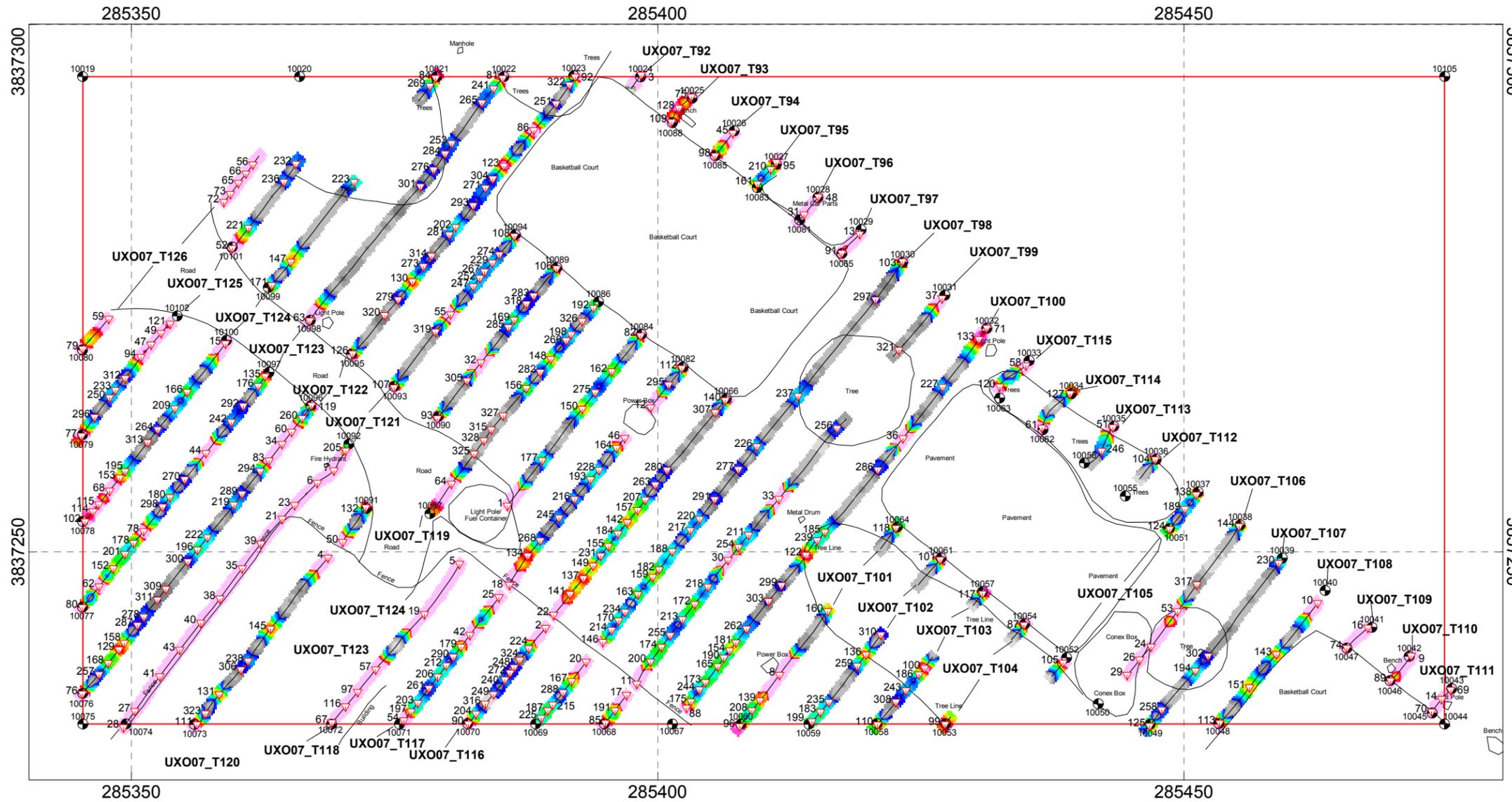
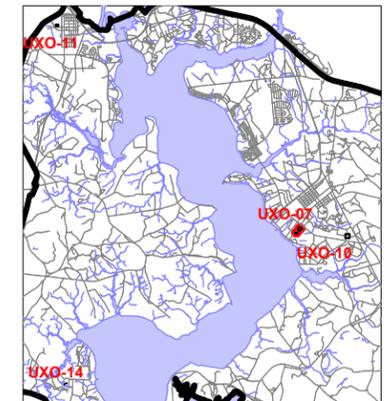
**Plate 1**

**Client: CH2M HILL**

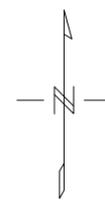
EM61 MK2 Bottom Coil  
Block UXO07 Transects UXO07\_T00 - UXO07\_T91  
Site UXO-07  
CTO-014\_MRP Site Inspections  
Marine Corps Base, Camp Lejeune, North Carolina

Date of Survey: May 21, 2009  
Date of Map Creation: May 27, 2009

Map Approver: J. Guillard

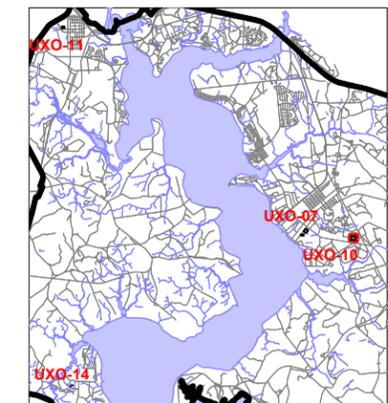
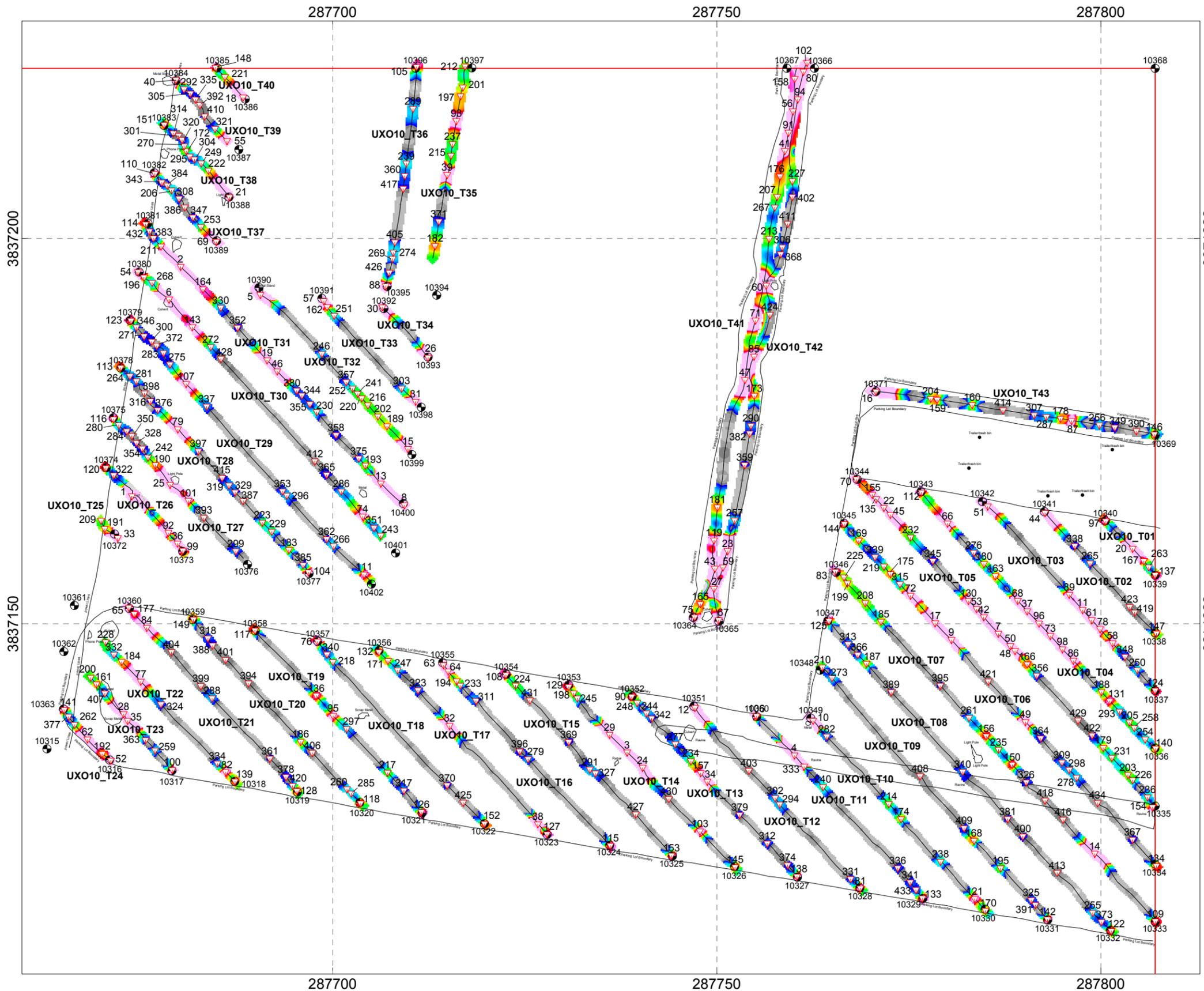


- Legend**
- Transect Path
  - Surveyed Transect End Point(s)
  - Thin black lines, symbols and text indicate field culture sketch (Accuracy in the range of 1-3m)
  - Selected Target (See Target Pick List For Response and Location)



**1:480**  
 (meters)  
 NAD83 / UTM zone 18N

<b>Plate 2</b>
<b>Client: CH2M HILL</b>
EM61 MK2 Bottom Coil Block UXO07 Transects UXO07_T92 - UXO07_T126 Site UXO-07 CTO-014_MRP Site Inspections Marine Corps Base, Camp Lejeune, North Carolina
Date of Survey: May 21, 2009 Date of Map Creation: May 28, 2009
Map Approver: J. Guillard



**Legend**

- Transect Path
- Surveyed Transect End Point(s)
- Thin black lines, symbols and text indicate field culture sketch (Accuracy in the range of 1-3m)
- Selected Target (See Target Pick List For Response and Location)

mV  
Channel 2

10 0 10 20 30  
(meters)

1:540

NAD83 / UTM zone 18N

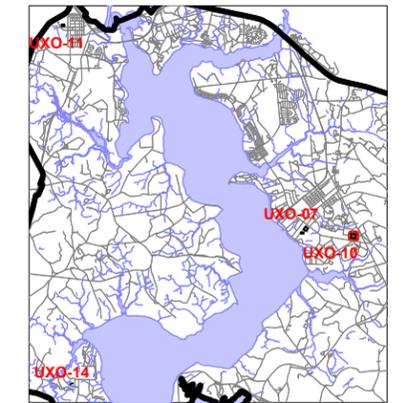
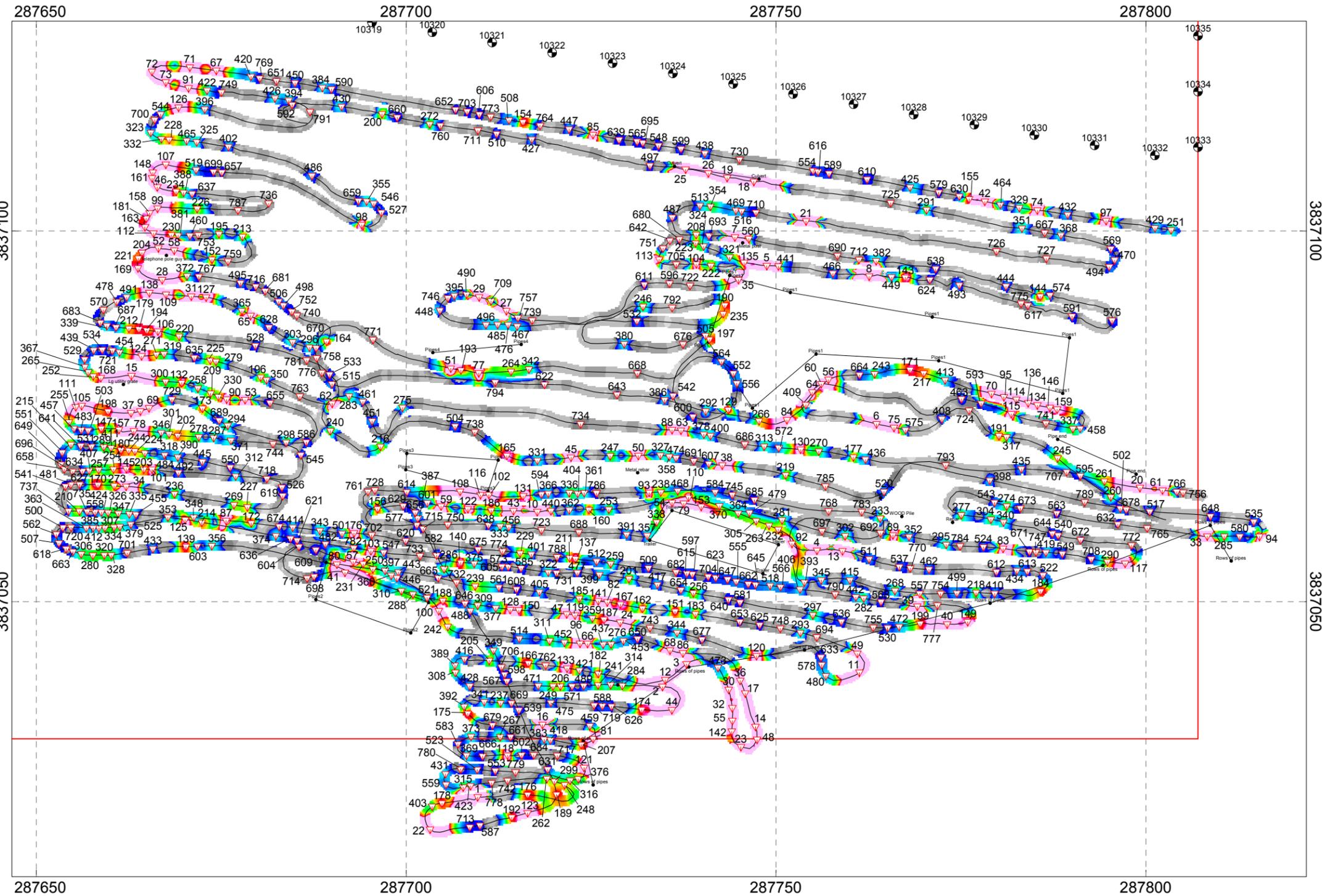
**Plate 3**

**Client: CH2M HILL**

EM61 MK2 Bottom Coil  
 Block UXO10 Transects UXO10\_T01 - UXO10\_T43  
 Site UXO-10  
 CTO-014\_MRP Site Inspections  
 Marine Corps Base, Camp Lejeune, North Carolina

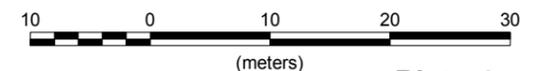
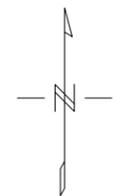
Date of Survey: May 21, 2009  
 Date of Map Creation: May 20, 2009

Map Approver: J. Guillard



**Legend**

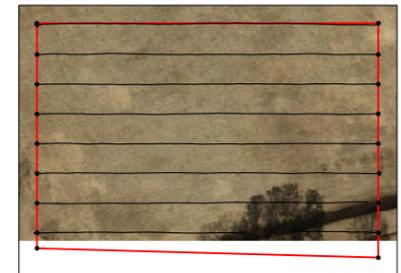
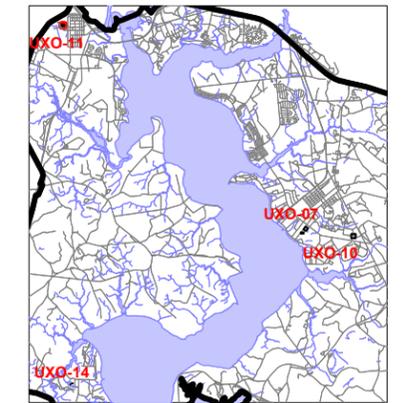
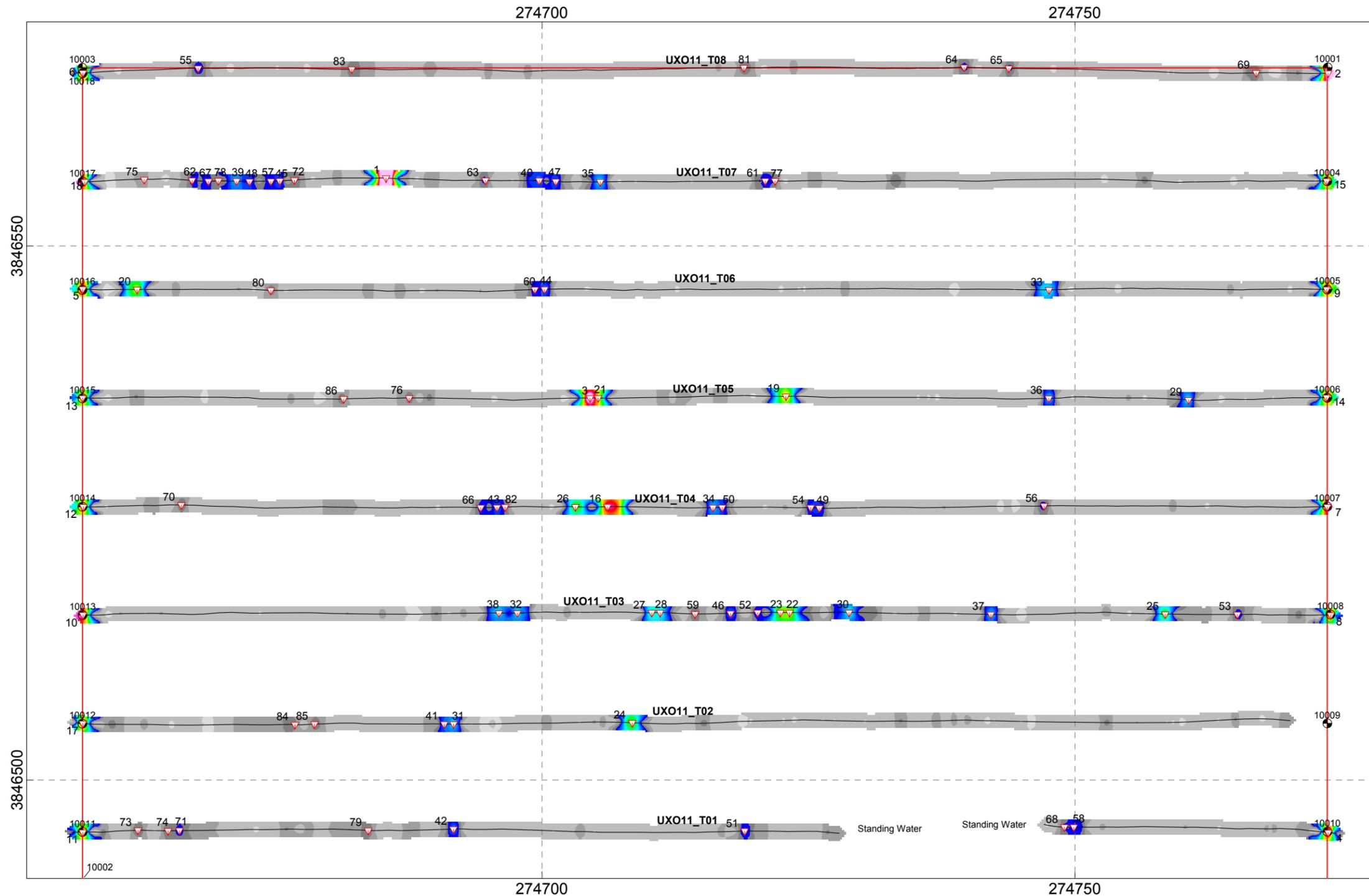
- Meandering Path
- Surveyed Transect End Point(s)
- Thin black lines, symbols and text indicate field culture sketch (Accuracy in the range of 1-3m)
- Selected Target (See Target Pick List For Response and Location)



(meters)  
 NAD83 / UTM zone 18N

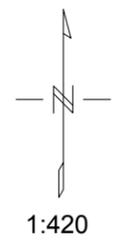
**Plate 4**

<b>Client: CH2M HILL</b>
EM61 MK2 Bottom Coil Block UXO10A Meandering Paths UXO10_MP Site UXO-10
CTO-014_MRP Site Inspections Marine Corps Base, Camp Lejeune, North Carolina
Date of Survey: May 20, 2009 Date of Map Creation: May 26, 2009
Map Approver: J. Guillard

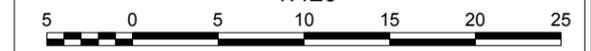


**Legend**

- Transect Path
- Surveyed Transect End Point(s)
- Thin black lines, symbols and text indicate field culture sketch (Accuracy in the range of 1-3m)
- Selected Target (See Target Pick List For Response and Location)



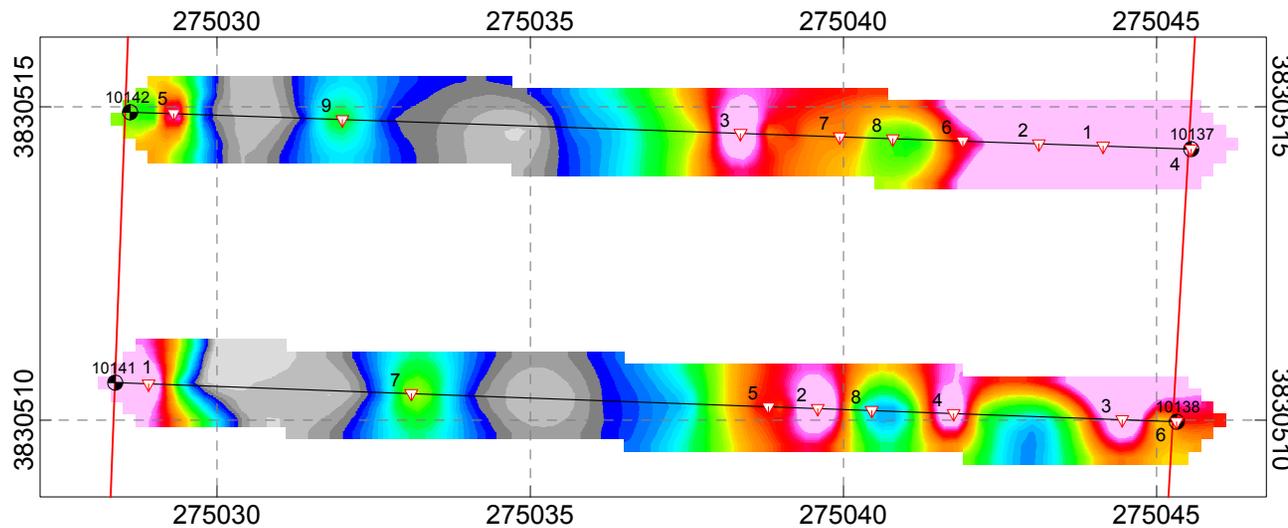
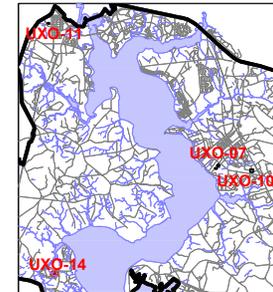
1:420



(meters)  
 NAD83 / UTM zone 18N

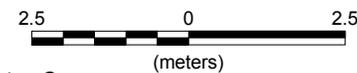
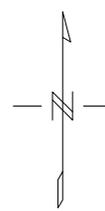
**Plate 5**

<b>Client: CH2M HILL</b>
EM61 MK2 Bottom Coil Block UXO11 Transects UXO11_T01 - UXO11_T08 Site UXO-11
CTO-014_MRP Site Inspections Marine Corps Base, Camp Lejeune, North Carolina
Date of Survey: May 20, 2009 Date of Map Creation: May 22, 2009
Map Approver: J. Guillard



mV  
Channel 2

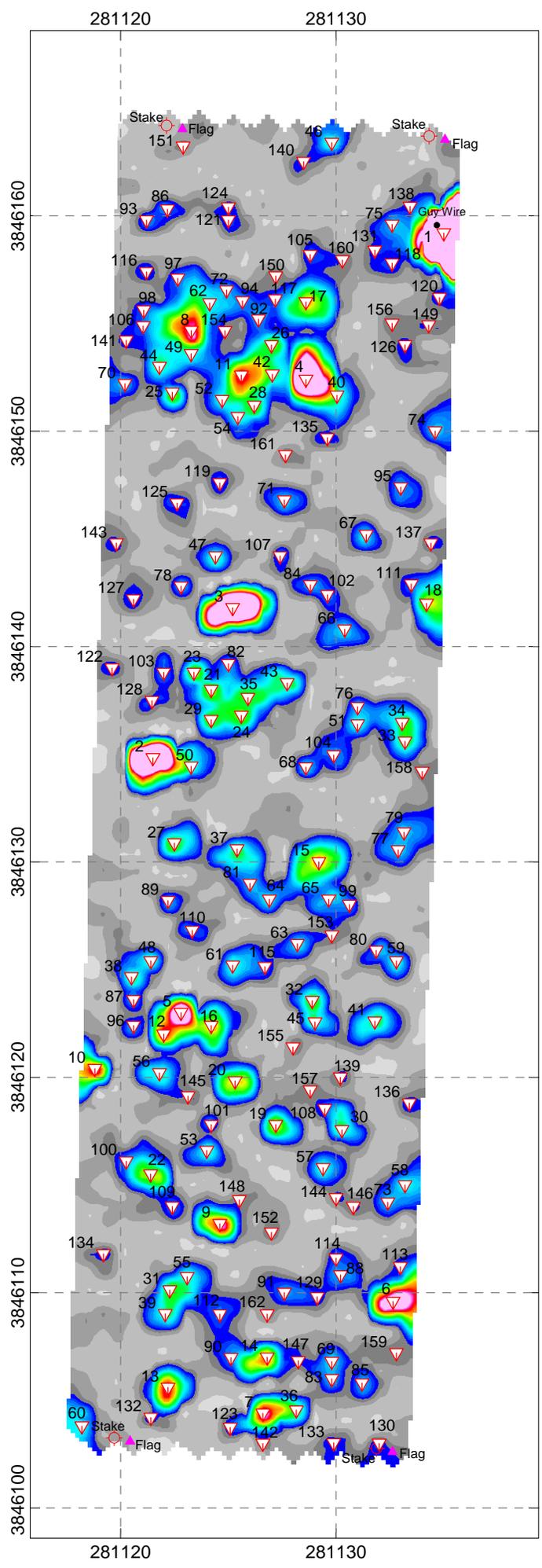
- Legend**
- Transect Path
  - Surveyed Transect End Point(s)
  - Thin black lines, symbols and text indicate field culture sketch (Accuracy in the range of 1-3m)
  - Selected Target (See Target Pick List For Response and Location)



**Plate 6** NAD83 / UTM zone 18N

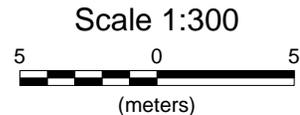
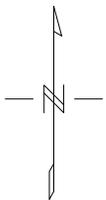
<b>Client: CH2M HILL</b>
EM61 MK2 Bottom Coil Block UXO14 Transects UXO14_T01, UXO14_T02 Site UXO-14
CTO-014_MRP Site Inspections Marine Corps Base, Camp Lejeune, North Carolina
Date of Survey: May 19, 2009 Date of Map Creation: May 21, 2009
Map Approver: J. Guillard

**APPENDIX A:  
GPO COLOR CONTOUR  
MAPS**



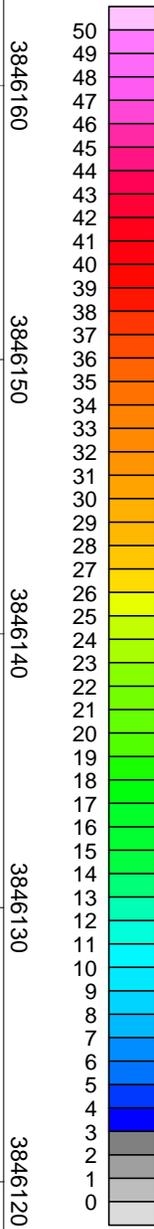
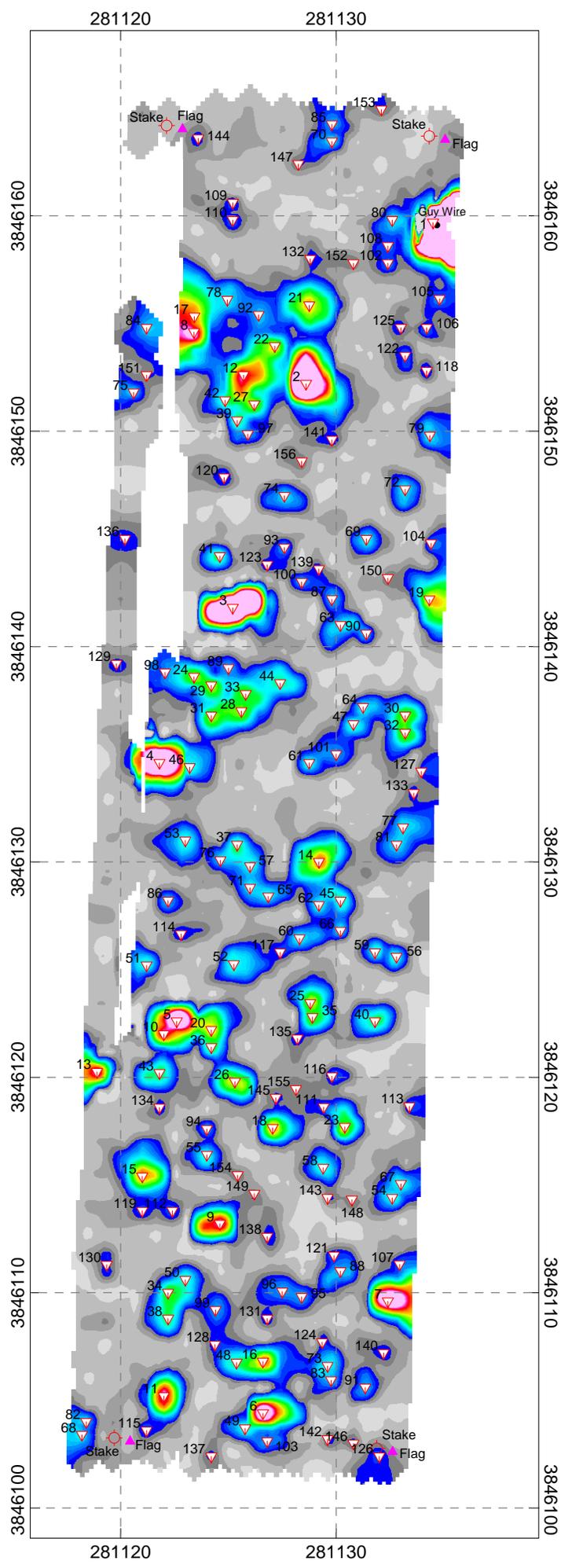
**mV**  
Channel 2

- Legend**
- 2 ▽ Selected Target  
(See Target Pick List For Response and Location)  
(Unique Target ID is XXX, eg. 002)
  - brush ● Culture (if noted)
  - Grid Corner (Idealized)
  - ▲ Flag Location



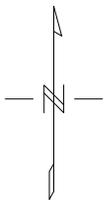
NAD83(NSRS2007) / UTM zone 18N

<b>Client: CH2M HILL</b>
EM61 MK2 Bottom Coil Geophysical Prove Out (GPO - FID) Camp Lejeune CTO-014_MRP Site Inspections Marine Corps Base, Camp Lejeune, North Carolina
Date of Survey: 05/19/2009 Date of Map Creation: 05/20/2009
Map Approver: K. Lemley



- Legend**
- 2 ▽ Selected Target  
(See Target Pick List For Response and Location)  
 (Unique Target ID is XXX, eg. 002)
  - Culture (if noted)
  - ⊕ Grid Corner (Idealized)
  - ▲ Flag Location

mV  
Channel 2



NAD83(NSRS2007) / UTM zone 18N

<b>Client: CH2M HILL</b>
EM61 MK2 Bottom Coil Geophysical Prove Out (GPO - GPS) Camp Lejeune CTO-014_MRP Site Inspections Marine Corps Base, Camp Lejeune, North Carolina
Date of Survey: 05/19/2009 Date of Map Creation: 05/20/2009
Map Approver: K. Lemley

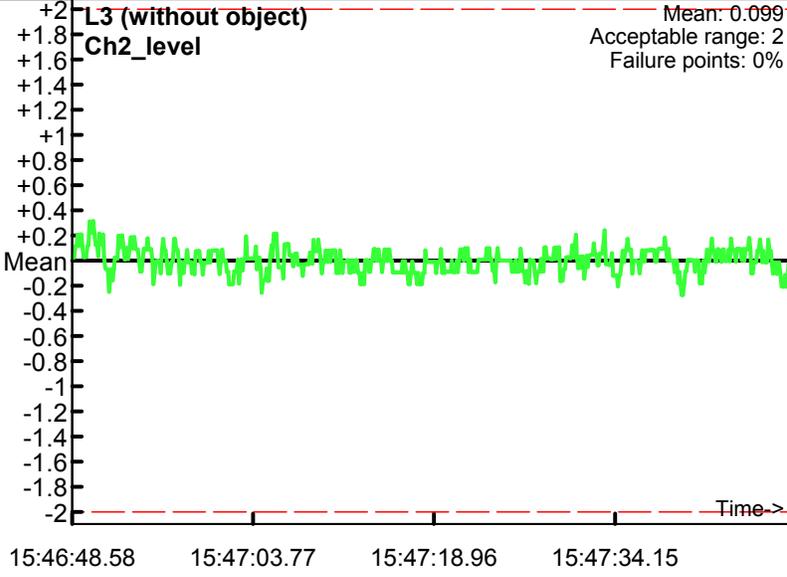
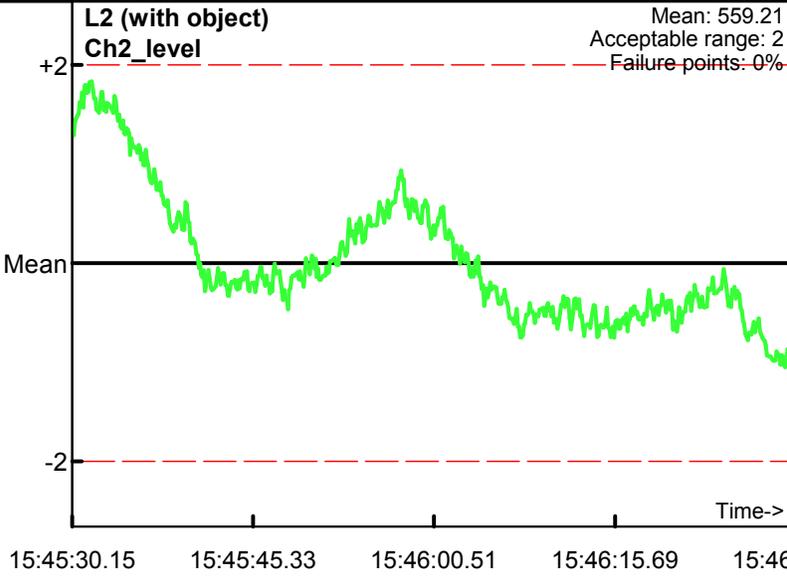
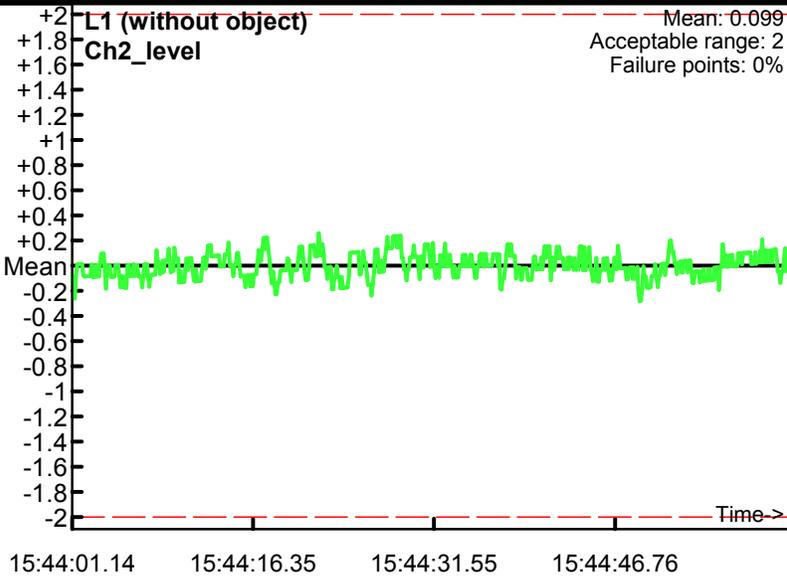
**APPENDIX B:  
EXAMPLES OF QC TEST  
RESULTS**

# Static Calibration Test

Project: CTO-014\_MRP Site Inspections Camp Lejeune  
Equipment: EM-61 Mark II  
Grid/Location: Localized QC Area

Instrument Threshold: 20%  
● Outside range  
- - - Acceptable limits

PM test  
Operator: Geo1  
Date: 2009/05/19

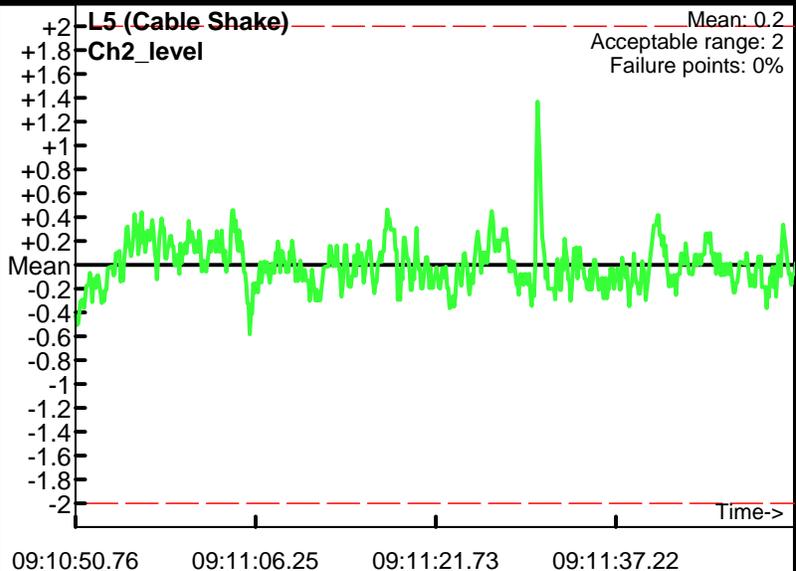
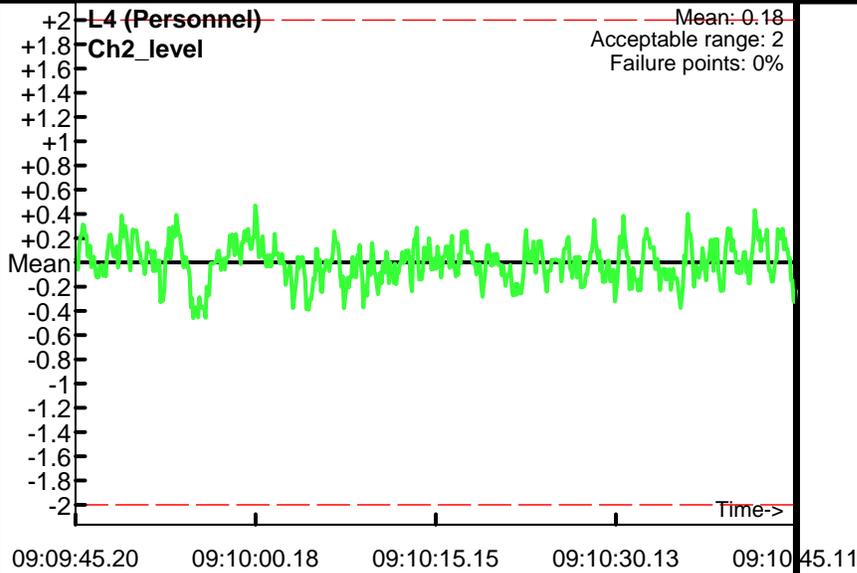


# Personnel & Cable Shake Tests

Project: CTO-014\_MRP Site Inspections Camp Lejeune  
Equipment: EM-61 Mark II  
Grid/Location: Localized QC Area

Instrument Threshold: 20%  
● Outside range  
--- Acceptable limits

QC1 test  
Operator: Geo1  
Date: 2009/05/21

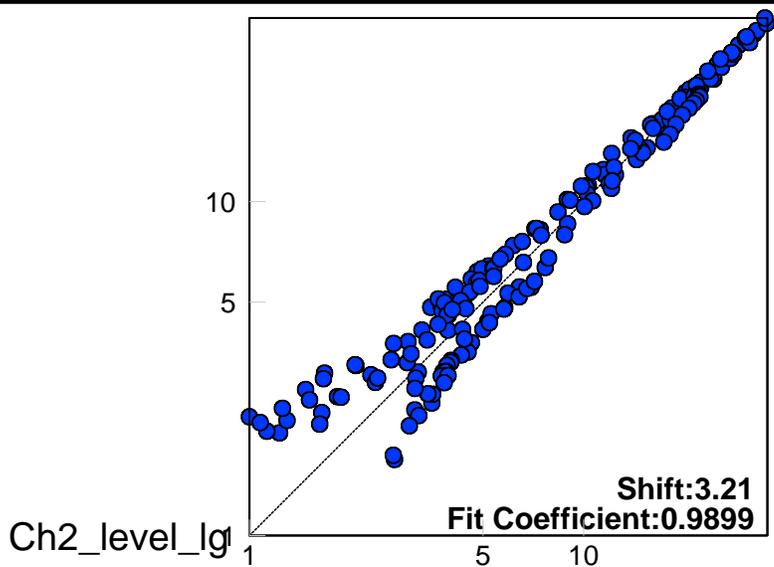
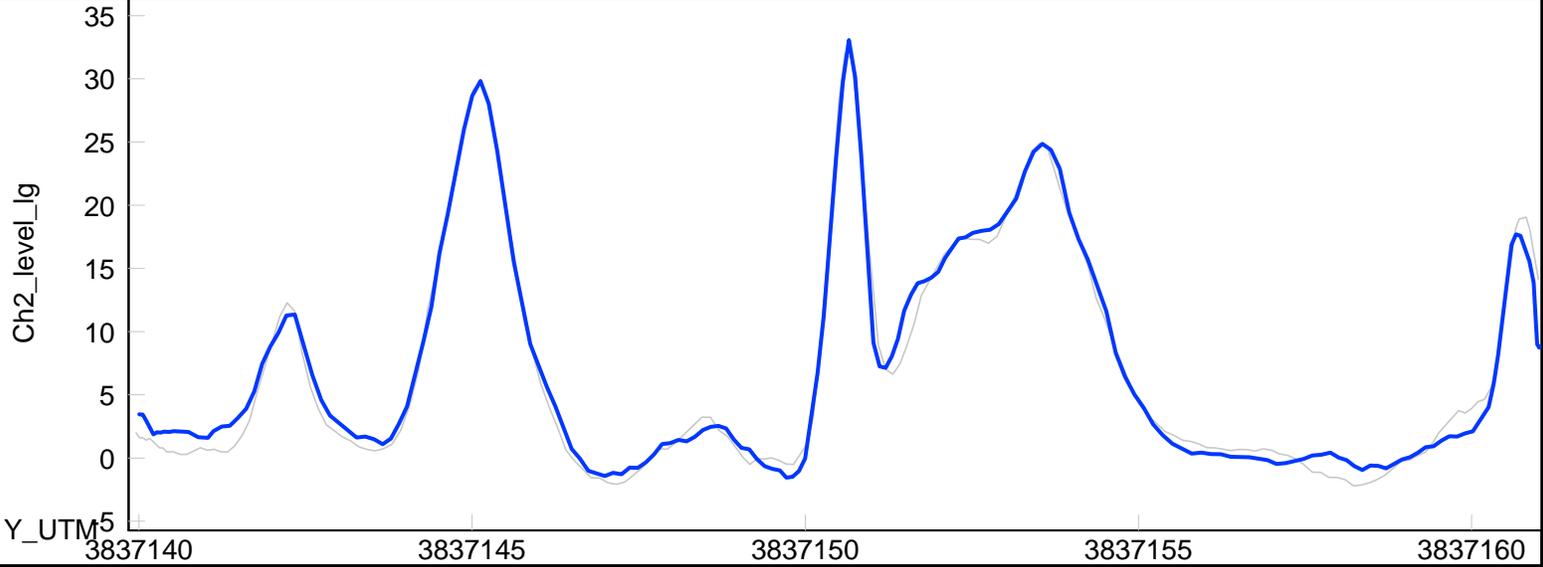
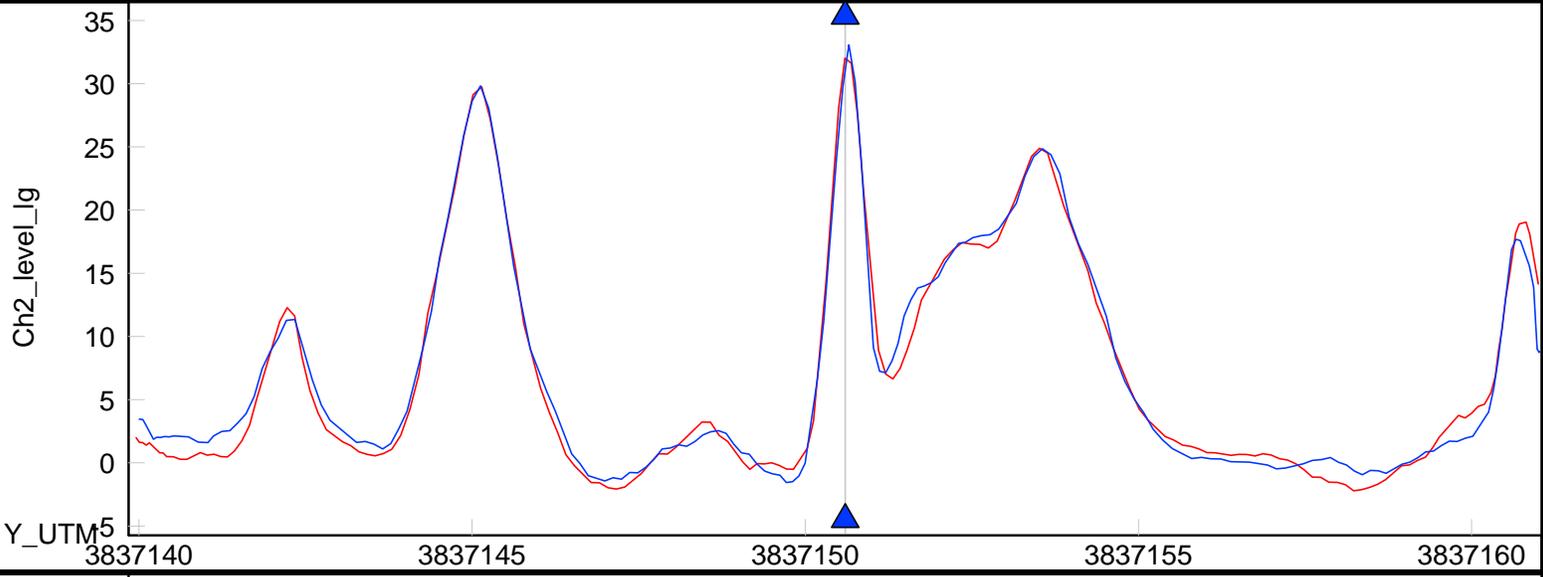


# Dynamic Response Test

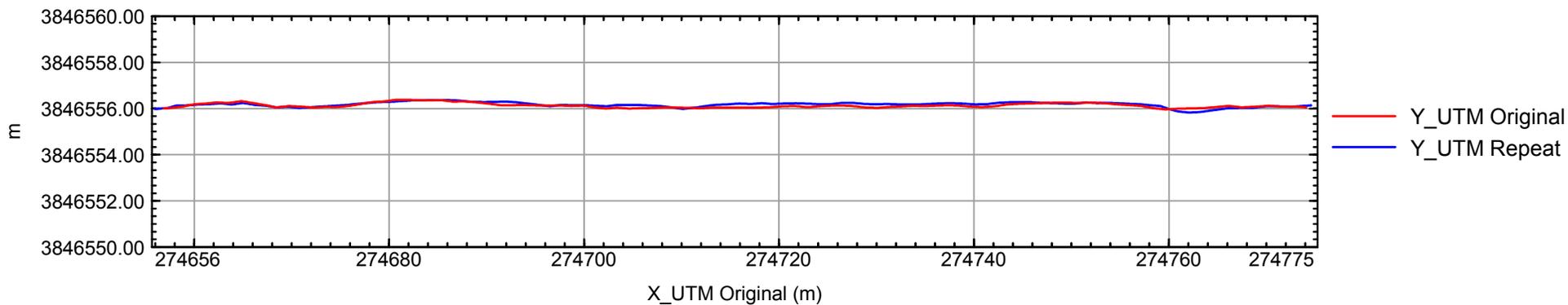
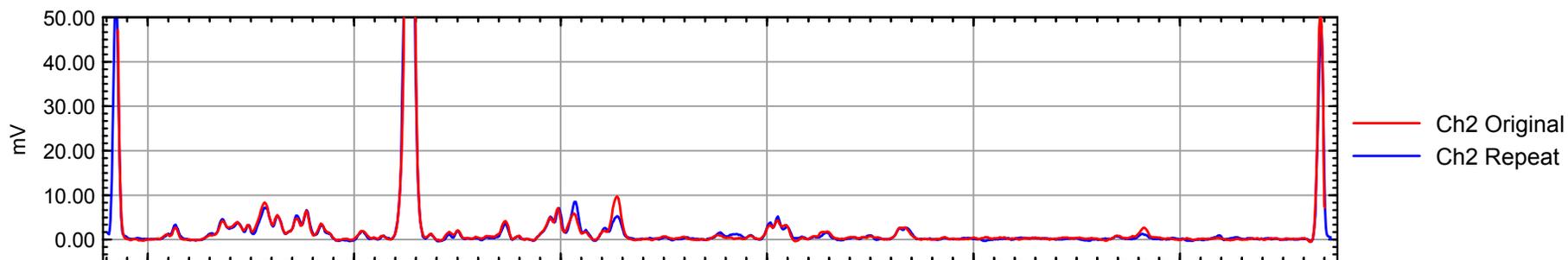
Peak Tolerance(Value): 20(%)  
 Operator: Geo1  
 Project: CTO-014\_MRP Site Inspections Camp Lejeune  
 Equipment: EM-61 Mark II  
 Grid/Location: Localized QC Area

— Previous Profiles  
 — Reference Profile  
 — Comparison Profile

△ Top:First/Bottom:Second Profile  
 ▲ Target Value <= Tolerance  
 ▲ Target Value > Tolerance  
 ▲ No Data at Target

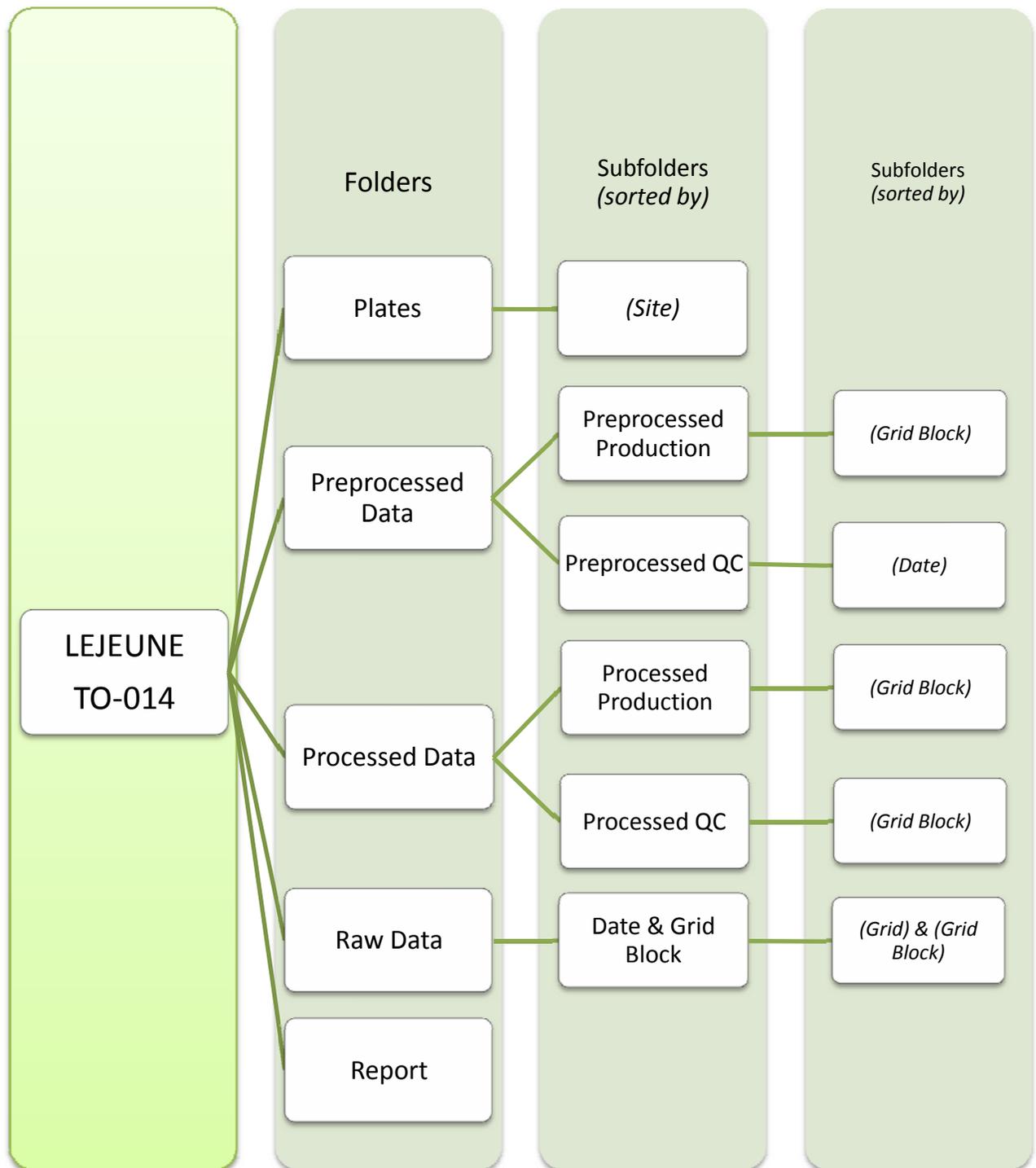


# CTO-014\_MRP Site Inspections - Camp Lejeune, North Carolina EM61MK2 - Block UXO11 - Repeat Line 7



# CONTENTS OF CD

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**Appendix D**  
**Data Validation Summary Reports**

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**METALS & CYANIDE**  
USEPA Region IV - Level IV Review

Site: MCB Camp Lejeune, CTO-014, UXO-14 SDG #: UX014\_002

Client: CH2M HILL, Inc., Virginia Beach, Virginia Date: January 24, 2010

Laboratory: Empirical Laboratories, Nashville, Tennessee Reviewer: Nancy Weaver

EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1*	MR14-EB120409-IS	0912056-01	Water
2*	MR14-FB120409	0912056-02	Water
3*	MR14-IS01-2-3-09D	0912056-03	Soil
3MS*	MR14-IS01-2-3-09DMS	0912056-03MS	Soil
3MSD*	MR14-IS01-2-3-09DMSD	0912056-03MSD	Soil
4*	MR14-IS02-2-3-09D (T)	0912056-06	Soil
5*	MR14-IS03-2-3-09D (T)	0912056-07	Soil
6	MR14-TW03-09D (T)	0912080-01	Water
7	MR14-TW03-09D (D)	0912080-02	Water
8	MR14-TW02-09D (T)	0912080-03	Water
9	MR14-TW02-09D (D)	0912080-04	Water
10	MR14-TW01-09D (T)	0912080-05	Water
11	MR14-TW01-09D (D)	0912080-06	Water
11MS	MR14-TW01-09D (D)MS	0912080-06MS	Water
11MSD	MR14-TW01-09D (D)MSD	0912080-06MSD	Water
12	MR14-FB120809-GW (T)	0912080-07	Water
13	MR14-FB120809-GW (D)	0912080-08	Water

\* - Cyanide analyzed in samples 1-5 only

The USEPA "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," October 2004, and professional judgement were used in evaluating the data in this summary report.

Holding Times - All samples were prepared and analyzed within 14 days for cyanide, 28 days for mercury and 180 days for all other metals.

Calibration - The ICV and CCV %R values were acceptable except the following.

Compound	%R	Qualifier	Affected Samples
Manganese	111%	J	4, 6-11
Aluminum	112%, 114%	J	4, 6-11

Compound	%R	Qualifier	Affected Samples
Potassium	111%, 113%	J	6-11

CRDL Standard - The CRDL standards exhibited acceptable %R values.

Method and Calibration Blanks - The method blanks and continuing calibration blanks exhibited the following contamination.

Blank ID	Compound	Conc. mg/kg	Action Level mg/kg	Qualifier	Affected Samples
9L29001-BLK1	Zinc	0.306	1.53	U	4

Field and Equipment Blank - Field QC results are summarized below.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB120409-IS	None - ND	-	-	-	-
MR14-FB120409	None - ND	-	-	-	-
MR14-FB120809-GW (T)	None - ND	-	-	-	-
MR14-FB120809-GW (D)	Zinc	1.51	7.55	U	7, 9, 11

ICP Interference Check Sample - All %R values were acceptable.

Matrix Spike/Duplicate - The matrix spike/duplicate samples exhibited acceptable %R and RPD values except the following.

MS/MSD Sample ID	Compound	%R	Qualifier	Affected Samples
3	Calcium	135%/134%/Ok	None	All ND
	Potassium	134%/135%/Ok		
11	Aluminum	149%/138%/Ok	None	All ND

LCS - The LCS samples exhibited acceptable %R values.

ICP Serial Dilution - The ICP serial dilution sample exhibited acceptable %D values.

Field Duplicates - Field duplicate samples were not included in this data package.

Compound Quantitation - No discrepancies were identified.

# ANALYSIS DATA SHEET

MR14-EB120409-IS

Laboratory: Empirical Laboratories, LLC  
 Client: CH2M Hill, Inc.  
 Matrix: Water  
 Sampled: 12/04/09 11:35  
 % Solids: 0.00

SDG: UXO14\_002  
 Project: Lejeune CTO014 (UX14)  
 Laboratory ID: 0912056-01  
 Received: 12/05/09 08:45

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9L10013	12/14/09 08:45
7429-90-5	Aluminum		12.5	50.0	1	U	SW6010B	9L15006	12/16/09 17:34
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9L15006	12/16/09 17:34
7440-38-2	Arsenic		0.750	1.25	1	U	SW6010B	9L15006	12/16/09 17:34
7440-39-3	Barium		1.25	10.0	1	U	SW6010B	9L15006	12/16/09 17:34
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9L15006	12/16/09 17:34
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9L15006	12/16/09 17:34
7440-70-2	Calcium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:34
7440-47-3	Chromium		0.500	1.25	1	U	SW6010B	9L15006	12/16/09 17:34
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9L15006	12/16/09 17:34
7440-50-8	Copper		1.25	2.50	1	U	SW6010B	9L15006	12/16/09 17:34
7439-89-6	Iron		7.50	25.0	1	U	SW6010B	9L15006	12/16/09 17:34
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9L15006	12/16/09 17:34
7439-95-4	Magnesium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:34
7439-96-5	Manganese		0.750	3.75	1	U	SW6010B	9L15006	12/16/09 17:34
7440-02-0	Nickel		0.750	2.50	1	U	SW6010B	9L15006	12/16/09 17:34
7440-09-7	Potassium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:34
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9L15006	12/16/09 17:34
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9L15006	12/16/09 17:34
7440-23-5	Sodium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:34
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9L15006	12/16/09 17:34
7440-62-2	Vanadium		1.25	3.12	1	U	SW6010B	9L15006	12/16/09 17:34
7440-66-6	Zinc		1.25	5.00	1	U	SW6010B	9L15006	12/16/09 17:34
CAS NO.	Analyte	Concentration (mg/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.00500	0.0100	1	U	SW9012A	9L14012	12/15/09 14:27

*luw*  
2/24/10

# ANALYSIS DATA SHEET

**MR14-FB120409**
2

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14 002

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Water

 Laboratory ID: 0912056-02

 Sampled: 12/04/09 11:45

 Received: 12/05/09 08:45

 % Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9L10013	12/14/09 08:46
7429-90-5	Aluminum		12.5	50.0	1	U	SW6010B	9L15006	12/16/09 17:39
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9L15006	12/16/09 17:39
7440-38-2	Arsenic		0.750	1.25	1	U	SW6010B	9L15006	12/16/09 17:39
7440-39-3	Barium		1.25	10.0	1	U	SW6010B	9L15006	12/16/09 17:39
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9L15006	12/16/09 17:39
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9L15006	12/16/09 17:39
7440-70-2	Calcium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:39
7440-47-3	Chromium		0.500	1.25	1	U	SW6010B	9L15006	12/16/09 17:39
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9L15006	12/16/09 17:39
7440-50-8	Copper		1.25	2.50	1	U	SW6010B	9L15006	12/16/09 17:39
7439-89-6	Iron		7.50	25.0	1	U	SW6010B	9L15006	12/16/09 17:39
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9L15006	12/16/09 17:39
7439-95-4	Magnesium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:39
7439-96-5	Manganese		0.750	3.75	1	U	SW6010B	9L15006	12/16/09 17:39
7440-02-0	Nickel		0.750	2.50	1	U	SW6010B	9L15006	12/16/09 17:39
7440-09-7	Potassium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:39
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9L15006	12/16/09 17:39
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9L15006	12/16/09 17:39
7440-23-5	Sodium		250	1250	1	U	SW6010B	9L15006	12/16/09 17:39
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9L15006	12/16/09 17:39
7440-62-2	Vanadium		1.25	3.12	1	U	SW6010B	9L15006	12/16/09 17:39
7440-66-6	Zinc		1.25	5.00	1	U	SW6010B	9L15006	12/16/09 17:39
CAS NO.	Analyte	Concentration (mg/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.00500	0.0100	1	U	SW9012A	9L14012	12/15/09 14:28

*lwl*  
2/24/10

# ANALYSIS DATA SHEET

 MR14-IS01-2-3-09D 3

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14\_002

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Soil

 Laboratory ID: 0912056-03

 Sampled: 12/04/09 10:50

 Received: 12/05/09 08:45

 % Solids: 81.96

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.153	0.305	1	U	SW9012A	9L14013	12/15/09 14:50
7439-97-6	Mercury	0.0342	0.0154	0.0390	1	J	SW7471A	9L23014	12/29/09 12:45
7429-90-5	Aluminum	1530	3.07	12.3	1		SW6010B	9L29001	12/30/09 23:21
7440-36-0	Antimony	2.62	0.307	0.920	1		SW6010B	9L29001	12/30/09 23:21
7440-38-2	Arsenic	0.208	0.184	0.307	1	J	SW6010B	9L29001	12/30/09 23:21
7440-39-3	Barium	2.49	0.307	2.45	1		SW6010B	9L29001	12/30/09 23:21
7440-41-7	Beryllium		0.0613	0.307	1	U	SW6010B	9L29001	12/30/09 23:21
7440-43-9	Cadmium		0.0613	0.307	1	U	SW6010B	9L29001	12/30/09 23:21
7440-70-2	Calcium		61.3	307	1	U	SW6010B	9L29001	12/30/09 23:21
7440-47-3	Chromium	1.06	0.123	0.307	1		SW6010B	9L29001	12/30/09 23:21
7440-48-4	Cobalt		0.307	0.766	1	U	SW6010B	9L29001	12/30/09 23:21
7440-50-8	Copper	1.28	0.307	0.613	1		SW6010B	9L29001	12/30/09 23:21
7439-89-6	Iron	370	1.84	6.13	1		SW6010B	9L29001	12/30/09 23:21
7439-92-1	Lead	290	0.0920	0.184	1		SW6010B	9L29001	12/30/09 23:21
7439-95-4	Magnesium		61.3	307	1	U	SW6010B	9L29001	12/30/09 23:21
7439-96-5	Manganese	3.29	0.184	0.920	1		SW6010B	9L29001	12/30/09 23:21
7440-02-0	Nickel	0.430	0.307	0.613	1	J	SW6010B	9L29001	12/30/09 23:21
7440-09-7	Potassium		61.3	307	1	U	SW6010B	9L29001	12/30/09 23:21
7782-49-2	Selenium		0.184	0.307	1	U	SW6010B	9L29001	12/30/09 23:21
7440-22-4	Silver		0.0613	0.307	1	U	SW6010B	9L29001	12/30/09 23:21
7440-23-5	Sodium		61.3	307	1	U	SW6010B	9L29001	12/30/09 23:21
7440-28-0	Thallium		0.184	0.491	1	U	SW6010B	9L29001	12/30/09 23:21
7440-62-2	Vanadium	1.28	0.307	0.766	1		SW6010B	9L29001	12/30/09 23:21
7440-66-6	Zinc	9.98	0.307	1.23	1		SW6010B	9L29001	12/30/09 23:21

lw  
2/24/10

# ANALYSIS DATA SHEET

MR14-IS02-2-3-09D

4

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_002

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0912056-06

Sampled: 12/04/09 08:50

Received: 12/05/09 08:45

% Solids: 84.82

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.147	0.295	1	U	SW9012A	9L17015	12/18/09 09:34
7439-97-6	Mercury		0.0131	0.0333	1	U	SW7471A	9L23014	12/29/09 12:49
7429-90-5	Aluminum	881 <i>J</i>	2.96	11.8	1		SW6010B	9L29001	12/30/09 23:45
7440-36-0	Antimony		0.296	0.889	1	U	SW6010B	9L29001	12/30/09 23:45
7440-38-2	Arsenic	0.195	0.178	0.296	1	J	SW6010B	9L29001	12/30/09 23:45
7440-39-3	Barium	1.78	0.296	2.37	1	J	SW6010B	9L29001	12/30/09 23:45
7440-41-7	Beryllium		0.0592	0.296	1	U	SW6010B	9L29001	12/30/09 23:45
7440-43-9	Cadmium		0.0592	0.296	1	U	SW6010B	9L29001	12/30/09 23:45
7440-70-2	Calcium		59.2	296	1	<i>U</i>	SW6010B	9L29001	12/30/09 23:45
7440-47-3	Chromium	0.740	0.118	0.296	1		SW6010B	9L29001	12/30/09 23:45
7440-48-4	Cobalt		0.296	0.741	1	U	SW6010B	9L29001	12/30/09 23:45
7440-50-8	Copper		0.296	0.592	1	U	SW6010B	9L29001	12/30/09 23:45
7439-89-6	Iron	322	1.78	5.92	1		SW6010B	9L29001	12/30/09 23:45
7439-92-1	Lead	1.34	0.0889	0.178	1	<i>J</i>	SW6010B	9L29001	12/30/09 23:45
7439-95-4	Magnesium		59.2	296	1	U	SW6010B	9L29001	12/30/09 23:45
7439-96-5	Manganese	2.81 <i>J</i>	0.178	0.889	1	<i>X</i>	SW6010B	9L29001	12/30/09 23:45
7440-02-0	Nickel	0.368	0.296	0.592	1	J	SW6010B	9L29001	12/30/09 23:45
7440-09-7	Potassium		59.2	296	1	<i>U</i>	SW6010B	9L29001	12/30/09 23:45
7782-49-2	Selenium		0.178	0.296	1	U	SW6010B	9L29001	12/30/09 23:45
7440-22-4	Silver		0.0592	0.296	1	U	SW6010B	9L29001	12/30/09 23:45
7440-23-5	Sodium		59.2	296	1	U	SW6010B	9L29001	12/30/09 23:45
7440-28-0	Thallium		0.178	0.474	1	U	SW6010B	9L29001	12/30/09 23:45
7440-62-2	Vanadium	1.20	0.296	0.741	1		SW6010B	9L29001	12/30/09 23:45
7440-66-6	Zinc	1.18 <i>0.662</i>	0.296	1.18	1	J	SW6010B	9L29001	12/30/09 23:45

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# ANALYSIS DATA SHEET

MR14-IS03-2-3-09D

5

Laboratory: Empirical Laboratories, LLC  
 Client: CH2M Hill, Inc.  
 Matrix: Soil  
 Sampled: 12/04/09 08:10  
 % Solids: 80.54

SDG: UXO14\_002  
 Project: Lejeune CTO014 (UX14)  
 Laboratory ID: 0912056-07  
 Received: 12/05/09 08:45

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.155	0.310	1	U	SW9012A	9L17015	12/18/09 09:35
7439-97-6	Mercury		0.0161	0.0410	1	U	SW7471A	9L23014	12/29/09 12:50
7429-90-5	Aluminum	793	3.04	12.2	1		SW6010B	9L29001	12/30/09 23:49
7440-36-0	Antimony		0.304	0.913	1	U	SW6010B	9L29001	12/30/09 23:49
7440-38-2	Arsenic		0.183	0.304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-39-3	Barium	1.44	0.304	2.43	1	J	SW6010B	9L29001	12/30/09 23:49
7440-41-7	Beryllium		0.0609	0.304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-43-9	Cadmium		0.0609	0.304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-70-2	Calcium		60.9	304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-47-3	Chromium	0.748	0.122	0.304	1		SW6010B	9L29001	12/30/09 23:49
7440-48-4	Cobalt		0.304	0.761	1	U	SW6010B	9L29001	12/30/09 23:49
7440-50-8	Copper		0.304	0.609	1	U	SW6010B	9L29001	12/30/09 23:49
7439-89-6	Iron	183	1.83	6.09	1		SW6010B	9L29001	12/30/09 23:49
7439-92-1	Lead	1.80	0.0913	0.183	1		SW6010B	9L29001	12/30/09 23:49
7439-95-4	Magnesium		60.9	304	1	U	SW6010B	9L29001	12/30/09 23:49
7439-96-5	Manganese	1.54	0.183	0.913	1		SW6010B	9L29001	12/30/09 23:49
7440-02-0	Nickel	0.357	0.304	0.609	1	J	SW6010B	9L29001	12/30/09 23:49
7440-09-7	Potassium		60.9	304	1	U	SW6010B	9L29001	12/30/09 23:49
7782-49-2	Selenium		0.183	0.304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-22-4	Silver		0.0609	0.304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-23-5	Sodium		60.9	304	1	U	SW6010B	9L29001	12/30/09 23:49
7440-28-0	Thallium		0.183	0.487	1	U	SW6010B	9L29001	12/30/09 23:49
7440-62-2	Vanadium	0.799	0.304	0.761	1		SW6010B	9L29001	12/30/09 23:49
7440-66-6	Zinc	3.30	0.304	1.22	1		SW6010B	9L29001	12/30/09 23:49

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# ANALYSIS DATA SHEET

MR14-TW03-09D

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_002

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Ground Water

Laboratory ID: 0912080-01

Sampled: 12/08/09 10:45

Received: 12/09/09 08:15

% Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9L10015	12/14/09 09:15
7429-90-5	Aluminum	CCH 293 J	12.5	50.0	1	<del>U</del>	SW6010B	9L21004	12/30/09 16:41
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 16:41
7440-38-2	Arsenic		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 16:41
7440-39-3	Barium	46.9	1.25	10.0	1		SW6010B	9L21004	12/30/09 16:41
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:41
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:41
7440-70-2	Calcium	31600	250	1250	1		SW6010B	9L21004	12/30/09 16:41
7440-47-3	Chromium	1.36	0.500	1.25	1		SW6010B	9L21004	12/30/09 16:41
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 16:41
7440-50-8	Copper		1.25	2.50	1	U	SW6010B	9L21004	12/30/09 16:41
7439-89-6	Iron	1230	7.50	25.0	1	<del>U</del>	SW6010B	9L21004	12/30/09 16:41
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9L21004	12/30/09 16:41
7439-95-4	Magnesium	1500	250	1250	1		SW6010B	9L21004	12/30/09 16:41
7439-96-5	Manganese	CCH 13.7 J	0.750	3.75	1		SW6010B	9L21004	12/30/09 16:41
7440-02-0	Nickel		0.750	2.50	1	U	SW6010B	9L21004	12/30/09 16:41
7440-09-7	Potassium	CCH 1710 J	250	1250	1		SW6010B	9L21004	12/30/09 16:41
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 16:41
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:41
7440-23-5	Sodium	12100	250	1250	1		SW6010B	9L21004	12/30/09 16:41
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 16:41
7440-62-2	Vanadium	2.20	1.25	3.12	1	J	SW6010B	9L21004	12/30/09 16:41
7440-66-6	Zinc		1.25	5.00	1	U	SW6010B	9L21004	12/30/09 16:41

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2/24/10

# ANALYSIS DATA SHEET

MR14-TW03-09D

7

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_002

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Ground Water

Laboratory ID: 0912080-02

Sampled: 12/08/09 10:45

Received: 12/09/09 08:15

% Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury (dissolved)		0.0800	0.200	1	U	SW7470A	9L15020	12/16/09 15:49
7429-90-5	Aluminum (dissolved) <i>CEH</i>	149 <i>J</i>	12.5	50.0	1	<del>X</del>	SW6010B	9L21004	12/30/09 16:46
7440-36-0	Antimony (dissolved)		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 16:46
7440-38-2	Arsenic (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 16:46
7440-39-3	Barium (dissolved)	47.5	1.25	10.0	1		SW6010B	9L21004	12/30/09 16:46
7440-41-7	Beryllium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:46
7440-43-9	Cadmium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:46
7440-70-2	Calcium (dissolved)	32600	250	1250	1		SW6010B	9L21004	12/30/09 16:46
7440-47-3	Chromium (dissolved)	0.980	0.500	1.25	1	J	SW6010B	9L21004	12/30/09 16:46
7440-48-4	Cobalt (dissolved)		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 16:46
7440-50-8	Copper (dissolved)		1.25	2.50	1	U	SW6010B	9L21004	12/30/09 16:46
7439-89-6	Iron (dissolved)	1160	7.50	25.0	1	<del>X</del>	SW6010B	9L21004	12/30/09 16:46
7439-92-1	Lead (dissolved)		0.375	0.750	1	U	SW6010B	9L21004	12/30/09 16:46
7439-95-4	Magnesium (dissolved)	1530	250	1250	1		SW6010B	9L21004	12/30/09 16:46
7439-96-5	Manganese (dissolved) <i>CEH</i>	13.4 <i>J</i>	0.750	3.75	1		SW6010B	9L21004	12/30/09 16:46
7440-02-0	Nickel (dissolved)		0.750	2.50	1	U	SW6010B	9L21004	12/30/09 16:46
7440-09-7	Potassium (dissolved) <i>CEH</i>	1750 <i>J</i>	250	1250	1		SW6010B	9L21004	12/30/09 16:46
7782-49-2	Selenium (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 16:46
7440-22-4	Silver (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:46
7440-23-5	Sodium (dissolved)	12500	250	1250	1		SW6010B	9L21004	12/30/09 16:46
7440-28-0	Thallium (dissolved)		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 16:46
7440-62-2	Vanadium (dissolved)	1.94	1.25	3.12	1	J	SW6010B	9L21004	12/30/09 16:46
7440-66-6	Zinc (dissolved) <i>FBL</i>	5 <i>not U</i>	1.25	5.00	1	<del>X</del>	SW6010B	9L21004	12/30/09 16:46

*llw*  
*2/24/10*

# ANALYSIS DATA SHEET

 MR14-TW02-09D 8

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14 002

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Ground Water

 Laboratory ID: 0912080-03

 Sampled: 12/08/09 10:05

 Received: 12/09/09 08:15

 % Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9L10015	12/14/09 09:16
7429-90-5	Aluminum	CUH 175 J	12.5	50.0	1	<del>X</del>	SW6010B	9L21004	12/30/09 16:51
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 16:51
7440-38-2	Arsenic	4.09	0.750	1.25	1		SW6010B	9L21004	12/30/09 16:51
7440-39-3	Barium	63.6	1.25	10.0	1		SW6010B	9L21004	12/30/09 16:51
7440-41-7	Beryllium	0.254	0.250	1.25	1	J	SW6010B	9L21004	12/30/09 16:51
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:51
7440-70-2	Calcium	5870	250	1250	1		SW6010B	9L21004	12/30/09 16:51
7440-47-3	Chromium	1.14	0.500	1.25	1	J	SW6010B	9L21004	12/30/09 16:51
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 16:51
7440-50-8	Copper	103	1.25	2.50	1		SW6010B	9L21004	12/30/09 16:51
7439-89-6	Iron	2910	7.50	25.0	1	<del>X</del>	SW6010B	9L21004	12/30/09 16:51
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9L21004	12/30/09 16:51
7439-95-4	Magnesium	1170	250	1250	1	J	SW6010B	9L21004	12/30/09 16:51
7439-96-5	Manganese	CUH 23.4 J	0.750	3.75	1		SW6010B	9L21004	12/30/09 16:51
7440-02-0	Nickel	1.23	0.750	2.50	1	J	SW6010B	9L21004	12/30/09 16:51
7440-09-7	Potassium	CUH 1250 J	250	1250	1	J	SW6010B	9L21004	12/30/09 16:51
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 16:51
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:51
7440-23-5	Sodium	8000	250	1250	1		SW6010B	9L21004	12/30/09 16:51
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 16:51
7440-62-2	Vanadium	1.88	1.25	3.12	1	J	SW6010B	9L21004	12/30/09 16:51
7440-66-6	Zinc	3.16	1.25	5.00	1	J	SW6010B	9L21004	12/30/09 16:51

CW  
2/24/10

# ANALYSIS DATA SHEET

MR14-TW02-09D

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_002

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Ground Water

Laboratory ID: 0912080-04

Sampled: 12/08/09 10:05

Received: 12/09/09 08:15

% Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury (dissolved)		0.0800	0.200	1	U	SW7470A	9L15020	12/16/09 15:49
7429-90-5	Aluminum (dissolved) <i>CCM</i>	118 <i>J</i>	12.5	50.0	1	<del>U</del>	SW6010B	9L21004	12/30/09 16:55
7440-36-0	Antimony (dissolved)		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 16:55
7440-38-2	Arsenic (dissolved)	3.29	0.750	1.25	1		SW6010B	9L21004	12/30/09 16:55
7440-39-3	Barium (dissolved)	61.5	1.25	10.0	1		SW6010B	9L21004	12/30/09 16:55
7440-41-7	Beryllium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:55
7440-43-9	Cadmium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:55
7440-70-2	Calcium (dissolved)	5550	250	1250	1		SW6010B	9L21004	12/30/09 16:55
7440-47-3	Chromium (dissolved)	0.860	0.500	1.25	1	J	SW6010B	9L21004	12/30/09 16:55
7440-48-4	Cobalt (dissolved)		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 16:55
7440-50-8	Copper (dissolved)		1.25	2.50	1	U	SW6010B	9L21004	12/30/09 16:55
7439-89-6	Iron (dissolved)	2670	7.50	25.0	1	<del>U</del>	SW6010B	9L21004	12/30/09 16:55
7439-92-1	Lead (dissolved)		0.375	0.750	1	U	SW6010B	9L21004	12/30/09 16:55
7439-95-4	Magnesium (dissolved)	1140	250	1250	1	J	SW6010B	9L21004	12/30/09 16:55
7439-96-5	Manganese (dissolved) <i>CCM</i>	22.8 <i>J</i>	0.750	3.75	1		SW6010B	9L21004	12/30/09 16:55
7440-02-0	Nickel (dissolved)	1.35	0.750	2.50	1	J	SW6010B	9L21004	12/30/09 16:55
7440-09-7	Potassium (dissolved) <i>CCM</i>	1260 <i>J</i>	250	1250	1		SW6010B	9L21004	12/30/09 16:55
7782-49-2	Selenium (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 16:55
7440-22-4	Silver (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 16:55
7440-23-5	Sodium (dissolved)	9510	250	1250	1		SW6010B	9L21004	12/30/09 16:55
7440-28-0	Thallium (dissolved)		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 16:55
7440-62-2	Vanadium (dissolved)	2.33	1.25	3.12	1	J	SW6010B	9L21004	12/30/09 16:55
7440-66-6	Zinc (dissolved) <i>FBL</i>	5 <i>4.52 U</i>	1.25	5.00	1	<del>U</del>	SW6010B	9L21004	12/30/09 16:55

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2/24/10

# ANALYSIS DATA SHEET

MR14-TW01-09D

10

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14 002

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Ground Water

 Laboratory ID: 0912080-05

 Sampled: 12/08/09 09:30

 Received: 12/09/09 08:15

 % Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9L10015	12/14/09 09:17
7429-90-5	Aluminum	CC4 246 J	12.5	50.0	1	<del>N</del>	SW6010B	9L21004	12/30/09 17:12
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 17:12
7440-38-2	Arsenic	1.03	0.750	1.25	1	J	SW6010B	9L21004	12/30/09 17:12
7440-39-3	Barium	8.48	1.25	10.0	1	J	SW6010B	9L21004	12/30/09 17:12
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:12
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:12
7440-70-2	Calcium	7480	250	1250	1		SW6010B	9L21004	12/30/09 17:12
7440-47-3	Chromium	2.00	0.500	1.25	1		SW6010B	9L21004	12/30/09 17:12
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 17:12
7440-50-8	Copper	1.49	1.25	2.50	1	J	SW6010B	9L21004	12/30/09 17:12
7439-89-6	Iron	518	7.50	25.0	1	<del>N</del>	SW6010B	9L21004	12/30/09 17:12
7439-92-1	Lead	0.975	0.375	0.750	1		SW6010B	9L21004	12/30/09 17:12
7439-95-4	Magnesium	437	250	1250	1	J	SW6010B	9L21004	12/30/09 17:12
7439-96-5	Manganese	CC4 5.01 J	0.750	3.75	1		SW6010B	9L21004	12/30/09 17:12
7440-02-0	Nickel	0.851	0.750	2.50	1	J	SW6010B	9L21004	12/30/09 17:12
7440-09-7	Potassium	CC4 1070 J	250	1250	1	J	SW6010B	9L21004	12/30/09 17:12
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 17:12
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:12
7440-23-5	Sodium	13600	250	1250	1		SW6010B	9L21004	12/30/09 17:12
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 17:12
7440-62-2	Vanadium		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 17:12
7440-66-6	Zinc	3.16	1.25	5.00	1	J	SW6010B	9L21004	12/30/09 17:12

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2/24/10

# ANALYSIS DATA SHEET

MR14-TW01-09D

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_002

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Ground Water

Laboratory ID: 0912080-06

Sampled: 12/08/09 09:30

Received: 12/09/09 08:15

% Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury (dissolved)		0.0800	0.200	1	U	SW7470A	9L15020	12/16/09 15:50
7429-90-5	Aluminum (dissolved) <i>CCH</i>	100 <i>J</i>	12.5	50.0	1	<del>X</del>	SW6010B	9L21004	12/30/09 17:36
7440-36-0	Antimony (dissolved)		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 17:36
7440-38-2	Arsenic (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 17:36
7440-39-3	Barium (dissolved)	8.10	1.25	10.0	1	J	SW6010B	9L21004	12/30/09 17:36
7440-41-7	Beryllium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:36
7440-43-9	Cadmium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:36
7440-70-2	Calcium (dissolved)	7220	250	1250	1		SW6010B	9L21004	12/30/09 17:36
7440-47-3	Chromium (dissolved)	1.51	0.500	1.25	1		SW6010B	9L21004	12/30/09 17:36
7440-48-4	Cobalt (dissolved)		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 17:36
7440-50-8	Copper (dissolved)	1.32	1.25	2.50	1	J	SW6010B	9L21004	12/30/09 17:36
7439-89-6	Iron (dissolved)	398	7.50	25.0	1	<del>X</del>	SW6010B	9L21004	12/30/09 17:36
7439-92-1	Lead (dissolved)	0.830	0.375	0.750	1		SW6010B	9L21004	12/30/09 17:36
7439-95-4	Magnesium (dissolved)	422	250	1250	1	J	SW6010B	9L21004	12/30/09 17:36
7439-96-5	Manganese (dissolved) <i>CCH</i>	5.53 <i>J</i>	0.750	3.75	1		SW6010B	9L21004	12/30/09 17:36
7440-02-0	Nickel (dissolved)	0.780	0.750	2.50	1	J	SW6010B	9L21004	12/30/09 17:36
7440-09-7	Potassium (dissolved) <i>CCH</i>	1060 <i>J</i>	250	1250	1	J	SW6010B	9L21004	12/30/09 17:36
7782-49-2	Selenium (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 17:36
7440-22-4	Silver (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:36
7440-23-5	Sodium (dissolved)	13400	250	1250	1		SW6010B	9L21004	12/30/09 17:36
7440-28-0	Thallium (dissolved)		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 17:36
7440-62-2	Vanadium (dissolved)		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 17:36
7440-66-6	Zinc (dissolved) <i>FBL</i>	5 <del>4.78</del> <i>u</i>	1.25	5.00	1	<i>J</i>	SW6010B	9L21004	12/30/09 17:36

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*2/24/10*

# ANALYSIS DATA SHEET

MR14-FB120809-GW

12

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14\_002

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Water

 Laboratory ID: 0912080-07

 Sampled: 12/08/09 11:00

 Received: 12/09/09 08:15

 % Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9L10015	12/14/09 09:23
7429-90-5	Aluminum		12.5	50.0	1	U	SW6010B	9L21004	12/30/09 17:59
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 17:59
7440-38-2	Arsenic		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 17:59
7440-39-3	Barium		1.25	10.0	1	U	SW6010B	9L21004	12/30/09 17:59
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:59
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:59
7440-70-2	Calcium		250	1250	1	U	SW6010B	9L21004	12/30/09 17:59
7440-47-3	Chromium		0.500	1.25	1	U	SW6010B	9L21004	12/30/09 17:59
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 17:59
7440-50-8	Copper		1.25	2.50	1	U	SW6010B	9L21004	12/30/09 17:59
7439-89-6	Iron		7.50	25.0	1	U	SW6010B	9L21004	12/30/09 17:59
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9L21004	12/30/09 17:59
7439-95-4	Magnesium		250	1250	1	U	SW6010B	9L21004	12/30/09 17:59
7439-96-5	Manganese		0.750	3.75	1	U	SW6010B	9L21004	12/30/09 17:59
7440-02-0	Nickel		0.750	2.50	1	U	SW6010B	9L21004	12/30/09 17:59
7440-09-7	Potassium		250	1250	1	U	SW6010B	9L21004	12/30/09 17:59
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 17:59
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 17:59
7440-23-5	Sodium		250	1250	1	U	SW6010B	9L21004	12/30/09 17:59
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 17:59
7440-62-2	Vanadium		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 17:59
7440-66-6	Zinc		1.25	5.00	1	U	SW6010B	9L21004	12/30/09 17:59

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# ANALYSIS DATA SHEET

MR14-FB120809-GW

13

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14 002

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Water

 Laboratory ID: 0912080-08

 Sampled: 12/08/09 11:00

 Received: 12/09/09 08:15

 % Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury (dissolved)		0.0800	0.200	1	U	SW7470A	9L15020	12/16/09 15:54
7429-90-5	Aluminum (dissolved)		12.5	50.0	1	U	SW6010B	9L21004	12/30/09 18:03
7440-36-0	Antimony (dissolved)		1.25	3.75	1	U	SW6010B	9L21004	12/30/09 18:03
7440-38-2	Arsenic (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 18:03
7440-39-3	Barium (dissolved)		1.25	10.0	1	U	SW6010B	9L21004	12/30/09 18:03
7440-41-7	Beryllium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 18:03
7440-43-9	Cadmium (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 18:03
7440-70-2	Calcium (dissolved)		250	1250	1	U	SW6010B	9L21004	12/30/09 18:03
7440-47-3	Chromium (dissolved)		0.500	1.25	1	U	SW6010B	9L21004	12/30/09 18:03
7440-48-4	Cobalt (dissolved)		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 18:03
7440-50-8	Copper (dissolved)		1.25	2.50	1	U	SW6010B	9L21004	12/30/09 18:03
7439-89-6	Iron (dissolved)		7.50	25.0	1	U	SW6010B	9L21004	12/30/09 18:03
7439-92-1	Lead (dissolved)		0.375	0.750	1	U	SW6010B	9L21004	12/30/09 18:03
7439-95-4	Magnesium (dissolved)		250	1250	1	U	SW6010B	9L21004	12/30/09 18:03
7439-96-5	Manganese (dissolved)		0.750	3.75	1	U	SW6010B	9L21004	12/30/09 18:03
7440-02-0	Nickel (dissolved)		0.750	2.50	1	U	SW6010B	9L21004	12/30/09 18:03
7440-09-7	Potassium (dissolved)		250	1250	1	U	SW6010B	9L21004	12/30/09 18:03
7782-49-2	Selenium (dissolved)		0.750	1.25	1	U	SW6010B	9L21004	12/30/09 18:03
7440-22-4	Silver (dissolved)		0.250	1.25	1	U	SW6010B	9L21004	12/30/09 18:03
7440-23-5	Sodium (dissolved)		250	1250	1	U	SW6010B	9L21004	12/30/09 18:03
7440-28-0	Thallium (dissolved)		0.750	2.00	1	U	SW6010B	9L21004	12/30/09 18:03
7440-62-2	Vanadium (dissolved)		1.25	3.12	1	U	SW6010B	9L21004	12/30/09 18:03
7440-66-6	Zinc (dissolved)	1.51	1.25	5.00	1	J	SW6010B	9L21004	12/30/09 18:03

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**POLYNUCLEAR AROMATIC HYDROCARBONS**  
USEPA Region IV - Level IV Review

Site: MCB Camp Lejeune, CTO-014, UXO-14 SDG #: UX014\_002

Client: CH2M HILL, Inc., Virginia Beach, Virginia Date: January 24, 2010

Laboratory: Empirical Laboratories, Nashville, Tennessee Reviewer: Nancy Weaver

EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	MR14-EB120409-IS	0912056-01	Water
2	MR14-FB120409	0912056-02	Water
3	MR14-IS01-2-3-09D	0912056-03	Soil
3MS	MR14-IS01-2-3-09DMS	0912056-03MS	Soil
3MSD	MR14-IS01-2-3-09DMSD	0912056-03MSD	Soil
4	MR14-IS04-4-5-09D	0912056-04	Soil
4MS	MR14-IS04-4-5-09DMS	0912056-04MS	Soil
4MSD	MR14-IS04-4-5-09DMSD	0912056-04MSD	Soil
5	MR14-IS04D-4-5-09D	0912056-05	Soil
6	MR14-IS02-2-3-09D	0912056-06	Soil
7	MR14-IS03-2-3-09D	0912056-07	Soil
8	MR14-FB120809-GW	0912080-07	Water
9	MR14-TW04-09D	0912099-01	Water
10	MR14- TW04D-09D	0912099-02	Water

The USEPA "Contract Laboratory Program National Functional Guidelines for Organic Data Review," October 1999, and professional judgement were used in evaluating the data in this summary report.

Holding Times - All samples were extracted within 7 days for water samples, 14 days for soil samples and analyzed within 40 days for all samples.

GC/MS Tuning - All of the DFTPP tunes in the initial and continuing calibrations met the percent relative abundance criteria.

Initial Calibration - The initial calibrations exhibited acceptable %RSD and mean RRF values.

Continuing Calibration - The continuing calibrations exhibited acceptable %D and RRF values.

Surrogates - All samples exhibited acceptable surrogate recoveries.

MS/MSD - The MS/MSD sample exhibited acceptable %R and RPD values.

Laboratory Control Sample - The LCS samples exhibited acceptable %R values.

Internal Standard (IS) Area Performance - All internal standards met response and retention time (RT) criteria.

Method Blank - The method blanks exhibited the following contamination.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
9L08015-BLK2	Benzo(a)anthracene	0.034	0.017	U	1
	Benzo(b)fluoranthene	0.024	0.12		1
	Benzo(k)fluoranthene	0.023	0.115		1
	Fluoranthene	0.042	0.21		1
	Fluorene	0.070	0.35		1, 2
	Hexachlorobenzene	0.065	0.325		1
	Hexachlorobutadiene	0.066	0.33		1, 2
	2-Methylnaphthalene	0.089	0.445		1, 2
	Naphthalene	0.092	0.46		1, 2
	Phenanthrene	0.075	0.375		1, 2
	Pyrene	0.044	0.22		1
9L10023-BLK2	Benzo(a)anthracene	0.032	0.16	U	9, 10
	Benzo(b)fluoranthene	0.026	0.13		9, 10
	Benzo(k)fluoranthene	0.030	0.15		9, 10
	Fluoranthene	0.038	0.19		9, 10
	Fluorene	0.020	0.10		9, 10
	Hexachlorobenzene	0.024	0.12		9, 10
	2-Methylnaphthalene	0.026	0.13		9, 10
	Naphthalene	0.029	0.145		8, 9, 10
	Phenanthrene	0.036	0.18		9, 10
	Pyrene	0.042	0.21		9, 10

Field, Equipment Blank - Field QC results are summarized below.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB120409-IS	Benzo(g,h,i)perylene	0.050	0.25	None	All ND
	Benzo(a)pyrene	0.038	0.19		
	Dibenzo(a,h)anthracene	0.053	0.265		
	Hexachlorocyclopentadiene	0.059	0.295		

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB120409-IS	Indeno(1,2,3-cd)pyrene	0.051	0.255	None	All ND
MR14-FB120409	Hexachlorocyclopentadiene	0.069	0.345	None	All ND
MR14-FB120809-GW	None - ND	-	-	-	-

Field Duplicates - Field duplicate results are summarized below.

Compound	MR14-IS04-4-5-09D ug/kg	MR14-IS04D-4-5-09D ug/kg	RPD	Qualifier
Naphthalene	1.8	13 U	NC	None

Compound	MR14- TW04-09D ug/L	MR14- TW04D-09D ug/L	RPD	Qualifier
Benzo(g,h,i)perylene	0.080	0.073	9%	None
Benzo(a)pyrene	0.070	0.070	0%	None
Dibenz(a,h)anthracene	0.078	0.074	5%	None
Indeno(1,2,3-cd)pyrene	0.069	0.071	3%	None

Compound Quantitation - No discrepancies were identified.

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-EB1  
20409-IS

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912056-01

Sample wt/vol: 1000 (g/mL) ML Lab File ID: 1205601

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/04/09 11:35

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/08/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 13:05

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L				
		MDL	RL	CONC	Q	
56-55-3	Benzo (a) anthracene	0.020	MBL	0.25	0.25	0.052 JB U
205-99-2	Benzo (b) fluoranthene	0.020		0.25	0.25	0.051 JB U
207-08-9	Benzo (k) fluoranthene	0.020	↓	0.25	0.25	0.048 JB U
191-24-2	Benzo (g, h, i) perylene	0.020		0.25		0.050 J
50-32-8	Benzo (a) pyrene	0.020		0.25		0.038 J
53-70-3	Dibenz (a, h) anthracene	0.020		0.25		0.053 J
206-44-0	Fluoranthene	0.020	MBL	0.25	0.25	0.053 JB U
86-73-7	Fluorene	0.020	↓	0.25		0.073 JB
118-74-1	Hexachlorobenzene	0.020	↓	0.25		0.064 JB
87-68-3	Hexachlorobutadiene	0.020	↓	0.25		0.077 JB
77-47-4	Hexachlorocyclopentadiene	0.020		0.25		0.059 J
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.020		0.25		0.051 J
91-57-6	2-Methylnaphthalene	0.020	MBL	0.25	0.25	0.082 JB U
91-20-3	Naphthalene	0.020	↓	0.25		0.10 JB U
621-64-7	N-Nitroso-di-n-propylamine	0.020		5.0		U
85-01-8	Phenanthrene	0.020	MBL	0.25	0.25	0.072 JB U
129-00-0	Pyrene	0.020	MBL	0.25		0.054 JB U

FORM I SV

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2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

2

MR14FB120409

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912056-02

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1205602

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/04/09 11:45

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/08/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 13:39

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
56-55-3	Benzo (a) anthracene	0.018	0.23		U
205-99-2	Benzo (b) fluoranthene	0.018	0.23		U
207-08-9	Benzo (k) fluoranthene	0.018	0.23		U
191-24-2	Benzo (g, h, i) perylene	0.018	0.23		U
50-32-8	Benzo (a) pyrene	0.018	0.23		U
53-70-3	Dibenz (a, h) anthracene	0.018	0.23		U
206-44-0	Fluoranthene	0.018	0.23		U
86-73-7	Fluorene	0.018	MBL 0.23	0.23 0.063	<del>JB</del> U
118-74-1	Hexachlorobenzene	0.018	0.23		U
87-68-3	Hexachlorobutadiene	0.018	MBL 0.23	0.23 0.089	<del>JB</del> U
77-47-4	Hexachlorocyclopentadiene	0.018	0.23	0.069	J
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.018	0.23		U
91-57-6	2-Methylnaphthalene	0.018	MBL 0.23	0.23 0.10	<del>JB</del> U
91-20-3	Naphthalene	0.018	↓ 0.23	0.23 0.13	<del>JB</del> U
621-64-7	N-Nitroso-di-n-propylamine	0.018	4.6		U
85-01-8	Phenanthrene	0.018	MBL 0.23	0.23 0.042	<del>JB</del> U
129-00-0	Pyrene	0.018	0.23		U

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FORM 1  
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CLIENT SAMPLE NO.

3

MR14-ISO 1-2-3-09D
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Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-03

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205603

% Moisture: 18 decanted: (Y/N) N Date Sampled: 12/04/09 10:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/14/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/15/09 00:22

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

56-55-3	Benzo (a) anthracene	1.6	12		U
205-99-2	Benzo (b) fluoranthene	1.6	12		U
207-08-9	Benzo (k) fluoranthene	1.6	12		U
191-24-2	Benzo (g, h, i) perylene	1.6	12		U
50-32-8	Benzo (a) pyrene	1.6	12		U
53-70-3	Dibenz (a, h) anthracene	1.6	12		U
206-44-0	Fluoranthene	1.6	12		U
86-73-7	Fluorene	1.6	12		U
118-74-1	Hexachlorobenzene	1.6	12		U
87-68-3	Hexachlorobutadiene	1.6	12		U
77-47-4	Hexachlorocyclopentadiene	1.6	20		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.6	12		U
91-57-6	2-Methylnaphthalene	1.6	12		U
91-20-3	Naphthalene	1.6	12		U
621-64-7	N-Nitroso-di-n-propylamine	1.6	61		U
85-01-8	Phenanthrene	1.6	12		U
129-00-0	Pyrene	1.6	12		U

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CLIENT SAMPLE NO.

4

MR14-ISO 4-4-5-09D
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Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-04

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205604

% Moisture: 22 decanted: (Y/N) N Date Sampled: 12/04/09 10:05

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/16/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/18/09 12:07

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or RL	ug/Kg) CONC	
56-55-3	Benzo (a) anthracene	1.7	13		U
205-99-2	Benzo (b) fluoranthene	1.7	13		U
207-08-9	Benzo (k) fluoranthene	1.7	13		U
191-24-2	Benzo (g, h, i) perylene	1.7	13		U
50-32-8	Benzo (a) pyrene	1.7	13		U
53-70-3	Dibenz (a, h) anthracene	1.7	13		U
206-44-0	Fluoranthene	1.7	13		U
86-73-7	Fluorene	1.7	13		U
118-74-1	Hexachlorobenzene	1.7	13		U
87-68-3	Hexachlorobutadiene	1.7	13		U
77-47-4	Hexachlorocyclopentadiene	1.7	21		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.7	13		U
91-57-6	2-Methylnaphthalene	1.7	13		U
91-20-3	Naphthalene	1.7	13	1.8	J
621-64-7	N-Nitroso-di-n-propylamine	1.7	64		U
85-01-8	Phenanthrene	1.7	13		U
129-00-0	Pyrene	1.7	13		U

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FORM 1  
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CLIENT SAMPLE NO.

5

MR14-IS04  
D-4-5-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-05

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205605

% Moisture: 22 decanted: (Y/N) N Date Sampled: 12/04/09 10:10

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/16/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/18/09 12:41

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

56-55-3-----	Benzo (a) anthracene	1.7	13		U
205-99-2-----	Benzo (b) fluoranthene	1.7	13		U
207-08-9-----	Benzo (k) fluoranthene	1.7	13		U
191-24-2-----	Benzo (g, h, i) perylene	1.7	13		U
50-32-8-----	Benzo (a) pyrene	1.7	13		U
53-70-3-----	Dibenz (a, h) anthracene	1.7	13		U
206-44-0-----	Fluoranthene	1.7	13		U
86-73-7-----	Fluorene	1.7	13		U
118-74-1-----	Hexachlorobenzene	1.7	13		U
87-68-3-----	Hexachlorobutadiene	1.7	13		U
77-47-4-----	Hexachlorocyclopentadiene	1.7	21		U
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	1.7	13		U
91-57-6-----	2-Methylnaphthalene	1.7	13		U
91-20-3-----	Naphthalene	1.7	13		U
621-64-7-----	N-Nitroso-di-n-propylamine	1.7	64		U
85-01-8-----	Phenanthrene	1.7	13		U
129-00-0-----	Pyrene	1.7	13		U

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FORM 1  
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CLIENT SAMPLE NO.

6

MR14-ISO 2-2-3-09D
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Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-06

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205606

% Moisture: 15 decanted: (Y/N) N Date Sampled: 12/04/09 08:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/14/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/15/09 00:56

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
56-55-3-----	Benzo (a) anthracene	1.6	12		U
205-99-2-----	Benzo (b) fluoranthene	1.6	12		U
207-08-9-----	Benzo (k) fluoranthene	1.6	12		U
191-24-2-----	Benzo (g, h, i) perylene	1.6	12		U
50-32-8-----	Benzo (a) pyrene	1.6	12		U
53-70-3-----	Dibenz (a, h) anthracene	1.6	12		U
206-44-0-----	Fluoranthene	1.6	12		U
86-73-7-----	Fluorene	1.6	12		U
118-74-1-----	Hexachlorobenzene	1.6	12		U
87-68-3-----	Hexachlorobutadiene	1.6	12		U
77-47-4-----	Hexachlorocyclopentadiene	1.6	20		U
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	1.6	12		U
91-57-6-----	2-Methylnaphthalene	1.6	12		U
91-20-3-----	Naphthalene	1.6	12		U
621-64-7-----	N-Nitroso-di-n-propylamine	1.6	59		U
85-01-8-----	Phenanthrene	1.6	12		U
129-00-0-----	Pyrene	1.6	12		U

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

7

MR14-ISO  
3-2-3-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-07

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205607

% Moisture: 20 decanted: (Y/N) N Date Sampled: 12/04/09 08:10

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 17:37

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
56-55-3-----	Benzo (a) anthracene	1.6	12		U
205-99-2-----	Benzo (b) fluoranthene	1.6	12		U
207-08-9-----	Benzo (k) fluoranthene	1.6	12		U
191-24-2-----	Benzo (g, h, i) perylene	1.6	12		U
50-32-8-----	Benzo (a) pyrene	1.6	12		U
53-70-3-----	Dibenz (a, h) anthracene	1.6	12		U
206-44-0-----	Fluoranthene	1.6	12		U
86-73-7-----	Fluorene	1.6	12		U
118-74-1-----	Hexachlorobenzene	1.6	12		U
87-68-3-----	Hexachlorobutadiene	1.6	12		U
77-47-4-----	Hexachlorocyclopentadiene	1.6	21		U
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	1.6	12		U
91-57-6-----	2-Methylnaphthalene	1.6	12		U
91-20-3-----	Naphthalene	1.6	12		U
621-64-7-----	N-Nitroso-di-n-propylamine	1.6	62		U
85-01-8-----	Phenanthrene	1.6	12		U
129-00-0-----	Pyrene	1.6	12		U

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

8

MR14-FB1  
20809-GW

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912080-07

Sample wt/vol: 1040 (g/mL) ML Lab File ID: 1208007

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/08/09 11:00

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/15/09 08:05

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	UG/L CONC	
56-55-3	Benzo (a) anthracene	0.019	0.24		U
205-99-2	Benzo (b) fluoranthene	0.019	0.24		U
207-08-9	Benzo (k) fluoranthene	0.019	0.24		U
191-24-2	Benzo (g, h, i) perylene	0.019	0.24		U
50-32-8	Benzo (a) pyrene	0.019	0.24		U
53-70-3	Dibenz (a, h) anthracene	0.019	0.24		U
206-44-0	Fluoranthene	0.019	0.24		U
86-73-7	Fluorene	0.019	0.24		U
118-74-1	Hexachlorobenzene	0.019	0.24		U
87-68-3	Hexachlorobutadiene	0.019	0.24		U
77-47-4	Hexachlorocyclopentadiene	0.019	0.24		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.019	0.24		U
91-57-6	2-Methylnaphthalene	0.019	0.24		U
91-20-3	Naphthalene	0.019	0.24		U
621-64-7	N-Nitroso-di-n-propylamine	0.019	4.8		U
85-01-8	Phenanthrene	0.019	0.24		U
129-00-0	Pyrene	0.019	0.24		U

*MBL* 0.24 0.24 0.025 ~~0.025~~ U

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 9

MR14-TW04-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912099-01

Sample wt/vol: 1020 (g/mL) ML Lab File ID: 1209901

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/09/09 10:25

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/15/09 09:46

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L					
		MDL	RL	CONC	Q		
56-55-3	Benzo (a) anthracene	0.020	MBL	0.24	0.24	<del>0.083</del>	JB U
205-99-2	Benzo (b) fluoranthene	0.020	↓	0.24	↓	0.072	JB ↓
207-08-9	Benzo (k) fluoranthene	0.020	↓	0.24	↓	0.087	JB ↓
191-24-2	Benzo (g, h, i) perylene	0.020		0.24		0.080	J
50-32-8	Benzo (a) pyrene	0.020		0.24		0.070	J
53-70-3	Dibenz (a, h) anthracene	0.020		0.24		0.078	J
206-44-0	Fluoranthene	0.020	MBL	0.24	0.24	<del>0.085</del>	JB U
86-73-7	Fluorene	0.020		0.24	↓	<del>0.040</del>	JB ↓
118-74-1	Hexachlorobenzene	0.020	↓	0.24	↓	0.058	JB ↓
87-68-3	Hexachlorobutadiene	0.020		0.24			U
77-47-4	Hexachlorocyclopentadiene	0.020		0.24			U
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.020		0.24		0.069	J
91-57-6	2-Methylnaphthalene	0.020	MBL	0.24	0.24	<del>0.026</del>	JB U
91-20-3	Naphthalene	0.020	↓	0.24	0.24	<del>0.028</del>	JB U
621-64-7	N-Nitroso-di-n-propylamine	0.020		4.9			U
85-01-8	Phenanthrene	0.020		0.24	0.24	<del>0.059</del>	JB U
129-00-0	Pyrene	0.020	MBL	0.24	0.24	<del>0.087</del>	JB U

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

10

MR14-TW04D-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912099-02

Sample wt/vol: 1020 (g/mL) ML Lab File ID: 1209902

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/09/09 10:30

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/15/09 10:19

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L				
		MDL	RL	CONC	Q	
56-55-3	Benzo (a) anthracene	0.020	MBL 0.24	0.24	<del>0.088</del>	JB U
205-99-2	Benzo (b) fluoranthene	0.020	↓ 0.24	↓ 0.24	<del>0.072</del>	JB ↓
207-08-9	Benzo (k) fluoranthene	0.020	↓ 0.24	↓ 0.24	<del>0.089</del>	JB ↓
191-24-2	Benzo (g, h, i) perylene	0.020	0.24	0.24	0.073	J
50-32-8	Benzo (a) pyrene	0.020	0.24	0.24	0.070	J
53-70-3	Dibenz (a, h) anthracene	0.020	0.24	0.24	0.074	J
206-44-0	Fluoranthene	0.020	0.24	0.24	<del>0.088</del>	JB U
86-73-7	Fluorene	0.020	0.24	↓ 0.24	<del>0.040</del>	JB ↓
118-74-1	Hexachlorobenzene	0.020	0.24	↓ 0.24	<del>0.061</del>	JB ↓
87-68-3	Hexachlorobutadiene	0.020	0.24	0.24		U
77-47-4	Hexachlorocyclopentadiene	0.020	0.24	0.24		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.020	0.24	0.24	0.071	J
91-57-6	2-Methylnaphthalene	0.020	0.24	0.24	<del>0.021</del>	JB U
91-20-3	Naphthalene	0.020	0.24	0.24	<del>0.020</del>	JB U
621-64-7	N-Nitroso-di-n-propylamine	0.020	4.9	4.9		U
85-01-8	Phenanthrene	0.020	MBL 0.24	0.24	<del>0.064</del>	JB U
129-00-0	Pyrene	0.020	↓ 0.24	0.24	<del>0.091</del>	JB U

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**SEMIVOLATILE ORGANIC COMPOUNDS**

USEPA Region IV - Level IV Review

Site: MCB Camp Lejeune, CTO-014, UXO-14 SDG #: UX014\_002

Client: CH2M HILL, Inc., Virginia Beach, Virginia Date: January 24, 2010

Laboratory: Empirical Laboratories, Nashville, Tennessee Reviewer: Nancy Weaver

EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	MR14-EB120409-IS	0912056-01	Water
2	MR14-FB120409	0912056-02	Water
3	MR14-IS01-2-3-09D	0912056-03	Soil
3MS	MR14-IS01-2-3-09DMS	0912056-03MS	Soil
3MSD	MR14-IS01-2-3-09DMSD	0912056-03MSD	Soil
4	MR14-IS04-4-5-09D	0912056-04	Soil
4MS	MR14-IS04-4-5-09DMS	0912056-04MS	Soil
4MSD	MR14-IS04-4-5-09DMSD	0912056-04MSD	Soil
5	MR14-IS04D-4-5-09D	0912056-05	Soil
6	MR14-IS02-2-3-09D	0912056-06	Soil
7	MR14-IS03-2-3-09D	0912056-07	Soil
8	MR14-FB120809-GW	0912080-07	Water
9	MR14-TW04-09D	0912099-01	Water
10	MR14- TW04D-09D	0912099-02	Water

The USEPA "Contract Laboratory Program National Functional Guidelines for Organic Data Review," October 1999, and professional judgement were used in evaluating the data in this summary report.

Holding Times - All samples were extracted within 7 days for water samples, 14 days for soil samples and analyzed within 40 days for all samples.

GC/MS Tuning - All of the DFTPP tunes in the initial and continuing calibrations met the percent relative abundance criteria.

Initial Calibration - The initial calibrations exhibited acceptable %RSD and mean RRF values.

Continuing Calibration - The continuing calibrations exhibited acceptable %D and RRF values.

CCAL Date	Compound	%D/RRF	Qualifier	Affected Samples
12/14/09	Acetophenone	31.7%	J/UJ	1-2
	Caprolactam	39.2%		
	4-Methylphenol	29.4%		
	2-Nitroaniline	25.6%		
	4-Nitrophenol	35.2%		
	2-Chlorobenzalmalononitrile	33.6%		
12/16/09	Acetophenone	26.2%	J/UJ	8-10
	4,6-Dinitro-2-methylphenol	27.1%		
	2,4-Dinitrophenol	36.0%		
	4-Nitroaniline	25.4%		
12/21/09	Acetophenone	32.9%	J/UJ	3, 6, 7
	4-Methylphenol	34.1%		
12/22/09	Acetophenone	30.5%	J/UJ	4, 5
	Benzaldehyde	26.1%		
	4-Methylphenol	32.7%		
	4-Nitrophenol	29.3%		

Surrogates - All samples exhibited acceptable surrogate recoveries.

MS/MSD - The MS/MSD sample exhibited acceptable %R and RPD values except the following.

MS/MSD Sample ID	Compound	MS/MSD %R/RPD	Qualifier
3	2-Chloroacetophenone	67%/65%/Ok	J/UJ
4	Benzaldehyde	Ok/Ok/66	None for RPD alone
	bis(2-Chloroethoxy)methane	Ok/Ok/42	
	bis(2-Chloroethyl)ether	Ok/Ok/35	
	4-Chloroaniline	4%/9%/74	J/R
	4-Chloro-3-methylphenol	Ok/Ok/31	None for RPD alone
	3,3'-Dichlorobenzidine	0%/0%/Ok	J/R
	2,4-Dimethylphenol	Ok/Ok/33	None for RPD alone
	Isophorone	Ok/Ok/31	
	3-Nitroaniline	2%/Ok/167	J/R
	4-Nitroaniline	9%/29%/109	J/UJ
	2-Chloroacetophenone	Ok/57%/Ok	
	2-Chlorobenzalmalononitrile	Ok/Ok/35	None for RPD alone

Laboratory Control Sample - The LCS samples exhibited acceptable %R values except the following.

LCS ID	Compound	%R	Qualifier	Affected Samples
9L08006-BLK2	Benzaldehyde	6%	None	See CCAL

Internal Standard (IS) Area Performance - All internal standards met response and retention time (RT) criteria.

Method Blank - The method blanks exhibited the following contamination.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
9L08015-BLK1	bis(2-Ethylhexyl)phthalate	4.2	42	U	1, 2
	Caprolactam	1.8	9.0		
9L10023-BLK1	Caprolactam	1.0	5.0	U	8-10

Field, Equipment Blank - Field QC results are summarized below.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB120409-IS	Di-n-butylphthalate	1.6	16	None	All ND
MR14FB120409	Di-n-butylphthalate	1.4	14	None	All ND
MR14FB120809	None - ND	-	-	-	-

Field Duplicates - Field duplicate results are summarized below.

Compound	MR14-IS04-4-5-09D ug/kg	MR14-IS04D-4-5-09D ug/kg	RPD	Qualifier
Benzaldehyde	540	520	4%	None

Compound	MR14- TW04-09D ug/L	MR14- TW04D-09D ug/L	RPD	Qualifier
4-Methylphenol	1.7	1.6	6%	None

Tentatively Identified Compounds (TICs) - TICs were not reported.

Compound Quantitation - No discrepancies were identified.

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-EB1  
20409-IS

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912056-01

Sample wt/vol: 1000 (g/mL) ML Lab File ID: 1205601

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/04/09 11:35

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/08/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 22:27

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	0.63	5.0		U
208-96-8	Acenaphthylene	0.47	5.0		U
98-86-2	Acetophenone	0.75	5.0	CCH	<del>U</del> UJ
120-12-7	Anthracene	0.77	5.0		U
1912-24-9	Atrazine	0.69	5.0		U
100-52-7	Benzaldehyde	0.57	5.0		U
92-52-4	1,1'-Biphenyl	0.39	5.0		U
111-91-1	bis(2-Chloroethoxy)methane	0.52	5.0		U
111-44-4	bis(2-Chloroethyl) ether	0.45	5.0		U
108-60-1	2,2'-Oxybis(1-chloropropane)	0.85	5.0		U
117-81-7	Bis(2-ethylhexyl) phthalate	1.3	5.0	MBL 8.0	<del>U</del> U
101-55-3	4-Bromophenyl-phenylether	0.57	5.0		U
85-68-7	Butylbenzylphthalate	0.82	5.0		U
106-47-8	4-Chloroaniline	0.95	5.0	CCH	U
105-60-2	Caprolactam	0.36	5.0	MBL 5.0 3.5	<del>U</del> UJ
86-74-8	Carbazole	0.69	5.0		U
59-50-7	4-Chloro-3-methylphenol	0.58	5.0		U
91-58-7	2-Chloronaphthalene	0.58	5.0		U
95-57-8	2-Chlorophenol	0.59	5.0		U
7005-72-3	4-Chlorophenyl-phenylether	0.89	5.0		U
218-01-9	Chrysene	1.0	5.0		U
132-64-9	Dibenzofuran	0.65	5.0		U
91-94-1	3,3'-Dichlorobenzidine	0.89	5.0		U
120-83-2	2,4-Dichlorophenol	0.44	5.0		U
84-66-2	Diethylphthalate	1.0	5.0		U
105-67-9	2,4-Dimethylphenol	0.71	5.0		U
131-11-3	Dimethylphthalate	0.74	5.0		U
84-74-2	Di-n-butylphthalate	1.3	5.0	1.6	J
534-52-1	4,6-Dinitro-2-methylphenol	0.74	20		U
51-28-5	2,4-Dinitrophenol	0.85	20		U
121-14-2	2,4-Dinitrotoluene	0.49	5.0		U
606-20-2	2,6-Dinitrotoluene	0.66	5.0		U
117-84-0	Di-n-octylphthalate	0.33	5.0		U

FORM I SV

*luw*  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-EB1  
20409-IS

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912056-01

Sample wt/vol: 1000 (g/mL) ML Lab File ID: 1205601

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/04/09 11:35

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/08/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 22:27

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg)			UG/L Q
		MDL	RL	CONC	
67-72-1-----	Hexachloroethane	0.46	5.0		U
78-59-1-----	Isophorone	0.55	5.0		U
106-44-5-----	4-Methylphenol	0.77	5.0	CCM	<del>U</del> UJ
95-48-7-----	2-Methylphenol	0.83	5.0		U
88-74-4-----	2-Nitroaniline	1.2	20	CCM	<del>U</del> UJ
99-09-2-----	3-Nitroaniline	1.0	20		U
100-01-6-----	4-Nitroaniline	2.0	20		U
98-95-3-----	Nitrobenzene	0.62	5.0		U
88-75-5-----	2-Nitrophenol	0.74	5.0		U
100-02-7-----	4-Nitrophenol	0.83	20	CCM	<del>U</del> UJ
86-30-6-----	N-Nitrosodiphenylamine (1)	0.46	5.0		U
87-86-5-----	Pentachlorophenol	1.0	20		U
108-95-2-----	Phenol	0.46	5.0		U
95-95-4-----	2,4,5-Trichlorophenol	0.50	20		U
88-06-2-----	2,4,6-Trichlorophenol	0.73	5.0		U
532-27-4-----	2-Chloroacetophenone	1.0	5.0		U
2698-41-1-----	2-Chlorobenzalmalononitrile	1.0	5.0	CCM	<del>U</del> UJ

(1) - Cannot be separated from Diphenylamine

FORM I SV

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

2

MR14FB120409

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912056-02

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1205602

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/04/09 11:45

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/08/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 23:03

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9-----	Acenaphthene	0.58	4.6		U
208-96-8-----	Acenaphthylene	0.44	4.6		U
98-86-2-----	Acetophenone	0.69	4.6	CCH	U <del>U</del>
120-12-7-----	Anthracene	0.71	4.6		U
1912-24-9-----	Atrazine	0.64	4.6		U
100-52-7-----	Benzaldehyde	0.53	4.6		U
92-52-4-----	1,1'-Biphenyl	0.36	4.6		U
111-91-1-----	bis(2-Chloroethoxy)methane	0.48	4.6		U
111-44-4-----	bis(2-Chloroethyl) ether	0.42	4.6		U
108-60-1-----	2,2'-Oxybis(1-chloropropane)	0.79	4.6		U
117-81-7-----	Bis(2-ethylhexyl)phthalate	1.2	4.6	MBL 7.8	U <del>U</del>
101-55-3-----	4-Bromophenyl-phenylether	0.53	4.6		U
85-68-7-----	Butylbenzylphthalate	0.76	4.6		U
106-47-8-----	4-Chloroaniline	0.88	4.6	CCH	U
105-60-2-----	Caprolactam	0.33	4.6	MBL 4.6 2.9	U <del>U</del>
86-74-8-----	Carbazole	0.64	4.6		U
59-50-7-----	4-Chloro-3-methylphenol	0.54	4.6		U
91-58-7-----	2-Chloronaphthalene	0.54	4.6		U
95-57-8-----	2-Chlorophenol	0.55	4.6		U
7005-72-3-----	4-Chlorophenyl-phenylether	0.82	4.6		U
218-01-9-----	Chrysene	0.94	4.6		U
132-64-9-----	Dibenzofuran	0.60	4.6		U
91-94-1-----	3,3'-Dichlorobenzidine	0.82	4.6		U
120-83-2-----	2,4-Dichlorophenol	0.41	4.6		U
84-66-2-----	Diethylphthalate	0.94	4.6		U
105-67-9-----	2,4-Dimethylphenol	0.66	4.6		U
131-11-3-----	Dimethylphthalate	0.68	4.6		U
84-74-2-----	Di-n-butylphthalate	1.2	4.6	1.4	J
534-52-1-----	4,6-Dinitro-2-methylphenol	0.68	18		U
51-28-5-----	2,4-Dinitrophenol	0.79	18		U
121-14-2-----	2,4-Dinitrotoluene	0.45	4.6		U
606-20-2-----	2,6-Dinitrotoluene	0.61	4.6		U
117-84-0-----	Di-n-octylphthalate	0.30	4.6		U

FORM I SV

uw  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

2

MR14FB120409

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912056-02

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1205602

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/04/09 11:45

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/08/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/14/09 23:03

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
67-72-1-----	Hexachloroethane	0.42	4.6		U
78-59-1-----	Isophorone	0.51	4.6		U
106-44-5-----	4-Methylphenol	0.71	4.6	CCH	<del>U</del> UJ
95-48-7-----	2-Methylphenol	0.77	4.6		U
88-74-4-----	2-Nitroaniline	1.1	18	CCH	<del>U</del> UJ
99-09-2-----	3-Nitroaniline	0.97	18		U
100-01-6-----	4-Nitroaniline	1.9	18		U
98-95-3-----	Nitrobenzene	0.57	4.6		U
88-75-5-----	2-Nitrophenol	0.68	4.6		U
100-02-7-----	4-Nitrophenol	0.77	18	CCH	<del>U</del> UJ
86-30-6-----	N-Nitrosodiphenylamine (1)	0.42	4.6		U
87-86-5-----	Pentachlorophenol	0.92	18		U
108-95-2-----	Phenol	0.42	4.6		U
95-95-4-----	2,4,5-Trichlorophenol	0.46	18		U
88-06-2-----	2,4,6-Trichlorophenol	0.68	4.6		U
532-27-4-----	2-Chloroacetophenone	0.92	4.6		U
2698-41-1-----	2-Chlorobenzalmalononitrile	0.92	4.6	CCH	<del>U</del> UJ

(1) - Cannot be separated from Diphenylamine

FORM I SV

*fw*  
2124/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

3

MR14-IS0  
1-2-3-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-03

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205603

% Moisture: 18 decanted: (Y/N) N Date Sampled: 12/04/09 10:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/21/09 16:40

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	UG/KG
83-32-9	Acenaphthene	32	280		U
208-96-8	Acenaphthylene	24	280		U
98-86-2	Acetophenone	50	280	CCM	U
120-12-7	Anthracene	33	280		U
1912-24-9	Atrazine	35	280		U
100-52-7	Benzaldehyde	68	280		U
92-52-4	1,1'-Biphenyl	36	280		U
111-91-1	bis(2-Chloroethoxy)methane	38	280		U
111-44-4	bis(2-Chloroethyl) ether	50	120		U
108-60-1	2,2'-Oxybis(1-chloropropane)	62	280		U
117-81-7	Bis(2-ethylhexyl) phthalate	44	280		U
101-55-3	4-Bromophenyl-phenylether	32	280		U
85-68-7	Butylbenzylphthalate	36	280		U
106-47-8	4-Chloroaniline	58	280		U
105-60-2	Caprolactam	82	280		U
86-74-8	Carbazole	44	280		U
59-50-7	4-Chloro-3-methylphenol	34	280		U
91-58-7	2-Chloronaphthalene	39	280		U
95-57-8	2-Chlorophenol	50	280		U
7005-72-3	4-Chlorophenyl-phenylether	38	280		U
218-01-9	Chrysene	38	280		U
132-64-9	Dibenzofuran	30	280		U
91-94-1	3,3'-Dichlorobenzidine	38	280		U
120-83-2	2,4-Dichlorophenol	23	280		U
84-66-2	Diethylphthalate	41	280		U
105-67-9	2,4-Dimethylphenol	26	280		U
131-11-3	Dimethylphthalate	37	280		U
84-74-2	Di-n-butylphthalate	37	280		U
534-52-1	4,6-Dinitro-2-methylphenol	27	570		U
51-28-5	2,4-Dinitrophenol	160	570		U
121-14-2	2,4-Dinitrotoluene	29	280		U
606-20-2	2,6-Dinitrotoluene	46	280		U
117-84-0	Di-n-octylphthalate	33	410		U

FORM I SV

*lew*  
212410

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

3

MR14-ISO  
1-2-3-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-03

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205603

% Moisture: 18 decanted: (Y/N) N Date Sampled: 12/04/09 10:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/21/09 16:40

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
67-72-1-----	Hexachloroethane	48	280		U
78-59-1-----	Isophorone	34	280		U
106-44-5-----	4-Methylphenol	32	280	CLH	U
95-48-7-----	2-Methylphenol	47	280		U
88-74-4-----	2-Nitroaniline	39	570		U
99-09-2-----	3-Nitroaniline	58	570		U
100-01-6-----	4-Nitroaniline	120	570		U
98-95-3-----	Nitrobenzene	42	280		U
88-75-5-----	2-Nitrophenol	27	280		U
100-02-7-----	4-Nitrophenol	99	570		U
86-30-6-----	N-Nitrosodiphenylamine (1)	39	280		U
87-86-5-----	Pentachlorophenol	41	810		U
108-95-2-----	Phenol	44	280		U
95-95-4-----	2,4,5-Trichlorophenol	33	570		U
88-06-2-----	2,4,6-Trichlorophenol	42	280		U
532-27-4-----	2-Chloroacetophenone	120	280	MSL	U
2698-41-1-----	2-Chlorobenzalmalononitrile	120	280		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

MSL  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 4

MR14-ISO  
4-4-5-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-04

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205604

% Moisture: 22 decanted: (Y/N) N Date Sampled: 12/04/09 10:05

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/16/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/22/09 20:16

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	34	300		U
208-96-8	Acenaphthylene	25	300		U
98-86-2	Acetophenone	52	300	CCH	<del>U</del> J
120-12-7	Anthracene	35	300		U
1912-24-9	Atrazine	36	300		U
100-52-7	Benzaldehyde	71	300	CCH 540	<del>U</del> J
92-52-4	1,1'-Biphenyl	38	300		U
111-91-1	bis(2-Chloroethoxy)methane	39	300		U
111-44-4	bis(2-Chloroethyl) ether	52	130		U
108-60-1	2,2'-Oxybis(1-chloropropane)	65	300		U
117-81-7	Bis(2-ethylhexyl) phthalate	46	300		U
101-55-3	4-Bromophenyl-phenylether	33	300		U
85-68-7	Butylbenzylphthalate	38	300		U
106-47-8	4-Chloroaniline	61	300	MSL	<del>U</del> R
105-60-2	Caprolactam	86	300		U
86-74-8	Carbazole	46	300		U
59-50-7	4-Chloro-3-methylphenol	35	300		U
91-58-7	2-Chloronaphthalene	41	300		U
95-57-8	2-Chlorophenol	52	300		U
7005-72-3	4-Chlorophenyl-phenylether	39	300		U
218-01-9	Chrysene	39	300		U
132-64-9	Dibenzofuran	31	300		U
91-94-1	3,3'-Dichlorobenzidine	40	300	MSL	<del>U</del> R
120-83-2	2,4-Dichlorophenol	24	300		U
84-66-2	Diethylphthalate	43	300		U
105-67-9	2,4-Dimethylphenol	27	300		U
131-11-3	Dimethylphthalate	39	300		U
84-74-2	Di-n-butylphthalate	39	300		U
534-52-1	4,6-Dinitro-2-methylphenol	28	600		U
51-28-5	2,4-Dinitrophenol	170	600		U
121-14-2	2,4-Dinitrotoluene	31	300		U
606-20-2	2,6-Dinitrotoluene	48	300		U
117-84-0	Di-n-octylphthalate	34	420		U

FORM I SV

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

4

MR14-ISO  
4-4-5-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-04

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205604

% Moisture: 22 decanted: (Y/N) N Date Sampled: 12/04/09 10:05

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/16/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/22/09 20:16

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
67-72-1-----	Hexachloroethane	50	300		U
78-59-1-----	Isophorone	36	300		U
106-44-5-----	4-Methylphenol	34	300	CCH	<del>U</del> UJ
95-48-7-----	2-Methylphenol	49	300		U
88-74-4-----	2-Nitroaniline	41	600		U
99-09-2-----	3-Nitroaniline	60	600	MSL	<del>U</del> R
100-01-6-----	4-Nitroaniline	130	600	MSL	<del>U</del> R
98-95-3-----	Nitrobenzene	44	300		U
88-75-5-----	2-Nitrophenol	28	300		U
100-02-7-----	4-Nitrophenol	100	600	CCH	<del>U</del> UJ
86-30-6-----	N-Nitrosodiphenylamine (1)	41	300		U
87-86-5-----	Pentachlorophenol	43	850		U
108-95-2-----	Phenol	46	300		U
95-95-4-----	2,4,5-Trichlorophenol	34	600		U
88-06-2-----	2,4,6-Trichlorophenol	44	300		U
532-27-4-----	2-Chloroacetophenone	130	300	MSL	<del>U</del> UJ
2698-41-1-----	2-Chlorobenzalmalononitrile	130	300		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

llw  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

5

MR14-IS04  
D-4-5-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-05

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205605

% Moisture: 22 decanted: (Y/N) N Date Sampled: 12/04/09 10:10

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/16/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/22/09 20:52

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	34	300		U
208-96-8	Acenaphthylene	25	300		U
98-86-2	Acetophenone	53	300	ccn	<del>U</del> U
120-12-7	Anthracene	35	300		U
1912-24-9	Atrazine	36	300		U
100-52-7	Benzaldehyde	71	300	ccn 520	<del>U</del> J
92-52-4	1,1'-Biphenyl	38	300		U
111-91-1	bis(2-Chloroethoxy) methane	40	300		U
111-44-4	bis(2-Chloroethyl) ether	52	130		U
108-60-1	2,2'-Oxybis(1-chloropropane)	66	300		U
117-81-7	Bis(2-ethylhexyl) phthalate	46	300		U
101-55-3	4-Bromophenyl-phenylether	33	300		U
85-68-7	Butylbenzylphthalate	38	300		U
106-47-8	4-Chloroaniline	61	300		U
105-60-2	Caprolactam	86	300		U
86-74-8	Carbazole	46	300		U
59-50-7	4-Chloro-3-methylphenol	36	300		U
91-58-7	2-Chloronaphthalene	41	300		U
95-57-8	2-Chlorophenol	52	300		U
7005-72-3	4-Chlorophenyl-phenylether	40	300		U
218-01-9	Chrysene	40	300		U
132-64-9	Dibenzofuran	31	300		U
91-94-1	3,3'-Dichlorobenzidine	40	300		U
120-83-2	2,4-Dichlorophenol	24	300		U
84-66-2	Diethylphthalate	44	300		U
105-67-9	2,4-Dimethylphenol	27	300		U
131-11-3	Dimethylphthalate	39	300		U
84-74-2	Di-n-butylphthalate	39	300		U
534-52-1	4,6-Dinitro-2-methylphenol	28	600		U
51-28-5	2,4-Dinitrophenol	170	600		U
121-14-2	2,4-Dinitrotoluene	31	300		U
606-20-2	2,6-Dinitrotoluene	49	300		U
117-84-0	Di-n-octylphthalate	34	430		U

FORM I SV

*llw*  
2124110

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

5

MRI4-IS04  
D-4-5-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-05

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205605

% Moisture: 22 decanted: (Y/N) N Date Sampled: 12/04/09 10:10

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/16/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/22/09 20:52

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

67-72-1-----	Hexachloroethane	50	300		U
78-59-1-----	Isophorone	36	300		U
106-44-5-----	4-Methylphenol	34	300	CCM	U UJ
95-48-7-----	2-Methylphenol	50	300		U
88-74-4-----	2-Nitroaniline	41	600		U
99-09-2-----	3-Nitroaniline	61	600		U
100-01-6-----	4-Nitroaniline	130	600		U
98-95-3-----	Nitrobenzene	44	300		U
88-75-5-----	2-Nitrophenol	28	300		U
100-02-7-----	4-Nitrophenol	100	600	CCM	U UJ
86-30-6-----	N-Nitrosodiphenylamine (1)	41	300		U
87-86-5-----	Pentachlorophenol	43	860		U
108-95-2-----	Phenol	46	300		U
95-95-4-----	2,4,5-Trichlorophenol	34	600		U
88-06-2-----	2,4,6-Trichlorophenol	45	300		U
532-27-4-----	2-Chloroacetophenone	130	300		U
2698-41-1-----	2-Chlorobenzalmalononitrile	130	300		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

Red  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 6

MR14-IS0  
2-2-3-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-06

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205606

% Moisture: 15 decanted: (Y/N) N Date Sampled: 12/04/09 08:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/21/09 17:16

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	31	280		U
208-96-8	Acenaphthylene	23	280		U
98-86-2	Acetophenone	48	280	CCU	U UT
120-12-7	Anthracene	32	280		U
1912-24-9	Atrazine	33	280		U
100-52-7	Benzaldehyde	65	280		U
92-52-4	1,1'-Biphenyl	35	280		U
111-91-1	bis(2-Chloroethoxy)methane	36	280		U
111-44-4	bis(2-Chloroethyl) ether	48	120		U
108-60-1	2,2'-Oxybis(1-chloropropane)	60	280		U
117-81-7	Bis(2-ethylhexyl) phthalate	43	280		U
101-55-3	4-Bromophenyl-phenylether	30	280		U
85-68-7	Butylbenzylphthalate	35	280		U
106-47-8	4-Chloroaniline	56	280		U
105-60-2	Caprolactam	79	280		U
86-74-8	Carbazole	43	280		U
59-50-7	4-Chloro-3-methylphenol	33	280		U
91-58-7	2-Chloronaphthalene	38	280		U
95-57-8	2-Chlorophenol	48	280		U
7005-72-3	4-Chlorophenyl-phenylether	36	280		U
218-01-9	Chrysene	36	280		U
132-64-9	Dibenzofuran	29	280		U
91-94-1	3,3'-Dichlorobenzidine	37	280		U
120-83-2	2,4-Dichlorophenol	22	280		U
84-66-2	Diethylphthalate	40	280		U
105-67-9	2,4-Dimethylphenol	25	280		U
131-11-3	Dimethylphthalate	36	280		U
84-74-2	Di-n-butylphthalate	36	280		U
534-52-1	4,6-Dinitro-2-methylphenol	26	550		U
51-28-5	2,4-Dinitrophenol	160	550		U
121-14-2	2,4-Dinitrotoluene	28	280		U
606-20-2	2,6-Dinitrotoluene	45	280		U
117-84-0	Di-n-octylphthalate	32	390		U

FORM I SV

*CCU*  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MRI4-IS0  
2-2-3-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-06

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205606

% Moisture: 15 decanted: (Y/N) N Date Sampled: 12/04/09 08:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/21/09 17:16

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	UG/KG Q
67-72-1-----	Hexachloroethane	46	280		U
78-59-1-----	Isophorone	33	280		U
106-44-5-----	4-Methylphenol	31	280	CCN	U
95-48-7-----	2-Methylphenol	46	280		U
88-74-4-----	2-Nitroaniline	38	550		U
99-09-2-----	3-Nitroaniline	56	550		U
100-01-6-----	4-Nitroaniline	120	550		U
98-95-3-----	Nitrobenzene	41	280		U
88-75-5-----	2-Nitrophenol	26	280		U
100-02-7-----	4-Nitrophenol	95	550		U
86-30-6-----	N-Nitrosodiphenylamine_(1)	38	280		U
87-86-5-----	Pentachlorophenol	40	790		U
108-95-2-----	Phenol	42	280		U
95-95-4-----	2,4,5-Trichlorophenol	32	550		U
88-06-2-----	2,4,6-Trichlorophenol	41	280		U
532-27-4-----	2-Chloroacetophenone	120	280		U
2698-41-1-----	2-Chlorobenzalmalononitrile	120	280		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 7

MR14-IS0  
3-2-3-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) SOIL Lab Sample ID: 0912056-07

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1205607

% Moisture: 20 decanted: (Y/N) N Date Sampled: 12/04/09 08:10

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/21/09 17:52

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

83-32-9-----	Acenaphthene	33	290		U
208-96-8-----	Acenaphthylene	24	290		U
98-86-2-----	Acetophenone	51	290	CUH	U
120-12-7-----	Anthracene	34	290		U
1912-24-9-----	Atrazine	35	290		U
100-52-7-----	Benzaldehyde	69	290		U
92-52-4-----	1,1'-Biphenyl	36	290		U
111-91-1-----	bis(2-Chloroethoxy)methane	38	290		U
111-44-4-----	bis(2-Chloroethyl) ether	51	120		U
108-60-1-----	2,2'-Oxybis(1-chloropropane)	64	290		U
117-81-7-----	Bis(2-ethylhexyl) phthalate	45	290		U
101-55-3-----	4-Bromophenyl-phenylether	32	290		U
85-68-7-----	Butylbenzylphthalate	37	290		U
106-47-8-----	4-Chloroaniline	59	290		U
105-60-2-----	Caprolactam	84	290		U
86-74-8-----	Carbazole	45	290		U
59-50-7-----	4-Chloro-3-methylphenol	34	290		U
91-58-7-----	2-Chloronaphthalene	40	290		U
95-57-8-----	2-Chlorophenol	51	290		U
7005-72-3-----	4-Chlorophenyl-phenylether	38	290		U
218-01-9-----	Chrysene	38	290		U
132-64-9-----	Dibenzofuran	30	290		U
91-94-1-----	3,3'-Dichlorobenzidine	39	290		U
120-83-2-----	2,4-Dichlorophenol	23	290		U
84-66-2-----	Diethylphthalate	42	290		U
105-67-9-----	2,4-Dimethylphenol	26	290		U
131-11-3-----	Dimethylphthalate	38	290		U
84-74-2-----	Di-n-butylphthalate	38	290		U
534-52-1-----	4,6-Dinitro-2-methylphenol	27	580		U
51-28-5-----	2,4-Dinitrophenol	160	580		U
121-14-2-----	2,4-Dinitrotoluene	30	290		U
606-20-2-----	2,6-Dinitrotoluene	47	290		U
117-84-0-----	Di-n-octylphthalate	33	410		U

FORM I SV

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 7

MR14-IS0  
3-2-3-09D

Lab Name: EMPIRICAL LABS      Contract: CH2MHILL

Lab Code: NA      Case No.: NA      SAS No.: NA      SDG No.: UX014\_002

Matrix: (soil/water) SOIL      Lab Sample ID: 0912056-07

Sample wt/vol:      15.0 (g/mL) G      Lab File ID:      1205607

% Moisture: 20      decanted: (Y/N) N      Date Sampled:      12/04/09 08:10

Extraction: (SepF/Cont/Sonc/Soxh) SOXH      Date Extracted: 12/09/09

Concentrated Extract Volume: 1000.0 (uL)      Date Analyzed: 12/21/09 17:52

Injection Volume:      0.5 (uL)      Dilution Factor: 1.0

GPC Cleanup:      (Y/N) N      pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
67-72-1-----	Hexachloroethane	49	290		U
78-59-1-----	Isophorone	35	290		U
106-44-5-----	4-Methylphenol	33	290	CUH	OUT
95-48-7-----	2-Methylphenol	48	290		U
88-74-4-----	2-Nitroaniline	40	580		U
99-09-2-----	3-Nitroaniline	59	580		U
100-01-6-----	4-Nitroaniline	120	580		U
98-95-3-----	Nitrobenzene	43	290		U
88-75-5-----	2-Nitrophenol	27	290		U
100-02-7-----	4-Nitrophenol	100	580		U
86-30-6-----	N-Nitrosodiphenylamine (1)	40	290		U
87-86-5-----	Pentachlorophenol	42	830		U
108-95-2-----	Phenol	45	290		U
95-95-4-----	2,4,5-Trichlorophenol	33	580		U
88-06-2-----	2,4,6-Trichlorophenol	43	290		U
532-27-4-----	2-Chloroacetophenone	120	290		U
2698-41-1-----	2-Chlorobenzalmalononitrile	120	290		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*lws*  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-FBI  
20809-GW

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912080-07

Sample wt/vol: 1040 (g/mL) ML Lab File ID: 1208007

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/08/09 11:00

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/16/09 12:55

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/L	Q
		MDL	(ug/L or ug/Kg) RL CONC		
83-32-9	Acenaphthene	0.60	4.8		U
208-96-8	Acenaphthylene	0.45	4.8		U
98-86-2	Acetophenone	0.72	4.8	CCH	U UJ
120-12-7	Anthracene	0.74	4.8		U
1912-24-9	Atrazine	0.66	4.8		U
100-52-7	Benzaldehyde	0.55	4.8		U
92-52-4	1,1'-Biphenyl	0.38	4.8		U
111-91-1	bis(2-Chloroethoxy)methane	0.50	4.8		U
111-44-4	bis(2-Chloroethyl) ether	0.43	4.8		U
108-60-1	2,2'-Oxybis(1-chloropropane)	0.82	4.8		U
117-81-7	Bis(2-ethylhexyl)phthalate	1.2	4.8		U
101-55-3	4-Bromophenyl-phenylether	0.55	4.8		U
85-68-7	Butylbenzylphthalate	0.79	4.8		U
106-47-8	4-Chloroaniline	0.91	4.8		U
105-60-2	Caprolactam	0.35	4.8	MBL 4.80 72	U U
86-74-8	Carbazole	0.66	4.8		U
59-50-7	4-Chloro-3-methylphenol	0.56	4.8		U
91-58-7	2-Chloronaphthalene	0.56	4.8		U
95-57-8	2-Chlorophenol	0.57	4.8		U
7005-72-3	4-Chlorophenyl-phenylether	0.86	4.8		U
218-01-9	Chrysene	0.97	4.8		U
132-64-9	Dibenzofuran	0.62	4.8		U
91-94-1	3,3'-Dichlorobenzidine	0.86	4.8		U
120-83-2	2,4-Dichlorophenol	0.42	4.8		U
84-66-2	Diethylphthalate	0.98	4.8		U
105-67-9	2,4-Dimethylphenol	0.68	4.8		U
131-11-3	Dimethylphthalate	0.71	4.8		U
84-74-2	Di-n-butylphthalate	1.2	4.8		U
534-52-1	4,6-Dinitro-2-methylphenol	0.71	19	CCH	U UJ
51-28-5	2,4-Dinitrophenol	0.82	19	CCH	U UJ
121-14-2	2,4-Dinitrotoluene	0.47	4.8		U
606-20-2	2,6-Dinitrotoluene	0.63	4.8		U
117-84-0	Di-n-octylphthalate	0.32	4.8		U

FORM I SV

*Jew*  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

8

MR14-FBI 20809-GW
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Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912080-07

Sample wt/vol: 1040 (g/mL) ML Lab File ID: 1208007

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/08/09 11:00

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/16/09 12:55

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
67-72-1-----	Hexachloroethane	0.44	4.8		U
78-59-1-----	Isophorone	0.53	4.8		U
106-44-5-----	4-Methylphenol	0.74	4.8		U
95-48-7-----	2-Methylphenol	0.80	4.8		U
88-74-4-----	2-Nitroaniline	1.1	19		U
99-09-2-----	3-Nitroaniline	1.0	19		U
100-01-6-----	4-Nitroaniline	2.0	19	CCH	U
98-95-3-----	Nitrobenzene	0.60	4.8		U
88-75-5-----	2-Nitrophenol	0.71	4.8		U
100-02-7-----	4-Nitrophenol	0.80	19		U
86-30-6-----	N-Nitrosodiphenylamine (1)	0.44	4.8		U
87-86-5-----	Pentachlorophenol	0.96	19		U
108-95-2-----	Phenol	0.44	4.8		U
95-95-4-----	2,4,5-Trichlorophenol	0.48	19		U
88-06-2-----	2,4,6-Trichlorophenol	0.70	4.8		U
532-27-4-----	2-Chloroacetophenone	0.96	4.8		U
2698-41-1-----	2-Chlorobenzalmalononitrile	0.96	4.8		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

law  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 9

MR14-TW04-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912099-01

Sample wt/vol: 1020 (g/mL) ML Lab File ID: 1209901

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/09/09 10:25

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/16/09 13:31

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	0.62	4.9		U
208-96-8	Acenaphthylene	0.46	4.9		U
98-86-2	Acetophenone	0.74	4.9	CC#	U
120-12-7	Anthracene	0.75	4.9		U
1912-24-9	Atrazine	0.68	4.9		U
100-52-7	Benzaldehyde	0.56	4.9		U
92-52-4	1,1'-Biphenyl	0.38	4.9		U
111-91-1	bis(2-Chloroethoxy)methane	0.51	4.9		U
111-44-4	bis(2-Chloroethyl) ether	0.44	4.9		U
108-60-1	2,2'-Oxybis(1-chloropropane)	0.83	4.9		U
117-81-7	Bis(2-ethylhexyl) phthalate	1.2	4.9		U
101-55-3	4-Bromophenyl-phenylether	0.56	4.9		U
85-68-7	Butylbenzylphthalate	0.80	4.9		U
106-47-8	4-Chloroaniline	0.93	4.9		U
105-60-2	Caprolactam	0.35	4.9	MA 4.9 0.73	U
86-74-8	Carbazole	0.68	4.9		U
59-50-7	4-Chloro-3-methylphenol	0.57	4.9		U
91-58-7	2-Chloronaphthalene	0.57	4.9		U
95-57-8	2-Chlorophenol	0.58	4.9		U
7005-72-3	4-Chlorophenyl-phenylether	0.87	4.9		U
218-01-9	Chrysene	0.99	4.9		U
132-64-9	Dibenzofuran	0.64	4.9		U
91-94-1	3,3'-Dichlorobenzidine	0.87	4.9		U
120-83-2	2,4-Dichlorophenol	0.43	4.9		U
84-66-2	Diethylphthalate	1.0	4.9		U
105-67-9	2,4-Dimethylphenol	0.70	4.9		U
131-11-3	Dimethylphthalate	0.72	4.9		U
84-74-2	Di-n-butylphthalate	1.3	4.9		U
534-52-1	4,6-Dinitro-2-methylphenol	0.72	20	CC#	U
51-28-5	2,4-Dinitrophenol	0.83	20	CC#	U
121-14-2	2,4-Dinitrotoluene	0.48	4.9		U
606-20-2	2,6-Dinitrotoluene	0.65	4.9		U
117-84-0	Di-n-octylphthalate	0.32	4.9		U

FORM I SV

RUW  
2124/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

9

MR14-TW04-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912099-01

Sample wt/vol: 1020 (g/mL) ML Lab File ID: 1209901

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/09/09 10:25

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/16/09 13:31

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	UG/L CONC	
67-72-1-----	Hexachloroethane	0.45	4.9		U
78-59-1-----	Isophorone	0.54	4.9		U
106-44-5-----	4-Methylphenol	0.75	4.9	1.7	J
95-48-7-----	2-Methylphenol	0.81	4.9		U
88-74-4-----	2-Nitroaniline	1.2	20		U
99-09-2-----	3-Nitroaniline	1.0	20		U
100-01-6-----	4-Nitroaniline	2.0	20		U
98-95-3-----	Nitrobenzene	0.61	4.9		U
88-75-5-----	2-Nitrophenol	0.72	4.9		U
100-02-7-----	4-Nitrophenol	0.81	20		U
86-30-6-----	N-Nitrosodiphenylamine (1)	0.45	4.9		U
87-86-5-----	Pentachlorophenol	0.98	20		U
108-95-2-----	Phenol	0.45	4.9		U
95-95-4-----	2,4,5-Trichlorophenol	0.49	20		U
88-06-2-----	2,4,6-Trichlorophenol	0.72	4.9		U
532-27-4-----	2-Chloroacetophenone	0.98	4.9		U
2698-41-1-----	2-Chlorobenzalmalononitrile	0.98	4.9		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

luw  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

10

MR14-TW04D-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912099-02

Sample wt/vol: 1020 (g/mL) ML Lab File ID: 1209902

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/09/09 10:30

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/16/09 14:07

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/L	Q
		MDL	(ug/L or ug/Kg) RL CONC		
83-32-9	Acenaphthene	0.62	4.9		U
208-96-8	Acenaphthylene	0.46	4.9		U
98-86-2	Acetophenone	0.74	4.9	CCH	U U J
120-12-7	Anthracene	0.75	4.9		U
1912-24-9	Atrazine	0.68	4.9		U
100-52-7	Benzaldehyde	0.56	4.9		U
92-52-4	1,1'-Biphenyl	0.38	4.9		U
111-91-1	bis(2-Chloroethoxy)methane	0.51	4.9		U
111-44-4	bis(2-Chloroethyl) ether	0.44	4.9		U
108-60-1	2,2'-Oxybis(1-chloropropane)	0.83	4.9		U
117-81-7	Bis(2-ethylhexyl) phthalate	1.2	4.9		U
101-55-3	4-Bromophenyl-phenylether	0.56	4.9		U
85-68-7	Butylbenzylphthalate	0.80	4.9		U
106-47-8	4-Chloroaniline	0.93	4.9		U
105-60-2	Caprolactam	0.35	4.9	MBL 4.9 1.2	<del>U</del> U
86-74-8	Carbazole	0.68	4.9		U
59-50-7	4-Chloro-3-methylphenol	0.57	4.9		U
91-58-7	2-Chloronaphthalene	0.57	4.9		U
95-57-8	2-Chlorophenol	0.58	4.9		U
7005-72-3	4-Chlorophenyl-phenylether	0.87	4.9		U
218-01-9	Chrysene	0.99	4.9		U
132-64-9	Dibenzofuran	0.64	4.9		U
91-94-1	3,3'-Dichlorobenzidine	0.87	4.9		U
120-83-2	2,4-Dichlorophenol	0.43	4.9		U
84-66-2	Diethylphthalate	1.0	4.9		U
105-67-9	2,4-Dimethylphenol	0.70	4.9		U
131-11-3	Dimethylphthalate	0.72	4.9		U
84-74-2	Di-n-butylphthalate	1.3	4.9		U
534-52-1	4,6-Dinitro-2-methylphenol	0.72	20	CCH	U U J
51-28-5	2,4-Dinitrophenol	0.83	20	CCH	U U J
121-14-2	2,4-Dinitrotoluene	0.48	4.9		U
606-20-2	2,6-Dinitrotoluene	0.65	4.9		U
117-84-0	Di-n-octylphthalate	0.32	4.9		U

FORM I SV

llw  
2/24/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

10

MR14-TW04D-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_002

Matrix: (soil/water) WATER Lab Sample ID: 0912099-02

Sample wt/vol: 1020 (g/mL) ML Lab File ID: 1209902

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 12/09/09 10:30

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 12/11/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/16/09 14:07

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L CONC	UG/L Q
		MDL	(ug/L or ug/Kg) RL			
67-72-1-----	Hexachloroethane	0.45	4.9		U	
78-59-1-----	Isophorone	0.54	4.9		U	
106-44-5-----	4-Methylphenol	0.75	4.9	1.6	J	
95-48-7-----	2-Methylphenol	0.81	4.9		U	
88-74-4-----	2-Nitroaniline	1.2	20		U	
99-09-2-----	3-Nitroaniline	1.0	20		U	
100-01-6-----	4-Nitroaniline	2.0	20		U	
98-95-3-----	Nitrobenzene	0.61	4.9		U	
88-75-5-----	2-Nitrophenol	0.72	4.9		U	
100-02-7-----	4-Nitrophenol	0.81	20		U	
86-30-6-----	N-Nitrosodiphenylamine (1)	0.45	4.9		U	
87-86-5-----	Pentachlorophenol	0.98	20		U	
108-95-2-----	Phenol	0.45	4.9		U	
95-95-4-----	2,4,5-Trichlorophenol	0.49	20		U	
88-06-2-----	2,4,6-Trichlorophenol	0.72	4.9		U	
532-27-4-----	2-Chloroacetophenone	0.98	4.9		U	
2698-41-1-----	2-Chlorobenzalmalononitrile	0.98	4.9		U	

(1) - Cannot be separated from Diphenylamine

FORM I SV

*mu*  
2/24/10

**METALS & CYANIDE**  
USEPA Region IV - Level IV Review

Site: MCB Camp Lejeune, CTO-014, UXO-14 SDG #: UX014\_001

Client: CH2M HILL, Inc., Virginia Beach, Virginia Date: January 25, 2010

Laboratory: Empirical Laboratories, Nashville, Tennessee Reviewer: Nancy Weaver

EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	MR14-SS01-09D	0911082-01	Soil
2	MR14-SS01D-09D	0911082-02	Soil
3	MR14-SS02-09D	0911082-03	Soil
3MS*	MR14-SS02-09DMS	0911082-03MS	Soil
3MSD*	MR14-SS02-09DMSD	0911082-03MSD	Soil
4	MR14-SS03-09D	0911082-04	Soil
5	MR14-SS04-09D	0911082-05	Soil
6	MR14-SS05-09D	0911082-06	Soil
7	MR14-SS06-09D	0911082-07	Soil
8	MR14-SS07-09D	0911082-08	Soil
9	MR14-SS08-09D	0911082-09	Soil
10	MR14-SS09-09D	0911082-10	Soil
11	MR14-SS10-09D	0911082-11	Soil
12	MR14-SS11-09D	0911082-12	Soil
13	MR14-SS12-09D	0911082-13	Soil
14	MR14-EB110609-SS	0911082-23	Water
15	MR14-FB110609	0911082-24	Water

\* - Copper only

The USEPA "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," October 2004, and professional judgement were used in evaluating the data in this summary report.

Holding Times - All samples were prepared and analyzed within 14 days for cyanide, 28 days for mercury and 180 days for all other metals.

Calibration - The ICV and CCV %R values were acceptable except the following.

Compound	%R	Qualifier	Affected Samples
Zinc	87.7%	J/UJ	7-13

CRDL Standard - The CRDL standards exhibited acceptable %R values.

Method and Calibration Blanks - The method blanks and continuing calibration blanks exhibited contamination for several compounds, however, all sample results are non-detect or greater than 5X the blank concentration with the exception of the following:

Compound	Conc. mg/kg	Action Level mg/kg	Qualifier	Affected Samples
Cadmium	0.0776	0.388	U	1-13
Selenium	0.168	0.84	U	1, 2, 9, 13

Field and Equipment Blank - Field QC results are summarized below.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB110609-SS	None - ND	-	-	-	-
MR14-FB110609	None - ND	-	-	-	-

ICP Interference Check Sample - All %R values were acceptable.

Matrix Spike/Duplicate - The matrix spike/duplicate samples exhibited acceptable %R and RPD values.

LCS - The LCS samples exhibited acceptable %R values.

ICP Serial Dilution - The ICP serial dilution sample exhibited acceptable %D values.

Field Duplicates - Field duplicate results are summarized below.

Compound	MR14-SS01-09D mg/kg	MR14-SS01D-09D mg/kg	RPD	Qualifier
Mercury	0.0486	0.0520	7%	None
Aluminum	1590	1760	10%	None
Antimony	23.1	6.43	113%	J
Arsenic	0.931	1.19	24%	None
Barium	13.2	10.4	24%	None
Calcium	390	550	34%	None
Chromium	3.76	3.26	14%	None
Cobalt	0.267	0.665 U	NC	None
Copper	4.57	12.8	95%	None

Compound	MR14-SS01-09D mg/kg	MR14-SS01D-09D mg/kg	RPD	Qualifier
Iron	1470	1150	24%	None
Lead	3000	1250	82%	None
Magnesium	77.3	93.6	19%	None
Manganese	21.2	18.0	16%	None
Nickel	1.83	1.78	3%	None
Potassium	74.9	82.4	10%	None
Silver	0.0563	0.266 U	NC	None
Vanadium	7.66	7.17	7%	None
Zinc	65.3	57.7	12%	None

Compound Quantitation - Several analytes in several samples were analyzed at a dilution due to high concentrations.

# ANALYSIS DATA SHEET

MR14-SS01-09D

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-01

Sampled: 11/06/09 08:15

Received: 11/07/09 09:15

% Solids: 93.90

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.133	0.266	1	U	SW9012A	9K18008	11/19/09 10:53
7439-97-6	Mercury	0.0486	0.0134	0.0340	1		SW7471A	9K13014	11/17/09 11:26
7429-90-5	Aluminum	1590	2.56	10.2	1		SW6010B	9K13005	11/16/09 19:38
7440-36-0	Antimony	23.1	0.256	0.768	1	J	SW6010B	9K13005	11/16/09 19:38
7440-38-2	Arsenic	0.931	0.154	0.256	1		SW6010B	9K13005	11/16/09 19:38
7440-39-3	Barium	13.2	0.256	2.05	1		SW6010B	9K13005	11/16/09 19:38
7440-41-7	Beryllium		0.0512	0.256	1	U	SW6010B	9K13005	11/16/09 19:38
7440-43-9	Cadmium	0.256	0.185	0.0512	1	U	SW6010B	9K13005	11/16/09 19:38
7440-70-2	Calcium	390	51.2	256	1		SW6010B	9K13005	11/16/09 19:38
7440-47-3	Chromium	3.76	0.102	0.256	1		SW6010B	9K13005	11/16/09 19:38
7440-48-4	Cobalt	0.267	0.256	0.640	1	J	SW6010B	9K13005	11/16/09 19:38
7440-50-8	Copper	4.57	0.256	0.512	1		SW6010B	9K13005	11/16/09 19:38
7439-89-6	Iron	1470	1.54	5.12	1		SW6010B	9K13005	11/16/09 19:38
7439-92-1	Lead	3000	1.92	3.84	25		SW6010B	9K13005	11/17/09 19:11
7439-95-4	Magnesium	77.3	51.2	256	1	J	SW6010B	9K13005	11/16/09 19:38
7439-96-5	Manganese	21.2	0.154	0.768	1		SW6010B	9K13005	11/16/09 19:38
7440-02-0	Nickel	1.83	0.256	0.512	1		SW6010B	9K13005	11/16/09 19:38
7440-09-7	Potassium	74.9	51.2	256	1	J	SW6010B	9K13005	11/16/09 19:38
7782-49-2	Selenium	0.256	0.164	0.154	1	U	SW6010B	9K13005	11/16/09 19:38
7440-22-4	Silver	0.0563	0.0512	0.256	1	J	SW6010B	9K13005	11/16/09 19:38
7440-23-5	Sodium		51.2	256	1	U	SW6010B	9K13005	11/16/09 19:38
7440-28-0	Thallium		0.205	0.410	1	U	SW6010B	9K13005	11/16/09 19:38
7440-62-2	Vanadium	7.66	0.256	0.640	1		SW6010B	9K13005	11/16/09 19:38
7440-66-6	Zinc	65.3	0.256	1.02	1		SW6010B	9K13005	11/16/09 19:38

FD

MBL

MBL

mw  
1125110

# ANALYSIS DATA SHEET

2

MR14-SS01D-09D

Laboratory: Empirical Laboratories, LLC  
 Client: CH2M Hill, Inc.  
 Matrix: Soil  
 Sampled: 11/06/09 08:20  
 % Solids: 93.49

SDG: UXO14 001  
 Project: Lejeune CTO014 (UX14)  
 Laboratory ID: 0911082-02  
 Received: 11/07/09 09:15

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.134	0.267	1	U	SW9012A	9K18008	11/19/09 10:54
7439-97-6	Mercury	0.0520	0.0135	0.0342	1		SW7471A	9K13014	11/17/09 11:27
7429-90-5	Aluminum	1760	2.66	10.6	1		SW6010B	9K13005	11/16/09 19:42
7440-36-0	Antimony	6.43	0.266	0.798	1	J	SW6010B	9K13005	11/16/09 19:42
7440-38-2	Arsenic	1.19	0.160	0.266	1		SW6010B	9K13005	11/16/09 19:42
7440-39-3	Barium	10.4	0.266	2.13	1		SW6010B	9K13005	11/16/09 19:42
7440-41-7	Beryllium		0.0532	0.266	1	U	SW6010B	9K13005	11/16/09 19:42
7440-43-9	Cadmium	0.266	0.0532	0.266	1	U	SW6010B	9K13005	11/16/09 19:42
7440-70-2	Calcium	550	53.2	266	1		SW6010B	9K13005	11/16/09 19:42
7440-47-3	Chromium	3.26	0.106	0.266	1		SW6010B	9K13005	11/16/09 19:42
7440-48-4	Cobalt		0.266	0.665	1	U	SW6010B	9K13005	11/16/09 19:42
7440-50-8	Copper	12.8	0.266	0.532	1		SW6010B	9K13005	11/16/09 19:42
7439-89-6	Iron	1150	1.60	5.32	1		SW6010B	9K13005	11/16/09 19:42
7439-92-1	Lead	1250	2.00	3.99	25	J	SW6010B	9K13005	11/17/09 19:16
7439-95-4	Magnesium	93.6	53.2	266	1	J	SW6010B	9K13005	11/16/09 19:42
7439-96-5	Manganese	18.0	0.160	0.798	1		SW6010B	9K13005	11/16/09 19:42
7440-02-0	Nickel	1.78	0.266	0.532	1		SW6010B	9K13005	11/16/09 19:42
7440-09-7	Potassium	82.4	53.2	266	1	J	SW6010B	9K13005	11/16/09 19:42
7782-49-2	Selenium	0.266	0.160	0.266	1	U	SW6010B	9K13005	11/16/09 19:42
7440-22-4	Silver		0.0532	0.266	1	U	SW6010B	9K13005	11/16/09 19:42
7440-23-5	Sodium		53.2	266	1	U	SW6010B	9K13005	11/16/09 19:42
7440-28-0	Thallium		0.213	0.426	1	U	SW6010B	9K13005	11/16/09 19:42
7440-62-2	Vanadium	7.17	0.266	0.665	1		SW6010B	9K13005	11/16/09 19:42
7440-66-6	Zinc	57.7	0.266	1.06	1		SW6010B	9K13005	11/16/09 19:42

FD

MBL

MBL

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# ANALYSIS DATA SHEET

MR14-SS02-09D

3

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-03

Sampled: 11/06/09 08:25

Received: 11/07/09 09:15

% Solids: 97.26

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.129	0.257	1	U	SW9012A	9K18008	11/19/09 10:56
7439-97-6	Mercury	1.08	0.0143	0.0364	1		SW7471A	9K13014	11/17/09 11:29
7429-90-5	Aluminum	869	2.51	10.0	1		SW6010B	9K13005	11/16/09 19:47
7440-36-0	Antimony	22.1	0.251	0.752	1		SW6010B	9K13005	11/16/09 19:47
7440-38-2	Arsenic	0.696	0.150	0.251	1		SW6010B	9K13005	11/16/09 19:47
7440-39-3	Barium	6.57	0.251	2.01	1		SW6010B	9K13005	11/16/09 19:47
7440-41-7	Beryllium		0.0502	0.251	1	U	SW6010B	9K13005	11/16/09 19:47
7440-43-9	Cadmium	0.251	<del>0.100</del>	0.0502	1	U /	SW6010B	9K13005	11/16/09 19:47
7440-70-2	Calcium	1350	50.2	251	1		SW6010B	9K13005	11/16/09 19:47
7440-47-3	Chromium	1.55	0.100	0.251	1		SW6010B	9K13005	11/16/09 19:47
7440-48-4	Cobalt		0.251	0.627	1	U	SW6010B	9K13005	11/16/09 19:47
7440-50-8	Copper	2.68	0.251	0.502	1		SW6010B	9K13005	11/16/09 19:47
7439-89-6	Iron	1080	1.50	5.02	1		SW6010B	9K13005	11/16/09 19:47
7439-92-1	Lead	3110	1.88	3.76	25	/	SW6010B	9K13005	11/17/09 19:21
7439-95-4	Magnesium		50.2	251	1	U	SW6010B	9K13005	11/16/09 19:47
7439-96-5	Manganese	13.1	0.150	0.752	1		SW6010B	9K13005	11/16/09 19:47
7440-02-0	Nickel	1.42	0.251	0.502	1		SW6010B	9K13005	11/16/09 19:47
7440-09-7	Potassium		50.2	251	1	U	SW6010B	9K13005	11/16/09 19:47
7782-49-2	Selenium		0.150	0.251	1	U	SW6010B	9K13005	11/16/09 19:47
7440-22-4	Silver	0.110	0.0502	0.251	1	J	SW6010B	9K13005	11/16/09 19:47
7440-23-5	Sodium		50.2	251	1	U	SW6010B	9K13005	11/16/09 19:47
7440-28-0	Thallium		0.201	0.401	1	U	SW6010B	9K13005	11/16/09 19:47
7440-62-2	Vanadium	7.10	0.251	0.627	1		SW6010B	9K13005	11/16/09 19:47
7440-66-6	Zinc	43.8	0.251	1.00	1		SW6010B	9K13005	11/16/09 19:47

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# ANALYSIS DATA SHEET

MR14-SS03-09D

4

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-04

Sampled: 11/06/09 08:35

Received: 11/07/09 09:15

% Solids: 97.36

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.128	0.257	1	U	SW9012A	9K18008	11/19/09 10:57
7439-97-6	Mercury	0.0399	0.0138	0.0351	1		SW7471A	9K13014	11/17/09 11:30
7429-90-5	Aluminum	856	2.47	9.88	1		SW6010B	9K13005	11/16/09 19:52
7440-36-0	Antimony	34.9	0.247	0.741	1		SW6010B	9K13005	11/16/09 19:52
7440-38-2	Arsenic	0.434	0.148	0.247	1		SW6010B	9K13005	11/16/09 19:52
7440-39-3	Barium	6.09	0.247	1.98	1		SW6010B	9K13005	11/16/09 19:52
7440-41-7	Beryllium		0.0494	0.247	1	U	SW6010B	9K13005	11/16/09 19:52
7440-43-9	Cadmium	0.270	0.0494	0.247	1	U	SW6010B	9K13005	11/16/09 19:52
7440-70-2	Calcium	474	49.4	247	1		SW6010B	9K13005	11/16/09 19:52
7440-47-3	Chromium	1.93	0.0988	0.247	1		SW6010B	9K13005	11/16/09 19:52
7440-48-4	Cobalt	0.592	0.247	0.617	1	J	SW6010B	9K13005	11/16/09 19:52
7440-50-8	Copper	2.78	0.247	0.494	1		SW6010B	9K13005	11/16/09 19:52
7439-89-6	Iron	942	1.48	4.94	1		SW6010B	9K13005	11/16/09 19:52
7439-92-1	Lead	4990	7.41	14.8	100	U	SW6010B	9K13005	11/17/09 19:26
7439-95-4	Magnesium	68.7	49.4	247	1	J	SW6010B	9K13005	11/16/09 19:52
7439-96-5	Manganese	8.78	0.148	0.741	1		SW6010B	9K13005	11/16/09 19:52
7440-02-0	Nickel	1.91	0.247	0.494	1		SW6010B	9K13005	11/16/09 19:52
7440-09-7	Potassium		49.4	247	1	U	SW6010B	9K13005	11/16/09 19:52
7782-49-2	Selenium		0.148	0.247	1	U	SW6010B	9K13005	11/16/09 19:52
7440-22-4	Silver	0.0506	0.0494	0.247	1	J	SW6010B	9K13005	11/16/09 19:52
7440-23-5	Sodium		49.4	247	1	U	SW6010B	9K13005	11/16/09 19:52
7440-28-0	Thallium		0.247	0.395	1	U	SW6010B	9K13005	11/16/09 19:52
7440-62-2	Vanadium	8.74	0.247	0.617	1		SW6010B	9K13005	11/16/09 19:52
7440-66-6	Zinc	62.1	0.247	0.988	1		SW6010B	9K13005	11/16/09 19:52

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# ANALYSIS DATA SHEET

MR14-SS04-09D

Laboratory: Empirical Laboratories, LLC

SDG: UXO14 001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-05

Sampled: 11/06/09 08:40

Received: 11/07/09 09:15

% Solids: 97.60

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.128	0.256	1	U	SW9012A	9K18008	11/19/09 11:00
7439-97-6	Mercury	0.0170	0.0118	0.0330	1	J	SW7471A	9K13014	11/17/09 11:31
7429-90-5	Aluminum	662	2.54	10.1	1		SW6010B	9K13005	11/16/09 19:57
7440-36-0	Antimony	0.675	0.254	0.761	1	J	SW6010B	9K13005	11/16/09 19:57
7440-38-2	Arsenic	0.246	0.152	0.254	1	J	SW6010B	9K13005	11/16/09 19:57
7440-39-3	Barium	3.15	0.254	2.03	1		SW6010B	9K13005	11/16/09 19:57
7440-41-7	Beryllium		0.0507	0.254	1	U	SW6010B	9K13005	11/16/09 19:57
7440-43-9	Cadmium	0.254	0.0507	0.254	1	U	SW6010B	9K13005	11/16/09 19:57
7440-70-2	Calcium	127	50.7	254	1	J	SW6010B	9K13005	11/16/09 19:57
7440-47-3	Chromium	1.30	0.101	0.254	1		SW6010B	9K13005	11/16/09 19:57
7440-48-4	Cobalt		0.254	0.634	1	U	SW6010B	9K13005	11/16/09 19:57
7440-50-8	Copper	1.39	0.254	0.507	1		SW6010B	9K13005	11/16/09 19:57
7439-89-6	Iron	683	1.52	5.07	1		SW6010B	9K13005	11/16/09 19:57
7439-92-1	Lead	303	0.0761	0.152	1		SW6010B	9K13005	11/16/09 19:57
7439-95-4	Magnesium		50.7	254	1	U	SW6010B	9K13005	11/16/09 19:57
7439-96-5	Manganese	5.09	0.152	0.761	1		SW6010B	9K13005	11/16/09 19:57
7440-02-0	Nickel	1.01	0.254	0.507	1		SW6010B	9K13005	11/16/09 19:57
7440-09-7	Potassium		50.7	254	1	U	SW6010B	9K13005	11/16/09 19:57
7782-49-2	Selenium		0.152	0.254	1	U	SW6010B	9K13005	11/16/09 19:57
7440-22-4	Silver		0.0507	0.254	1	U	SW6010B	9K13005	11/16/09 19:57
7440-23-5	Sodium		50.7	254	1	U	SW6010B	9K13005	11/16/09 19:57
7440-28-0	Thallium		0.203	0.406	1	U	SW6010B	9K13005	11/16/09 19:57
7440-62-2	Vanadium	3.45	0.254	0.634	1		SW6010B	9K13005	11/16/09 19:57
7440-66-6	Zinc	19.6	0.254	1.01	1		SW6010B	9K13005	11/16/09 19:57

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# ANALYSIS DATA SHEET

MR14-SS05-09D

6

 Laboratory: Empirical Laboratories, LLC

 SDG: UXO14\_001

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO014 (UX14)

 Matrix: Soil

 Laboratory ID: 0911082-06

 Sampled: 11/06/09 08:50

 Received: 11/07/09 09:15

 % Solids: 96.97

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.129	0.258	1	U	SW9012A	9K18008	11/19/09 11:03
7439-97-6	Mercury		0.0115	0.0330	1	U	SW7471A	9K13014	11/17/09 11:32
7429-90-5	Aluminum	744	2.48	9.92	1		SW6010B	9K13005	11/16/09 20:01
7440-36-0	Antimony		0.248	0.744	1	U	SW6010B	9K13005	11/16/09 20:01
7440-38-2	Arsenic	0.204	0.149	0.248	1	J	SW6010B	9K13005	11/16/09 20:01
7440-39-3	Barium	2.21	0.248	1.98	1		SW6010B	9K13005	11/16/09 20:01
7440-41-7	Beryllium		0.0496	0.248	1	U	SW6010B	9K13005	11/16/09 20:01
7440-43-9	Cadmium	0.248	<del>0.0692</del>	0.0496	1	U ✓	SW6010B	9K13005	11/16/09 20:01
7440-70-2	Calcium	53.0	49.6	248	1	J	SW6010B	9K13005	11/16/09 20:01
7440-47-3	Chromium	1.04	0.0992	0.248	1		SW6010B	9K13005	11/16/09 20:01
7440-48-4	Cobalt		0.248	0.620	1	U	SW6010B	9K13005	11/16/09 20:01
7440-50-8	Copper	0.962	0.248	0.496	1		SW6010B	9K13005	11/16/09 20:01
7439-89-6	Iron	616	1.49	4.96	1		SW6010B	9K13005	11/16/09 20:01
7439-92-1	Lead	145	0.0744	0.149	1		SW6010B	9K13005	11/16/09 20:01
7439-95-4	Magnesium		49.6	248	1	U	SW6010B	9K13005	11/16/09 20:01
7439-96-5	Manganese	4.89	0.149	0.744	1		SW6010B	9K13005	11/16/09 20:01
7440-02-0	Nickel	0.592	0.248	0.496	1		SW6010B	9K13005	11/16/09 20:01
7440-09-7	Potassium		49.6	248	1	U	SW6010B	9K13005	11/16/09 20:01
7782-49-2	Selenium		0.149	0.248	1	U	SW6010B	9K13005	11/16/09 20:01
7440-22-4	Silver		0.0496	0.248	1	U	SW6010B	9K13005	11/16/09 20:01
7440-23-5	Sodium		49.6	248	1	U	SW6010B	9K13005	11/16/09 20:01
7440-28-0	Thallium		0.149	0.397	1	U	SW6010B	9K13005	11/16/09 20:01
7440-62-2	Vanadium	1.63	0.248	0.620	1		SW6010B	9K13005	11/16/09 20:01
7440-66-6	Zinc	15.0	0.248	0.992	1		SW6010B	9K13005	11/16/09 20:01

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# ANALYSIS DATA SHEET

MR14-SS06-09D

7

Laboratory: Empirical Laboratories, LLC  
 Client: CH2M Hill, Inc.  
 Matrix: Soil  
 Sampled: 11/06/09 09:05  
 % Solids: 97.44

SDG: UXO14 001  
 Project: Lejeune CTO014 (UX14)  
 Laboratory ID: 0911082-07  
 Received: 11/07/09 09:15

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.128	0.257	1	U	SW9012A	9K18008	11/19/09 11:04
7439-97-6	Mercury		0.0121	0.0330	1	U	SW7471A	9K13014	11/17/09 11:33
7429-90-5	Aluminum	551	2.57	10.3	1		SW6010B	9K13006	11/16/09 20:32
7440-36-0	Antimony		0.257	0.770	1	U	SW6010B	9K13006	11/16/09 20:32
7440-38-2	Arsenic		0.154	0.257	1	U	SW6010B	9K13006	11/16/09 20:32
7440-39-3	Barium	2.17	0.257	2.05	1		SW6010B	9K13006	11/16/09 20:32
7440-41-7	Beryllium		0.0513	0.257	1	U	SW6010B	9K13006	11/16/09 20:32
7440-43-9	Cadmium	0.257	<del>0.0698</del>	0.0513	0.257	1	U /	SW6010B	9K13006
7440-70-2	Calcium	200	51.3	257	1	J	SW6010B	9K13006	11/16/09 20:32
7440-47-3	Chromium	0.882	0.103	0.257	1		SW6010B	9K13006	11/16/09 20:32
7440-48-4	Cobalt		0.257	0.641	1	U	SW6010B	9K13006	11/16/09 20:32
7440-50-8	Copper	1.08	0.257	0.513	1		SW6010B	9K13006	11/16/09 20:32
7439-89-6	Iron	243	1.54	5.13	1		SW6010B	9K13006	11/16/09 20:32
7439-92-1	Lead	132	0.0770	0.154	1		SW6010B	9K13006	11/16/09 20:32
7439-95-4	Magnesium		51.3	257	1	U	SW6010B	9K13006	11/16/09 20:32
7439-96-5	Manganese	3.69	0.154	0.770	1		SW6010B	9K13006	11/16/09 20:32
7440-02-0	Nickel	0.404	0.257	0.513	1	J	SW6010B	9K13006	11/16/09 20:32
7440-09-7	Potassium		51.3	257	1	U	SW6010B	9K13006	11/16/09 20:32
7782-49-2	Selenium		0.154	0.257	1	U	SW6010B	9K13006	11/16/09 20:32
7440-22-4	Silver		0.0513	0.257	1	U	SW6010B	9K13006	11/16/09 20:32
7440-23-5	Sodium		51.3	257	1	U	SW6010B	9K13006	11/16/09 20:32
7440-28-0	Thallium		0.205	0.411	1	U	SW6010B	9K13006	11/16/09 20:32
7440-62-2	Vanadium	1.09	0.257	0.641	1		SW6010B	9K13006	11/16/09 20:32
7440-66-6	Zinc	16.6	0.257	1.03	1	J	SW6010B	9K13006	11/16/09 20:32

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# ANALYSIS DATA SHEET

MR14-SS07-09D

8

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-08

Sampled: 11/06/09 09:00

Received: 11/07/09 09:15

% Solids: 83.29

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.150	0.300	1	U	SW9012A	9K18008	11/19/09 11:06
7439-97-6	Mercury	0.0301	0.0134	0.0340	1	J	SW7471A	9K13015	11/17/09 11:43
7429-90-5	Aluminum	821	3.02	12.1	1		SW6010B	9K13006	11/16/09 20:37
7440-36-0	Antimony	0.347	0.302	0.905	1	J	SW6010B	9K13006	11/16/09 20:37
7440-38-2	Arsenic	0.402	0.181	0.302	1		SW6010B	9K13006	11/16/09 20:37
7440-39-3	Barium	6.32	0.302	2.41	1		SW6010B	9K13006	11/16/09 20:37
7440-41-7	Beryllium		0.0603	0.302	1	U	SW6010B	9K13006	11/16/09 20:37
7440-43-9	Cadmium	<i>0.302</i>	<i>0.141</i>	0.0603	1	<i>U ✓</i>	SW6010B	9K13006	11/16/09 20:37
7440-70-2	Calcium	203	60.3	302	1	J	SW6010B	9K13006	11/16/09 20:37
7440-47-3	Chromium	2.36	0.121	0.302	1		SW6010B	9K13006	11/16/09 20:37
7440-48-4	Cobalt		0.302	0.754	1	U	SW6010B	9K13006	11/16/09 20:37
7440-50-8	Copper	8.47	0.302	0.603	1		SW6010B	9K13006	11/16/09 20:37
7439-89-6	Iron	907	1.81	6.03	1		SW6010B	9K13006	11/16/09 20:37
7439-92-1	Lead	910	2.26	4.52	25	<i>U ✓</i>	SW6010B	9K13006	11/17/09 19:31
7439-95-4	Magnesium	62.2	60.3	302	1	J	SW6010B	9K13006	11/16/09 20:37
7439-96-5	Manganese	13.5	0.181	0.905	1		SW6010B	9K13006	11/16/09 20:37
7440-02-0	Nickel	1.43	0.302	0.603	1		SW6010B	9K13006	11/16/09 20:37
7440-09-7	Potassium		60.3	302	1	U	SW6010B	9K13006	11/16/09 20:37
7782-49-2	Selenium		0.181	0.302	1	U	SW6010B	9K13006	11/16/09 20:37
7440-22-4	Silver		0.0603	0.302	1	U	SW6010B	9K13006	11/16/09 20:37
7440-23-5	Sodium		60.3	302	1	U	SW6010B	9K13006	11/16/09 20:37
7440-28-0	Thallium		0.181	0.483	1	U	SW6010B	9K13006	11/16/09 20:37
7440-62-2	Vanadium	6.02	0.302	0.754	1		SW6010B	9K13006	11/16/09 20:37
7440-66-6	Zinc	61.4	0.302	1.21	1	<i>J</i>	SW6010B	9K13006	11/16/09 20:37

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# ANALYSIS DATA SHEET

MR14-SS08-09D

9

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-09

Sampled: 11/06/09 09:10

Received: 11/07/09 09:15

% Solids: 97.40

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.128	0.257	1	U	SW9012A	9K18008	11/19/09 11:07
7439-97-6	Mercury	0.0135	0.0125	0.0330	1	J	SW7471A	9K13015	11/17/09 11:44
7429-90-5	Aluminum	963	2.53	10.1	1		SW6010B	9K13006	11/16/09 20:42
7440-36-0	Antimony		0.253	0.759	1	U	SW6010B	9K13006	11/16/09 20:42
7440-38-2	Arsenic	0.337	0.152	0.253	1		SW6010B	9K13006	11/16/09 20:42
7440-39-3	Barium	2.44	0.253	2.02	1		SW6010B	9K13006	11/16/09 20:42
7440-41-7	Beryllium		0.0506	0.253	1	U	SW6010B	9K13006	11/16/09 20:42
7440-43-9	Cadmium	0.253 <del>0.0639</del>	0.0506	0.253	1	U	SW6010B	9K13006	11/16/09 20:42
7440-70-2	Calcium		50.6	253	1	U	SW6010B	9K13006	11/16/09 20:42
7440-47-3	Chromium	1.32	0.101	0.253	1		SW6010B	9K13006	11/16/09 20:42
7440-48-4	Cobalt		0.253	0.632	1	U	SW6010B	9K13006	11/16/09 20:42
7440-50-8	Copper	1.43	0.253	0.506	1		SW6010B	9K13006	11/16/09 20:42
7439-89-6	Iron	537	1.52	5.06	1		SW6010B	9K13006	11/16/09 20:42
7439-92-1	Lead	271	0.0759	0.152	1		SW6010B	9K13006	11/16/09 20:42
7439-95-4	Magnesium		50.6	253	1	U	SW6010B	9K13006	11/16/09 20:42
7439-96-5	Manganese	9.04	0.152	0.759	1		SW6010B	9K13006	11/16/09 20:42
7440-02-0	Nickel	0.912	0.253	0.506	1		SW6010B	9K13006	11/16/09 20:42
7440-09-7	Potassium		50.6	253	1	U	SW6010B	9K13006	11/16/09 20:42
7782-49-2	Selenium	0.253 <del>0.179</del>	0.152	0.253	1	U	SW6010B	9K13006	11/16/09 20:42
7440-22-4	Silver		0.0506	0.253	1	U	SW6010B	9K13006	11/16/09 20:42
7440-23-5	Sodium		50.6	253	1	U	SW6010B	9K13006	11/16/09 20:42
7440-28-0	Thallium		0.152	0.405	1	U	SW6010B	9K13006	11/16/09 20:42
7440-62-2	Vanadium	3.63	0.253	0.632	1		SW6010B	9K13006	11/16/09 20:42
7440-66-6	Zinc	24.2	0.253	1.01	1	J	SW6010B	9K13006	11/16/09 20:42

MBL

MBL

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MS  
11/25/10

# ANALYSIS DATA SHEET

MR14-SS09-09D

10

Laboratory: Empirical Laboratories, LLC

SDG: UXO14 001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-10

Sampled: 11/06/09 09:15

Received: 11/07/09 09:15

% Solids: 96.23

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.130	0.260	1	U	SW9012A	9K18008	11/19/09 11:08
7439-97-6	Mercury		0.0119	0.0330	1	U	SW7471A	9K13015	11/17/09 11:46
7429-90-5	Aluminum	1380	2.59	10.3	1		SW6010B	9K13006	11/16/09 20:47
7440-36-0	Antimony		0.259	0.776	1	U	SW6010B	9K13006	11/16/09 20:47
7440-38-2	Arsenic	0.330	0.155	0.259	1		SW6010B	9K13006	11/16/09 20:47
7440-39-3	Barium	2.96	0.259	2.07	1		SW6010B	9K13006	11/16/09 20:47
7440-41-7	Beryllium		0.0517	0.259	1	U	SW6010B	9K13006	11/16/09 20:47
7440-43-9	Cadmium	0.259	<del>0.0580</del>	0.0517	1	U	SW6010B	9K13006	11/16/09 20:47
7440-70-2	Calcium	1080	51.7	259	1		SW6010B	9K13006	11/16/09 20:47
7440-47-3	Chromium	1.48	0.103	0.259	1		SW6010B	9K13006	11/16/09 20:47
7440-48-4	Cobalt		0.259	0.646	1	U	SW6010B	9K13006	11/16/09 20:47
7440-50-8	Copper	1.20	0.259	0.517	1		SW6010B	9K13006	11/16/09 20:47
7439-89-6	Iron	639	1.55	5.17	1		SW6010B	9K13006	11/16/09 20:47
7439-92-1	Lead	73.9	0.0776	0.155	1		SW6010B	9K13006	11/16/09 20:47
7439-95-4	Magnesium	58.8	51.7	259	1	J	SW6010B	9K13006	11/16/09 20:47
7439-96-5	Manganese	6.92	0.155	0.776	1		SW6010B	9K13006	11/16/09 20:47
7440-02-0	Nickel	0.961	0.259	0.517	1		SW6010B	9K13006	11/16/09 20:47
7440-09-7	Potassium		51.7	259	1	U	SW6010B	9K13006	11/16/09 20:47
7782-49-2	Selenium		0.155	0.259	1	U	SW6010B	9K13006	11/16/09 20:47
7440-22-4	Silver		0.0517	0.259	1	U	SW6010B	9K13006	11/16/09 20:47
7440-23-5	Sodium		51.7	259	1	U	SW6010B	9K13006	11/16/09 20:47
7440-28-0	Thallium		0.155	0.414	1	U	SW6010B	9K13006	11/16/09 20:47
7440-62-2	Vanadium	2.52	0.259	0.646	1		SW6010B	9K13006	11/16/09 20:47
7440-66-6	Zinc	12.9	0.259	1.03	1	J	SW6010B	9K13006	11/16/09 20:47

MBL

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11/25/10

# ANALYSIS DATA SHEET

MR14-SS10-09D

Laboratory: Empirical Laboratories, LLC

SDG: UXO14 001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-11

Sampled: 11/06/09 09:20

Received: 11/07/09 09:15

% Solids: 97.58

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.128	0.256	1	U	SW9012A	9K18008	11/19/09 11:09
7439-97-6	Mercury		0.0125	0.0330	1	U	SW7471A	9K13015	11/17/09 11:47
7429-90-5	Aluminum	1060	2.49	9.95	1		SW6010B	9K13006	11/16/09 20:51
7440-36-0	Antimony	0.862	0.249	0.746	1		SW6010B	9K13006	11/16/09 20:51
7440-38-2	Arsenic	0.335	0.149	0.249	1		SW6010B	9K13006	11/16/09 20:51
7440-39-3	Barium	2.83	0.249	1.99	1		SW6010B	9K13006	11/16/09 20:51
7440-41-7	Beryllium		0.0497	0.249	1	U	SW6010B	9K13006	11/16/09 20:51
7440-43-9	Cadmium	0.249	0.0497	0.249	1	U	SW6010B	9K13006	11/16/09 20:51
7440-70-2	Calcium	97.7	49.7	249	1	J	SW6010B	9K13006	11/16/09 20:51
7440-47-3	Chromium	1.25	0.0995	0.249	1		SW6010B	9K13006	11/16/09 20:51
7440-48-4	Cobalt		0.249	0.622	1	U	SW6010B	9K13006	11/16/09 20:51
7440-50-8	Copper	1.30	0.249	0.497	1		SW6010B	9K13006	11/16/09 20:51
7439-89-6	Iron	598	1.49	4.97	1		SW6010B	9K13006	11/16/09 20:51
7439-92-1	Lead	366	0.0746	0.149	1		SW6010B	9K13006	11/16/09 20:51
7439-95-4	Magnesium		49.7	249	1	U	SW6010B	9K13006	11/16/09 20:51
7439-96-5	Manganese	8.51	0.149	0.746	1		SW6010B	9K13006	11/16/09 20:51
7440-02-0	Nickel	0.936	0.249	0.497	1		SW6010B	9K13006	11/16/09 20:51
7440-09-7	Potassium		49.7	249	1	U	SW6010B	9K13006	11/16/09 20:51
7782-49-2	Selenium		0.149	0.249	1	U	SW6010B	9K13006	11/16/09 20:51
7440-22-4	Silver		0.0497	0.249	1	U	SW6010B	9K13006	11/16/09 20:51
7440-23-5	Sodium		49.7	249	1	U	SW6010B	9K13006	11/16/09 20:51
7440-28-0	Thallium		0.149	0.398	1	U	SW6010B	9K13006	11/16/09 20:51
7440-62-2	Vanadium	3.55	0.249	0.622	1		SW6010B	9K13006	11/16/09 20:51
7440-66-6	Zinc	18.8	0.249	0.995	1	J	SW6010B	9K13006	11/16/09 20:51

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*1125/10*

# ANALYSIS DATA SHEET

MR14-SS11-09D

12

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-12

Sampled: 11/06/09 09:25

Received: 11/07/09 09:15

% Solids: 89.63

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.139	0.279	1	U	SW9012A	9K19016	11/20/09 12:17
7439-97-6	Mercury	0.0688	0.0155	0.0394	1		SW7471A	9K13015	11/17/09 11:48
7429-90-5	Aluminum	1080	2.69	10.8	1		SW6010B	9K13006	11/16/09 20:56
7440-36-0	Antimony	57.5	0.269	0.808	1		SW6010B	9K13006	11/16/09 20:56
7440-38-2	Arsenic	1.01	0.162	0.269	1		SW6010B	9K13006	11/16/09 20:56
7440-39-3	Barium	5.57	0.269	2.16	1		SW6010B	9K13006	11/16/09 20:56
7440-41-7	Beryllium		0.0539	0.269	1	U	SW6010B	9K13006	11/16/09 20:56
7440-43-9	Cadmium	0.269	<del>0.183</del>	0.0539	1	U	SW6010B	9K13006	11/16/09 20:56
7440-70-2	Calcium	4960	53.9	269	1		SW6010B	9K13006	11/16/09 20:56
7440-47-3	Chromium	2.70	0.108	0.269	1		SW6010B	9K13006	11/16/09 20:56
7440-48-4	Cobalt	0.375	0.269	0.674	1	J	SW6010B	9K13006	11/16/09 20:56
7440-50-8	Copper	4.43	0.269	0.539	1		SW6010B	9K13006	11/16/09 20:56
7439-89-6	Iron	721	1.62	5.39	1		SW6010B	9K13006	11/16/09 20:56
7439-92-1	Lead	6430	8.08	16.2	100	J	SW6010B	9K13006	11/17/09 19:36
7439-95-4	Magnesium	141	53.9	269	1	J	SW6010B	9K13006	11/16/09 20:56
7439-96-5	Manganese	18.0	0.162	0.808	1		SW6010B	9K13006	11/16/09 20:56
7440-02-0	Nickel	1.73	0.269 *	0.539	1		SW6010B	9K13006	11/16/09 20:56
7440-09-7	Potassium	82.9	53.9	269	1	J	SW6010B	9K13006	11/16/09 20:56
7782-49-2	Selenium		0.162	0.269	1	U	SW6010B	9K13006	11/16/09 20:56
7440-22-4	Silver	0.195	0.0539	0.269	1	J	SW6010B	9K13006	11/16/09 20:56
7440-23-5	Sodium	225	53.9	269	1	J	SW6010B	9K13006	11/16/09 20:56
7440-28-0	Thallium		0.323	0.431	1	U	SW6010B	9K13006	11/16/09 20:56
7440-62-2	Vanadium	5.39	0.269	0.674	1		SW6010B	9K13006	11/16/09 20:56
7440-66-6	Zinc	47.2	0.269	1.08	1	J	SW6010B	9K13006	11/16/09 20:56

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11/25/10

# ANALYSIS DATA SHEET

MR14-SS12-09D

3

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Soil

Laboratory ID: 0911082-13

Sampled: 11/06/09 09:30

Received: 11/07/09 09:15

% Solids: 96.28

CAS NO.	Analyte	Concentration (mg/Kg dry)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.130	0.260	1	U	SW9012A	9K19016	11/20/09 12:20
7439-97-6	Mercury	0.0293	0.0119	0.0330	1	J	SW7471A	9K13015	11/17/09 11:49
7429-90-5	Aluminum	807	2.48	9.94	1		SW6010B	9K13006	11/16/09 21:01
7440-36-0	Antimony	387	0.248	0.745	1		SW6010B	9K13006	11/16/09 21:01
7440-38-2	Arsenic	2.70	0.149	0.248	1		SW6010B	9K13006	11/16/09 21:01
7440-39-3	Barium	7.79	0.248	1.99	1		SW6010B	9K13006	11/16/09 21:01
7440-41-7	Beryllium	0.0503	0.0497	0.248	1	J	SW6010B	9K13006	11/16/09 21:01
7440-43-9	Cadmium	0.248 <del>0.175</del>	0.0497	0.248	1	U	SW6010B	9K13006	11/16/09 21:01
7440-70-2	Calcium	405	49.7	248	1		SW6010B	9K13006	11/16/09 21:01
7440-47-3	Chromium	3.14	0.0994	0.248	1		SW6010B	9K13006	11/16/09 21:01
7440-48-4	Cobalt	0.314	0.248	0.621	1	J	SW6010B	9K13006	11/16/09 21:01
7440-50-8	Copper	11.3	0.248	0.497	1		SW6010B	9K13006	11/16/09 21:01
7439-89-6	Iron	740	1.49	4.97	1		SW6010B	9K13006	11/16/09 21:01
7439-92-1	Lead	35500	18.6	37.3	250	U	SW6010B	9K13006	11/17/09 19:55
7439-95-4	Magnesium		49.7	248	1	U	SW6010B	9K13006	11/16/09 21:01
7439-96-5	Manganese	13.0	0.149	0.745	1		SW6010B	9K13006	11/16/09 21:01
7440-02-0	Nickel	2.01	0.248	0.497	1		SW6010B	9K13006	11/16/09 21:01
7440-09-7	Potassium		49.7	248	1	U	SW6010B	9K13006	11/16/09 21:01
7782-49-2	Selenium	0.253	0.149	0.248	1	U	SW6010B	9K13006	11/16/09 21:01
7440-22-4	Silver	0.634	0.0497	0.248	1		SW6010B	9K13006	11/16/09 21:01
7440-23-5	Sodium		49.7	248	1	U	SW6010B	9K13006	11/16/09 21:01
7440-28-0	Thallium		0.795	0.795	2	U	SW6010B	9K13006	11/18/09 09:43
7440-62-2	Vanadium	5.40	0.248	0.621	1		SW6010B	9K13006	11/16/09 21:01
7440-66-6	Zinc	47.3	0.248	0.994	1	J	SW6010B	9K13006	11/16/09 21:01

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11/25/10

# ANALYSIS DATA SHEET

MR14-EB110609-SS

4

Laboratory: Empirical Laboratories, LLC

SDG: UXO14\_001

Client: CH2M Hill, Inc.

Project: Lejeune CTO014 (UX14)

Matrix: Water

Laboratory ID: 0911082-23

Sampled: 11/06/09 09:45

Received: 11/07/09 09:15

% Solids: 0.00

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9K16002	11/16/09 11:55
7429-90-5	Aluminum		12.5	50.0	1	U	SW6010B	9K16008	11/17/09 14:48
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9K16008	11/17/09 14:48
7440-38-2	Arsenic		0.750	1.25	1	U	SW6010B	9K16008	11/17/09 14:48
7440-39-3	Barium		1.25	10.0	1	U	SW6010B	9K16008	11/17/09 14:48
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9K16008	11/17/09 14:48
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9K16008	11/17/09 14:48
7440-70-2	Calcium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:48
7440-47-3	Chromium		0.500	1.25	1	U	SW6010B	9K16008	11/17/09 14:48
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9K16008	11/17/09 14:48
7440-50-8	Copper		1.25	2.50	1	U	SW6010B	9K16008	11/17/09 14:48
7439-89-6	Iron		7.50	25.0	1	U	SW6010B	9K16008	11/17/09 14:48
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9K16008	11/17/09 14:48
7439-95-4	Magnesium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:48
7439-96-5	Manganese		0.750	3.75	1	U	SW6010B	9K16008	11/17/09 14:48
7440-02-0	Nickel		0.750	2.50	1	U	SW6010B	9K16008	11/17/09 14:48
7440-09-7	Potassium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:48
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9K16008	11/17/09 14:48
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9K16008	11/17/09 14:48
7440-23-5	Sodium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:48
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9K16008	11/17/09 14:48
7440-62-2	Vanadium		1.25	3.12	1	U	SW6010B	9K16008	11/17/09 14:48
7440-66-6	Zinc		1.25	5.00	1	U	SW6010B	9K16008	11/17/09 14:48
CAS NO.	Analyte	Concentration (mg/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.00500	0.0100	1	U	SW9012A	9K11001	11/12/09 13:36

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112910

# ANALYSIS DATA SHEET

15

MR14-FB110609

Laboratory: Empirical Laboratories, LLC  
 Client: CH2M Hill, Inc.  
 Matrix: Water  
 Sampled: 11/06/09 10:12  
 % Solids: 0.00

SDG: UXO14 001  
 Project: Lejeune CTO014 (UX14)  
 Laboratory ID: 0911082-24  
 Received: 11/07/09 09:15

CAS NO.	Analyte	Concentration (ug/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
7439-97-6	Mercury		0.0800	0.200	1	U	SW7470A	9K16002	11/16/09 11:56
7429-90-5	Aluminum		12.5	50.0	1	U	SW6010B	9K16008	11/17/09 14:53
7440-36-0	Antimony		1.25	3.75	1	U	SW6010B	9K16008	11/17/09 14:53
7440-38-2	Arsenic		0.750	1.25	1	U	SW6010B	9K16008	11/17/09 14:53
7440-39-3	Barium		1.25	10.0	1	U	SW6010B	9K16008	11/17/09 14:53
7440-41-7	Beryllium		0.250	1.25	1	U	SW6010B	9K16008	11/17/09 14:53
7440-43-9	Cadmium		0.250	1.25	1	U	SW6010B	9K16008	11/17/09 14:53
7440-70-2	Calcium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:53
7440-47-3	Chromium		0.500	1.25	1	U	SW6010B	9K16008	11/17/09 14:53
7440-48-4	Cobalt		1.25	3.12	1	U	SW6010B	9K16008	11/17/09 14:53
7440-50-8	Copper		1.25	2.50	1	U	SW6010B	9K16008	11/17/09 14:53
7439-89-6	Iron		7.50	25.0	1	U	SW6010B	9K16008	11/17/09 14:53
7439-92-1	Lead		0.375	0.750	1	U	SW6010B	9K16008	11/17/09 14:53
7439-95-4	Magnesium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:53
7439-96-5	Manganese		0.750	3.75	1	U	SW6010B	9K16008	11/17/09 14:53
7440-02-0	Nickel		0.750	2.50	1	U	SW6010B	9K16008	11/17/09 14:53
7440-09-7	Potassium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:53
7782-49-2	Selenium		0.750	1.25	1	U	SW6010B	9K16008	11/17/09 14:53
7440-22-4	Silver		0.250	1.25	1	U	SW6010B	9K16008	11/17/09 14:53
7440-23-5	Sodium		250	1250	1	U	SW6010B	9K16008	11/17/09 14:53
7440-28-0	Thallium		0.750	2.00	1	U	SW6010B	9K16008	11/17/09 14:53
7440-62-2	Vanadium		1.25	3.12	1	U	SW6010B	9K16008	11/17/09 14:53
7440-66-6	Zinc		1.25	5.00	1	U	SW6010B	9K16008	11/17/09 14:53
CAS NO.	Analyte	Concentration (mg/L)	MDL	RL	Dilution Factor	Q	Method	Batch	Analyzed
57-12-5	Cyanide		0.00500	0.0100	1	U	SW9012A	9K11001	11/12/09 13:37

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1125/10

**POLYNUCLEAR AROMATIC HYDROCARBONS**  
USEPA Region IV - Level IV Review

Site: MCB Camp Lejeune, CTO-014, UXO-14 SDG #: UX014\_001

Client: CH2M HILL, Inc., Virginia Beach, Virginia Date: January 25, 2010

Laboratory: Empirical Laboratories, Nashville, Tennessee Reviewer: Nancy Weaver

EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	MR14-SS13-09D	0911082-14	Soil
2	MR14-SS13D-09D	0911082-15	Soil
3	MR14-SS14-09D	0911082-16	Soil
4	MR14-SS15-09D	0911082-17	Soil
5	MR14-SS16-09D	0911082-18	Soil
6	MR14-SS17-09D	0911082-19	Soil
7	MR14-SS18-09D	0911082-20	Soil
8	MR14-SS19-09D	0911082-21	Soil
9	MR14-SS20-09D	0911082-22	Soil
9MS	MR14-SS20-09DMS	0911082-22MS	Soil
9MSD	MR14-SS20-09DMSD	0911082-22MSD	Soil
10	MR14-EB110609-SS	0911082-23	Water
11	MR14-FB110609	0911082-24	Water

The USEPA "Contract Laboratory Program National Functional Guidelines for Organic Data Review," October 1999, and professional judgement were used in evaluating the data in this summary report.

Holding Times - All samples were extracted within 7 days for water samples, 14 days for soil samples and analyzed within 40 days for all samples.

GC/MS Tuning - All of the DFTPP tunes in the initial and continuing calibrations met the percent relative abundance criteria.

Initial Calibration - The initial calibrations exhibited acceptable %RSD and mean RRF values.

Continuing Calibration - The continuing calibrations exhibited acceptable %D and RRF values except the following.

CCAL Date	Compound	%D/RRF	Qualifier	Affected Samples
11/15/09	Hexachlorocyclopentadiene	36.7%	J/UJ	2, 3, 9
11/16/09	Benzo(a)anthracene	25.7%	J/UJ	1, 4-8, 10, 11

Surrogates - All samples exhibited acceptable surrogate recoveries.

MS/MSD - The MS/MSD sample exhibited acceptable %R and RPD values.

Laboratory Control Sample - The LCS samples exhibited acceptable %R values.

Internal Standard (IS) Area Performance - All internal standards met response and retention time (RT) criteria.

Method Blank - The method blanks exhibited the following contamination.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
9K06019-BLK2	Benzo(a)anthracene	0.024	0.12	U	10
	Fluoranthene	0.041	0.205		
	Fluorene	0.033	0.165		
	2-Methylnaphthalene	0.032	0.16	U	10, 11
Naphthalene	0.033	0.165			
Phenanthrene	0.051	0.255			
	Pyrene	0.044	0.22		

Field, Equipment Blank - Field QC results are summarized below.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB110609-SS	Benzo(b)fluoranthene	0.022	7.33	None	All >5X or ND
	Benzo(k)fluoranthene	0.023	7.67		
	Benzo(g,h,i)perylene	0.021	7.00		
	Benzo(a)pyrene	0.021	7.00	None	All ND
	Dibenz(a,h)anthracene	0.023	7.67		
	Indeno(1,2,3-cd)pyrene	0.022	7.33		
MR14-FB110109	None - ND	-	-	-	-

Field Duplicates - Field duplicate results are summarized below.

Compound	MR14-SS13-09D ug/kg	MR14-SS13D-09D ug/kg	RPD	Qualifier
Fluoranthene	1.8	2.5	33%	None
Pyrene	2.0	3.0	40%	None

Compound Quantitation - No discrepancies were identified.

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CLIENT SAMPLE NO.

MR14-SS13-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-14

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108214

% Moisture: 12 decanted: (Y/N) N Date Sampled: 11/06/09 09:45

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 19:45

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	UG/KG Q
56-55-3	Benzo (a) anthracene	1.5	11		U
205-99-2	Benzo (b) fluoranthene	1.5	11		U
207-08-9	Benzo (k) fluoranthene	1.5	11		U
191-24-2	Benzo (g, h, i) perylene	1.5	11		U
50-32-8	Benzo (a) pyrene	1.5	11		U
53-70-3	Dibenz (a, h) anthracene	1.5	11		U
206-44-0	Fluoranthene	1.5	11	1.8	J
86-73-7	Fluorene	1.5	11		U
118-74-1	Hexachlorobenzene	1.5	11		U
87-68-3	Hexachlorobutadiene	1.5	11		U
77-47-4	Hexachlorocyclopentadiene	1.5	19		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.5	11		U
91-57-6	2-Methylnaphthalene	1.5	11		U
91-20-3	Naphthalene	1.5	11		U
621-64-7	N-Nitroso-di-n-propylamine	1.5	57		U
85-01-8	Phenanthrene	1.5	11		U
129-00-0	Pyrene	1.5	11	2.0	J

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CLIENT SAMPLE NO.

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MR14-SS13D-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-15

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108215

% Moisture: 13 decanted: (Y/N) N Date Sampled: 11/06/09 09:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/15/09 14:40

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
56-55-3	Benzo(a) anthracene	1.5	11		U
205-99-2	Benzo(b) fluoranthene	1.5	11		U
207-08-9	Benzo(k) fluoranthene	1.5	11		U
191-24-2	Benzo(g,h,i) perylene	1.5	11		U
50-32-8	Benzo(a) pyrene	1.5	11		U
53-70-3	Dibenz(a,h) anthracene	1.5	11		U
206-44-0	Fluoranthene	1.5	11	2.5	J
86-73-7	Fluorene	1.5	11		U
118-74-1	Hexachlorobenzene	1.5	11		U
87-68-3	Hexachlorobutadiene	1.5	11		U
77-47-4	Hexachlorocyclopentadiene	1.5	19		U
193-39-5	Indeno(1,2,3-cd) pyrene	1.5	11		U
91-57-6	2-Methylnaphthalene	1.5	11		U
91-20-3	Naphthalene	1.5	11		U
621-64-7	N-Nitroso-di-n-propylamine	1.5	57		U
85-01-8	Phenanthrene	1.5	11		U
129-00-0	Pyrene	1.5	11	3.0	J

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS14-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-16

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108216

% Moisture: 7 decanted: (Y/N) N Date Sampled: 11/06/09 09:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/15/09 15:14

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

56-55-3	Benzo (a) anthracene	1.4	11		U
205-99-2	Benzo (b) fluoranthene	1.4	11		U
207-08-9	Benzo (k) fluoranthene	1.4	11		U
191-24-2	Benzo (g, h, i) perylene	1.4	11		U
50-32-8	Benzo (a) pyrene	1.4	11		U
53-70-3	Dibenz (a, h) anthracene	1.4	11		U
206-44-0	Fluoranthene	1.4	11	1.5	J
86-73-7	Fluorene	1.4	11		U
118-74-1	Hexachlorobenzene	1.4	11		U
87-68-3	Hexachlorobutadiene	1.4	11		U
77-47-4	Hexachlorocyclopentadiene	1.4	18		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.4	11		U
91-57-6	2-Methylnaphthalene	1.4	11		U
91-20-3	Naphthalene	1.4	11		U
621-64-7	N-Nitroso-di-n-propylamine	1.4	54		U
85-01-8	Phenanthrene	1.4	11		U
129-00-0	Pyrene	1.4	11		U

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS15-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-17

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108217

% Moisture: 15 decanted: (Y/N) N Date Sampled: 11/06/09 10:15

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 20:19

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	Q
56-55-3	Benzo (a) anthracene	1.6	12		X UJ CCH
205-99-2	Benzo (b) fluoranthene	1.6	12		U
207-08-9	Benzo (k) fluoranthene	1.6	12		U
191-24-2	Benzo (g, h, i) perylene	1.6	12		U
50-32-8	Benzo (a) pyrene	1.6	12		U
53-70-3	Dibenz (a, h) anthracene	1.6	12		U
206-44-0	Fluoranthene	1.6	12	4.0	J
86-73-7	Fluorene	1.6	12		U
118-74-1	Hexachlorobenzene	1.6	12		U
87-68-3	Hexachlorobutadiene	1.6	12		U
77-47-4	Hexachlorocyclopentadiene	1.6	20		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.6	12		U
91-57-6	2-Methylnaphthalene	1.6	12		U
91-20-3	Naphthalene	1.6	12		U
621-64-7	N-Nitroso-di-n-propylamine	1.6	59		U
85-01-8	Phenanthrene	1.6	12		U
129-00-0	Pyrene	1.6	12		U

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CLIENT SAMPLE NO.

MR14-SS16-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-18

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108218

% Moisture: 16 decanted: (Y/N) N Date Sampled: 11/06/09 10:20

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 20:53

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
56-55-3	Benzo(a) anthracene	1.6	12		U
205-99-2	Benzo(b) fluoranthene	1.6	12		U
207-08-9	Benzo(k) fluoranthene	1.6	12		U
191-24-2	Benzo(g,h,i) perylene	1.6	12		U
50-32-8	Benzo(a) pyrene	1.6	12		U
53-70-3	Dibenz(a,h) anthracene	1.6	12		U
206-44-0	Fluoranthene	1.6	12	6.0	J
86-73-7	Fluorene	1.6	12		U
118-74-1	Hexachlorobenzene	1.6	12		U
87-68-3	Hexachlorobutadiene	1.6	12		U
77-47-4	Hexachlorocyclopentadiene	1.6	20		U
193-39-5	Indeno(1,2,3-cd) pyrene	1.6	12		U
91-57-6	2-Methylnaphthalene	1.6	12		U
91-20-3	Naphthalene	1.6	12		U
621-64-7	N-Nitroso-di-n-propylamine	1.6	60		U
85-01-8	Phenanthrene	1.6	12		U
129-00-0	Pyrene	1.6	12	6.3	J

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS17-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-19

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108219

% Moisture: 20 decanted: (Y/N) N Date Sampled: 11/06/09 10:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 21:27

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	Q
56-55-3	Benzo (a) anthracene	1.7	12		
205-99-2	Benzo (b) fluoranthene	1.7	12	18	
207-08-9	Benzo (k) fluoranthene	1.7	12	4.4	J
191-24-2	Benzo (g, h, i) perylene	1.7	12	7.2	J
50-32-8	Benzo (a) pyrene	1.7	12		U
53-70-3	Dibenz (a, h) anthracene	1.7	12		U
206-44-0	Fluoranthene	1.7	12	11	J
86-73-7	Fluorene	1.7	12		U
118-74-1	Hexachlorobenzene	1.7	12		U
87-68-3	Hexachlorobutadiene	1.7	12		U
77-47-4	Hexachlorocyclopentadiene	1.7	21		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.7	12		U
91-57-6	2-Methylnaphthalene	1.7	12	12	J
91-20-3	Naphthalene	1.7	12	10	J
621-64-7	N-Nitroso-di-n-propylamine	1.7	62		U
85-01-8	Phenanthrene	1.7	12	20	
129-00-0	Pyrene	1.7	12	12	J

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS18-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-20

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108220

% Moisture: 16 decanted: (Y/N) N Date Sampled: 11/06/09 10:40

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 22:01

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/KG Q
		MDL	(ug/L or ug/Kg) RL CONC	
56-55-3	Benzo (a) anthracene	1.6	12	J
205-99-2	Benzo (b) fluoranthene	1.6	12	4.7 J
207-08-9	Benzo (k) fluoranthene	1.6	12	2.3 J
191-24-2	Benzo (g, h, i) perylene	1.6	12	U
50-32-8	Benzo (a) pyrene	1.6	12	U
53-70-3	Dibenz (a, h) anthracene	1.6	12	U
206-44-0	Fluoranthene	1.6	12	4.7 J
86-73-7	Fluorene	1.6	12	U
118-74-1	Hexachlorobenzene	1.6	12	U
87-68-3	Hexachlorobutadiene	1.6	12	U
77-47-4	Hexachlorocyclopentadiene	1.6	20	U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.6	12	U
91-57-6	2-Methylnaphthalene	1.6	12	1.6 J
91-20-3	Naphthalene	1.6	12	U
621-64-7	N-Nitroso-di-n-propylamine	1.6	60	U
85-01-8	Phenanthrene	1.6	12	3.3 J
129-00-0	Pyrene	1.6	12	4.6 J

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CLIENT SAMPLE NO.

MR14-SS19-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-21

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108221

% Moisture: 14 decanted: (Y/N) N Date Sampled: 11/06/09 10:35

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 22:35

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	UG/KG Q
56-55-3	Benzo (a) anthracene	1.6	12	2.8	J J CC
205-99-2	Benzo (b) fluoranthene	1.6	12	7.3	J
207-08-9	Benzo (k) fluoranthene	1.6	12	2.8	J
191-24-2	Benzo (g, h, i) perylene	1.6	12	2.6	J
50-32-8	Benzo (a) pyrene	1.6	12		U
53-70-3	Dibenz (a, h) anthracene	1.6	12		U
206-44-0	Fluoranthene	1.6	12	5.0	J
86-73-7	Fluorene	1.6	12		U
118-74-1	Hexachlorobenzene	1.6	12		U
87-68-3	Hexachlorobutadiene	1.6	12		U
77-47-4	Hexachlorocyclopentadiene	1.6	19		U
193-39-5	Indeno (1, 2, 3-cd) pyrene	1.6	12		U
91-57-6	2-Methylnaphthalene	1.6	12	3.3	J
91-20-3	Naphthalene	1.6	12		U
621-64-7	N-Nitroso-di-n-propylamine	1.6	58		U
85-01-8	Phenanthrene	1.6	12	5.3	J
129-00-0	Pyrene	1.6	12	6.2	J

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CLIENT SAMPLE NO.

MR14-SS20-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-22

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108222

% Moisture: 26 decanted: (Y/N) N Date Sampled: 11/06/09 10:25

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/15/09 19:12

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

56-55-3-----	Benzo (a) anthracene	1.8	13	3.2	J
205-99-2-----	Benzo (b) fluoranthene	1.8	13		U
207-08-9-----	Benzo (k) fluoranthene	1.8	13		U
191-24-2-----	Benzo (g, h, i) perylene	1.8	13		U
50-32-8-----	Benzo (a) pyrene	1.8	13		U
53-70-3-----	Dibenz (a, h) anthracene	1.8	13		U
206-44-0-----	Fluoranthene	1.8	13	7.2	J
86-73-7-----	Fluorene	1.8	13	4.0	J
118-74-1-----	Hexachlorobenzene	1.8	13		U
87-68-3-----	Hexachlorobutadiene	1.8	13	4.3	J
77-47-4-----	Hexachlorocyclopentadiene	1.8	22		J us 804
193-39-5-----	Indeno (1, 2, 3-cd) pyrene	1.8	13		U
91-57-6-----	2-Methylnaphthalene	1.8	13	11	J
91-20-3-----	Naphthalene	1.8	13	11	J
621-64-7-----	N-Nitroso-di-n-propylamine	1.8	67		U
85-01-8-----	Phenanthrene	1.8	13	9.4	J
129-00-0-----	Pyrene	1.8	13	6.8	J

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-EB1  
10609-SS

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) WATER Lab Sample ID: 0911082-23

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1108223

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 11/06/09 09:45

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 18:38

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	CONC	
56-55-3	Benzo (a) anthracene	0.018	0.23	0.23	0.027 JB UJ
205-99-2	Benzo (b) fluoranthene	0.018	0.23	0.23	0.022 J
207-08-9	Benzo (k) fluoranthene	0.018	0.23	0.23	0.023 J
191-24-2	Benzo (g, h, i) perylene	0.018	0.23	0.23	0.021 J
50-32-8	Benzo (a) pyrene	0.018	0.23	0.23	0.021 J
53-70-3	Dibenz (a, h) anthracene	0.018	0.23	0.23	0.023 J
206-44-0	Fluoranthene	0.018	0.23	0.23	0.032 JB U MBL
86-73-7	Fluorene	0.018	0.23	0.23	0.022 JB U MBL
118-74-1	Hexachlorobenzene	0.018	0.23	0.23	U
87-68-3	Hexachlorobutadiene	0.018	0.23	0.23	U
77-47-4	Hexachlorocyclopentadiene	0.018	0.23	0.23	U
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.018	0.23	0.23	0.022 J
91-57-6	2-Methylnaphthalene	0.018	0.23	0.23	0.029 JB U MBL
91-20-3	Naphthalene	0.018	0.23	0.23	0.043 JB U MBL
621-64-7	N-Nitroso-di-n-propylamine	0.018	4.6	4.6	U
85-01-8	Phenanthrene	0.018	0.23	0.23	0.035 JB U MBL
129-00-0	Pyrene	0.018	0.23	0.23	0.032 JB U MBL

CCJ  
MBL  
MBL  
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MBL

FORM I SV

AW  
11/29/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-FB110609

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) WATER Lab Sample ID: 0911082-24

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1108224

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 11/06/09 10:12

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/16/09 19:11

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	UG/L	Q
56-55-3	Benzo (a) anthracene	0.018	0.23		U	UJ CCY
205-99-2	Benzo (b) fluoranthene	0.018	0.23		U	
207-08-9	Benzo (k) fluoranthene	0.018	0.23		U	
191-24-2	Benzo (g, h, i) perylene	0.018	0.23		U	
50-32-8	Benzo (a) pyrene	0.018	0.23		U	
53-70-3	Dibenz (a, h) anthracene	0.018	0.23		U	
206-44-0	Fluoranthene	0.018	0.23		U	
86-73-7	Fluorene	0.018	0.23		U	
118-74-1	Hexachlorobenzene	0.018	0.23		U	
87-68-3	Hexachlorobutadiene	0.018	0.23		U	
77-47-4	Hexachlorocyclopentadiene	0.018	0.23		U	
193-39-5	Indeno (1, 2, 3-cd) pyrene	0.018	0.23		U	
91-57-6	2-Methylnaphthalene	0.018	0.23	0.23 0.025	U	MBL
91-20-3	Naphthalene	0.018	0.23	0.23 0.046	U	MBL
621-64-7	N-Nitroso-di-n-propylamine	0.018	4.6		U	
85-01-8	Phenanthrene	0.018	0.23	0.23 0.021	U	MB
129-00-0	Pyrene	0.018	0.23		U	

FORM I SV

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**SEMIVOLATILE ORGANIC COMPOUNDS**  
USEPA Region IV - Level IV Review

Site: MCB Camp Lejeune, CTO-014, UXO-14 SDG #: UX014\_001

Client: CH2M HILL, Inc., Virginia Beach, Virginia Date: January 25, 2010

Laboratory: Empirical Laboratories, Nashville, Tennessee Reviewer: Nancy Weaver

EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	MR14-SS13-09D	0911082-14	Soil
2	MR14-SS13D-09D	0911082-15	Soil
3	MR14-SS14-09D	0911082-16	Soil
4	MR14-SS15-09D	0911082-17	Soil
5	MR14-SS16-09D	0911082-18	Soil
6	MR14-SS17-09D	0911082-19	Soil
7	MR14-SS18-09D	0911082-20	Soil
8	MR14-SS19-09D	0911082-21	Soil
9	MR14-SS20-09D	0911082-22	Soil
9MS	MR14-SS20-09DMS	0911082-22MS	Soil
9MSD	MR14-SS20-09DMSD	0911082-22MSD	Soil
10	MR14-EB110609-SS	0911082-23	Water
11	MR14-FB110609	0911082-24	Water

The USEPA "Contract Laboratory Program National Functional Guidelines for Organic Data Review," October 1999, and professional judgement were used in evaluating the data in this summary report.

Holding Times - All samples were extracted within 7 days for water samples, 14 days for soil samples and analyzed within 40 days for all samples.

GC/MS Tuning - All of the DFTPP tunes in the initial and continuing calibrations met the percent relative abundance criteria.

Initial Calibration - The initial calibrations exhibited acceptable %RSD and mean RRF values.

Continuing Calibration - The continuing calibrations exhibited acceptable %D and RRF values except the following.

CCAL Date	Compound	%D/RRF	Qualifier	Affected Samples
11/23/09	Atrazine	49.7%	J/UJ	10, 11
	Caprolactam	30.2%		
	3,3'-Dichlorobenzidine	116.8%		
	4-Nitrophenol	25.6%		
	2-Chlorobenzalmalonitrile	26.7%		
12/01/09	4-Bromophenyl-phenylether	25.5%	J/UJ	1-5
	Carbazole	28.7%		
	2,4-Dinitrophenol	25.3%		
12/02/09	3,3'-Dichlorobenzidine	36.4%	J/UJ	6-8
	2,4-Dinitrophenol	26.6%	J/UJ	6-9
	3-Nnitroaniline	27.5%	J/UJ	6-8
	4-Nitroaniline	27.8%		

Surrogates - All samples exhibited acceptable surrogate recoveries.

MS/MSD - The MS/MSD sample exhibited acceptable %R and RPD values except the following.

MS/MSD Sample ID	Compound	MS/MSD %R/RPD	Qualifier
9	Atrazine	51%/Ok/Ok	J/UJ
	3,3'-Dichlorobenzidine	0%/0%/Ok	J/R
	3-Nitroaniline	0%/0%/Ok	
	4-Nitroaniline	4%/5%/Ok	
	2-Chlorobenzalmalonitrile	68%/Ok/Ok	J/UJ

Laboratory Control Sample - The LCS samples exhibited acceptable %R values except the following.

LCS ID	Compound	%R	Qualifier	Affected Samples
9K06018-BLK1	Benzaldehyde	2%	J/R	1-9
9K06019-BLK1	Butylbenzylphthalate	124%	None	All ND
	Caprolactam	19%	None	See ICAL

Internal Standard (IS) Area Performance - All internal standards met response and retention time (RT) criteria except the following.

Sample ID	Internal Standard	Area Count	Qualifier
1	Chrysene-d12	Low	J/UJ
	Perylene-d12		
3	Chrysene-d12	Low	J/UJ
	Perylene-d12		
4	Chrysene-d12	Low	J/UJ
	Perylene-d12		
5	Perylene-d12	Low	J/UJ

Method Blank - The method blanks exhibited the following contamination.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
9K06019-BLK1	Caprolactam	0.38	1.9	U	10, 11

Field, Equipment Blank - Field QC results are summarized below.

Blank ID	Compound	Conc. ug/L	Action Level ug/L	Qualifier	Affected Samples
MR14-EB110609-SS	None - ND	-	-	-	-
MR14-FB110609	None - ND	-	-	-	-

Field Duplicates - Field duplicate results are summarized below.

Compound	MR14-SS13-09D ug/kg	MR14-SS13D-09D ug/kg	RPD	Qualifier
None	ND	ND	-	-

Tentatively Identified Compounds (TICs) - TICs were not included in this data package.

Compound Quantitation - No discrepancies were identified.

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS13-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL  
 Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001  
 Matrix: (soil/water) SOIL Lab Sample ID: 0911082-14  
 Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108214  
 % Moisture: 12 decanted: (Y/N) N Date Sampled: 11/06/09 09:45  
 Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09  
 Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 20:47  
 Injection Volume: 0.5 (uL) Dilution Factor: 1.0  
 GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	30	260		U
208-96-8	Acenaphthylene	22	260		U
98-86-2	Acetophenone	46	260		U
120-12-7	Anthracene	31	260		U
1912-24-9	Atrazine	32	260		U
100-52-7	Benzaldehyde	63	260		<del>U</del> R
92-52-4	1,1'-Biphenyl	33	260		U
111-91-1	bis(2-Chloroethoxy)methane	35	260		U
111-44-4	bis(2-Chloroethyl) ether	46	110		U
108-60-1	2,2'-Oxybis(1-chloropropane)	58	260		U
117-81-7	Bis(2-ethylhexyl) phthalate	41	260		<del>U</del> UJ ISL
101-55-3	4-Bromophenyl-phenylether	29	260		<del>U</del> UJ COH
85-68-7	Butylbenzylphthalate	34	260		<del>U</del> UJ ISL
106-47-8	4-Chloroaniline	54	260		U
105-60-2	Caprolactam	76	260		U
86-74-8	Carbazole	41	260		<del>U</del> UJ COH
59-50-7	4-Chloro-3-methylphenol	31	260		U
91-58-7	2-Chloronaphthalene	36	260		U
95-57-8	2-Chlorophenol	46	260		U
7005-72-3	4-Chlorophenyl-phenylether	35	260		U
218-01-9	Chrysene	35	260		<del>U</del> UJ ISL
132-64-9	Dibenzofuran	28	260		U
91-94-1	3,3'-Dichlorobenzidine	36	260		U
120-83-2	2,4-Dichlorophenol	21	260		U
84-66-2	Diethylphthalate	38	260		U
105-67-9	2,4-Dimethylphenol	24	260		U
131-11-3	Dimethylphthalate	34	260		U
84-74-2	Di-n-butylphthalate	34	260		U
534-52-1	4,6-Dinitro-2-methylphenol	25	530		U
51-28-5	2,4-Dinitrophenol	150	530		<del>U</del> UJ COH
121-14-2	2,4-Dinitrotoluene	27	260		U
606-20-2	2,6-Dinitrotoluene	43	260		U
117-84-0	Di-n-octylphthalate	30	380		<del>U</del> UJ ISL

FORM I SV

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FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS13-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-14

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108214

% Moisture: 12 decanted: (Y/N) N Date Sampled: 11/06/09 09:45

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 20:47

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/KG Q
		MDL	(ug/L or ug/Kg) RL CONC	
67-72-1-----	Hexachloroethane	44	260	U
78-59-1-----	Isophorone	32	260	U
106-44-5-----	4-Methylphenol	30	260	U
95-48-7-----	2-Methylphenol	44	260	U
88-74-4-----	2-Nitroaniline	36	530	U
99-09-2-----	3-Nitroaniline	54	530	U
100-01-6-----	4-Nitroaniline	110	530	U
98-95-3-----	Nitrobenzene	39	260	U
88-75-5-----	2-Nitrophenol	25	260	U
100-02-7-----	4-Nitrophenol	92	530	U
86-30-6-----	N-Nitrosodiphenylamine (1)	36	260	U
87-86-5-----	Pentachlorophenol	38	760	U
108-95-2-----	Phenol	41	260	U
95-95-4-----	2,4,5-Trichlorophenol	30	530	U
88-06-2-----	2,4,6-Trichlorophenol	39	260	U
532-27-4-----	2-Chloroacetophenone	110	260	U
2698-41-1-----	2-Chlorobenzalmalonitrile	110	260	U

(1) - Cannot be separated from Diphenylamine

FORM I SV

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*11/25/10*

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

2

MR14-SS13D-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL  
 Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001  
 Matrix: (soil/water) SOIL Lab Sample ID: 0911082-15  
 Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108215  
 % Moisture: 13 decanted: (Y/N) N Date Sampled: 11/06/09 09:50  
 Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09  
 Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 21:23  
 Injection Volume: 0.5 (uL) Dilution Factor: 1.0  
 GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		
		MDL	(ug/L or ug/Kg) RL CONC	UG/KG Q
83-32-9	Acenaphthene	30	270	U
208-96-8	Acenaphthylene	22	270	U
98-86-2	Acetophenone	47	270	U
120-12-7	Anthracene	31	270	U
1912-24-9	Atrazine	32	270	U
100-52-7	Benzaldehyde	63	270	U
92-52-4	1,1'-Biphenyl	34	270	U R BSL
111-91-1	bis(2-Chloroethoxy)methane	35	270	U
111-44-4	bis(2-Chloroethyl) ether	47	110	U
108-60-1	2,2'-Oxybis(1-chloropropane)	58	270	U
117-81-7	Bis(2-ethylhexyl) phthalate	41	270	U
101-55-3	4-Bromophenyl-phenylether	30	270	U US CCH
85-68-7	Butylbenzylphthalate	34	270	U
106-47-8	4-Chloroaniline	55	270	U
105-60-2	Caprolactam	77	270	U
86-74-8	Carbazole	41	270	U US CCH
59-50-7	4-Chloro-3-methylphenol	32	270	U
91-58-7	2-Chloronaphthalene	36	270	U
95-57-8	2-Chlorophenol	46	270	U
7005-72-3	4-Chlorophenyl-phenylether	35	270	U
218-01-9	Chrysene	35	270	U
132-64-9	Dibenzofuran	28	270	U
91-94-1	3,3'-Dichlorobenzidine	36	270	U
120-83-2	2,4-Dichlorophenol	22	270	U
84-66-2	Diethylphthalate	39	270	U
105-67-9	2,4-Dimethylphenol	24	270	U
131-11-3	Dimethylphthalate	35	270	U
84-74-2	Di-n-butylphthalate	35	270	U
534-52-1	4,6-Dinitro-2-methylphenol	25	530	U
51-28-5	2,4-Dinitrophenol	150	530	U US CCH
121-14-2	2,4-Dinitrotoluene	28	270	U
606-20-2	2,6-Dinitrotoluene	43	270	U
117-84-0	Di-n-octylphthalate	31	380	U

FORM I SV

W  
11/25/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS13D-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-15

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108215

% Moisture: 13 decanted: (Y/N) N Date Sampled: 11/06/09 09:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 21:23

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	Q
67-72-1-----	Hexachloroethane	45	270		U
78-59-1-----	Isophorone	32	270		U
106-44-5-----	4-Methylphenol	30	270		U
95-48-7-----	2-Methylphenol	44	270		U
88-74-4-----	2-Nitroaniline	37	530		U
99-09-2-----	3-Nitroaniline	54	530		U
100-01-6-----	4-Nitroaniline	110	530		U
98-95-3-----	Nitrobenzene	40	270		U
88-75-5-----	2-Nitrophenol	25	270		U
100-02-7-----	4-Nitrophenol	92	530		U
86-30-6-----	N-Nitrosodiphenylamine (1)	36	270		U
87-86-5-----	Pentachlorophenol	38	760		U
108-95-2-----	Phenol	41	270		U
95-95-4-----	2,4,5-Trichlorophenol	31	530		U
88-06-2-----	2,4,6-Trichlorophenol	40	270		U
532-27-4-----	2-Chloroacetophenone	110	270		U
2698-41-1-----	2-Chlorobenzalmalonitrile	110	270		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*lw*  
11/25/10

3

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS14-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-16

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108216

% Moisture: 7 decanted: (Y/N) N Date Sampled: 11/06/09 09:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 21:58

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/KG Q	
		MDL	(ug/L or ug/Kg) RL CONC		
83-32-9	Acenaphthene	28	250		U
208-96-8	Acenaphthylene	21	250		U
98-86-2	Acetophenone	44	250		U
120-12-7	Anthracene	29	250		U
1912-24-9	Atrazine	30	250		U
100-52-7	Benzaldehyde	60	250		U
92-52-4	1,1'-Biphenyl	32	250		U
111-91-1	bis(2-Chloroethoxy)methane	33	250		U
111-44-4	bis(2-Chloroethyl) ether	44	110		U
108-60-1	2,2'-Oxybis(1-chloropropane)	55	250		U
117-81-7	Bis(2-ethylhexyl) phthalate	39	250		U
101-55-3	4-Bromophenyl-phenylether	28	250		U
85-68-7	Butylbenzylphthalate	32	250		U
106-47-8	4-Chloroaniline	52	250		U
105-60-2	Caprolactam	72	250		U
86-74-8	Carbazole	39	250		U
59-50-7	4-Chloro-3-methylphenol	30	250		U
91-58-7	2-Chloronaphthalene	34	250		U
95-57-8	2-Chlorophenol	44	250		U
7005-72-3	4-Chlorophenyl-phenylether	33	250		U
218-01-9	Chrysene	33	250		U
132-64-9	Dibenzofuran	26	250		U
91-94-1	3,3'-Dichlorobenzidine	34	250		U
120-83-2	2,4-Dichlorophenol	20	250		U
84-66-2	Diethylphthalate	36	250		U
105-67-9	2,4-Dimethylphenol	23	250		U
131-11-3	Dimethylphthalate	33	250		U
84-74-2	Di-n-butylphthalate	33	250		U
534-52-1	4,6-Dinitro-2-methylphenol	23	500		U
51-28-5	2,4-Dinitrophenol	140	500		U
121-14-2	2,4-Dinitrotoluene	26	250		U
606-20-2	2,6-Dinitrotoluene	41	250		U
117-84-0	Di-n-octylphthalate	29	360		U

FORM I SV

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3

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS14-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-16

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108216

% Moisture: 7 decanted: (Y/N) N Date Sampled: 11/06/09 09:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 21:58

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	Q
67-72-1-----	Hexachloroethane	42	250		U
78-59-1-----	Isophorone	30	250		U
106-44-5-----	4-Methylphenol	28	250		U
95-48-7-----	2-Methylphenol	42	250		U
88-74-4-----	2-Nitroaniline	34	500		U
99-09-2-----	3-Nitroaniline	51	500		U
100-01-6-----	4-Nitroaniline	110	500		U
98-95-3-----	Nitrobenzene	37	250		U
88-75-5-----	2-Nitrophenol	24	250		U
100-02-7-----	4-Nitrophenol	87	500		U
86-30-6-----	N-Nitrosodiphenylamine (1)	34	250		U
87-86-5-----	Pentachlorophenol	36	720		U
108-95-2-----	Phenol	39	250		U
95-95-4-----	2,4,5-Trichlorophenol	29	500		U
88-06-2-----	2,4,6-Trichlorophenol	38	250		U
532-27-4-----	2-Chloroacetophenone	110	250		U
2698-41-1-----	2-Chlorobenzalmalononitrile	110	250		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

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4

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS15-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL  
 Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001  
 Matrix: (soil/water) SOIL Lab Sample ID: 0911082-17  
 Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108217  
 % Moisture: 15 decanted: (Y/N) N Date Sampled: 11/06/09 10:15  
 Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09  
 Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 22:34  
 Injection Volume: 0.5 (uL) Dilution Factor: 1.0  
 GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
 MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	UG/KG	Q
83-32-9	Acenaphthene	31	270			U
208-96-8	Acenaphthylene	23	270			U
98-86-2	Acetophenone	48	270			U
120-12-7	Anthracene	32	270			U
1912-24-9	Atrazine	33	270			U
100-52-7	Benzaldehyde	65	270			U R BSL
92-52-4	1,1'-Biphenyl	35	270			U
111-91-1	bis(2-Chloroethoxy)methane	36	270			U
111-44-4	bis(2-Chloroethyl) ether	48	120			U
108-60-1	2,2'-Oxybis(1-chloropropane)	60	270			U
117-81-7	Bis(2-ethylhexyl)phthalate	42	270			U UJ ISL
101-55-3	4-Bromophenyl-phenylether	30	270			U UJ CCH ISL
85-68-7	Butylbenzylphthalate	35	270			U UJ ISL
106-47-8	4-Chloroaniline	56	270			U
105-60-2	Caprolactam	79	270			U
86-74-8	Carbazole	42	270			U UJ CCH
59-50-7	4-Chloro-3-methylphenol	33	270			U
91-58-7	2-Chloronaphthalene	38	270			U
95-57-8	2-Chlorophenol	48	270			U
7005-72-3	4-Chlorophenyl-phenylether	36	270			U
218-01-9	Chrysene	36	270			U UJ ISL
132-64-9	Dibenzofuran	29	270			U
91-94-1	3,3'-Dichlorobenzidine	37	270			U
120-83-2	2,4-Dichlorophenol	22	270			U
84-66-2	Diethylphthalate	40	270			U
105-67-9	2,4-Dimethylphenol	25	270			U
131-11-3	Dimethylphthalate	36	270			U
84-74-2	Di-n-butylphthalate	36	270			U
534-52-1	4,6-Dinitro-2-methylphenol	26	550			U
51-28-5	2,4-Dinitrophenol	160	550			U UJ CCH
121-14-2	2,4-Dinitrotoluene	28	270			U
606-20-2	2,6-Dinitrotoluene	44	270			U
117-84-0	Di-n-octylphthalate	32	390			U UJ ISL

FORM I SV

UW  
1/25/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

4

MR14-SS15-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-17

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108217

% Moisture: 15 decanted: (Y/N) N Date Sampled: 11/06/09 10:15

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 22:34

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/KG Q
		MDL	(ug/L or ug/Kg) RL CONC	
67-72-1-----	Hexachloroethane	46	270	U
78-59-1-----	Isophorone	33	270	U
106-44-5-----	4-Methylphenol	31	270	U
95-48-7-----	2-Methylphenol	45	270	U
88-74-4-----	2-Nitroaniline	38	550	U
99-09-2-----	3-Nitroaniline	56	550	U
100-01-6-----	4-Nitroaniline	120	550	U
98-95-3-----	Nitrobenzene	41	270	U
88-75-5-----	2-Nitrophenol	26	270	U
100-02-7-----	4-Nitrophenol	95	550	U
86-30-6-----	N-Nitrosodiphenylamine (1)	38	270	U
87-86-5-----	Pentachlorophenol	40	780	U
108-95-2-----	Phenol	42	270	U
95-95-4-----	2,4,5-Trichlorophenol	32	550	U
88-06-2-----	2,4,6-Trichlorophenol	41	270	U
532-27-4-----	2-Chloroacetophenone	120	270	U
2698-41-1-----	2-Chlorobenzalmalononitrile	120	270	U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*Handwritten:* 11/25/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS16-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-18

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108218

% Moisture: 16 decanted: (Y/N) N Date Sampled: 11/06/09 10:20

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 23:10

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	32	280		U
208-96-8	Acenaphthylene	23	280		U
98-86-2	Acetophenone	49	280		U
120-12-7	Anthracene	32	280		U
1912-24-9	Atrazine	34	280		U
100-52-7	Benzaldehyde	66	280		R BSU
92-52-4	1,1'-Biphenyl	35	280		U
111-91-1	bis(2-Chloroethoxy)methane	37	280		U
111-44-4	bis(2-Chloroethyl) ether	49	120		U
108-60-1	2,2'-Oxybis(1-chloropropane)	61	280		U
117-81-7	Bis(2-ethylhexyl) phthalate	43	280		U ISL
101-55-3	4-Bromophenyl-phenylether	31	280		U CCH
85-68-7	Butylbenzylphthalate	35	280		U
106-47-8	4-Chloroaniline	57	280		U
105-60-2	Caprolactam	80	280		U
86-74-8	Carbazole	43	280		U CCH
59-50-7	4-Chloro-3-methylphenol	33	280		U
91-58-7	2-Chloronaphthalene	38	280		U
95-57-8	2-Chlorophenol	49	280		U
7005-72-3	4-Chlorophenyl-phenylether	37	280		U
218-01-9	Chrysene	37	280		U
132-64-9	Dibenzofuran	29	280		U
91-94-1	3,3'-Dichlorobenzidine	38	280		U
120-83-2	2,4-Dichlorophenol	22	280		U
84-66-2	Diethylphthalate	40	280		U
105-67-9	2,4-Dimethylphenol	26	280		U
131-11-3	Dimethylphthalate	36	280		U
84-74-2	Di-n-butylphthalate	36	280		U
534-52-1	4,6-Dinitro-2-methylphenol	26	560		U
51-28-5	2,4-Dinitrophenol	160	560		U CCH
121-14-2	2,4-Dinitrotoluene	29	280		U
606-20-2	2,6-Dinitrotoluene	45	280		U
117-84-0	Di-n-octylphthalate	32	400		U ISL

FORM I SV

*Handwritten signature*  
11/25/10

5

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS16-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-18

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108218

% Moisture: 16 decanted: (Y/N) N Date Sampled: 11/06/09 10:20

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/01/09 23:10

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

67-72-1-----	Hexachloroethane	47	280		U
78-59-1-----	Isophorone	34	280		U
106-44-5-----	4-Methylphenol	32	280		U
95-48-7-----	2-Methylphenol	46	280		U
88-74-4-----	2-Nitroaniline	38	560		U
99-09-2-----	3-Nitroaniline	56	560		U
100-01-6-----	4-Nitroaniline	120	560		U
98-95-3-----	Nitrobenzene	41	280		U
88-75-5-----	2-Nitrophenol	26	280		U
100-02-7-----	4-Nitrophenol	97	560		U
86-30-6-----	N-Nitrosodiphenylamine (1)	38	280		U
87-86-5-----	Pentachlorophenol	40	800		U
108-95-2-----	Phenol	43	280		U
95-95-4-----	2,4,5-Trichlorophenol	32	560		U
88-06-2-----	2,4,6-Trichlorophenol	42	280		U
532-27-4-----	2-Chloroacetophenone	120	280		U
2698-41-1-----	2-Chlorobenzalmalononitrile	120	280		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*MW*  
1125/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS17-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-19

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108219

% Moisture: 20 decanted: (Y/N) N Date Sampled: 11/06/09 10:50

Extraction: (SepF/Cont/Sonic/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/02/09 12:26

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/KG Q	
		MDL	(ug/L or ug/Kg) RL CONC		
83-32-9	Acenaphthene	33	290		U
208-96-8	Acenaphthylene	24	290		U
98-86-2	Acetophenone	51	290		UY
120-12-7	Anthracene	34	290		U
1912-24-9	Atrazine	35	290		U
100-52-7	Benzaldehyde	69	290	94	J BSL
92-52-4	1,1'-Biphenyl	37	290		U
111-91-1	bis(2-Chloroethoxy)methane	39	290		U
111-44-4	bis(2-Chloroethyl) ether	51	120		U
108-60-1	2,2'-Oxybis(1-chloropropane)	64	290		U
117-81-7	Bis(2-ethylhexyl)phthalate	45	290	60	J
101-55-3	4-Bromophenyl-phenylether	32	290		U
85-68-7	Butylbenzylphthalate	37	290		U
106-47-8	4-Chloroaniline	60	290		U
105-60-2	Caprolactam	84	290		U
86-74-8	Carbazole	45	290		U
59-50-7	4-Chloro-3-methylphenol	35	290		U
91-58-7	2-Chloronaphthalene	40	290		U
95-57-8	2-Chlorophenol	51	290		U
7005-72-3	4-Chlorophenyl-phenylether	38	290		U
218-01-9	Chrysene	39	290		U
132-64-9	Dibenzofuran	30	290		U
91-94-1	3,3'-Dichlorobenzidine	39	290		U CC4
120-83-2	2,4-Dichlorophenol	24	290		U
84-66-2	Diethylphthalate	42	290		U
105-67-9	2,4-Dimethylphenol	27	290		U
131-11-3	Dimethylphthalate	38	290		U
84-74-2	Di-n-butylphthalate	38	290		U
534-52-1	4,6-Dinitro-2-methylphenol	27	580		U
51-28-5	2,4-Dinitrophenol	170	580		U CC4
121-14-2	2,4-Dinitrotoluene	30	290		U
606-20-2	2,6-Dinitrotoluene	47	290		U
117-84-0	Di-n-octylphthalate	34	420		U

FORM I SV

112510

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS17-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-19

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108219

% Moisture: 20 decanted: (Y/N) N Date Sampled: 11/06/09 10:50

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/02/09 12:26

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL CONC	UG/KG Q	
67-72-1-----	Hexachloroethane	49	290		U
78-59-1-----	Isophorone	35	290		U
106-44-5-----	4-Methylphenol	33	290		U
95-48-7-----	2-Methylphenol	48	290		U
88-74-4-----	2-Nitroaniline	40	580		U
99-09-2-----	3-Nitroaniline	59	580		U
100-01-6-----	4-Nitroaniline	120	580		U
98-95-3-----	Nitrobenzene	43	290		U
88-75-5-----	2-Nitrophenol	28	290		U
100-02-7-----	4-Nitrophenol	100	580		U
86-30-6-----	N-Nitrosodiphenylamine (1)	40	290		U
87-86-5-----	Pentachlorophenol	42	830	630	J
108-95-2-----	Phenol	45	290		U
95-95-4-----	2,4,5-Trichlorophenol	33	580		U
88-06-2-----	2,4,6-Trichlorophenol	44	290		U
532-27-4-----	2-Chloroacetophenone	120	290		U
2698-41-1-----	2-Chlorobenzalmalononitrile	120	290		U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*luw*  
1125/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-SS18-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-20

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108220

% Moisture: 16 decanted: (Y/N) N Date Sampled: 11/06/09 10:40

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/02/09 13:04

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO. COMPOUND CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  
MDL RL CONC Q

CAS NO.	COMPOUND	MDL	RL	CONC	Q
83-32-9	Acenaphthene	32	280		U
208-96-8	Acenaphthylene	23	280		U
98-86-2	Acetophenone	49	280		U <sup>†</sup>
120-12-7	Anthracene	32	280		U
1912-24-9	Atrazine	34	280		U
100-52-7	Benzaldehyde	66	280	92	J BSL
92-52-4	1,1'-Biphenyl	35	280		U
111-91-1	bis(2-Chloroethoxy)methane	37	280		U
111-44-4	bis(2-Chloroethyl) ether	49	120		U
108-60-1	2,2'-Oxybis(1-chloropropane)	61	280		U
117-81-7	Bis(2-ethylhexyl) phthalate	43	280		U
101-55-3	4-Bromophenyl-phenylether	31	280		U
85-68-7	Butylbenzylphthalate	36	280		U
106-47-8	4-Chloroaniline	57	280		U
105-60-2	Caprolactam	80	280		U
86-74-8	Carbazole	43	280		U
59-50-7	4-Chloro-3-methylphenol	33	280		U
91-58-7	2-Chloronaphthalene	38	280		U
95-57-8	2-Chlorophenol	49	280		U
7005-72-3	4-Chlorophenyl-phenylether	37	280		U
218-01-9	Chrysene	37	280		U
132-64-9	Dibenzofuran	29	280		U
91-94-1	3,3'-Dichlorobenzidine	38	280		U <sup>†</sup> CC4
120-83-2	2,4-Dichlorophenol	22	280		U
84-66-2	Diethylphthalate	40	280		U
105-67-9	2,4-Dimethylphenol	26	280		U
131-11-3	Dimethylphthalate	36	280		U
84-74-2	Di-n-butylphthalate	36	280		U
534-52-1	4,6-Dinitro-2-methylphenol	26	560		U
51-28-5	2,4-Dinitrophenol	160	560		U <sup>†</sup> CC4
121-14-2	2,4-Dinitrotoluene	29	280		U
606-20-2	2,6-Dinitrotoluene	45	280		U
117-84-0	Di-n-octylphthalate	32	400		U

FORM I SV

MW  
1125/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

7

MR14-SS18-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-20

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108220

% Moisture: 16 decanted: (Y/N) N Date Sampled: 11/06/09 10:40

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/02/09 13:04

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL CONC		
67-72-1	Hexachloroethane	47	280		U
78-59-1	Isophorone	34	280		U
106-44-5	4-Methylphenol	32	280		U
95-48-7	2-Methylphenol	46	280		U
88-74-4	2-Nitroaniline	38	560		U
99-09-2	3-Nitroaniline	56	560		U
100-01-6	4-Nitroaniline	120	560		U
98-95-3	Nitrobenzene	41	280		U
88-75-5	2-Nitrophenol	26	280		U
100-02-7	4-Nitrophenol	97	560		U
86-30-6	N-Nitrosodiphenylamine (1)	38	280		U
87-86-5	Pentachlorophenol	40	800		U
108-95-2	Phenol	43	280		U
95-95-4	2,4,5-Trichlorophenol	32	560		U
88-06-2	2,4,6-Trichlorophenol	42	280		U
532-27-4	2-Chloroacetophenone	120	280		U
2698-41-1	2-Chlorobenzalmalononitrile	120	280		U

UJ CC  
UJ CC

(1) - Cannot be separated from Diphenylamine

FORM I SV

fw  
1125/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 8

MR14-SS19-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-21

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108221

% Moisture: 14 decanted: (Y/N) N Date Sampled: 11/06/09 10:35

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/02/09 13:40

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL CONC	UG/KG Q	
83-32-9	Acenaphthene	31	270	U	
208-96-8	Acenaphthylene	23	270	U	
98-86-2	Acetophenone	48	270	U	
120-12-7	Anthracene	32	270	U	
1912-24-9	Atrazine	33	270	U	
100-52-7	Benzaldehyde	65	270	R	
92-52-4	1,1'-Biphenyl	34	270	U	
111-91-1	bis(2-Chloroethoxy)methane	36	270	U	
111-44-4	bis(2-Chloroethyl) ether	48	120	U	
108-60-1	2,2'-Oxybis(1-chloropropane)	60	270	U	
117-81-7	Bis(2-ethylhexyl) phthalate	42	270	U	
101-55-3	4-Bromophenyl-phenylether	30	270	U	
85-68-7	Butylbenzylphthalate	35	270	U	
106-47-8	4-Chloroaniline	56	270	U	
105-60-2	Caprolactam	79	270	U	
86-74-8	Carbazole	42	270	U	
59-50-7	4-Chloro-3-methylphenol	32	270	U	
91-58-7	2-Chloronaphthalene	37	270	U	
95-57-8	2-Chlorophenol	48	270	U	
7005-72-3	4-Chlorophenyl-phenylether	36	270	U	
218-01-9	Chrysene	36	270	U	
132-64-9	Dibenzofuran	28	270	U	
91-94-1	3,3'-Dichlorobenzidine	37	270	U	
120-83-2	2,4-Dichlorophenol	22	270	U	
84-66-2	Diethylphthalate	40	270	U	
105-67-9	2,4-Dimethylphenol	25	270	U	
131-11-3	Dimethylphthalate	36	270	U	
84-74-2	Di-n-butylphthalate	35	270	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	540	U	
51-28-5	2,4-Dinitrophenol	160	540	U	
121-14-2	2,4-Dinitrotoluene	28	270	U	
606-20-2	2,6-Dinitrotoluene	44	270	U	
117-84-0	Di-n-octylphthalate	31	390	U	

FORM I SV

*MS*  
11/25/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

8

MR14-SS19-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-21

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108221

% Moisture: 14 decanted: (Y/N) N Date Sampled: 11/06/09 10:35

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 12/02/09 13:40

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
67-72-1-----	Hexachloroethane	46	270		U
78-59-1-----	Isophorone	33	270		U
106-44-5-----	4-Methylphenol	31	270		U
95-48-7-----	2-Methylphenol	45	270		U
88-74-4-----	2-Nitroaniline	37	540		U
99-09-2-----	3-Nitroaniline	55	540		U
100-01-6-----	4-Nitroaniline	120	540		U
98-95-3-----	Nitrobenzene	40	270		U
88-75-5-----	2-Nitrophenol	26	270		U
100-02-7-----	4-Nitrophenol	94	540		U
86-30-6-----	N-Nitrosodiphenylamine (1)	37	270		U
87-86-5-----	Pentachlorophenol	39	780		U
108-95-2-----	Phenol	42	270		U
95-95-4-----	2,4,5-Trichlorophenol	31	540		U
88-06-2-----	2,4,6-Trichlorophenol	41	270		U
532-27-4-----	2-Chloroacetophenone	120	270		U
2698-41-1-----	2-Chlorobenzalmononitrile	120	270		U

UJ CH  
UJ CH

(1) - Cannot be separated from Diphenylamine

FORM I SV

lw  
11/25/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO. 9

MR14-SS20-09D

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) SOIL Lab Sample ID: 0911082-22

Sample wt/vol: 15.0 (g/mL) G Lab File ID: 1108222

% Moisture: 26 decanted: (Y/N) N Date Sampled: 11/06/09 10:25

Extraction: (SepF/Cont/Sonc/Soxh) SOXH Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0(uL) Date Analyzed: 12/02/09 14:17

Injection Volume: 0.5(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/KG Q
		MDL	(ug/L or ug/Kg) RL	CONC	
83-32-9	Acenaphthene	36	310		U
208-96-8	Acenaphthylene	26	310		U
98-86-2	Acetophenone	55	310		U
120-12-7	Anthracene	37	310		U
1912-24-9	Atrazine	38	310		U
100-52-7	Benzaldehyde	75	310	110	U
92-52-4	1,1'-Biphenyl	40	310		U
111-91-1	bis(2-Chloroethoxy)methane	42	310		U
111-44-4	bis(2-Chloroethyl) ether	55	130		U
108-60-1	2,2'-Oxybis(1-chloropropane)	69	310		U
117-81-7	Bis(2-ethylhexyl)phthalate	49	310		U
101-55-3	4-Bromophenyl-phenylether	35	310		U
85-68-7	Butylbenzylphthalate	40	310		U
106-47-8	4-Chloroaniline	65	310		U
105-60-2	Caprolactam	91	310		U
86-74-8	Carbazole	49	310		U
59-50-7	4-Chloro-3-methylphenol	37	310		U
91-58-7	2-Chloronaphthalene	43	310		U
95-57-8	2-Chlorophenol	55	310		U
7005-72-3	4-Chlorophenyl-phenylether	42	310		U
218-01-9	Chrysene	42	310		U
132-64-9	Dibenzofuran	33	310		U
91-94-1	3,3'-Dichlorobenzidine	42	310		U
120-83-2	2,4-Dichlorophenol	25	310		U
84-66-2	Diethylphthalate	46	310		U
105-67-9	2,4-Dimethylphenol	29	310		U
131-11-3	Dimethylphthalate	41	310		U
84-74-2	Di-n-butylphthalate	41	310		U
534-52-1	4,6-Dinitro-2-methylphenol	29	630		U
51-28-5	2,4-Dinitrophenol	180	630		U
121-14-2	2,4-Dinitrotoluene	32	310		U
606-20-2	2,6-Dinitrotoluene	51	310		U
117-84-0	Di-n-octylphthalate	36	450		U

FORM I SV

*Handwritten:* 11/25/10





FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-EB1  
10609-SS

Lab Name: EMPIRICAL LABS Contract: CH2MHILL  
 Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001  
 Matrix: (soil/water) WATER Lab Sample ID: 0911082-23  
 Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1108223  
 % Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 11/06/09 09:45  
 Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 11/10/09  
 Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/23/09 22:20  
 Injection Volume: 0.5 (uL) Dilution Factor: 1.0  
 GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/L Q
		MDL	(ug/L or ug/Kg) RL CONC	
67-72-1-----	Hexachloroethane	0.42	4.6	U
78-59-1-----	Isophorone	0.51	4.6	U
106-44-5-----	4-Methylphenol	0.71	4.6	U
95-48-7-----	2-Methylphenol	0.77	4.6	U
88-74-4-----	2-Nitroaniline	1.1	18	U
99-09-2-----	3-Nitroaniline	0.97	18	U
100-01-6-----	4-Nitroaniline	1.9	18	U
98-95-3-----	Nitrobenzene	0.57	4.6	U
88-75-5-----	2-Nitrophenol	0.68	4.6	U
100-02-7-----	4-Nitrophenol	0.77	18	U
86-30-6-----	N-Nitrosodiphenylamine (1)	0.42	4.6	U
87-86-5-----	Pentachlorophenol	0.92	18	U
108-95-2-----	Phenol	0.42	4.6	U
95-95-4-----	2,4,5-Trichlorophenol	0.46	18	U
88-06-2-----	2,4,6-Trichlorophenol	0.68	4.6	U
532-27-4-----	2-Chloroacetophenone	0.92	4.6	U
2698-41-1----	2-Chlorobenzalmalononitrile	0.92	4.6	U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*EW*  
112510

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-FB110609

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) WATER Lab Sample ID: 0911082-24

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1108224

% Moisture: \_\_\_\_\_ decanted: (Y/N)\_\_\_\_ Date Sampled: 11/06/09 10:12

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/23/09 22:56

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:			UG/L Q
		MDL	(ug/L or ug/Kg) RL	UG/L CONC	
83-32-9	Acenaphthene	0.58	4.6		U
208-96-8	Acenaphthylene	0.44	4.6		U
98-86-2	Acetophenone	0.69	4.6		U
120-12-7	Anthracene	0.71	4.6		U
1912-24-9	Atrazine	0.64	4.6		U
100-52-7	Benzaldehyde	0.53	4.6		U
92-52-4	1,1'-Biphenyl	0.36	4.6		U
111-91-1	bis(2-Chloroethoxy)methane	0.48	4.6		U
111-44-4	bis(2-Chloroethyl) ether	0.42	4.6		U
108-60-1	2,2'-Oxybis(1-chloropropane)	0.79	4.6		U
117-81-7	Bis(2-ethylhexyl)phthalate	1.2	4.6		U
101-55-3	4-Bromophenyl-phenylether	0.53	4.6		U
85-68-7	Butylbenzylphthalate	0.76	4.6		U
106-47-8	4-Chloroaniline	0.88	4.6		U
105-60-2	Caprolactam	0.33	4.6	4.6	U
86-74-8	Carbazole	0.64	4.6		U
59-50-7	4-Chloro-3-methylphenol	0.54	4.6		U
91-58-7	2-Chloronaphthalene	0.54	4.6		U
95-57-8	2-Chlorophenol	0.55	4.6		U
7005-72-3	4-Chlorophenyl-phenylether	0.82	4.6		U
218-01-9	Chrysene	0.94	4.6		U
132-64-9	Dibenzofuran	0.60	4.6		U
91-94-1	3,3'-Dichlorobenzidine	0.82	4.6		U
120-83-2	2,4-Dichlorophenol	0.41	4.6		U
84-66-2	Diethylphthalate	0.94	4.6		U
105-67-9	2,4-Dimethylphenol	0.66	4.6		U
131-11-3	Dimethylphthalate	0.68	4.6		U
84-74-2	Di-n-butylphthalate	1.2	4.6		U
534-52-1	4,6-Dinitro-2-methylphenol	0.68	18		U
51-28-5	2,4-Dinitrophenol	0.79	18		U
121-14-2	2,4-Dinitrotoluene	0.45	4.6		U
606-20-2	2,6-Dinitrotoluene	0.61	4.6		U
117-84-0	Di-n-octylphthalate	0.30	4.6		U

FORM I SV

*uw*  
11/25/10

FORM 1  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MR14-FB110609

Lab Name: EMPIRICAL LABS Contract: CH2MHILL

Lab Code: NA Case No.: NA SAS No.: NA SDG No.: UX014\_001

Matrix: (soil/water) WATER Lab Sample ID: 0911082-24

Sample wt/vol: 1080 (g/mL) ML Lab File ID: 1108224

% Moisture: \_\_\_\_\_ decanted: (Y/N) \_\_\_\_\_ Date Sampled: 11/06/09 10:12

Extraction: (SepF/Cont/Sonc/Soxh) SEPF Date Extracted: 11/10/09

Concentrated Extract Volume: 1000.0 (uL) Date Analyzed: 11/23/09 22:56

Injection Volume: 0.5 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: NA

CAS NO.	COMPOUND	CONCENTRATION UNITS:		UG/L Q
		MDL	(ug/L or ug/Kg) RL CONC	
67-72-1-----	Hexachloroethane	0.42	4.6	U
78-59-1-----	Isophorone	0.51	4.6	U
106-44-5-----	4-Methylphenol	0.71	4.6	U
95-48-7-----	2-Methylphenol	0.77	4.6	U
88-74-4-----	2-Nitroaniline	1.1	18	U
99-09-2-----	3-Nitroaniline	0.97	18	U
100-01-6-----	4-Nitroaniline	1.9	18	U
98-95-3-----	Nitrobenzene	0.57	4.6	U
88-75-5-----	2-Nitrophenol	0.68	4.6	U
100-02-7-----	4-Nitrophenol	0.77	18	U
86-30-6-----	N-Nitrosodiphenylamine (1)	0.42	4.6	U
87-86-5-----	Pentachlorophenol	0.92	18	U
108-95-2-----	Phenol	0.42	4.6	U
95-95-4-----	2,4,5-Trichlorophenol	0.46	18	U
88-06-2-----	2,4,6-Trichlorophenol	0.68	4.6	U
532-27-4-----	2-Chloroacetophenone	0.92	4.6	U
2698-41-1----	2-Chlorobenzalmalonitrile	0.92	4.6	U

(1) - Cannot be separated from Diphenylamine

FORM I SV

*luw*  
*1125/10*

Appendix E  
Soil Boring Logs and Well Completion Diagrams

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<b>PROJECT NUMBER:</b> 378849.SI.FK	<b>BORING NUMBER:</b> MR14-IS01	<b>SHEET 1 OF 1</b>
<b>Soil Boring Log</b>		

CLIENT: NAVFAC      PROJECT : CTO-14      LOCATION : UXO-14, Camp Lejeune, NC  
 ELEVATION : 43.4 ft      DRILLING CONTRACTOR : Probe Technologies  
 COORDINATES : 3830552.4 N 275114.0 E      DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 6620DT, Macro-core samplers  
 WATER LEVEL: 3.5 ft bgs at time of drilling      START :      END : 12/4/09 11:07      LOGGER : S Forker

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS No charcoal filter With charcoal filter	GRAPHIC LOG	SOIL DESCRIPTION	COMMENTS	
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION	WELL DETAILS
0.0						<b>POORLY GRADED SAND (SP)</b> light tan, moist, loose.		0ft: Riser
5.0	5.0	5.0	HA-1	0 ppm 0 ppm		NR.	Sample: MR14-IS01-2-3-09D@1050 + MS/MSD	4ft: Bentonite Chips
10.0	10.0	2.0	DP-1			<b>POORLY GRADED SAND (SP)</b> gray with orange, wet, medium dense, little clay.		6ft: Filter pack 8ft: Native sands backfill* 8ft: Pre-packed, 0.010 in slotted screen
15.0							Boring terminated at 10'	
20.0								18ft: Bottom of well
25.0								

FID: Flame ionization detector  
 \* Borehole collapsed due to heaving sands before filter pack sand could be placed in hole.



<b>PROJECT NUMBER:</b> <b>378849.SI.FK</b>	<b>BORING NUMBER:</b> <b>MR14-IS02</b>	<b>SHEET 1 OF 1</b>
<b>Soil Boring Log</b>		

CLIENT: NAVFAC      PROJECT : CTO-14      LOCATION : UXO-14, Camp Lejeune, NC  
 ELEVATION : 44.4 ft      DRILLING CONTRACTOR : Probe Technologies  
 COORDINATES : 3830543.1 N 275121.5 E      DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 6620DT, Macro-core samplers  
 WATER LEVEL: ---      START :      END : 12/4/09 08:57      LOGGER : S Forker

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS <small>No charcoal filter With charcoal filter</small>	GRAPHIC LOG	SOIL DESCRIPTION	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION	COMMENTS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		WELL DETAILS
0.0						<b>POORLY GRADED SAND (SP)</b> light tan, moist, loose.		0ft: Bentonite Chips 0ft: Riser
5.0	5.0	5.0	HA-1	0 ppm		<b>CLAYEY SAND (SC)</b> grayish tan, wet, medium dense.	Sample: MR14-IS02-2-3-09D @ 0850	2ft: Filter pack 3ft: Native sands backfill*
10.0	10.0	2.0	DP-1	0 ppm		NR.		
15.0	15.0	5.0	DP-2			<b>POORLY GRADED SAND WITH CLAY (SP-SC)</b> grayish tan, wet, medium dense, and, clay nodules.		8ft: Pre-packed, 0.010 in slotted screen
						<b>POORLY GRADED SAND (SP)</b> grayish tan, wet, dense, with, clay nodules.		
						<b>SANDY LEAN CLAY (CL)</b> dark gray, wet, soft.		
						<b>POORLY GRADED SAND (SP)</b> gray, wet, dense, trace clay.		
20							Boring terminated at 15'	18ft: Bottom of well
25								

FID: Flame ionization detector  
 \* Borehole collapsed due to heaving sands before filter pack sand could be placed in hole.



<b>PROJECT NUMBER:</b> 378849.SI.FK	<b>BORING NUMBER:</b> MR14-IS03	<b>SHEET 1 OF 1</b>
<b>Soil Boring Log</b>		

CLIENT: NAVFAC      PROJECT : CTO-14      LOCATION : UXO-14, Camp Lejeune, NC  
 ELEVATION : 45.1 ft      DRILLING CONTRACTOR : Probe Technologies  
 COORDINATES : 3830552.0 N 275132.8 E      DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 6620DT, Macro-core samplers  
 WATER LEVEL: 2.5 ft bgs at time of drilling      START : 12/4/09 07:49      END : 12/4/09 08:30      LOGGER : S Forker

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS No charcoal filter With charcoal filter	GRAPHIC LOG	SOIL DESCRIPTION	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION	COMMENTS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		WELL DETAILS
0.0						<b>POORLY GRADED SAND (SP)</b> light tan, moist, loose.		0ft: Bentonite Chips 0ft: Riser
5.0	5.0	5.0	HA-1	0 ppm  0 ppm		<b>SILTY SAND (SM)</b> dark grayish brown, wet, loose. NR.	Sample: MR14-IS03-2-3-09D @ 0810 Sample saturated; no dry soils.	2ft: Native sands backfill*
10.0	10.0		DP-1			<b>POORLY GRADED SAND WITH CLAY (SP-SC)</b> tan, wet, medium dense.  <b>POORLY GRADED SAND (SP)</b> dark gray, wet, medium dense.		8ft: Pre-packed, 0.010 in slotted screen
15.0							Boring terminated at 10'	
20.0								
25.0								18ft: Bottom of well

FID: Flame ionization detector  
\* Borehole collapsed due to heaving sands before filter pack sand could be placed in hole.



<b>PROJECT NUMBER:</b> 378849.SI.FK	<b>BORING NUMBER:</b> MR14-IS04	<b>SHEET 1 OF 1</b>
<b>Soil Boring Log</b>		

CLIENT: NAVFAC      PROJECT : CTO-14      LOCATION : UXO-14, Camp Lejeune, NC  
 ELEVATION : 32.6 ft      DRILLING CONTRACTOR : Probe Technologies  
 COORDINATES : 3830508.9 N 275035.5 E      DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 6620DT, Macro-core samplers  
 WATER LEVEL: 4.5 ft bgs at time of drilling      START : 12/4/09 09:58      END : 12/4/09 10:31      LOGGER : S Forker

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS No charcoal filter With charcoal filter	GRAPHIC LOG	SOIL DESCRIPTION	COMMENTS	
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, & INSTRUMENTATION	WELL DETAILS
0.0						<b>POORLY GRADED SAND (SP)</b> very dark brown, moist, loose, with organics.		0ft: Riser
	5.0	5.0	HA-1	0 ppm		<b>POORLY GRADED SAND (SP)</b> dark brown, loose, trace silt.		1ft: Bentonite Chips
				0 ppm				3ft: Filter pack
5	5.0					NR.	Sample: MR14-IS04-4-5-09D @ 1005 Sample: MR14-IS04D-4-5-09D @ 1010	5ft: Native sands backfill* 5ft: Pre-packed, 0.010 in slotted screen
			DP-1			<b>CLAYEY SAND (SC)</b> gray, wet, loose, with roots.		
10	10.0							
15							Boring terminated at 15'	15ft: Bottom of well
20								
25								

FID: Flame ionization detector  
 \* Borehole collapsed due to heaving sands before filter pack sand could be placed in hole.

**Appendix F**  
**Groundwater Sampling Data Sheets**

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**GROUNDWATER SAMPLING DATA SHEET**

Client: NAVFAC Mid-Atlantic  
 Location: MCB CAMP LEJEUNE  
 Event: CTO-014  
 Date: 12/9/09  
 Weather: 58°

Project Number: 378849.SI.FK  
 Well ID: MR14-DW T204-09D  
 Sample ID: MR14-TW04  
 Sampling Team: D. See & RUV

Total Depth: 14.89 FT.(BTOC)  
 Depth to water: (-) 4.4 FT.(BTOC)  
 Water Column: 10.49 FT.  
(x) .041 GAL/FT.  
 Well Volume: 0.42 GAL.  
 Total Purge Vol.: 1.8 GAL.

Measuring Device: YSI 456 05730  
 Date and Time: HANNA# 08969

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: Peristaltic Pump

**FIELD PARAMETERS**

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
<b>Stabilization Criteria</b>		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
0950	4.6	17.25	0.080	6.04	5.48	58.9	45		
1010	6.2	17.44	0.086	3.27	5.04	-0.8	60		
1070	4.6	17.45	0.087	3.29	5.06	-0.8	12		
1075	4.6	17.46	0.086	3.30	5.07	-0.8	10		

**SAMPLE DATA**

Date: <u>12/9/09</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: <u>1025</u>								
Method: <u>Low flow</u>	<u>17.46</u>	<u>0.089</u>	<u>3.30</u>	<u>5.07</u>	<u>-0.8</u>	<u>10</u>	<u>1.8</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>4270c</u>			

Observations/Notes:

Total Volume Purged: 1.8 gallons

0940 pump started  
tubing intake @ 12 ft  
pump rate .34/min

MS/MSD: YES (NO) Duplicate ID No.: MR10-TW04D-09D

Signature(s):



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic  
 Location: MCB CAMP LEJEUNE  
 Event: CTO-014  
 Date: 12/8/09  
 Weather: 540

Project Number: 378849.SI.FK  
 Well ID: MR14-TW03-09D  
 Sample ID: MR14-TW03  
 Sampling Team: D. Seel/ROU

Total Depth: 19.85 FT.(BTOC)  
 Depth to water: (1)7.93 FT.(BTOC)  
 Water Column: 11.92 FT.  
 Well Volume: 0.48 GAL.  
 Total Purge Vol.: 2.0 GAL.

Measuring Device: YSI 556 #05730  
 Date and Time: 12/8/09 HANNA # 0890

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10	Val purged	
1025	8.42	17.07	0.211	0.56	5.60	-118.9	1.60	0.4	
1035	8.42	17.06	0.210	0.57	5.60	-120.4	2.2	1.2	
1045	8.42	17.06	0.205	0.57	5.59	-117.9	7.8	2.0	

SAMPLE DATA

Date: <u>12/8/09</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: <u>1045</u>								
Method: <u>low flow</u>	<u>17.05</u>	<u>0.205</u>	<u>0.57</u>	<u>5.59</u>	<u>-117.9</u>	<u>7.8</u>	<u>2</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>TAC metals</u>			
<u>D, dissolved metals</u>			

Observations/Notes:

Total Volume Purged: 2.0 gallons  
3L/min pulse rate  
pump started 1020  
 tubing intake @ 17 ft btoe

MS/MSD: YES  NO  Duplicate ID No.:

Signature(s):

**GROUNDWATER SAMPLING DATA SHEET**

Client: NAVFAC Mid-Atlantic  
 Location: MCB CAMP LEJEUNE  
 Event: CTO-014  
 Date: 12/8/09  
 Weather: 550

Project Number: 378849.SI.FK  
 Well ID: MR14-TW02-09D  
 Sample ID: MR14-TW02  
 Sampling Team: D. Seid/POU

Total Depth: 19.92 FT.(BTOC)  
 Depth to water: (H) 8.12 FT.(BTOC)  
 Water Column: 11.8 FT.  
(X) 0.04 GAL/FT.  
 Well Volume: 0.47 GAL.  
 Total Purge Vol.: 1.2 GAL.

Measuring Device: YSI 5561A 05730  
 Date and Time: HANNAH 08469

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

**FIELD PARAMETERS**

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (ml/min)	Color / Odor / Comments
<b>Stabilization Criteria</b>		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10	Vol purged	
0955	8.45	18.04	0.092	0.31	4.93	-83.6	12	0.4	
1000	8.45	18.03	0.092	0.38	4.95	-83.6	6.5	0.8	
1005	8.45	18.04	0.092	0.33	4.90	-83.6	3.4	1.2	

**SAMPLE DATA**

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other:	Color / Odor / Comments
<u>12/8/09</u>							<u>DTU</u>	
Time: <u>1005</u>								
Method: <u>Low flow</u>	<u>18.04</u>	<u>0.092</u>	<u>0.33</u>	<u>4.90</u>	<u>-83.6</u>	<u>3.4</u>	<u>8.45</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>TAC Metals</u>			
<u>Dissolved Metals</u>			

Observations/Notes:

Total Volume Purged: 7.3 Gallons  
intake @ 17 k H2O  
pump started 0950  
purge rate .36/min

MS/MSD: YES  NO  Duplicate ID No.:

Signature(s): [Signature]

**GROUNDWATER SAMPLING DATA SHEET**

Client: NAVFAC Mid-Atlantic  
 Location: MCB CAMP LEJEUNE  
 Event: CTO-014  
 Date: 12/9/09  
 Weather: 54°

Project Number: 378849.SI.FK  
 Well ID: MR14-TW02  
 Sample ID: MR14-TW02-09D  
 Sampling Team: D. Seed/ROU

Total Depth: 19.85 FT.(BTOC)  
 Depth to water: 16.60 FT.(BTOC)  
 Water Column: 13.25 FT.  
 (x) 0.041 GAL/FT.  
 Well Volume: 0.53 GAL.  
 Total Purge Vol.: 1.4 GAL.

Measuring Device: YSI 556H 05730  
 Date and Time: HANNAH 095969

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

**FIELD PARAMETERS**

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
<b>Stabilization Criteria</b>		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10	not purged	
0920	7.01	18.46	0.105	0.50	5.35	169.7	1.5	0.9	
0925	7.01	18.46	0.105	0.49	5.35	169.8	6.2	1.2	
0930	7.01	18.46	0.106	0.49	5.35	169.8	5.1	1.6	

**SAMPLE DATA**

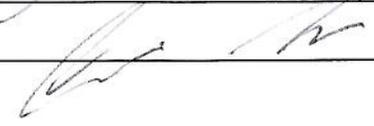
Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
<u>12/9/09</u>								
<u>Time: 0930</u>								
<u>Method: Low Flow</u>	<u>18.46</u>	<u>0.106</u>	<u>0.49</u>	<u>5.35</u>	<u>169.8</u>	<u>5.1</u>	<u>1.6</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>Trace Metals</u>			
<u>Dissolved Metals</u>			

Observations/Notes:  
 Total Volume Purged: 1.6 seconds  
4.63 intake @ 17 ft bgs  
pump started @ 0910  
04min

MS/MSD: YES NO Duplicate ID No.:

Signature(s): 

**Appendix G**  
**Raw Analytical Data**

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Appendix G  
Site UXO - 14  
Groundwater Raw Analytical Results  
December 2009

Station ID	MR14-IS01	MR14-IS02	MR14-IS03	MR14-IS04	
Sample ID	MR14-TW01-09D	MR14-TW02-09D	MR14-TW03-09D	MR14-TW04-09D	MR14-TW04D-09D
Sample Date	12/08/09	12/08/09	12/08/09	12/09/09	12/09/09
Chemical Name					
<b>Semivolatile Organic Compounds (µg/l)</b>					
1,1-Biphenyl	NA	NA	NA	4.9 U	4.9 U
2,2'-Oxybis(1-chloropropane)	NA	NA	NA	4.9 U	4.9 U
2,4,5-Trichlorophenol	NA	NA	NA	20 U	20 U
2,4,6-Trichlorophenol	NA	NA	NA	4.9 U	4.9 U
2,4-Dichlorophenol	NA	NA	NA	4.9 U	4.9 U
2,4-Dimethylphenol	NA	NA	NA	4.9 U	4.9 U
2,4-Dinitrophenol	NA	NA	NA	20 UJ	20 UJ
2,4-Dinitrotoluene	NA	NA	NA	4.9 U	4.9 U
2,6-Dinitrotoluene	NA	NA	NA	4.9 U	4.9 U
2-Chloroacetophenone	NA	NA	NA	4.9 U	4.9 U
2-Chlorobenzalmalonitrile	NA	NA	NA	4.9 U	4.9 U
2-Chloronaphthalene	NA	NA	NA	4.9 U	4.9 U
2-Chlorophenol	NA	NA	NA	4.9 U	4.9 U
2-Methylnaphthalene	NA	NA	NA	0.24 U	0.24 U
2-Methylphenol	NA	NA	NA	4.9 U	4.9 U
2-Nitroaniline	NA	NA	NA	20 U	20 U
2-Nitrophenol	NA	NA	NA	4.9 U	4.9 U
3,3'-Dichlorobenzidine	NA	NA	NA	4.9 U	4.9 U
3-Nitroaniline	NA	NA	NA	20 U	20 U
4,6-Dinitro-2-methylphenol	NA	NA	NA	20 UJ	20 UJ
4-Bromophenyl-phenylether	NA	NA	NA	4.9 U	4.9 U
4-Chloro-3-methylphenol	NA	NA	NA	4.9 U	4.9 U
4-Chloroaniline	NA	NA	NA	4.9 U	4.9 U
4-Chlorophenyl-phenylether	NA	NA	NA	4.9 U	4.9 U
4-Methylphenol	NA	NA	NA	1.7 J	1.6 J
4-Nitroaniline	NA	NA	NA	20 UJ	20 UJ
4-Nitrophenol	NA	NA	NA	20 U	20 U
Acenaphthene	NA	NA	NA	4.9 U	4.9 U
Acenaphthylene	NA	NA	NA	4.9 U	4.9 U
Acetophenone	NA	NA	NA	4.9 UJ	4.9 UJ
Anthracene	NA	NA	NA	4.9 U	4.9 U
Atrazine	NA	NA	NA	4.9 U	4.9 U
Benzaldehyde	NA	NA	NA	4.9 U	4.9 U
Benzo(a)anthracene	NA	NA	NA	0.24 U	0.24 U
Benzo(a)pyrene	NA	NA	NA	0.07 J	0.07 J
Benzo(b)fluoranthene	NA	NA	NA	0.24 U	0.24 U
Benzo(g,h,i)perylene	NA	NA	NA	0.08 J	0.073 J
Benzo(k)fluoranthene	NA	NA	NA	0.24 U	0.24 U
bis(2-Chloroethoxy)methane	NA	NA	NA	4.9 U	4.9 U
bis(2-Chloroethyl)ether	NA	NA	NA	4.9 U	4.9 U
bis(2-Ethylhexyl)phthalate	NA	NA	NA	4.9 U	4.9 U
Butylbenzylphthalate	NA	NA	NA	4.9 U	4.9 U
Caprolactam	NA	NA	NA	4.9 U	4.9 U
Carbazole	NA	NA	NA	4.9 U	4.9 U
Chrysene	NA	NA	NA	4.9 U	4.9 U
Dibenz(a,h)anthracene	NA	NA	NA	0.078 J	0.074 J
Dibenzofuran	NA	NA	NA	4.9 U	4.9 U
Diethylphthalate	NA	NA	NA	4.9 U	4.9 U
Dimethyl phthalate	NA	NA	NA	4.9 U	4.9 U
Di-n-butylphthalate	NA	NA	NA	4.9 U	4.9 U
Di-n-octylphthalate	NA	NA	NA	4.9 U	4.9 U
Fluoranthene	NA	NA	NA	0.24 U	0.24 U
Fluorene	NA	NA	NA	0.24 U	0.24 U
Hexachlorobenzene	NA	NA	NA	0.24 U	0.24 U
Hexachlorobutadiene	NA	NA	NA	0.24 U	0.24 U
Hexachlorocyclopentadiene	NA	NA	NA	0.24 U	0.24 U
Hexachloroethane	NA	NA	NA	4.9 U	4.9 U
Indeno(1,2,3-cd)pyrene	NA	NA	NA	0.069 J	0.071 J
Isophorone	NA	NA	NA	4.9 U	4.9 U
Naphthalene	NA	NA	NA	0.24 U	0.24 U
n-Nitroso-di-n-propylamine	NA	NA	NA	4.9 U	4.9 U
n-Nitrosodiphenylamine	NA	NA	NA	4.9 U	4.9 U
Nitrobenzene	NA	NA	NA	4.9 U	4.9 U
Pentachlorophenol	NA	NA	NA	20 U	20 U
Phenanthrene	NA	NA	NA	0.24 U	0.24 U
Phenol	NA	NA	NA	4.9 U	4.9 U
Pyrene	NA	NA	NA	0.24 U	0.24 U
<b>Total Metals (µg/l)</b>					
Aluminum	246 J	175 J	293 J	NA	NA
Antimony	3.75 U	3.75 U	3.75 U	NA	NA
Arsenic	1.03 J	4.09	1.25 U	NA	NA
Barium	8.48 J	63.6	46.9	NA	NA
Beryllium	1.25 U	0.254 J	1.25 U	NA	NA
Cadmium	1.25 U	1.25 U	1.25 U	NA	NA
Calcium	7,480	5,870	31,600	NA	NA
Chromium	2	1.14 J	1.36	NA	NA



Appendix G  
Site UXO - 14  
Subsurface Soil Raw Analytical Results  
December 2009

Station ID	MR14-IS01	MR14-IS02	MR14-IS03	MR14-IS04	
Sample ID	MR14-IS01-2-3-09D	MR14-IS02-2-3-09D	MR14-IS03-2-3-09D	MR14-IS04-4-5-09D	MR14-IS04D-4-5-09D
Sample Date	12/04/09	12/04/09	12/04/09	12/04/09	12/04/09
Chemical Name					
<b>Semivolatile Organic Compounds (µg/kg)</b>					
1,1-Biphenyl	280 U	280 U	290 U	300 U	300 U
2,2'-Oxybis(1-chloropropane)	280 U	280 U	290 U	300 U	300 U
2,4,5-Trichlorophenol	570 U	550 U	580 U	600 U	600 U
2,4,6-Trichlorophenol	280 U	280 U	290 U	300 U	300 U
2,4-Dichlorophenol	280 U	280 U	290 U	300 U	300 U
2,4-Dimethylphenol	280 U	280 U	290 U	300 U	300 U
2,4-Dinitrophenol	570 U	550 U	580 U	600 U	600 U
2,4-Dinitrotoluene	280 U	280 U	290 U	300 U	300 U
2,6-Dinitrotoluene	280 U	280 U	290 U	300 U	300 U
2-Chloroacetophenone	280 UJ	280 U	290 U	300 UJ	300 U
2-Chlorobenzalmononitrile	280 U	280 U	290 U	300 U	300 U
2-Chloronaphthalene	280 U	280 U	290 U	300 U	300 U
2-Chlorophenol	280 U	280 U	290 U	300 U	300 U
2-Methylnaphthalene	12 U	12 U	12 U	13 U	13 U
2-Methylphenol	280 U	280 U	290 U	300 U	300 U
2-Nitroaniline	570 U	550 U	580 U	600 U	600 U
2-Nitrophenol	280 U	280 U	290 U	300 U	300 U
3,3'-Dichlorobenzidine	280 U	280 U	290 U	300 R	300 U
3-Nitroaniline	570 U	550 U	580 U	600 R	600 U
4,6-Dinitro-2-methylphenol	570 U	550 U	580 U	600 U	600 U
4-Bromophenyl-phenylether	280 U	280 U	290 U	300 U	300 U
4-Chloro-3-methylphenol	280 U	280 U	290 U	300 U	300 U
4-Chloroaniline	280 U	280 U	290 U	300 R	300 U
4-Chlorophenyl-phenylether	280 U	280 U	290 U	300 U	300 U
4-Methylphenol	280 UJ	280 UJ	290 UJ	300 UJ	300 UJ
4-Nitroaniline	570 U	550 U	580 U	600 R	600 U
4-Nitrophenol	570 U	550 U	580 U	600 UJ	600 UJ
Acenaphthene	280 U	280 U	290 U	300 U	300 U
Acenaphthylene	280 U	280 U	290 U	300 U	300 U
Acetophenone	280 UJ	280 UJ	290 UJ	300 UJ	300 UJ
Anthracene	280 U	280 U	290 U	300 U	300 U
Atrazine	280 U	280 U	290 U	300 U	300 U
Benzaldehyde	280 U	280 U	290 U	540 J	520 J
Benzo(a)anthracene	12 U	12 U	12 U	13 U	13 U
Benzo(a)pyrene	12 U	12 U	12 U	13 U	13 U
Benzo(b)fluoranthene	12 U	12 U	12 U	13 U	13 U
Benzo(g,h,i)perylene	12 U	12 U	12 U	13 U	13 U
Benzo(k)fluoranthene	12 U	12 U	12 U	13 U	13 U
bis(2-Chloroethoxy)methane	280 U	280 U	290 U	300 U	300 U
bis(2-Chloroethyl)ether	120 U	120 U	120 U	130 U	130 U
bis(2-Ethylhexyl)phthalate	280 U	280 U	290 U	300 U	300 U
Butylbenzylphthalate	280 U	280 U	290 U	300 U	300 U
Caprolactam	280 U	280 U	290 U	300 U	300 U
Carbazole	280 U	280 U	290 U	300 U	300 U
Chrysene	280 U	280 U	290 U	300 U	300 U
Dibenz(a,h)anthracene	12 U	12 U	12 U	13 U	13 U
Dibenzofuran	280 U	280 U	290 U	300 U	300 U
Diethylphthalate	280 U	280 U	290 U	300 U	300 U
Dimethyl phthalate	280 U	280 U	290 U	300 U	300 U
Di-n-butylphthalate	280 U	280 U	290 U	300 U	300 U
Di-n-octylphthalate	410 U	390 U	410 U	420 U	430 U
Fluoranthene	12 U	12 U	12 U	13 U	13 U
Fluorene	12 U	12 U	12 U	13 U	13 U
Hexachlorobenzene	12 U	12 U	12 U	13 U	13 U
Hexachlorobutadiene	12 U	12 U	12 U	13 U	13 U
Hexachlorocyclopentadiene	20 U	20 U	21 U	21 U	21 U
Hexachloroethane	280 U	280 U	290 U	300 U	300 U
Indeno(1,2,3-cd)pyrene	12 U	12 U	12 U	13 U	13 U
Isophorone	280 U	280 U	290 U	300 U	300 U
Naphthalene	12 U	12 U	12 U	1.8 J	13 U
n-Nitroso-di-n-propylamine	61 U	59 U	62 U	64 U	64 U
n-Nitrosodiphenylamine	280 U	280 U	290 U	300 U	300 U
Nitrobenzene	280 U	280 U	290 U	300 U	300 U
Pentachlorophenol	810 U	790 U	830 U	850 U	860 U
Phenanthrene	12 U	12 U	12 U	13 U	13 U
Phenol	280 U	280 U	290 U	300 U	300 U
Pyrene	12 U	12 U	12 U	13 U	13 U
<b>Total Metals (mg/kg)</b>					
Aluminum	1,530	881 J	793	NA	NA
Antimony	2.62	0.889 U	0.913 U	NA	NA
Arsenic	0.208 J	0.195 J	0.304 U	NA	NA
Barium	2.49	1.78 J	1.44 J	NA	NA
Beryllium	0.307 U	0.296 U	0.304 U	NA	NA
Cadmium	0.307 U	0.296 U	0.304 U	NA	NA
Calcium	307 U	296 U	304 U	NA	NA
Chromium	1.06	0.74	0.748	NA	NA

Appendix G  
 Site UXO - 14  
 Subsurface Soil Raw Analytical Results  
 December 2009

Station ID	MR14-IS01	MR14-IS02	MR14-IS03	MR14-IS04	
Sample ID	MR14-IS01-2-3-09D	MR14-IS02-2-3-09D	MR14-IS03-2-3-09D	MR14-IS04-4-5-09D	MR14-IS04D-4-5-09D
Sample Date	12/04/09	12/04/09	12/04/09	12/04/09	12/04/09
Chemical Name					
Cobalt	0.766 U	0.741 U	0.761 U	NA	NA
Copper	1.28	0.592 U	0.609 U	NA	NA
Cyanide	0.305 U	0.295 U	0.31 U	NA	NA
Iron	370	322	183	NA	NA
Lead	290	1.34	1.8	NA	NA
Magnesium	307 U	296 U	304 U	NA	NA
Manganese	3.29	2.81 J	1.54	NA	NA
Mercury	0.0342 J	0.0333 U	0.041 U	NA	NA
Nickel	0.43 J	0.368 J	0.357 J	NA	NA
Potassium	307 U	296 U	304 U	NA	NA
Selenium	0.307 U	0.296 U	0.304 U	NA	NA
Silver	0.307 U	0.296 U	0.304 U	NA	NA
Sodium	307 U	296 U	304 U	NA	NA
Thallium	0.491 U	0.474 U	0.487 U	NA	NA
Vanadium	1.28	1.2	0.799	NA	NA
Zinc	9.98	1.18 U	3.3	NA	NA

**Notes:**

- Shading indicates detections
- NA - Not analyzed
- J - Analyte present, value may or may not be accurate or precise
- R - Unreliable Result
- U - The material was analyzed for, but not detected
- UU - Analyte not detected, quantitation limit may be inaccurate
- mg/kg - Milligrams per kilogram
- µg/kg - Micrograms per kilogram

Appendix G  
Site UXO-14  
Surface Soil Raw Analytical Results  
November 2009

Station ID	MR14-SS01		MR14-SS02	MR14-SS03	MR14-SS04	MR14-SS05	MR14-SS06	MR14-SS07	MR14-SS08	MR14-SS09	MR14-SS10	MR14-SS11	MR14-SS12	MR14-SS13		MR14-SS14	MR14-SS15	MR14-SS16	MR14-SS17	MR14-SS18	MR14-SS19	MR14-SS20
Sample ID	MR14-SS01-09D	MR14-SS01D-09D	MR14-SS02-09D	MR14-SS03-09D	MR14-SS04-09D	MR14-SS05-09D	MR14-SS06-09D	MR14-SS07-09D	MR14-SS08-09D	MR14-SS09-09D	MR14-SS10-09D	MR14-SS11-09D	MR14-SS12-09D	MR14-SS13-09D	MR14-SS13D-09D	MR14-SS14-09D	MR14-SS15-09D	MR14-SS16-09D	MR14-SS17-09D	MR14-SS18-09D	MR14-SS19-09D	MR14-SS20-09D
Sample Date	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09
Chemical Name																						
<b>Semivolatile Organic Compounds (µg/kg)</b>																						
1,1-Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2,2'-Oxybis(1-chloropropane)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	530 U	500 U	550 U	560 U	580 U	560 U	630 U
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 UJ	530 UJ	500 UJ	550 UJ	560 UJ	580 UJ	560 UJ	630 UJ
2-Chloroacetophenone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2-Chlorobenzalmonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 UJ
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 J	11 J
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	530 U	500 U	550 U	580 U	560 U	540 U	630 U
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 UJ	280 UJ	270 UJ	310 R
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	530 U	500 U	550 U	580 UJ	560 UJ	540 UJ	630 R
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	530 U	500 U	550 U	560 U	580 U	560 U	630 U
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 UJ	270 UJ	250 UJ	270 UJ	280 UJ	290 U	280 U	310 U
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
4-Chlorophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	530 U	500 U	550 U	560 UJ	580 UJ	560 UJ	630 R
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	530 U	500 U	550 U	560 U	580 U	560 U	630 U
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Atrazine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 UJ
Benzaldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 R	270 R	250 R	270 R	280 R	94 J	92 J	110 J
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 UJ	11 U	11 U	12 UJ	12 UJ	12 UJ	12 UJ	3.2 J
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	18	4.7	7.3 J
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	7.2 J	12 U	2.6 J
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	4.4 J	2.3	2.8 J
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
bis(2-Chloroethyl)ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	110 U	110 U	110 U	120 U	120 U	120 U	120 U	130 U
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 UJ	270 U	250 UJ	270 UJ	280 UJ	60 J	270 U	310 U
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 UJ	270 U	250 UJ	270 UJ	280 U	290 U	280 U	310 U
Caprolactam	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 UJ	270 UJ	250 UJ	270 UJ	280 UJ	290 U	280 U	310 U
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 UJ	270 U	250 UJ	270 UJ	280 U	290 U	280 U	310 U
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Diethylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Di-n-octylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 UJ	380 U	360 UJ	390 UJ	400 UJ	420 U	400 U	450 U
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8 J	2.5 J	1.5 J	4 J	6 J	11 J	4.7 J	7.2 J
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 U	4 J
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 U	4.3 J
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	19 U	19 UJ	18 UJ	20 U	20 U	21 U	20 U	22 UJ
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	10 J	12 U	11 J
n-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	57 U	57 U	54 U	59 U	60 U	62 U	60 U	67 U
n-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	760 U	760 U	720 U	780 U	800 U	630 J	800 U	900 U
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11 U	11 U	11 U	12 U	12 U	20	3.3	5.3 J
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	260 U	270 U	250 U	270 U	280 U	290 U	280 U	310 U
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 J	3 J	11 U	12 U	6.3 J	12 J		

Appendix G  
 Site UXO-14  
 Surface Soil Raw Analytical Results  
 November 2009

Station ID	MR14-SS01		MR14-SS02	MR14-SS03	MR14-SS04	MR14-SS05	MR14-SS06	MR14-SS07	MR14-SS08	MR14-SS09	MR14-SS10	MR14-SS11	MR14-SS12	MR14-SS13		MR14-SS14	MR14-SS15	MR14-SS16	MR14-SS17	MR14-SS18	MR14-SS19	MR14-SS20
Sample ID	MR14-SS01-09D	MR14-SS01D-09D	MR14-SS02-09D	MR14-SS03-09D	MR14-SS04-09D	MR14-SS05-09D	MR14-SS06-09D	MR14-SS07-09D	MR14-SS08-09D	MR14-SS09-09D	MR14-SS10-09D	MR14-SS11-09D	MR14-SS12-09D	MR14-SS13-09D	MR14-SS13D-09D	MR14-SS14-09D	MR14-SS15-09D	MR14-SS16-09D	MR14-SS17-09D	MR14-SS18-09D	MR14-SS19-09D	MR14-SS20-09D
Sample Date	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09	11/06/09
Chemical Name																						
Selenium	0.256 U	0.266 U	0.251 U	0.247 U	0.254 U	0.248 U	0.257 U	0.302 U	0.253 U	0.259 U	0.249 U	0.269 U	0.253 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.0563 J	0.266 U	0.11 J	0.0506 J	0.254 U	0.248 U	0.257 U	0.302 U	0.253 U	0.259 U	0.249 U	0.195 J	0.634	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	256 U	266 U	251 U	247 U	254 U	248 U	257 U	302 U	253 U	259 U	249 U	225 J	248 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.41 U	0.426 U	0.401 U	0.395 U	0.406 U	0.397 U	0.411 U	0.483 U	0.405 U	0.414 U	0.398 U	0.431 U	0.795 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	7.66	7.17	7.1	8.74	3.45	1.63	1.09	6.02	3.63	2.52	3.55	5.39	5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	65.3	57.7	43.8	62.1	19.6	15	16.6 J	61.4 J	24.2 J	12.9 J	18.8 J	47.2 J	47.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

- Shading indicates detections
- NA - Not analyzed
- J - Analyte present, value may or may not be accurate or precise
- R - Unreliable Result
- U - The material was analyzed for, but not detected
- UU - Analyte not detected, quantitation limit may be inaccurate
- mg/kg - Milligrams per kilogram
- µg/kg - Micrograms per kilogram

Appendix H  
Human Health Risk Screening Tables

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**TABLE H.1**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Deletion or Selection	
UXO-14	92-52-4	1,1-Biphenyl	ND	ND	MG/KG	MR14-SS17-09D	0/8	0.25 - 0.31	3.1E-01	N/A	2.1E+02 NS	4.3E+01	NCSSL	NO	DLBSL	
	108-60-1	2,2'-Oxybis(1-chloropropane)	ND	ND	MG/KG		0/4	0.25 - 0.28	2.8E-01	N/A	4.6E+00 C	N/A	NCSSL	NO	DLBSL	
	95-95-4	2,4,5-Trichlorophenol	ND	ND	MG/KG		0/8	0.5 - 0.63	6.3E-01	N/A	6.1E+02 N	N/A	NCSSL	NO	DLBSL	
	88-06-2	2,4,6-Trichlorophenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	6.1E+00 C**	N/A	NCSSL	NO	DLBSL	
	120-83-2	2,4-Dichlorophenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.8E+01 N	N/A	NCSSL	NO	DLBSL	
	105-67-9	2,4-Dimethylphenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.2E+02 N	1.4E+00	NCSSL	NO	DLBSL	
	51-28-5	2,4-Dinitrophenol	ND	ND	MG/KG		0/8	0.5 - 0.63	6.3E-01	N/A	1.2E+01 N	N/A	NCSSL	NO	DLBSL	
	532-27-4	2-Chloroacetophenone	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	4.3E+03 N	N/A	NCSSL	NO	DLBSL	
	2698-41-1	2-Chlorobenzalmononitrile	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	N/A	N/A	NCSSL	NO	NTX	
	91-58-7	2-Chloronaphthalene	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.8E+02 NS	N/A	NCSSL	NO	DLBSL	
	95-57-8	2-Chlorophenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.9E+01 N	4.1E-03	NCSSL	NO	DLBSL	
	91-57-6	2-Methylnaphthalene	1.6E-03 J	1.2E-02	MG/KG		4/8	0.011 - 0.013	1.2E-02	N/A	3.1E+01 N	1.6E+00	NCSSL	NO	BSL	
	95-48-7	2-Methylphenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.1E+02 N	N/A	NCSSL	NO	DLBSL	
	88-74-4	2-Nitroaniline	ND	ND	MG/KG		0/8	0.5 - 0.63	6.3E-01	N/A	6.1E+01 N	N/A	NCSSL	NO	DLBSL	
	88-75-5	2-Nitrophenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.9E+01 N	N/A	NCSSL	NO	DLBSL	
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	MG/KG		0/7	0.25 - 0.29	2.9E-01	N/A	1.1E+00 C	N/A	NCSSL	NO	DLBSL	
	99-09-2	3-Nitroaniline	ND	ND	MG/KG		0/7	0.5 - 0.58	5.8E-01	N/A	N/A	N/A	NCSSL	NO	NTX	
	534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	MG/KG		0/8	0.5 - 0.63	6.3E-01	N/A	4.9E-01 N	N/A	NCSSL	YES	DLASL	
	101-55-3	4-Bromophenyl-phenylether	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	N/A	N/A	NCSSL	NO	NTX	
	59-50-7	4-Chloro-3-methylphenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	6.1E+02 N	N/A	NCSSL	NO	DLBSL	
	106-47-8	4-Chloroaniline	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	2.4E+00 C	N/A	NCSSL	NO	DLBSL	
	7005-72-3	4-Chlorophenyl-phenylether	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.1E+01 N	N/A	NCSSL	NO	DLBSL	
	106-44-5	4-Methylphenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.1E+01 N	4.0E-01	NCSSL	NO	DLBSL	
	100-01-6	4-Nitroaniline	ND	ND	MG/KG		0/7	0.5 - 0.58	5.8E-01	N/A	2.4E+01 C*	N/A	NCSSL	NO	DLBSL	
	100-02-7	4-Nitrophenol	ND	ND	MG/KG		0/8	0.5 - 0.63	6.3E-01	N/A	4.8E+00 C*	N/A	NCSSL	NO	DLBSL	
	83-32-9	Acenaphthene	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.4E+02 N	8.4E+00	NCSSL	NO	DLBSL	
	208-96-8	Acenaphthylene	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.4E+02 N	1.1E+01	NCSSL	NO	DLBSL	
	98-86-2	Acetophenone	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	7.8E+02 NS	N/A	NCSSL	NO	DLBSL	
	120-12-7	Anthracene	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.7E+03 N	6.6E+02	NCSSL	NO	DLBSL	
	1912-24-9	Atrazine	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	2.1E+00 C	2.5E-02	NCSSL	NO	DLBSL	
	100-52-7	Benzaldehyde	9.2E-02 J	1.1E-01 J	MG/KG		MR14-SS20-09D	3/3	0.28 - 0.31	1.1E-01	N/A	7.8E+02 NS	N/A	NCSSL	NO	BSL
	56-55-3	Benzo(a)anthracene	2.8E-03 J	3.2E-03 J	MG/KG		MR14-SS20-09D	2/8	0.011 - 0.013	3.2E-03	N/A	1.5E-01 C	1.8E-01	NCSSL	NO	BSL
	50-32-8	Benzo(a)pyrene	ND	ND	MG/KG		MR14-SS17-09D	0/8	0.011 - 0.013	1.3E-02	N/A	1.5E-02 C	5.9E-02	NCSSL	NO	DLBSL
205-99-2	Benzo(b)fluoranthene	4.7E-03	1.8E-02	MG/KG	MR14-SS17-09D	3/8	0.011 - 0.013	1.8E-02	N/A	1.5E-01 C	6.0E-01	NCSSL	NO	BSL		

**TABLE H.1**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Deletion or Selection
	191-24-2	Benzo(g,h,i)perylene	2.6E-03 J	7.2E-03 J	MG/KG	MR14-SS17-09D	2/8	0.011 - 0.013	7.2E-03	N/A	1.7E+02 N	3.6E+02	NCSSL	NO	BSL
	207-08-9	Benzo(k)fluoranthene	2.3E-03	4.4E-03 J	MG/KG	MR14-SS17-09D	3/8	0.011 - 0.013	4.4E-03	N/A	1.5E+00 C	5.9E+00	NCSSL	NO	BSL
	111-91-1	bis(2-Chloroethoxy)methane	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.8E+01 N	N/A	NCSSL	NO	DLBSL
	111-44-4	bis(2-Chloroethyl)ether	ND	ND	MG/KG		0/8	0.11 - 0.13	1.3E-01	N/A	2.1E-01 C	1.4E-04	NCSSL	NO	DLBSL
	117-81-7	bis(2-Ethylhexyl)phthalate	6.0E-02 J	6.0E-02 J	MG/KG	MR14-SS17-09D	1/8	0.25 - 0.31	6.0E-02	N/A	3.5E+01 C*	7.2E+00	NCSSL	NO	BSL
	85-68-7	Butylbenzylphthalate	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	2.6E+02 C*	1.5E+02	NCSSL	NO	DLBSL
	105-60-2	Caprolactam	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	3.1E+03 N	1.8E+01	NCSSL	NO	DLBSL
	86-74-8	Carbazole	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	N/A	N/A	NCSSL	NO	NTX
	218-01-9	Chrysene	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.5E+01 C	1.8E+01	NCSSL	NO	DLBSL
	53-70-3	Dibenz(a,h)anthracene	ND	ND	MG/KG		0/8	0.011 - 0.013	1.3E-02	N/A	1.5E-02 C	1.9E-01	NCSSL	NO	DLBSL
	132-64-9	Dibenzofuran	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	7.8E+00 N	4.7E+00	NCSSL	NO	DLBSL
	84-66-2	Diethylphthalate	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	4.9E+03 N	3.7E+01	NCSSL	NO	DLBSL
	131-11-3	Dimethyl phthalate	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	N/A	N/A	NCSSL	NO	NTX
	84-74-2	Di-n-butylphthalate	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	6.1E+02 N	1.9E+01	NCSSL	NO	DLBSL
	117-84-0	Di-n-octylphthalate	ND	ND	MG/KG		0/8	0.36 - 0.45	4.5E-01	N/A	3.5E+01 C*	3.8E+01	NCSSL	NO	DLBSL
	206-44-0	Fluoranthene	1.5E-03 J	1.1E-02 J	MG/KG	MR14-SS17-09D	8/8	0.011 - 0.013	1.1E-02	N/A	2.3E+02 N	3.3E+02	NCSSL	NO	BSL
	86-73-7	Fluorene	4.0E-03 J	4.0E-03 J	MG/KG	MR14-SS20-09D	1/8	0.011 - 0.013	4.0E-03	N/A	2.3E+02 N	5.6E+01	NCSSL	NO	BSL
	118-74-1	Hexachlorobenzene	ND	ND	MG/KG		0/8	0.011 - 0.013	1.3E-02	N/A	3.0E-01 C	2.6E-03	NCSSL	NO	DLBSL
	87-68-3	Hexachlorobutadiene	4.3E-03 J	4.3E-03 J	MG/KG	MR14-SS20-09D	1/8	0.011 - 0.013	4.3E-03	N/A	6.1E+00 C**	8.7E-03	NCSSL	NO	BSL
	77-47-4	Hexachlorocyclopentadiene	ND	ND	MG/KG		0/8	0.018 - 0.022	2.2E-02	N/A	3.7E+01 N	N/A	NCSSL	NO	DLBSL
	67-72-1	Hexachloroethane	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	6.1E+00 C**	N/A	NCSSL	NO	DLBSL
	193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	MG/KG		0/8	0.011 - 0.013	1.3E-02	N/A	1.5E-01 C	2.0E+00	NCSSL	NO	DLBSL
	78-59-1	Isophorone	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	5.1E+02 C*	2.0E-01	NCSSL	NO	DLBSL
	91-20-3	Naphthalene	1.0E-02 J	1.1E-02 J	MG/KG	MR14-SS20-09D	2/8	0.011 - 0.013	1.1E-02	N/A	3.6E+00 C*	2.1E-01	NCSSL	NO	BSL
	621-64-7	n-Nitroso-di-n-propylamine	ND	ND	MG/KG		0/8	0.054 - 0.067	6.7E-02	N/A	6.9E-02 C	N/A	NCSSL	NO	DLBSL
	86-30-6	n-Nitrosodiphenylamine	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	9.9E+01 C	N/A	NCSSL	NO	DLBSL
	87-86-5	Pentachlorophenol	6.3E-01 J	6.3E-01 J	MG/KG	MR14-SS17-09D	1/8	0.72 - 0.9	6.3E-01	N/A	8.9E-01 C	3.1E-02	NCSSL	NO	BSL
	85-01-8	Phenanthrene	3.3E-03	2.0E-02	MG/KG	MR14-SS17-09D	4/8	0.011 - 0.013	2.0E-02	N/A	1.7E+03 N	5.7E+01	NCSSL	NO	BSL
	108-95-2	Phenol	ND	ND	MG/KG		0/8	0.25 - 0.31	3.1E-01	N/A	1.8E+03 N	2.3E-01	NCSSL	NO	DLBSL
	129-00-0	Pyrene	3.0E-03 J	1.2E-02 J	MG/KG	MR14-SS17-09D	6/8	0.011 - 0.013	1.2E-02	N/A	1.7E+02 N	2.2E+02	NCSSL	NO	BSL
	7429-90-5	Aluminum	5.5E+02	1.8E+03	MG/KG	MR14-SS01D-09D	12/12	9.88 - 12.1	1.8E+03	5.5E+03	7.7E+03 N	N/A	NCSSL	NO	BSL
	<b>7440-36-0</b>	<b>Antimony</b>	<b>3.5E-01 J</b>	<b>3.9E+02</b>	<b>MG/KG</b>	<b>MR14-SS12-09D</b>	<b>8/12</b>	<b>0.741 - 0.905</b>	<b>3.9E+02</b>	<b>4.5E-01</b>	<b>3.1E+00 N</b>	<b>N/A</b>		<b>YES</b>	<b>ASL</b>
	<b>7440-38-2</b>	<b>Arsenic</b>	<b>2.0E-01 J</b>	<b>2.7E+00</b>	<b>MG/KG</b>	<b>MR14-SS12-09D</b>	<b>11/12</b>	<b>0.247 - 0.302</b>	<b>2.7E+00</b>	<b>6.3E-01</b>	<b>3.9E-01 C*</b>	<b>5.8E+00</b>	<b>NCSSL</b>	<b>YES</b>	<b>ASL</b>
	7440-39-3	Barium	2.2E+00	1.3E+01	MG/KG	MR14-SS01-09D	12/12	1.98 - 2.41	1.3E+01	1.5E+01	1.5E+03 N	5.8E+02	NCSSL	NO	BSL

**TABLE H.1**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Current/Future  
 Medium: Surface Soil  
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-41-7	Beryllium	5.0E-02 J	5.0E-02 J	MG/KG	MR14-SS12-09D	1/12	0.247 - 0.302	5.0E-02	1.0E-01	1.6E+01 N	N/A		NO	BSL
	7440-43-9	Cadmium	ND	ND	MG/KG		0/12	0.247 - 0.302	3.0E-01	3.3E-02	7.0E+00 N	3.0E+00	NCSSL	NO	DLBSL
	7440-70-2	Calcium	5.3E+01 J	5.0E+03	MG/KG	MR14-SS11-09D	11/12	247 - 302	5.0E+03	6.4E+03	N/A	N/A		NO	NUT
	7440-47-3	Chromium	8.8E-01	3.8E+00	MG/KG	MR14-SS01-09D	12/12	0.247 - 0.302	3.8E+00	6.1E+00	2.9E-01 C	3.8E+00	NCSSL	NO	BBK
	7440-48-4	Cobalt	2.7E-01 J	5.9E-01 J	MG/KG	MR14-SS03-09D	4/12	0.617 - 0.754	5.9E-01	2.9E-01	2.3E+00 N	N/A		NO	BSL
	7440-50-8	Copper	9.6E-01	1.3E+01	MG/KG	MR14-SS01D-09D	12/12	0.494 - 0.603	1.3E+01	4.8E+00	3.1E+02 N	7.0E+02	NCSSL	NO	BSL
	57-12-5	Cyanide	ND	ND	MG/KG		0/12	0.256 - 0.3	3.0E-01	N/A	1.6E+02 N	2.8E-01	NCSSL	NO	DLBSL
	7439-89-6	Iron	2.4E+02	1.5E+03	MG/KG	MR14-SS01-09D	12/12	4.94 - 6.03	1.5E+03	3.2E+03	5.5E+03 N	1.5E+02	NCSSL	NO	BSL
	<b>7439-92-1</b>	<b>Lead</b>	<b>7.4E+01</b>	<b>3.6E+04</b>	<b>MG/KG</b>	<b>MR14-SS12-09D</b>	<b>12/12</b>	<b>0.149 - 37.3</b>	<b>3.6E+04</b>	<b>1.2E+01</b>	<b>4.0E+02 NL</b>	<b>2.7E+02</b>	<b>NCSSL</b>	<b>YES</b>	<b>ASL</b>
	7439-95-4	Magnesium	5.9E+01 J	1.4E+02 J	MG/KG	MR14-SS11-09D	5/12	247 - 302	1.4E+02	2.4E+02	N/A	N/A		NO	NUT
	7439-96-5	Manganese	3.7E+00	2.1E+01	MG/KG	MR14-SS01-09D	12/12	0.741 - 0.905	2.1E+01	1.4E+01	1.8E+02 N	6.5E+01	NCSSL	NO	BSL
	7439-97-6	Mercury	1.4E-02 J	1.1E+00	MG/KG	MR14-SS02-09D	8/12	0.033 - 0.0394	1.1E+00	8.1E-02	2.4E+00 N	1.0E+00	NCSSL	NO	BSL
	7440-02-0	Nickel	4.0E-01 J	2.0E+00	MG/KG	MR14-SS12-09D	12/12	0.494 - 0.603	2.0E+00	1.2E+00	1.5E+02 N	1.3E+02	NCSSL	NO	BSL
	7440-09-7	Potassium	8.2E+01 J	8.3E+01 J	MG/KG	MR14-SS11-09D	2/12	247 - 302	8.3E+01	1.2E+02	N/A	N/A		NO	NUT
	7782-49-2	Selenium	ND	ND	MG/KG		0/12	0.247 - 0.302	3.0E-01	5.6E-01	3.9E+01 N	2.1E+00	NCSSL	NO	DLBSL
	7440-22-4	Silver	5.1E-02 J	6.3E-01	MG/KG	MR14-SS12-09D	5/12	0.247 - 0.302	6.3E-01	1.4E-01	3.9E+01 N	3.4E+00	NCSSL	NO	BSL
	7440-23-5	Sodium	2.3E+02 J	2.3E+02 J	MG/KG	MR14-SS11-09D	1/12	247 - 302	2.3E+02	8.1E+01	N/A	N/A		NO	NUT
	7440-28-0	Thallium	ND	ND	MG/KG		0/12	0.395 - 0.795	8.0E-01	3.6E-01	N/A	N/A		NO	NTX
	7440-62-2	Vanadium	1.1E+00	8.7E+00	MG/KG	MR14-SS03-09D	12/12	0.617 - 0.754	8.7E+00	8.9E+00	3.9E+01 N	N/A		NO	BSL
	7440-66-6	Zinc	1.3E+01 J	6.5E+01	MG/KG	MR14-SS01-09D	12/12	0.988 - 1.21	6.5E+01	1.1E+01	2.4E+03 N	1.2E+03	NCSSL	NO	BSL

[1] Minimum/Maximum detected concentrations. Samples collected from former indoor pistol range analyzed for metals, samples collected from former gas chamber area analyzed for SVOCs.

[2] Maximum concentration is used for screening. If chemical was not detected, the maximum detection limit is used for screening.

[3] Background values are two times the arithmetic mean base-wide background surface soil concentrations. Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.

[4] Oak Ridge National Laboratory (ORNL). December 10, 2009. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) residential soil RSLs.  
 RSL value for methoxychlor used as surrogate for 4-chlorophenyl-phenylether.  
 RSL value for nitrobenzene used as surrogate for 4-nitrophenol.  
 RSL value for acenaphthene used as surrogate for acenaphthylene.  
 RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.  
 RSL value for anthracene used as surrogate for phenanthrene.  
 RSL value for 2-chlorophenol used as surrogate for 2-nitrophenol.  
 RSL value for chromium VI used for total chromium.

COPC = Chemical of Potential Concern  
 ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered  
 NCSSL = North Carolina Soil Screening Levels (NCDENR, 2010)  
 J = Estimated Value  
 C = Carcinogenic  
 C\* = N screening level < 100x C screening level, therefore N screening value/10 used as screening level  
 C\*\* = N screening level < 10x C screening level, therefore N screening value/10 used as screening level  
 N = Noncarcinogenic  
 N/A = Not available  
 ND = Non-detect  
 NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.  
 NS = RSL exceeds Csat, soil saturation concentration. Therefore, Csat

**TABLE H.1**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
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Manganese (water) used as surrogate for manganese.

used as screening level

Bis(2-ethylhexyl)phthalate used as surrogate for Di-n-octylphthalate.

[5] Rationale Codes

- Selection Reason: Above Screening Levels (ASL)
- Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA
- Deletion Reason: No Toxicity Information (NTX)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- Below Background (BBK)
- Detection Limit Below Screening Level (DLBSL)

**TABLE H.2**

Risk Ratio Screening for Surface Soil, Maximum Detected Concentration  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index <sup>a</sup>	Corresponding Cancer Risk <sup>b</sup>	Target Organ
<b>Metals<sup>c</sup> (mg/kg)</b>								
<b>Antimony</b>	8 / 12	3.9E+02	MR14-SS12-09D	3.1E+01	1	12.5	NA	Blood
Arsenic	11 / 12	2.7E+00	MR14-SS12-09D	3.9E-01	1E-06	NA	7E-06	NA
<b>Lead</b>	12 / 12	3.6E+04	MR14-SS12-09D	NA	NA	NA	NA	NA
<b>Cumulative Corresponding Hazard Index<sup>d</sup></b>						12.5		
<b>Cumulative Corresponding Cancer Risk<sup>e</sup></b>							7E-06	
Total Blood HI =								12.5

**Notes:**

- a Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.
- b Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.
- c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.
- d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.
- e Samples analyzed for metals collected from the former indoor pistol range, samples collected from former gas chamber were not analyzed for metals.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

HI = Hazard Index

mg/kg = micrograms per kilogram

NA = Not available/not applicable.

**TABLE H.3**

Risk Ratio Screening for Surface Soil, 95% UCL Concentration

Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL	95% UCL Rationale	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index <sup>a</sup>	Corresponding Cancer Risk <sup>b</sup>	Target Organ
<b>Metals<sup>c</sup> (mg/kg)</b>								
<b>Antimony</b>	8 / 12	1.0E+02	1, 3 95% KM-b	3.1E+01	1	3.4	NA	Blood
<b>Lead</b>	12 / 12	4.6E+03	6 Mean	NA	NA	NA	NA	NA
<b>Cumulative Corresponding Hazard Index<sup>c</sup></b>						3.4		
<b>Cumulative Corresponding Cancer Risk<sup>d</sup></b>							0E+00	
							Total Blood HI =	3.4

**Notes:**<sup>a</sup> Corresponding Hazard Index equals 95% UCL concentration divided by the RSL divided by the acceptable risk level<sup>b</sup> Corresponding Cancer Risk equals 95% UCL concentration divided by the RSL divided by the acceptable risk level<sup>c</sup> Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent<sup>d</sup> Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent<sup>e</sup> Samples analyzed for metals collected from the former indoor pistol range, samples collected from former gas chamber were not analyzed for metals

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

mg/kg = micrograms per kilogram

HI = Hazard Index

NA = Not available/not applicable

ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA, February 2009, ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: 95% Kaplan-Meier (BCA) UCL (95% KM-b)

Upper Confidence Limit (UCL) Rationale:

- (1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
- (2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
- (3) Test indicates data are gamma distributed.
- (4) Distribution tests are inconclusive
- (5) Max value used because 95% UCL greater than max.
- (6) Lead evaluated using arithmetic mean concentration in lead models, therefore, arithmetic mean concentration presented here.

**TABLE H.4**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
UXO-14	92-52-4	1,1-Biphenyl	ND	ND	MG/KG	MR14-SS17-09D	0/12	0.25 - 0.31	3.1E-01	N/A	2.1E+02 NS	4.3E+01	NCSSL	NO	DLBSL
	108-60-1	2,2'-Oxybis(1-chloropropane)	ND	ND	MG/KG		0/8	0.25 - 0.3	3.0E-01	N/A	4.6E+00 C	N/A		NO	DLBSL
	95-95-4	2,4,5-Trichlorophenol	ND	ND	MG/KG		0/12	0.5 - 0.63	6.3E-01	N/A	6.1E+02 N	N/A		NO	DLBSL
	88-06-2	2,4,6-Trichlorophenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	6.1E+00 C**	N/A		NO	DLBSL
	120-83-2	2,4-Dichlorophenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.8E+01 N	N/A		NO	DLBSL
	105-67-9	2,4-Dimethylphenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.2E+02 N	1.4E+00	NCSSL	NO	DLBSL
	51-28-5	2,4-Dinitrophenol	ND	ND	MG/KG		0/12	0.5 - 0.63	6.3E-01	N/A	1.2E+01 N	N/A		NO	DLBSL
	121-14-2	2,4-Dinitrotoluene	ND	ND	MG/KG		0/4	0.28 - 0.3	3.0E-01	N/A	1.6E+00 C*	N/A		NO	DLBSL
	606-20-2	2,6-Dinitrotoluene	ND	ND	MG/KG		0/4	0.28 - 0.3	3.0E-01	N/A	6.1E+00 N	N/A		NO	DLBSL
	532-27-4	2-Chloroacetophenone	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	4.3E+03 N	N/A		NO	DLBSL
	2698-41-1	2-Chlorobenzalmononitrile	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	N/A	N/A		NO	NTX
	91-58-7	2-Chloronaphthalene	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.8E+02 NS	N/A		NO	DLBSL
	95-57-8	2-Chlorophenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.9E+01 N	4.1E-03	NCSSL	NO	DLBSL
	91-57-6	2-Methylnaphthalene	1.6E-03 J	1.2E-02	MG/KG		4/12	0.011 - 0.013	1.2E-02	N/A	3.1E+01 N	1.6E+00	NCSSL	NO	BSL
	95-48-7	2-Methylphenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.1E+02 N	N/A		NO	DLBSL
	88-74-4	2-Nitroaniline	ND	ND	MG/KG		0/12	0.5 - 0.63	6.3E-01	N/A	6.1E+01 N	N/A		NO	DLBSL
	88-75-5	2-Nitrophenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.9E+01 N	N/A		NO	DLBSL
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	MG/KG		0/11	0.25 - 0.3	3.0E-01	N/A	1.1E+00 C	N/A		NO	DLBSL
	99-09-2	3-Nitroaniline	ND	ND	MG/KG		0/11	0.5 - 0.6	6.0E-01	N/A	N/A	N/A		NO	NTX
	534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	MG/KG		0/12	0.5 - 0.63	6.3E-01	N/A	6.1E-01 N	N/A		YES	DLASL
	101-55-3	4-Bromophenyl-phenylether	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	N/A	N/A		NO	NTX
	59-50-7	4-Chloro-3-methylphenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	6.1E+02 N	N/A		NO	DLBSL
	106-47-8	4-Chloroaniline	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	2.4E+00 C	N/A		NO	DLBSL
	7005-72-3	4-Chlorophenyl-phenylether	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.1E+01 N	N/A		NO	DLBSL
	106-44-5	4-Methylphenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.1E+01 N	4.0E-01	NCSSL	NO	DLBSL
	100-01-6	4-Nitroaniline	ND	ND	MG/KG		0/11	0.5 - 0.6	6.0E-01	N/A	2.4E+01 C*	N/A		NO	DLBSL
	100-02-7	4-Nitrophenol	ND	ND	MG/KG		0/12	0.5 - 0.63	6.3E-01	N/A	4.8E+00 C*	N/A		NO	DLBSL
	83-32-9	Acenaphthene	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.4E+02 N	8.4E+00	NCSSL	NO	DLBSL
	208-96-8	Acenaphthylene	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.4E+02 N	1.1E+01	NCSSL	NO	DLBSL
	98-86-2	Acetophenone	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	7.8E+02 NS	N/A		NO	DLBSL
	120-12-7	Anthracene	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.7E+03 N	6.6E+02	NCSSL	NO	DLBSL
	1912-24-9	Atrazine	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	2.1E+00 C	2.5E-02	NCSSL	NO	DLBSL
	100-52-7	Benzaldehyde	9.2E-02 J	5.4E-01 J	MG/KG		MR14-IS04-4-5-09D	4/7	0.28 - 0.31	5.4E-01	N/A	7.8E+02 NS	N/A		NO

**TABLE H.4**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	56-55-3	Benzo(a)anthracene	2.8E-03 J	3.2E-03 J	MG/KG	MR14-SS20-09D	2/12	0.011 - 0.013	3.2E-03	N/A	1.5E-01 C	1.8E-01	NCSSL	NO	BSL
	50-32-8	Benzo(a)pyrene	ND	ND	MG/KG		0/12	0.011 - 0.013	1.3E-02	N/A	1.5E-02 C	5.9E-02	NCSSL	NO	DLBSL
	205-99-2	Benzo(b)fluoranthene	4.7E-03	1.8E-02	MG/KG	MR14-SS17-09D	3/12	0.011 - 0.013	1.8E-02	N/A	1.5E-01 C	6.0E-01	NCSSL	NO	BSL
	191-24-2	Benzo(g,h,i)perylene	2.6E-03 J	7.2E-03 J	MG/KG	MR14-SS17-09D	2/12	0.011 - 0.013	7.2E-03	N/A	1.7E+02 N	3.6E+02	NCSSL	NO	BSL
	207-08-9	Benzo(k)fluoranthene	2.3E-03	4.4E-03 J	MG/KG	MR14-SS17-09D	3/12	0.011 - 0.013	4.4E-03	N/A	1.5E+00 C	5.9E+00	NCSSL	NO	BSL
	111-91-1	bis(2-Chloroethoxy)methane	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.8E+01 N	N/A		NO	DLBSL
	111-44-4	bis(2-Chloroethyl)ether	ND	ND	MG/KG		0/12	0.11 - 0.13	1.3E-01	N/A	2.1E-01 C	1.4E-04	NCSSL	NO	DLBSL
	117-81-7	bis(2-Ethylhexyl)phthalate	6.0E-02 J	6.0E-02 J	MG/KG	MR14-SS17-09D	1/12	0.25 - 0.31	6.0E-02	N/A	3.5E+01 C*	7.2E+00	NCSSL	NO	BSL
	85-68-7	Butylbenzylphthalate	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	2.6E+02 C*	1.5E+02	NCSSL	NO	DLBSL
	105-60-2	Caprolactam	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	3.1E+03 N	1.8E+01	NCSSL	NO	DLBSL
	86-74-8	Carbazole	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	N/A	N/A		NO	NTX
	218-01-9	Chrysene	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.5E+01 C	1.8E+01	NCSSL	NO	DLBSL
	53-70-3	Dibenz(a,h)anthracene	ND	ND	MG/KG		0/12	0.011 - 0.013	1.3E-02	N/A	1.5E-02 C	1.9E-01	NCSSL	NO	DLBSL
	132-64-9	Dibenzofuran	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	7.8E+00 N	4.7E+00	NCSSL	NO	DLBSL
	84-66-2	Diethylphthalate	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	4.9E+03 N	3.7E+01	NCSSL	NO	DLBSL
	131-11-3	Dimethyl phthalate	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	N/A	N/A		NO	NTX
	84-74-2	Di-n-butylphthalate	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	6.1E+02 N	1.9E+01	NCSSL	NO	DLBSL
	117-84-0	Di-n-octylphthalate	ND	ND	MG/KG		0/12	0.36 - 0.45	4.5E-01	N/A	3.5E+01 C*	3.8E+01	NCSSL	NO	DLBSL
	206-44-0	Fluoranthene	1.5E-03 J	1.1E-02 J	MG/KG	MR14-SS17-09D	8/12	0.011 - 0.013	1.1E-02	N/A	2.3E+02 N	3.3E+02	NCSSL	NO	BSL
	86-73-7	Fluorene	4.0E-03 J	4.0E-03 J	MG/KG	MR14-SS20-09D	1/12	0.011 - 0.013	4.0E-03	N/A	2.3E+02 N	5.6E+01	NCSSL	NO	BSL
	118-74-1	Hexachlorobenzene	ND	ND	MG/KG		0/12	0.011 - 0.013	1.3E-02	N/A	3.0E-01 C	2.6E-03	NCSSL	NO	DLBSL
	87-68-3	Hexachlorobutadiene	4.3E-03 J	4.3E-03 J	MG/KG	MR14-SS20-09D	1/12	0.011 - 0.013	4.3E-03	N/A	6.1E+00 C**	8.7E-03	NCSSL	NO	BSL
	77-47-4	Hexachlorocyclopentadiene	ND	ND	MG/KG		0/12	0.018 - 0.022	2.2E-02	N/A	3.7E+01 N	N/A		NO	DLBSL
	67-72-1	Hexachloroethane	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	6.1E+00 C**	N/A		NO	DLBSL
	193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	MG/KG		0/12	0.011 - 0.013	1.3E-02	N/A	1.5E-01 C	2.0E+00	NCSSL	NO	DLBSL
	78-59-1	Isophorone	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	5.1E+02 C*	2.0E-01	NCSSL	NO	DLBSL
	91-20-3	Naphthalene	1.8E-03 J	1.1E-02 J	MG/KG	MR14-SS20-09D	3/12	0.011 - 0.013	1.1E-02	N/A	3.6E+00 C*	2.1E-01	NCSSL	NO	BSL
	621-64-7	n-Nitroso-di-n-propylamine	ND	ND	MG/KG		0/12	0.054 - 0.067	6.7E-02	N/A	6.9E-02 C	N/A		NO	DLBSL
	86-30-6	n-Nitrosodiphenylamine	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	9.9E+01 C	N/A		NO	DLBSL
	98-95-3	Nitrobenzene	ND	ND	MG/KG		0/4	0.28 - 0.3	3.0E-01	N/A	4.8E+00 C*	N/A		NO	DLBSL
	87-86-5	Pentachlorophenol	6.3E-01 J	6.3E-01 J	MG/KG	MR14-SS17-09D	1/12	0.72 - 0.9	6.3E-01	N/A	3.0E+00 C	3.1E-02	NCSSL	NO	BSL
	85-01-8	Phenanthrene	3.3E-03	2.0E-02	MG/KG	MR14-SS17-09D	4/12	0.011 - 0.013	2.0E-02	N/A	1.7E+03 N	5.7E+01	NCSSL	NO	BSL
	108-95-2	Phenol	ND	ND	MG/KG		0/12	0.25 - 0.31	3.1E-01	N/A	1.8E+03 N	2.3E-01	NCSSL	NO	DLBSL
	129-00-0	Pyrene	3.0E-03 J	1.2E-02 J	MG/KG	MR14-SS17-09D	6/12	0.011 - 0.013	1.2E-02	N/A	1.7E+02 N	2.2E+02	NCSSL	NO	BSL

**TABLE H.4**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7429-90-5	Aluminum	5.5E+02	1.8E+03	MG/KG	MR14-SS01D-09D	15/15	9.88 - 12.3	1.8E+03	5.5E+03	7.7E+03 N	N/A		NO	BSL
	<b>7440-36-0</b>	<b>Antimony</b>	<b>3.5E-01 J</b>	<b>3.9E+02</b>	<b>MG/KG</b>	<b>MR14-SS12-09D</b>	<b>9/15</b>	<b>0.741 - 0.92</b>	<b>3.9E+02</b>	<b>3.6E-01</b>	<b>3.1E+00 N</b>	<b>N/A</b>		<b>YES</b>	<b>ASL</b>
	<b>7440-38-2</b>	<b>Arsenic</b>	<b>2.0E-01 J</b>	<b>2.7E+00</b>	<b>MG/KG</b>	<b>MR14-SS12-09D</b>	<b>13/15</b>	<b>0.247 - 0.307</b>	<b>2.7E+00</b>	<b>6.3E-01</b>	<b>3.9E-01 C*</b>	<b>5.8E+00</b>	<b>NCSSL</b>	<b>YES</b>	<b>ASL</b>
	7440-39-3	Barium	1.4E+00 J	1.3E+01	MG/KG	MR14-SS01-09D	15/15	1.98 - 2.45	1.3E+01	1.5E+01	1.5E+03 N	5.8E+02	NCSSL	NO	BSL
	7440-41-7	Beryllium	5.0E-02 J	5.0E-02 J	MG/KG	MR14-SS12-09D	1/15	0.247 - 0.307	5.0E-02	1.0E-01	1.6E+01 N	N/A		NO	BSL
	7440-43-9	Cadmium	ND	ND	MG/KG		0/15	0.247 - 0.307	3.1E-01	2.3E-02	7.0E+00 N	3.0E+00	NCSSL	NO	DLBSL
	7440-70-2	Calcium	5.3E+01 J	5.0E+03	MG/KG	MR14-SS11-09D	11/15	247 - 307	5.0E+03	4.4E+02	N/A	N/A		NO	NUT
	7440-47-3	Chromium	7.4E-01	3.8E+00	MG/KG	MR14-SS01-09D	15/15	0.247 - 0.307	3.8E+00	6.1E+00	2.9E-01 C	3.8E+00	NCSSL	NO	BBK
	7440-48-4	Cobalt	2.7E-01 J	5.9E-01 J	MG/KG	MR14-SS03-09D	4/15	0.617 - 0.766	5.9E-01	2.9E-01	2.3E+00 N	N/A		NO	BSL
	7440-50-8	Copper	9.6E-01	1.3E+01	MG/KG	MR14-SS01D-09D	13/15	0.494 - 0.613	1.3E+01	2.6E+00	3.1E+02 N	7.0E+02	NCSSL	NO	BSL
	57-12-5	Cyanide	ND	ND	MG/KG		0/15	0.256 - 0.31	3.1E-01	N/A	1.6E+02 N	2.8E-01	NCSSL	NO	DLBSL
	7439-89-6	Iron	1.8E+02	1.5E+03	MG/KG	MR14-SS01-09D	15/15	4.94 - 6.13	1.5E+03	3.2E+03	5.5E+03 N	1.5E+02	NCSSL	NO	BSL
	<b>7439-92-1</b>	<b>Lead</b>	<b>1.3E+00</b>	<b>3.6E+04</b>	<b>MG/KG</b>	<b>MR14-SS12-09D</b>	<b>15/15</b>	<b>0.149 - 37.3</b>	<b>3.6E+04</b>	<b>8.5E+00</b>	<b>4.0E+02 NL</b>	<b>2.7E+02</b>	<b>NCSSL</b>	<b>YES</b>	<b>ASL</b>
	7439-95-4	Magnesium	5.9E+01 J	1.4E+02 J	MG/KG	MR14-SS11-09D	5/15	247 - 307	1.4E+02	2.4E+02	N/A	N/A		NO	NUT
	7439-96-5	Manganese	1.5E+00	2.1E+01	MG/KG	MR14-SS01-09D	15/15	0.741 - 0.92	2.1E+01	9.3E+00	1.8E+02 N	6.5E+01	NCSSL	NO	BSL
	7439-97-6	Mercury	1.4E-02 J	1.1E+00	MG/KG	MR14-SS02-09D	9/15	0.033 - 0.041	1.1E+00	7.1E-02	2.4E+00 N	1.0E+00	NCSSL	NO	BSL
	7440-02-0	Nickel	3.6E-01 J	2.0E+00	MG/KG	MR14-SS12-09D	15/15	0.494 - 0.613	2.0E+00	1.2E+00	1.5E+02 N	1.3E+02	NCSSL	NO	BSL
	7440-09-7	Potassium	8.2E+01 J	8.3E+01 J	MG/KG	MR14-SS11-09D	2/15	247 - 307	8.3E+01	1.2E+02	N/A	N/A		NO	NUT
	7782-49-2	Selenium	ND	ND	MG/KG		0/15	0.247 - 0.307	3.1E-01	5.1E-01	3.9E+01 N	2.1E+00	NCSSL	NO	DLBSL
	7440-22-4	Silver	5.1E-02 J	6.3E-01	MG/KG	MR14-SS12-09D	5/15	0.247 - 0.307	6.3E-01	1.3E-01	3.9E+01 N	3.4E+00	NCSSL	NO	BSL
	7440-23-5	Sodium	2.3E+02 J	2.3E+02 J	MG/KG	MR14-SS11-09D	1/15	247 - 307	2.3E+02	6.8E+01	N/A	N/A		NO	NUT
	7440-28-0	Thallium	ND	ND	MG/KG		0/15	0.395 - 0.795	8.0E-01	3.6E-01	N/A	N/A		NO	NTX
	7440-62-2	Vanadium	8.0E-01	8.7E+00	MG/KG	MR14-SS03-09D	15/15	0.617 - 0.766	8.7E+00	8.9E+00	3.9E+01 N	N/A		NO	BSL
	7440-66-6	Zinc	3.3E+00	6.5E+01	MG/KG	MR14-SS01-09D	14/15	0.988 - 1.23	6.5E+01	6.6E+00	2.4E+03 N	1.2E+03	NCSSL	NO	BSL

**TABLE H.4**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future  
 Medium: Surface and Subsurface Soil  
 Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
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- [1] Minimum/Maximum detected concentrations. Samples collected from former indoor pistol range analyzed for metals, samples collected from former gas chamber area analyzed for SVOCs.
- [2] Maximum concentration is used for screening. If chemical was not detected, the maximum detection limit is used for screening.
- [3] Background values are lower of two times the arithmetic mean basewide background surface soil or subsurface soil concentrations. Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.
- [4] Oak Ridge National Laboratory (ORNL). November, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. <http://www.epa.gov/reg3hwmd/risk/>  $C^* = N$  screening level < 100x C screening level, therefore  $N$  screening value/10 used as screening level  
[http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/index.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm)  
 Residential soil RSLs. RSLs based on noncarcinogenic effects divided by 10 to account for exposure to more than on constituent that effects the same target organ.  $C^{**} = N$  screening level < 10x C screening level, therefore  $N$  screening value/10 used as screening level  
 RSL value for methoxychlor used as surrogate for 4-chlorophenyl-phenylether.  
 RSL value for nitrobenzene used as surrogate for 4-nitrophenol.  
 RSL value for acenaphthene used as surrogate for acenaphthylene.  
 RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.  
 RSL value for anthracene used as surrogate for phenanthrene.  
 RSL value for 2-chlorophenol used as surrogate for 2-nitrophenol.  
 RSL value for chromium VI used for total chromium.  
 Manganese (water) used as surrogate for manganese.  
 Bis(2-ethylhexyl)phthalate used as surrogate for Di-n-octylphthalate.
- [5] Rationale Codes
- |                   |   |
|-------------------|---|
| Selection Reason: | Above Screening Levels (ASL)<br>Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA<br>Was detected, and other carcinogenic PAHs that were detected were identified as COPCs (cPAH) |
| Deletion Reason:  | No Toxicity Information (NTX)<br>Essential Nutrient (NUT)<br>Below Screening Level (BSL)<br>Below Background (BBK)<br>Detection Limit Below Screening Level (DLBSL)   |

COPC = Chemical of Potential Concern  
 ARAR/TBC = Applicable or Relevant and Appropriate Requirement/  
 To Be Considered  
 NCSSL = North Carolina Soil Screening Levels (NCDENR, 2010)  
 J = Estimated Value  
 C = Carcinogenic  
 $C^* = N$  screening level < 100x C screening level, therefore  
 $N$  screening value/10 used as screening level  
 $C^{**} = N$  screening level < 10x C screening level, therefore  
 $N$  screening value/10 used as screening level  
 N = Noncarcinogenic  
 N/A = Not available  
 ND = Non-detect  
 NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.  
 NS = RSL exceeds Csat, soil saturation concentration. Therefore, Csat  
 used as screening level

**TABLE H.5**

Risk Ratio Screening for Surface and Subsurface Soil, Maximum Detected Concentration

Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index <sup>a</sup>	Corresponding Cancer Risk <sup>b</sup>	Target Organ
<b>Metals<sup>c</sup> (mg/kg)</b>								
<b>Antimony</b>	9 / 15	3.9E+02	MR14-SS12-09D	3.1E+01	1	12.5	NA	Blood
Arsenic	13 / 15	2.7E+00	MR14-SS12-09D	3.9E-01	1E-06	NA	7E-06	NA
<b>Lead</b>	15 / 15	3.6E+04	MR14-SS12-09D	NA	NA	NA	NA	NA
<b>Cumulative Corresponding Hazard Index<sup>c</sup></b>						12.5		
<b>Cumulative Corresponding Cancer Risk<sup>d</sup></b>							7E-06	
Total Blood HI =								12.5

**Notes:**

a Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

b Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

e Samples analyzed for metals collected from the former indoor pistol range, samples collected from former gas chamber were not analyzed for metals.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

HI = Hazard Index

mg/kg = micrograms per kilogram

NA = Not available/not applicable.

**TABLE H.6**

Risk Ratio Screening for Surface Soil, 95% UCL Concentration  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL	95% UCL Rationale	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index <sup>a</sup>	Corresponding Cancer Risk <sup>b</sup>	Target Organ	
<b>Metals<sup>c</sup> (mg/kg)</b>									
Antimony	9 / 15	8.6E+01	1, 3	95% KM-b	3.1E+01	1	2.8	NA	Blood
Lead	15 / 15	3.7E+03	6	Mean	NA	NA	NA	NA	NA
<b>Cumulative Corresponding Hazard Index<sup>c</sup></b>						2.8			
<b>Cumulative Corresponding Cancer Risk<sup>d</sup></b>							0E+00		
							Total Blood HI =	2.8	

**Notes:**

- <sup>a</sup> Corresponding Hazard Index equals 95% UCL concentration divided by the RSL divided by the acceptable risk level
- <sup>b</sup> Corresponding Cancer Risk equals 95% UCL concentration divided by the RSL divided by the acceptable risk level
- <sup>c</sup> Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent
- <sup>d</sup> Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent
- <sup>e</sup> Samples analyzed for metals collected from the former indoor pistol range, samples collected from former gas chamber were not analyzed for metals

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern  
 mg/kg = micrograms per kilogram  
 HI = Hazard Index  
 NA = Not available/not applicable

ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA, February 2009, ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).  
 Options: 95% Kaplan-Meier (BCA) UCL (95% KM-b)

Upper Confidence Limit (UCL) Rationale:

- (1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
- (2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
- (3) Test indicates data are gamma distributed.
- (4) Distribution tests are inconclusive
- (5) Max value used because 95% UCL greater than max.
- (6) Lead evaluated using arithmetic mean concentration in lead models, therefore, arithmetic mean concentration presented here.

**TABLE H.7**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future  
 Medium: Groundwater  
 Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection	
UXO-14	92-52-4	1,1-Biphenyl	ND	ND	UG/L	MR14-TW04-09D	0/1	4.9 - 4.9	4.9E+00	N/A	1.8E+02 N	4.0E+02	NC2LGW	NO	DLBSL	
	108-60-1	2,2'-Oxybis(1-chloropropane)	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.2E-01 C	N/A		YES	DLASL	
	95-95-4	2,4,5-Trichlorophenol	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	3.7E+02 N	N/A		NO	DLBSL	
	88-06-2	2,4,6-Trichlorophenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+00 C**	N/A		YES	DLASL	
	120-83-2	2,4-Dichlorophenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.1E+01 N	N/A		NO	DLBSL	
	105-67-9	2,4-Dimethylphenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	7.3E+01 N	1.0E+02	NC2LGW	NO	DLBSL	
	51-28-5	2,4-Dinitrophenol	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	7.3E+00 N	N/A		YES	DLASL	
	121-14-2	2,4-Dinitrotoluene	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	2.2E-01 C	N/A		YES	DLASL	
	606-20-2	2,6-Dinitrotoluene	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+00 N	N/A		YES	DLASL	
	532-27-4	2-Chloroacetophenone	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	N/A	N/A		NO	NTX	
	2698-41-1	2-Chlorobenzalmononitrile	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	N/A	N/A		NO	NTX	
	91-58-7	2-Chloronaphthalene	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	2.9E+02 N	N/A		NO	DLBSL	
	95-57-8	2-Chlorophenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.8E+01 N	4.0E-01	NC2LGW	NO	DLBSL	
	91-57-6	2-Methylnaphthalene	ND	ND	UG/L		0/1	0.24 - 0.24	2.4E-01	N/A	1.5E+01 N	3.0E+01	NC2LGW	NO	DLBSL	
	95-48-7	2-Methylphenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.8E+02 N	N/A		NO	DLBSL	
	88-74-4	2-Nitroaniline	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	3.7E+01 N	N/A		NO	DLBSL	
	88-75-5	2-Nitrophenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.8E+01 N	N/A		NO	DLBSL	
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.5E-01 C	N/A		YES	DLASL	
	99-09-2	3-Nitroaniline	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	N/A	N/A		NO	NTX	
	534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	2.9E-01 N	N/A		YES	DLASL	
	101-55-3	4-Bromophenyl-phenylether	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	N/A	N/A		NO	NTX	
	59-50-7	4-Chloro-3-methylphenol	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+02 N	N/A		NO	DLBSL	
	106-47-8	4-Chloroaniline	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.4E-01 C	N/A		YES	DLASL	
	7005-72-3	4-Chlorophenyl-phenylether	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.8E+01 N	N/A		NO	DLBSL	
	106-44-5	4-Methylphenol	1.7E+00 J	1.7E+00 J	UG/L		MR14-TW04-09D	1/1	4.9 - 4.9	1.7E+00	N/A	1.8E+01 N	4.0E+01	NC2LGW	NO	BSL
	100-01-6	4-Nitroaniline	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	3.4E+00 C*	N/A		YES	DLASL	
	100-02-7	4-Nitrophenol	ND	ND	UG/L		0/1	20 - 20	2.0E+01	N/A	1.2E-01 C	N/A		YES	DLASL	
	83-32-9	Acenaphthene	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	2.2E+02 N	8.0E+01	NC2LGW	NO	DLBSL	
	208-96-8	Acenaphthylene	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	2.2E+02 N	2.0E+02	NC2LGW	NO	DLBSL	
	98-86-2	Acetophenone	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+02 N	N/A		NO	DLBSL	
	120-12-7	Anthracene	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.1E+03 N	2.0E+03	NC2LGW	NO	DLBSL	
	1912-24-9	Atrazine	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	2.9E-01 C	3.0E+00	MCL, NC2LGW	YES	DLASL	
	100-52-7	Benzaldehyde	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+02 N	N/A		NO	DLBSL	
	56-55-3	Benzo(a)anthracene	ND	ND	UG/L		MR14-TW04D-09D :	0/1	0.24 - 0.24	2.4E-01	N/A	2.9E-02 C	5.0E-02	NC2LGW	YES	DLASL
50-32-8	Benzo(a)pyrene	7.0E-02 J	7.0E-02 J	UG/L	MR14-TW04-09D	1/1	0.24 - 0.24	7.0E-02	N/A	2.9E-03 C	2.0E-01	MCL	YES	ASL		

**TABLE H.7**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future  
 Medium: Groundwater  
 Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	205-99-2	Benzo(b)fluoranthene	ND	ND	UG/L	MR14-TW04-09D	0/1	0.24 - 0.24	2.4E-01	N/A	2.9E-02 C	5.0E-03	NC2LGW	YES	DLASL
	191-24-2	Benzo(g,h,i)perylene	8.0E-02 J	8.0E-02 J	UG/L		1/1	0.24 - 0.24	8.0E-02	N/A	1.1E+02 N	2.0E+02	NC2LGW	NO	BSL
	207-08-9	Benzo(k)fluoranthene	ND	ND	UG/L		0/1	0.24 - 0.24	2.4E-01	N/A	2.9E-01 C	5.0E-01	NC2LGW	NO	DLBSL
	111-91-1	bis(2-Chloroethoxy)methane	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.1E+01 N	N/A		NO	DLBSL
	111-44-4	bis(2-Chloroethyl)ether	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	1.2E-02 C	3.0E-02	NC2LGW	YES	DLASL
	117-81-7	bis(2-Ethylhexyl)phthalate	ND	ND	UG/L		0/1	4.9 - 4.9	4.9E+00	N/A	4.8E+00 C	6.0E+00	MCL	YES	DLASL
											3.0E+00	NC2LGW			
	85-68-7	Butylbenzylphthalate	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	3.5E+01 C	1.0E+03	NC2LGW	NO	DLBSL	
	105-60-2	Caprolactam	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	1.8E+03 N	4.0E+03	NC2LGW	NO	DLBSL	
	86-74-8	Carbazole	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	N/A	N/A		NO	NTX	
	218-01-9	Chrysene	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	2.9E+00 C	5.0E+00	NC2LGW	YES	DLASL	
	<b>53-70-3</b>	<b>Dibenz(a,h)anthracene</b>	<b>7.8E-02 J</b>	<b>7.8E-02 J</b>	<b>UG/L</b>	<b>MR14-TW04-09D</b>	<b>1/1</b>	<b>0.24 - 0.24</b>	<b>7.8E-02</b>	<b>N/A</b>	<b>2.9E-03 C</b>	<b>5.0E-03</b>	<b>NC2LGW</b>	<b>YES</b>	<b>ASL</b>
	132-64-9	Dibenzofuran	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+00 N	N/A		YES	DLASL	
	84-66-2	Diethylphthalate	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	2.9E+03 N	6.0E+03	NC2LGW	NO	DLBSL	
	131-11-3	Dimethyl phthalate	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	N/A	N/A		NO	NTX	
	84-74-2	Di-n-butylphthalate	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+02 N	7.0E+02	NC2LGW	NO	DLBSL	
	117-84-0	Di-n-octylphthalate	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	4.8E+00 C	1.0E+02	NC2LGW	YES	DLASL	
	206-44-0	Fluoranthene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	1.5E+02 N	3.0E+02	NC2LGW	NO	DLBSL	
	86-73-7	Fluorene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	1.5E+02 N	3.0E+02	NC2LGW	NO	DLBSL	
	118-74-1	Hexachlorobenzene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	4.2E-02 C	1.0E+00	MCL	YES	DLASL	
											2.0E-02	NC2LGW			
	87-68-3	Hexachlorobutadiene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	8.6E-01 C*	4.0E-01	NC2LGW	NO	DLBSL	
	77-47-4	Hexachlorocyclopentadiene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	2.2E+01 N	5.0E+01	MCL	NO	DLBSL	
	67-72-1	Hexachloroethane	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	3.7E+00 C**	N/A		YES	DLASL	
	<b>193-39-5</b>	<b>Indeno(1,2,3-cd)pyrene</b>	<b>7.1E-02 J</b>	<b>7.1E-02 J</b>	<b>UG/L</b>	<b>MR14-TW04D-09D</b>	<b>1/1</b>	<b>0.24 - 0.24</b>	<b>7.1E-02</b>	<b>N/A</b>	<b>2.9E-02 C</b>	<b>5.0E-02</b>	<b>NC2LGW</b>	<b>YES</b>	<b>ASL</b>
	78-59-1	Isophorone	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	7.1E+01 C	4.0E+01	NC2LGW	NO	DLBSL	
	91-20-3	Naphthalene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	1.4E-01 C*	6.0E+00	NC2LGW	YES	DLASL	
	621-64-7	n-Nitroso-di-n-propylamine	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	9.6E-03 C	N/A		YES	DLASL	
	86-30-6	n-Nitrosodiphenylamine	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	1.4E+01 C	N/A		NO	DLBSL	
	98-95-3	Nitrobenzene	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	1.2E-01 C	N/A		YES	DLASL	
	87-86-5	Pentachlorophenol	ND	ND	UG/L	0/1	20 - 20	2.0E+01	N/A	1.7E-01 C	1.0E+00	MCL	YES	DLASL	
											3.0E-01	NC2LGW			
	85-01-8	Phenanthrene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	1.1E+03 N	2.0E+02	NC2LGW	NO	DLBSL	
	108-95-2	Phenol	ND	ND	UG/L	0/1	4.9 - 4.9	4.9E+00	N/A	1.1E+03 N	3.0E+01	NC2LGW	NO	DLBSL	
	129-00-0	Pyrene	ND	ND	UG/L	0/1	0.24 - 0.24	2.4E-01	N/A	1.1E+02 N	2.0E+02	NC2LGW	NO	DLBSL	

**TABLE H.7**

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 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
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Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7429-90-5	Aluminum	1.8E+02 J	2.9E+02 J	UG/L	MR14-TW03-09D	3/3	50 - 50	2.9E+02	1.9E+03	3.7E+03 N	N/A		NO	BSL
	7440-36-0	Antimony	ND	ND	UG/L		0/3	3.75 - 3.75	3.8E+00	3.3E+00	1.5E+00 N	6.0E+00	MCL	YES	DLASL
	7440-38-2	Arsenic	1.0E+00 J	4.1E+00	UG/L	MR14-TW02-09D	2/3	1.25 - 1.25	4.1E+00	5.8E+00	4.5E-02 C	1.0E+01	MCL, NC2LGW	NO	BBK
	7440-39-3	Barium	8.5E+00 J	6.4E+01	UG/L	MR14-TW02-09D	3/3	10 - 10	6.4E+01	8.6E+01	7.3E+02 N	2.0E+03	MCL	NO	BSL
	7440-41-7	Beryllium	2.5E-01 J	2.5E-01 J	UG/L	MR14-TW02-09D	1/3	1.25 - 1.25	2.5E-01	3.1E-01	7.3E+00 N	4.0E+00	NC2LGW		
	7440-43-9	Cadmium	ND	ND	UG/L		0/3	1.25 - 1.25	1.3E+00	3.6E-01	1.8E+00 N	5.0E+00	MCL	NO	DLBSL
	7440-70-2	Calcium	5.9E+03	3.2E+04	UG/L	MR14-TW03-09D	3/3	1250 - 1250	3.2E+04	6.9E+04	N/A	N/A		NO	NUT
	7440-47-3	Chromium	1.1E+00 J	2.0E+00	UG/L	MR14-TW01-09D	3/3	1.25 - 1.25	2.0E+00	3.1E+00	4.3E-02 C	1.0E+02	MCL	NO	BBK
	7440-48-4	Cobalt	ND	ND	UG/L		0/3	3.12 - 3.12	3.1E+00	3.4E+00	1.1E+00 N	N/A		NO	DLBBK
	7440-50-8	Copper	1.5E+00 J	1.0E+02	UG/L	MR14-TW02-09D	2/3	2.5 - 2.5	1.0E+02	2.8E+00	1.5E+02 N	1.3E+03	MCL	NO	BSL
	7439-89-6	Iron	5.2E+02	2.9E+03	UG/L	MR14-TW02-09D	3/3	25 - 25	2.9E+03	6.0E+03	2.6E+03 N	3.0E+02	NC2LGW	NO	BBK
	7439-92-1	Lead	9.8E-01	9.8E-01	UG/L	MR14-TW01-09D	1/3	0.75 - 0.75	9.8E-01	2.8E+00	N/A	1.5E+01	MCL, NC2LGW	NO	NTX
	7439-95-4	Magnesium	4.4E+02 J	1.5E+03	UG/L	MR14-TW03-09D	3/3	1250 - 1250	1.5E+03	6.4E+03	N/A	N/A		NO	NUT
	7439-96-5	Manganese	5.0E+00 J	2.3E+01 J	UG/L	MR14-TW02-09D	3/3	3.75 - 3.75	2.3E+01	2.1E+02	8.8E+01 N	5.0E+01	NC2LGW	NO	BSL
	7439-97-6	Mercury	ND	ND	UG/L		0/3	0.2 - 0.2	2.0E-01	1.0E-01	1.1E+00 N	2.0E+00	MCL	NO	DLBSL
	7440-02-0	Nickel	8.5E-01 J	1.2E+00 J	UG/L	MR14-TW02-09D	2/3	2.5 - 2.5	1.2E+00	8.0E+00	7.3E+01 N	1.0E+02	NC2LGW	NO	BSL
	7440-09-7	Potassium	1.1E+03 J	1.7E+03 J	UG/L	MR14-TW03-09D	3/3	1250 - 1250	1.7E+03	3.3E+03	N/A	N/A		NO	NUT
	7782-49-2	Selenium	ND	ND	UG/L		0/3	1.25 - 1.25	1.3E+00	3.1E+00	1.8E+01 N	5.0E+01	MCL	NO	DLBSL
	7440-22-4	Silver	ND	ND	UG/L		0/3	1.25 - 1.25	1.3E+00	7.7E-01	1.8E+01 N	2.0E+01	NC2LGW	NO	DLBSL
	7440-23-5	Sodium	8.0E+03	1.4E+04	UG/L	MR14-TW01-09D	3/3	1250 - 1250	1.4E+04	2.3E+04	N/A	N/A		NO	NUT
	7440-28-0	Thallium	ND	ND	UG/L		0/3	2 - 2	2.0E+00	3.8E+00	N/A	2.0E+00	MCL	NO	NTX
	7440-62-2	Vanadium	1.9E+00 J	2.2E+00 J	UG/L	MR14-TW03-09D	2/3	3.12 - 3.12	2.2E+00	4.7E+00	1.8E+01 N	N/A		NO	BSL
	7440-66-6	Zinc	3.2E+00 J	3.2E+00 J	UG/L	MR14-TW01-09D : MR14-TW02-09D	2/3	5 - 5	3.2E+00	4.2E+01	1.1E+03 N	1.0E+03	NC2LGW	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values are two times the arithmetic mean basewide background shallow groundwater concentrations. Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.

[4] Oak Ridge National Laboratory (ORNL). November, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [http://www.epa.gov/reg3hwmd/risk/human/tb-concentration\\_table/index.htm](http://www.epa.gov/reg3hwmd/risk/human/tb-concentration_table/index.htm)

Tap water RSLs. RSLs based on noncarcinogenic effects divided by 10 to account for exposure to more than on constituent that effects the same target organ.

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/  
To Be Considered

MCL = Maximum Contaminant Level from EPA's National Primary Drinking Water Standards  
 NC2LGW = North Carolina Classifications and Groundwater Quality Standards,  
 January, 2010.

J = Estimated Value

**TABLE H.7**

Occurrence, Distribution, and Selection of Chemicals of Potential Concern  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
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RSL value for nitrobenzene used as surrogate for 4-nitrophenol.  
 RSL value for acenaphthene used as surrogate for acenaphthylene.  
 RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.  
 RSL value for anthracene used as surrogate for phenanthrene.  
 RSL value for chromium VI used for total chromium.  
 RSL value for cadmium (water) used for cadmium  
 RSL value for 2-chlorophenol used as surrogate for 4-Nitrophenol and 4-Chlorophenyl-phenylether.  
 RSL value for bis(2-ethylhexyl)phthalate used as surrogate for Di-n-octylphthalate.  
 RSL value for manganese (water) used for manganese.  
 RSL value for mercury, inorganic salts used for mercury.  
 RSL value for vanadium and compounds used for vanadium.

C\* = N screening level < 100x C screening level, therefore  
 N screening value/10 used as screening level  
 C\*\* = N screening level < 10x C screening level, therefore  
 N screening value/10 used as screening level  
 N = Noncarcinogenic  
 N/A = Not available  
 ND = Not detected

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)  
 Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA

Deletion Reason: No Toxicity Information (NTX)  
 Essential Nutrient (NUT)  
 Below Screening Level (BSL)  
 Below Background (BBK)  
 Detection Limit Below Screening Level (DLBSL)

**TABLE H.8**

Risk Ratio Screening for Groundwater, Maximum Detected Concentration  
 Site UXO-14 Former Indoor Pistol Range and Former Gas Chamber (Rifle Range Area)  
 MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Tap Water RSL	Acceptable Risk Level	Corresponding Hazard Index <sup>a</sup>	Corresponding Cancer Risk <sup>b</sup>	Target Organ
<b>SVOCs<sup>e</sup> (ug/L)</b>								
Benzo(a)pyrene	1 / 1	7.0E-02 J	MR14-TW04D-09D :	2.9E-03	1E-06	NA	2E-05	NA
Dibenz(a,h)anthracene	1 / 1	7.8E-02 J	MR14-TW04-09D	2.9E-03	1E-06	NA	3E-05	NA
Indeno(1,2,3-cd)pyrene	1 / 1	7.1E-02 J	MR14-TW04D-09D	2.9E-02	1E-06	NA	2E-06	NA
<b>Cumulative Corresponding Hazard Index<sup>c</sup></b>						<b>0.0</b>		
<b>Cumulative Corresponding Cancer Risk<sup>d</sup></b>							<b>5E-05</b>	

**Notes:**

<sup>a</sup> Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

<sup>b</sup> Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

<sup>c</sup> Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

<sup>d</sup> Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

<sup>e</sup> Samples analyzed for SVOCs collected from the former gas chamber, samples collected from the former indoor pistol range were not analyzed for SVOCs.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

HI = Hazard Index

J = Estimated Value

ug/L = micrograms per liter

NA = Not available/not applicable.

**Appendix I**  
**Ecological Risk Screening Tables**

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Table I-1  
ERS Surface Soil Screen for Site UXO-14  
MCB CamLej, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
Semivolatile Organic Compounds (UG/KG)																
1,1-Biphenyl	250 - 310	0 / 8	--	--	60,000	-- / --	0.0052	139	0.002	--	--	--	--	--	No	HQ less than one, not detected
2,2'-Oxybis(1-chloropropane)	250 - 280	0 / 4	--	--	NSV	-- / --	NSV	134	NSV	--	--	--	--	--	No	Not detected
2,4,5-Trichlorophenol	500 - 630	0 / 8	--	--	4,000	-- / --	0.16	278	0.07	--	--	--	--	--	No	HQ less than one, not detected
2,4,6-Trichlorophenol	250 - 310	0 / 8	--	--	10,000	-- / --	0.031	139	0.014	--	--	--	--	--	No	HQ less than one, not detected
2,4-Dichlorophenol	250 - 310	0 / 8	--	--	3.00	-- / --	103	139	46	--	--	--	--	--	No	Not detected
2,4-Dimethylphenol	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
2,4-Dinitrophenol	500 - 630	0 / 8	--	--	20,000	-- / --	0.032	278	0.014	--	--	--	--	--	No	HQ less than one, not detected
2-Chloroacetophenone	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
2-Chlorobenzalmalonitrile	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
2-Chloronaphthalene	250 - 310	0 / 8	--	--	1,000	-- / --	0.31	139	0.14	--	--	--	--	--	No	HQ less than one, not detected
2-Chlorophenol	250 - 310	0 / 8	--	--	10.0	-- / --	31	139	14	--	--	--	--	--	No	Not detected
2-Methylnaphthalene*	11.0 - 12.0	4 / 8	12.0	MR14-SS17-09D	NSV	0 / 8	NSV	6.36	NSV	--	--	--	--	--	No	See text for discussion
2-Methylphenol	250 - 310	0 / 8	--	--	500	-- / --	0.62	139	0.28	--	--	--	--	--	No	HQ less than one, not detected
2-Nitroaniline	500 - 630	0 / 8	--	--	NSV	-- / --	NSV	278	NSV	--	--	--	--	--	No	Not detected
2-Nitrophenol	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
3,3'-Dichlorobenzidine	250 - 290	0 / 7	--	--	NSV	-- / --	NSV	136	NSV	--	--	--	--	--	No	Not detected
3-Nitroaniline	500 - 580	0 / 7	--	--	NSV	-- / --	NSV	273	NSV	--	--	--	--	--	No	Not detected
4,6-Dinitro-2-methylphenol	500 - 630	0 / 8	--	--	NSV	-- / --	NSV	278	NSV	--	--	--	--	--	No	Not detected
4-Bromophenyl-phenylether	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
4-Chloro-3-methylphenol	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
4-Chloroaniline	250 - 310	0 / 8	--	--	20,000	-- / --	0.016	139	0.007	--	--	--	--	--	No	HQ less than one, not detected
4-Chlorophenyl-phenylether	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
4-Methylphenol	250 - 310	0 / 8	--	--	500	-- / --	0.62	139	0.28	--	--	--	--	--	No	HQ less than one, not detected
4-Nitroaniline	500 - 580	0 / 7	--	--	NSV	-- / --	NSV	273	NSV	--	--	--	--	--	No	Not detected
4-Nitrophenol	500 - 630	0 / 8	--	--	7,000	-- / --	0.090	278	0.040	--	--	--	--	--	No	HQ less than one, not detected
Acenaphthene*	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	HQ less than one, not detected
Acenaphthylene*	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	HQ less than one, not detected
Acetophenone	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
Anthracene*	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	HQ less than one, not detected
Atrazine	250 - 310	0 / 8	--	--	0.050	-- / --	6,200	139	2,775	--	--	--	--	--	No	Not detected
Benzaldehyde	-- - --	3 / 3	110	MR14-SS20-09D	NSV	-- / --	NSV	98.7	NSV	--	--	--	--	--	No	Uncertainty, no screening value
Benzo(a)anthracene*	11.0 - 12.0	2 / 8	3.20	MR14-SS20-09D	NSV	0 / 8	NSV	5.13	NSV	--	--	--	--	--	No	See text for discussion
Benzo(a)pyrene*	11.0 - 13.0	0 / 8	--	--	NSV	-- / --	NSV	5.94	NSV	--	--	--	--	--	No	Not detected
Benzo(b)fluoranthene*	11.0 - 13.0	3 / 8	18.0	MR14-SS17-09D	NSV	0 / 8	NSV	7.44	NSV	--	--	--	--	--	No	See text for discussion
Benzo(g,h,i)perylene*	11.0 - 13.0	2 / 8	7.20	MR14-SS17-09D	NSV	0 / 8	NSV	5.66	NSV	--	--	--	--	--	No	See text for discussion
Benzo(k)fluoranthene*	11.0 - 13.0	3 / 8	4.40	MR14-SS17-09D	NSV	0 / 8	NSV	4.88	NSV	--	--	--	--	--	No	See text for discussion
bis(2-Chloroethoxy)methane	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
bis(2-Chloroethyl)ether	110 - 130	0 / 8	--	--	NSV	-- / --	NSV	59.4	NSV	--	--	--	--	--	No	Not detected
bis(2-Ethylhexyl)phthalate	250 - 310	1 / 8	60.0	MR14-SS17-09D	100	0 / 8	0.60	128	1.28	--	--	--	--	--	No	HQ less than one, detected
Butylbenzylphthalate	250 - 310	0 / 8	--	--	100	-- / --	3.10	139	1.39	--	--	--	--	--	No	Not detected
Caprolactam	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
Carbazole	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
Chrysene*	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
Dibenz(a,h)anthracene*	11.0 - 13.0	0 / 8	--	--	NSV	-- / --	NSV	5.94	NSV	--	--	--	--	--	No	Not detected
Dibenzofuran	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
Diethylphthalate	250 - 310	0 / 8	--	--	100,000	-- / --	0.003	139	0.001	--	--	--	--	--	No	HQ less than one, not detected
Dimethyl phthalate	250 - 310	0 / 8	--	--	200,000	-- / --	1.55E-03	139	6.94E-04	--	--	--	--	--	No	HQ less than one, not detected
Di-n-butylphthalate	250 - 310	0 / 8	--	--	200,000	-- / --	1.55E-03	139	6.94E-04	--	--	--	--	--	No	HQ less than one, not detected
Di-n-octylphthalate	360 - 450	0 / 8	--	--	100	-- / --	4.50	199	1.99	--	--	--	--	--	No	Not detected
Fluoranthene*	-- - --	8 / 8	11.0	MR14-SS17-09D	NSV	0 / 8	NSV	5.24	NSV	--	--	--	--	--	No	See text for discussion
Fluorene*	11.0 - 12.0	1 / 8	4.00	MR14-SS20-09D	NSV	0 / 8	NSV	5.63	NSV	--	--	--	--	--	No	See text for discussion
Hexachlorobenzene	11.0 - 13.0	0 / 8	--	--	2.50	-- / --	5.20	5.94	2.38	--	--	--	--	--	No	Not detected
Hexachlorobutadiene	11.0 - 12.0	1 / 8	4.30	MR14-SS20-09D	NSV	-- / --	NSV	5.66	NSV	--	--	39.8	EPA, 2003	0.108	No	Supplemental HQ less than one
Hexachlorocyclopentadiene	18.0 - 22.0	0 / 8	--	--	10,000	-- / --	0.002	9.94	0.001	--	--	--	--	--	No	HQ less than one, not detected
Hexachloroethane	250 - 310	0 / 8	--	--	100	-- / --	3.10	139	1.39	--	--	--	--	--	No	Not detected

Table I-1  
ERS Surface Soil Screen for Site UXO-14  
MCB CamLej, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
Indeno(1,2,3-cd)pyrene*	11.0 - 13.0	0 / 8	--	--	NSV	-- / --	NSV	5.94	NSV	--	--	--	--	--	No	Not detected
Isophorone	250 - 310	0 / 8	--	--	NSV	-- / --	NSV	139	NSV	--	--	--	--	--	No	Not detected
Naphthalene*	11.0 - 12.0	2 / 8	11.0	MR14-SS20-09D	NSV	0 / 8	NSV	7.00	NSV	--	--	--	--	--	No	See text for discussion
n-Nitroso-di-n-propylamine	54.0 - 67.0	0 / 8	--	--	NSV	-- / --	NSV	29.8	NSV	--	--	--	--	--	No	Not detected
n-Nitrosodiphenylamine	250 - 310	0 / 8	--	--	20,000	-- / --	0.016	139	0.007	--	--	--	--	--	No	HQ less than one, not detected
Pentachlorophenol	720 - 900	1 / 8	630	MR14-SS17-09D	2,100	0 / 8	0.30	425	0.20	--	--	--	--	--	No	HQ less than one, detected
Phenanthrene*	11.0 - 12.0	4 / 8	20.0	MR14-SS17-09D	NSV	0 / 8	NSV	7.63	NSV	--	--	--	--	--	No	See text for discussion
Phenol	250 - 310	0 / 8	--	--	50.0	-- / --	6.20	139	2.78	--	--	--	--	--	No	Not detected
Pyrene*	11.0 - 12.0	6 / 8	12.0	MR14-SS17-09D	NSV	0 / 8	NSV	6.30	NSV	--	--	--	--	--	No	See text for discussion
<b>Inorganics (MG/KG)</b>																
Aluminum	-- - --	12 / 12	1,760	MR14-SS01-09D	50.0	12 / 12	35	963	19	5487	No	--	--	--	No	Consistent with background
Antimony	0.74 - 0.78	8 / 12	387	MR14-SS12-09D	0.27	8 / 12	1,433	44.0	163	0.45	Yes	--	--	--	Yes	HQ greater than one, exceeds background
Arsenic	0.26 - 0.26	11 / 12	2.70	MR14-SS12-09D	18.0	0 / 12	0.15	0.67	0.04	0.63	Yes	--	--	--	No	HQ less than one, detected
Barium	-- - --	12 / 12	13.2	MR14-SS01-09D	330	0 / 12	0.040	5.11	0.015	14.5	No	--	--	--	No	Consistent with background
Beryllium	0.25 - 0.30	1 / 12	0.050	MR14-SS12-09D	21.0	0 / 12	0.002	0.12	0.006	0.10	No	--	--	--	No	Consistent with background
Cadmium	0.25 - 0.30	0 / 12	--	--	0.36	-- / --	0.84	0.13	0.36	0.033	--	--	--	--	No	HQ less than one, not detected
Calcium <sup>2</sup>	253 - 253	11 / 12	4,960	MR14-SS11-09D	NSV	-- / --	NSV	802	NSV	6360	No	--	--	--	No	Macronutrient
Chromium	-- - --	12 / 12	3.76	MR14-SS01-09D	26.0	0 / 12	0.14	1.89	0.07	6.05	No	--	--	--	No	Consistent with background
Cobalt	0.62 - 0.75	4 / 12	0.59	MR14-SS03-09D	13.0	0 / 12	0.046	0.34	0.027	0.29	Yes	--	--	--	No	HQ less than one, detected
Copper	-- - --	12 / 12	12.8	MR14-SS01-09D	28.0	0 / 12	0.46	4.15	0.15	4.83	Yes	--	--	--	No	Within range of background
Cyanide	0.26 - 0.30	0 / 12	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
Iron	-- - --	12 / 12	1,470	MR14-SS01-09D	200	12 / 12	7.35	765	3.82	3245	No	--	--	--	No	Consistent with background
Lead	-- - --	12 / 12	35,500	MR14-SS12-09D	11.0	12 / 12	3,227	4,603	418	12	Yes	--	--	--	Yes	HQ greater than one, exceeds background
Magnesium <sup>2</sup>	248 - 257	5 / 12	141	MR14-SS11-09D	NSV	-- / --	NSV	109	NSV	238	No	--	--	--	No	Macronutrient
Manganese	-- - --	12 / 12	21.2	MR14-SS01-09D	220	0 / 12	0.096	10.5	0.048	14	Yes	--	--	--	No	Within range of background
Mercury	0.033 - 0.033	8 / 12	1.08	MR14-SS02-09D	0.10	1 / 12	10.8	0.12	1.16	0.081	Yes	--	--	--	Yes	HQ greater than 10, well above background range.
Nickel	-- - --	12 / 12	2.01	MR14-SS12-09D	38.0	0 / 12	0.053	1.26	0.033	1.21	Yes	--	--	--	No	HQ less than one, detected
Potassium <sup>2</sup>	247 - 302	2 / 12	82.9	MR14-SS11-09D	NSV	-- / --	NSV	121	NSV	116	No	--	--	--	No	Macronutrient
Selenium	0.25 - 0.30	0 / 12	--	--	0.52	-- / --	0.58	0.13	0.25	0.56	Yes	--	--	--	No	HQ less than one, not detected
Silver	0.25 - 0.30	5 / 12	0.63	MR14-SS12-09D	4.20	0 / 12	0.15	0.16	0.04	0.14	Yes	--	--	--	No	Within range of background
Sodium <sup>2</sup>	247 - 302	1 / 12	225	MR14-SS11-09D	NSV	-- / --	NSV	137	NSV	81	Yes	--	--	--	No	Macronutrient
Thallium	0.40 - 0.80	0 / 12	--	--	1.00	-- / --	0.80	0.22	0.22	0.36	Yes	--	--	--	No	HQ less than one, not detected
Vanadium	-- - --	12 / 12	8.74	MR14-SS03-09D	7.80	1 / 12	1.12	4.68	0.60	8.9	No	--	--	--	No	Consistent with background
Zinc	-- - --	12 / 12	65.3	MR14-SS01-09D	46.0	5 / 12	1.42	36.2	0.79	10.8	Yes	--	--	--	No	Within range of background

NOTES

\*Evaluated based on total low molecular weight or high molecular weight concentrations

1 - Count of detected samples exceeding or equaling Screening Value

2 - Macronutrient - Not considered to be a contaminant of potential concern (COPC)

HQ - Hazard Quotient

MG/KG - Milligrams per kilogram

NSV - No Screening Value

UG/KG - Micrograms per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

Table I-2

ERS Subsurface Soil Screen for Site UXO-14

MCB CamLej, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
<b>Semivolatile Organic Compounds (UG/KG)</b>																
1,1-Biphenyl	280 - 300	0 / 4	--	--	60,000	-- / --	0.0050	144	0.002	--	--	--	--	--	No	HQ less than one, not detected
2,2'-Oxybis(1-chloropropane)	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
2,4,5-Trichlorophenol	550 - 600	0 / 4	--	--	4,000	-- / --	0.150	288	0.072	--	--	--	--	--	No	HQ less than one, not detected
2,4,6-Trichlorophenol	280 - 300	0 / 4	--	--	10,000	-- / --	0.030	144	0.014	--	--	--	--	--	No	HQ less than one, not detected
2,4-Dichlorophenol	280 - 300	0 / 4	--	--	3.00	-- / --	100.0	144	48	--	--	--	--	--	No	Not detected
2,4-Dimethylphenol	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
2,4-Dinitrophenol	550 - 600	0 / 4	--	--	20,000	-- / --	0.030	288	0.014	--	--	--	--	--	No	HQ less than one, not detected
2,4-Dinitrotoluene	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
2,6-Dinitrotoluene	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
2-Chloroacetophenone	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
2-Chlorobenzalmalononitrile	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
2-Chloronaphthalene	280 - 300	0 / 4	--	--	1,000	-- / --	0.30	144	0.14	--	--	--	--	--	No	HQ less than one, not detected
2-Chlorophenol	280 - 300	0 / 4	--	--	10.0	-- / --	30.0	144	14	--	--	--	--	--	No	Not detected
2-Methylnaphthalene	12.0 - 13.0	0 / 4	--	--	29,000	-- / --	4.48E-04	6.13	2.11E-04	--	--	--	--	--	No	HQ less than one, not detected
2-Methylphenol	280 - 300	0 / 4	--	--	500	-- / --	0.60	144	0.29	--	--	--	--	--	No	HQ less than one, not detected
2-Nitroaniline	550 - 600	0 / 4	--	--	NSV	-- / --	NSV	288	NSV	--	--	--	--	--	No	Not detected
2-Nitrophenol	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
3,3'-Dichlorobenzidine	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
3-Nitroaniline	550 - 600	0 / 4	--	--	NSV	-- / --	NSV	288	NSV	--	--	--	--	--	No	Not detected
4,6-Dinitro-2-methylphenol	550 - 600	0 / 4	--	--	NSV	-- / --	NSV	288	NSV	--	--	--	--	--	No	Not detected
4-Bromophenyl-phenylether	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
4-Chloro-3-methylphenol	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
4-Chloroaniline	280 - 300	0 / 4	--	--	20,000	-- / --	0.0150	144	0.007	--	--	--	--	--	No	HQ less than one, not detected
4-Chlorophenyl-phenylether	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
4-Methylphenol	280 - 300	0 / 4	--	--	500	-- / --	0.60	144	0.29	--	--	--	--	--	No	HQ less than one, not detected
4-Nitroaniline	550 - 600	0 / 4	--	--	NSV	-- / --	NSV	288	NSV	--	--	--	--	--	No	Not detected
4-Nitrophenol	550 - 600	0 / 4	--	--	7,000	-- / --	0.086	288	0.041	--	--	--	--	--	No	HQ less than one, not detected
Acenaphthene	280 - 300	0 / 4	--	--	29,000	-- / --	0.0103	144	0.005	--	--	--	--	--	No	HQ less than one, not detected
Acenaphthylene	280 - 300	0 / 4	--	--	29,000	-- / --	0.0103	144	0.005	--	--	--	--	--	No	HQ less than one, not detected
Acetophenone	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
Anthracene	280 - 300	0 / 4	--	--	29,000	-- / --	0.0103	144	0.005	--	--	--	--	--	No	HQ less than one, not detected
Atrazine	280 - 300	0 / 4	--	--	0.050	-- / --	6,000	144	2,875	--	--	--	--	--	No	Not detected
Benzaldehyde	280 - 290	1 / 4	540	MR14-IS04-4-5-09D	NSV	-- / --	NSV	241	NSV	--	--	--	--	--	No	Uncertainty, no screening value
Benzo(a)anthracene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
Benzo(a)pyrene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
Benzo(b)fluoranthene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
Benzo(g,h,i)perylene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
Benzo(k)fluoranthene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
bis(2-Chloroethoxy)methane	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
bis(2-Chloroethyl)ether	120 - 130	0 / 4	--	--	NSV	-- / --	NSV	61.3	NSV	--	--	--	--	--	No	Not detected
bis(2-Ethylhexyl)phthalate	280 - 300	0 / 4	--	--	100	-- / --	3.00	144	1.44	--	--	--	--	--	No	Not detected
Butylbenzylphthalate	280 - 300	0 / 4	--	--	100	-- / --	3.00	144	1.44	--	--	--	--	--	No	Not detected
Caprolactam	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
Carbazole	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
Chrysene	280 - 300	0 / 4	--	--	1,100	-- / --	0.27	144	0.13	--	--	--	--	--	No	HQ less than one, not detected
Dibenz(a,h)anthracene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
Dibenzofuran	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
Diethylphthalate	280 - 300	0 / 4	--	--	100,000	-- / --	0.0030	144	0.001	--	--	--	--	--	No	HQ less than one, not detected
Dimethyl phthalate	280 - 300	0 / 4	--	--	200,000	-- / --	1.50E-03	144	7.19E-04	--	--	--	--	--	No	HQ less than one, not detected
Di-n-butylphthalate	280 - 300	0 / 4	--	--	200,000	-- / --	1.50E-03	144	7.19E-04	--	--	--	--	--	No	HQ less than one, not detected
Di-n-octylphthalate	390 - 430	0 / 4	--	--	100	-- / --	4.30	205	2.05	--	--	--	--	--	No	Not detected
Fluoranthene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected

Table I-2  
ERS Subsurface Soil Screen for Site UXO-14  
MCB CamLej, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
Fluorene	12.0 - 13.0	0 / 4	--	--	29,000	-- / --	4.48E-04	6.13	2.11E-04	--	--	--	--	--	No	HQ less than one, not detected
Hexachlorobenzene	12.0 - 13.0	0 / 4	--	--	2.50	-- / --	5.20	6.13	2.45	--	--	--	--	--	No	Not detected
Hexachlorobutadiene	12.0 - 13.0	0 / 4	--	--	NSV	-- / --	NSV	6.13	NSV	--	--	--	--	--	No	Not detected
Hexachlorocyclopentadiene	20.0 - 21.0	0 / 4	--	--	10,000	-- / --	0.0021	10.3	0.001	--	--	--	--	--	No	HQ less than one, not detected
Hexachloroethane	280 - 300	0 / 4	--	--	100	-- / --	3.00	144	1.44	--	--	--	--	--	No	Not detected
Indeno(1,2,3-cd)pyrene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
Isophorone	280 - 300	0 / 4	--	--	NSV	-- / --	NSV	144	NSV	--	--	--	--	--	No	Not detected
Naphthalene	12.0 - 12.0	1 / 4	1.80	MR14-IS04-4-5-09D	29,000	0 / 4	6.21E-05	4.95	1.71E-04	--	--	--	--	--	No	HQ less than one, detected
n-Nitroso-di-n-propylamine	59.0 - 64.0	0 / 4	--	--	NSV	-- / --	NSV	30.8	NSV	--	--	--	--	--	No	Not detected
n-Nitrosodiphenylamine	280 - 300	0 / 4	--	--	20,000	-- / --	0.0150	144	0.007	--	--	--	--	--	No	HQ less than one, not detected
Nitrobenzene	280 - 300	0 / 4	--	--	40,000	-- / --	0.0075	144	0.004	--	--	--	--	--	No	HQ less than one, not detected
Pentachlorophenol	790 - 860	0 / 4	--	--	2,100	-- / --	0.41	411	0.20	--	--	--	--	--	No	HQ less than one, not detected
Phenanthrene	12.0 - 13.0	0 / 4	--	--	29,000	-- / --	4.48E-04	6.13	2.11E-04	--	--	--	--	--	No	HQ less than one, not detected
Phenol	280 - 300	0 / 4	--	--	50.0	-- / --	6.00	144	2.88	--	--	--	--	--	No	Not detected
Pyrene	12.0 - 13.0	0 / 4	--	--	1,100	-- / --	0.0118	6.13	0.006	--	--	--	--	--	No	HQ less than one, not detected
<b>Inorganics (MG/KG)</b>																
Aluminum	-- --	3 / 3	1,530	MR14-IS01-2-3-09D	50.0	3 / 3	30.6	1,068	21	10,369	No	--	--	--	No	Consistent with background
Antimony	0.89 - 0.91	1 / 3	2.62	MR14-IS01-2-3-09D	0.27	1 / 3	9.70	1.17	4.35	0.36	Yes	--	--	--	Yes	HQ greater than one, exceeds background range
Arsenic	0.30 - 0.30	2 / 3	0.21	MR14-IS01-2-3-09D	18.0	0 / 3	0.012	0.19	0.01	2.12	No	--	--	--	No	Consistent with background
Barium	-- --	3 / 3	2.49	MR14-IS01-2-3-09D	330	0 / 3	0.0075	1.90	0.006	17	No	--	--	--	No	Consistent with background
Beryllium	0.30 - 0.31	0 / 3	--	--	21.0	-- / --	0.0146	0.15	0.007	0.17	--	--	--	--	No	HQ less than one, not detected
Cadmium	0.30 - 0.31	0 / 3	--	--	0.36	-- / --	0.85	0.15	0.42	0.023	--	--	--	--	No	HQ less than one, not detected
Calcium <sup>2</sup>	296 - 307	0 / 3	--	--	NSV	-- / --	NSV	151	NSV	441	--	--	--	--	No	Macronutrient
Chromium	-- --	3 / 3	1.06	MR14-IS01-2-3-09D	26.0	0 / 3	0.041	0.85	0.033	14.49	No	--	--	--	No	Consistent with background
Cobalt	0.74 - 0.77	0 / 3	--	--	13.0	-- / --	0.059	0.38	0.029	0.82	--	--	--	--	No	HQ less than one, not detected
Copper	0.59 - 0.61	1 / 3	1.28	MR14-IS01-2-3-09D	28.0	0 / 3	0.046	0.63	0.022	2.56	No	--	--	--	No	Consistent with background
Cyanide	0.30 - 0.31	0 / 3	--	--	NSV	-- / --	NSV	0.15	NSV	--	--	--	--	--	No	Not detected
Iron	-- --	3 / 3	370	MR14-IS01-2-3-09D	200	2 / 3	1.85	292	1.46	5,439	No	--	--	--	No	Consistent with background
Lead	-- --	3 / 3	290	MR14-IS01-2-3-09D	11.0	1 / 3	26.36	97.7	8.88	8.49	Yes	50	EPA, 2001	5.8	Yes	HQ greater than one, exceeds background range
Magnesium <sup>2</sup>	296 - 307	0 / 3	--	--	NSV	-- / --	NSV	151	NSV	363	--	--	--	--	No	Macronutrient
Manganese	-- --	3 / 3	3.29	MR14-IS01-2-3-09D	220	0 / 3	0.015	2.55	0.012	9.25	No	--	--	--	No	Consistent with background
Mercury	0.033 - 0.041	1 / 3	0.034	MR14-IS01-2-3-09D	0.10	0 / 3	0.34	0.024	0.24	0.07	No	--	--	--	No	Consistent with background
Nickel	-- --	3 / 3	0.43	MR14-IS01-2-3-09D	38.0	0 / 3	0.011	0.39	0.010	2.27	No	--	--	--	No	Consistent with background
Potassium <sup>2</sup>	296 - 307	0 / 3	--	--	NSV	-- / --	NSV	151	NSV	361	--	--	--	--	No	Macronutrient
Selenium	0.30 - 0.31	0 / 3	--	--	0.52	-- / --	0.59	0.15	0.29	0.50	--	--	--	--	No	HQ less than one, not detected
Silver	0.30 - 0.31	0 / 3	--	--	4.20	-- / --	0.073	0.15	0.036	0.13	--	--	--	--	No	HQ less than one, not detected
Sodium <sup>2</sup>	296 - 307	0 / 3	--	--	NSV	-- / --	NSV	151	NSV	68	--	--	--	--	No	Macronutrient
Thallium	0.47 - 0.49	0 / 3	--	--	1.00	-- / --	0.49	0.24	0.24	0.38	--	--	--	--	No	HQ less than one, not detected
Vanadium	-- --	3 / 3	1.28	MR14-IS01-2-3-09D	7.80	0 / 3	0.16	1.09	0.14	17	No	--	--	--	No	Consistent with background
Zinc	1.18 - 1.18	2 / 3	9.98	MR14-IS01-2-3-09D	46.0	0 / 3	0.22	4.62	0.10	6.59	Yes	--	--	--	No	HQ less than one, detected

NOTES

- 1 - Count of detected samples exceeding or equaling Screening Value
- 2 - Macronutrient - Not considered to be a contaminant of potential concern (COPC)
- HQ - Hazard Quotient
- MG/KG - Milligrams per kilogram
- NSV - No Screening Value
- UG/KG - Micrograms per kilogram
- Generated by: Sara Kent
- Checked by: Kelly Taylor

Table I-3  
ERS Groundwater Screen for CTO-14 UXO-14  
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
Semivolatile Organic Compounds (UG/L)																
1,1-Biphenyl	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2,2'-Oxybis(1-chloropropane)	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2,4,5-Trichlorophenol	20.0 - 20.0	0 / 1	--	--	NSV	-- / --	NSV	10.0	NSV	--	--	--	--	--	No	Not detected
2,4,6-Trichlorophenol	4.90 - 4.90	0 / 1	--	--	3.20	-- / --	1.53	2.45	0.77	--	--	--	--	--	No	Not detected
2,4-Dichlorophenol	4.90 - 4.90	0 / 1	--	--	36.5	-- / --	0.13	2.45	0.067	--	--	--	--	--	No	HQ less than one, not detected
2,4-Dimethylphenol	4.90 - 4.90	0 / 1	--	--	21.2	-- / --	0.23	2.45	0.12	--	--	--	--	--	No	HQ less than one, not detected
2,4-Dinitrophenol	20.0 - 20.0	0 / 1	--	--	6.20	-- / --	3.23	10.0	1.61	--	--	--	--	--	No	Not detected
2,4-Dinitrotoluene	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2,6-Dinitrotoluene	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2-Chloroacetophenone	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2-Chlorobenzalmononitrile	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2-Chloronaphthalene	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2-Chlorophenol	4.90 - 4.90	0 / 1	--	--	43.8	-- / --	0.11	2.45	0.056	--	--	--	--	--	No	HQ less than one, not detected
2-Methylnaphthalene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
2-Methylphenol	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
2-Nitroaniline	20.0 - 20.0	0 / 1	--	--	NSV	-- / --	NSV	10.0	NSV	--	--	--	--	--	No	Not detected
2-Nitrophenol	4.90 - 4.90	0 / 1	--	--	3,500	-- / --	0.0014	2.45	7.00E-04	--	--	--	--	--	No	HQ less than one, not detected
3,3'-Dichlorobenzidine	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
3-Nitroaniline	20.0 - 20.0	0 / 1	--	--	NSV	-- / --	NSV	10.0	NSV	--	--	--	--	--	No	Not detected
4,6-Dinitro-2-methylphenol	20.0 - 20.0	0 / 1	--	--	2.30	-- / --	8.70	10.0	4.35	--	--	--	--	--	No	Not detected
4-Bromophenyl-phenylether	4.90 - 4.90	0 / 1	--	--	12.2	-- / --	0.40	2.45	0.20	--	--	--	--	--	No	HQ less than one, not detected
4-Chloro-3-methylphenol	4.90 - 4.90	0 / 1	--	--	0.30	-- / --	16.3	2.45	8.17	--	--	--	--	--	No	Not detected
4-Chloroaniline	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
4-Chlorophenyl-phenylether	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
4-Methylphenol	-- - --	1 / 1	1.70	MR14-TW04-09D	NSV	-- / --	NSV	1.70	NSV	--	--	272	TCEQ, 2006	6.25E-03	No	Supplemental HQ less than one
4-Nitroaniline	20.0 - 20.0	0 / 1	--	--	NSV	-- / --	NSV	10.0	NSV	--	--	--	--	--	No	Not detected
4-Nitrophenol	20.0 - 20.0	0 / 1	--	--	71.7	-- / --	0.28	10.0	0.14	--	--	--	--	--	No	HQ less than one, not detected
Acenaphthene	4.90 - 4.90	0 / 1	--	--	9.70	-- / --	0.51	2.45	0.25	--	--	--	--	--	No	HQ less than one, not detected
Acenaphthylene	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Acetophenone	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Anthracene	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Atrazine	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Benzaldehyde	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Benzo(a)anthracene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
Benzo(a)pyrene	-- - --	1 / 1	0.070	MR14-TW04-09D	NSV	-- / --	NSV	0.070	NSV	--	--	0.014	TCEQ, 2006	5.00	No	See text for discussion
Benzo(b)fluoranthene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
Benzo(g,h,i)perylene	-- - --	1 / 1	0.080	MR14-TW04-09D	NSV	-- / --	NSV	0.080	NSV	--	--	7.64	EPA, 2003	1.05E-02	No	Supplemental HQ less than one
Benzo(k)fluoranthene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
bis(2-Chloroethoxy)methane	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
bis(2-Chloroethyl)ether	4.90 - 4.90	0 / 1	--	--	2,380	-- / --	0.0021	2.45	0.001	--	--	--	--	--	No	HQ less than one, not detected
bis(2-Ethylhexyl)phthalate	4.90 - 4.90	0 / 1	--	--	0.30	-- / --	16.3	2.45	8.17	--	--	--	--	--	No	Not detected
Butylbenzylphthalate	4.90 - 4.90	0 / 1	--	--	22.0	-- / --	0.22	2.45	0.11	--	--	--	--	--	No	HQ less than one, not detected
Caprolactam	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Carbazole	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Chrysene	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Dibenz(a,h)anthracene	-- - --	1 / 1	0.078	MR14-TW04-09D	NSV	-- / --	NSV	0.078	NSV	--	--	5	TRNCC, 2001	1.56E-02	No	Supplemental HQ less than one
Dibenzofuran	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Diethylphthalate	4.90 - 4.90	0 / 1	--	--	521	-- / --	0.0094	2.45	0.005	--	--	--	--	--	No	HQ less than one, not detected
Dimethyl phthalate	4.90 - 4.90	0 / 1	--	--	330	-- / --	0.015	2.45	0.007	--	--	--	--	--	No	HQ less than one, not detected
Di-n-butylphthalate	4.90 - 4.90	0 / 1	--	--	3.40	-- / --	1.44	2.45	0.72	--	--	--	--	--	No	Not detected

Table I-3  
ERS Groundwater Screen for CTO-14 UXO-14  
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
Di-n-octylphthalate	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
Fluoranthene	0.24 - 0.24	0 / 1	--	--	1.60	-- / --	0.15	0.12	0.075	--	--	--	--	--	No	HQ less than one, not detected
Fluorene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
Hexachlorobenzene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
Hexachlorobutadiene	0.24 - 0.24	0 / 1	--	--	0.32	-- / --	0.75	0.12	0.38	--	--	--	--	--	No	HQ less than one, not detected
Hexachlorocyclopentadiene	0.24 - 0.24	0 / 1	--	--	0.070	-- / --	3.43	0.12	1.71	--	--	--	--	--	No	Not detected
Hexachloroethane	4.90 - 4.90	0 / 1	--	--	9.40	-- / --	0.52	2.45	0.26	--	--	--	--	--	No	HQ less than one, not detected
Indeno(1,2,3-cd)pyrene	-- --	1 / 1	0.071	MR14-TW04-09D	NSV	-- / --	NSV	0.071	NSV	--	--	4.31	EPA, 2003	1.65E-02	No	Supplemental HQ less than one
Isophorone	4.90 - 4.90	0 / 1	--	--	129	-- / --	0.038	2.45	0.019	--	--	--	--	--	No	HQ less than one, not detected
Naphthalene	0.24 - 0.24	0 / 1	--	--	23.5	-- / --	0.010	0.12	0.005	--	--	--	--	--	No	HQ less than one, not detected
n-Nitroso-di-n-propylamine	4.90 - 4.90	0 / 1	--	--	NSV	-- / --	NSV	2.45	NSV	--	--	--	--	--	No	Not detected
n-Nitrosodiphenylamine	4.90 - 4.90	0 / 1	--	--	58.5	-- / --	0.084	2.45	0.042	--	--	--	--	--	No	HQ less than one, not detected
Nitrobenzene	4.90 - 4.90	0 / 1	--	--	66.8	-- / --	0.073	2.45	0.037	--	--	--	--	--	No	HQ less than one, not detected
Pentachlorophenol	20.0 - 20.0	0 / 1	--	--	7.90	-- / --	2.53	10.0	1.27	--	--	--	--	--	No	Not detected
Phenanthrene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
Phenol	4.90 - 4.90	0 / 1	--	--	58.0	-- / --	0.084	2.45	0.042	--	--	--	--	--	No	HQ less than one, not detected
Pyrene	0.24 - 0.24	0 / 1	--	--	NSV	-- / --	NSV	0.12	NSV	--	--	--	--	--	No	Not detected
<b>Inorganics (UG/L)</b>																
Aluminum	-- --	3 / 3	293	MR14-TW03-09D	87.0	3 / 3	3.37	238	2.74	1886	No	--	--	--	No	Consistent with background
Antimony	3.75 - 3.75	0 / 3	--	--	160	-- / --	0.023	1.88	0.012	3.28	Yes	--	--	--	No	HQ less than one, not detected
Arsenic	1.25 - 1.25	2 / 3	4.09	MR14-TW02-09D	36.0	0 / 3	0.11	1.92	0.053	5.77	No	--	--	--	No	Consistent with background
Barium	-- --	3 / 3	63.6	MR14-TW02-09D	NSV	-- / --	NSV	39.7	NSV	86	No	--	--	--	No	Consistent with background
Beryllium	1.25 - 1.25	1 / 3	0.25	MR14-TW02-09D	0.53	0 / 3	0.48	0.50	0.95	0.31	No	--	--	--	No	Consistent with background
Cadmium	1.25 - 1.25	0 / 3	--	--	0.25	-- / --	5.00	0.63	2.50	0.36	Yes	--	--	--	No	Not detected
Calcium <sup>3</sup>	-- --	3 / 3	31,600	MR14-TW03-09D	NSV	-- / --	NSV	14,983	NSV	69078	No	--	--	--	No	Macronutrient
Chromium	-- --	3 / 3	2.00	MR14-TW01-09D	50.0	0 / 3	0.040	1.50	0.030	3.13	No	--	--	--	No	Consistent with background
Cobalt	3.12 - 3.12	0 / 3	--	--	NSV	-- / --	NSV	1.56	NSV	3.40	Yes	--	--	--	No	Not detected
Copper	2.50 - 2.50	2 / 3	103	MR14-TW02-09D	3.10	1 / 3	33.2	35.2	11	2.76	Yes	--	--	--	No	Consistent with background based on dissolved data
Iron	-- --	3 / 3	2,910	MR14-TW02-09D	1,000	2 / 3	2.91	1,553	1.55	5999	No	--	--	--	No	Consistent with background
Lead	0.75 - 0.75	1 / 3	0.98	MR14-TW01-09D	8.10	0 / 3	0.12	0.58	0.071	2.80	No	--	--	--	No	Consistent with background
Magnesium <sup>3</sup>	-- --	3 / 3	1,500	MR14-TW03-09D	NSV	-- / --	NSV	1,036	NSV	6363	No	--	--	--	No	Macronutrient
Manganese	-- --	3 / 3	23.4	MR14-TW02-09D	NSV	-- / --	NSV	14.0	NSV	214	No	--	--	--	No	Consistent with background
Mercury	0.20 - 0.20	0 / 3	--	--	0.77	-- / --	0.26	0.10	0.13	0.10	Yes	--	--	--	No	Not detected
Nickel	2.50 - 2.50	2 / 3	1.23	MR14-TW02-09D	8.20	0 / 3	0.15	1.11	0.14	7.97	No	--	--	--	No	Consistent with background
Potassium <sup>3</sup>	-- --	3 / 3	1,710	MR14-TW03-09D	NSV	-- / --	NSV	1,343	NSV	3277	No	--	--	--	No	Macronutrient
Selenium	1.25 - 1.25	0 / 3	--	--	5.00	-- / --	0.25	0.63	0.13	3.14	Yes	--	--	--	No	HQ less than one, not detected
Silver	1.25 - 1.25	0 / 3	--	--	0.012	-- / --	104	0.63	52	0.77	Yes	--	--	--	No	Not detected
Sodium <sup>3</sup>	-- --	3 / 3	13,600	MR14-TW01-09D	NSV	-- / --	NSV	11,233	NSV	22508	No	--	--	--	No	Macronutrient
Thallium	2.00 - 2.00	0 / 3	--	--	4.00	-- / --	0.50	1.00	0.25	3.78	Yes	--	--	--	No	HQ less than one, not detected
Vanadium	3.12 - 3.12	2 / 3	2.20	MR14-TW03-09D	NSV	-- / --	NSV	1.88	NSV	4.72	No	--	--	--	No	Consistent with background
Zinc	5.00 - 5.00	2 / 3	3.16	MR14-TW01-09D	81.0	0 / 3	0.039	2.94	0.036	42	No	--	--	--	No	Consistent with background
<b>Dissolved Metals (UG/L)</b>																
Aluminum, Dissolved	-- --	3 / 3	149	MR14-TW03-09D	87.0	3 / 3	1.71	122	1.41	1886	No	--	--	--	No	Consistent with background
Antimony, Dissolved	3.75 - 3.75	0 / 3	--	--	160	-- / --	0.023	1.88	0.012	3.28	Yes	--	--	--	No	HQ less than one, not detected
Arsenic, Dissolved	1.25 - 1.25	1 / 3	3.29	MR14-TW02-09D	36.0	0 / 3	0.091	1.51	0.042	5.77	No	--	--	--	No	Consistent with background
Barium, Dissolved	-- --	3 / 3	61.5	MR14-TW02-09D	NSV	-- / --	NSV	39.0	NSV	86	No	--	--	--	No	Consistent with background
Beryllium, Dissolved	1.25 - 1.25	0 / 3	--	--	0.53	-- / --	2.36	0.63	1.18	0.31	Yes	--	--	--	No	Not detected
Cadmium, Dissolved	1.25 - 1.25	0 / 3	--	--	0.25	-- / --	5.00	0.63	2.5	0.36	Yes	--	--	--	No	Not detected
Calcium, Dissolved <sup>3</sup>	-- --	3 / 3	32,600	MR14-TW03-09D	NSV	-- / --	NSV	15,123	NSV	69078	No	--	--	--	No	Macronutrient

Table I-3

ERS Groundwater Screen for CTO-14 UXO-14

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance <sup>1</sup>	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Screening Value Hazard Quotient	Retain?	Rationale
Chromium, Dissolved	-- - --	3 / 3	1.51	MR14-TW01-09D	50.0	0 / 3	0.030	1.12	0.022	3.13	No	--	--	--	No	Consistent with background
Cobalt, Dissolved	3.12 - 3.12	0 / 3	--	--	NSV	-- / --	NSV	1.56	NSV	3.40	Yes	--	--	--	No	Not detected
Copper, Dissolved	2.50 - 2.50	1 / 3	1.32	MR14-TW01-09D	3.10	0 / 3	0.43	1.27	0.41	2.76	No	--	--	--	No	Consistent with background
Iron, Dissolved	-- - --	3 / 3	2,670	MR14-TW02-09D	NSV	-- / --	NSV	1,409	NSV	5999	No	--	--	--	No	Consistent with background
Lead, Dissolved	0.75 - 0.75	1 / 3	0.83	MR14-TW01-09D	8.10	0 / 3	0.10	0.53	0.065	2.80	No	--	--	--	No	Consistent with background
Magnesium, Dissolved <sup>3</sup>	-- - --	3 / 3	1,530	MR14-TW03-09D	NSV	-- / --	NSV	1,031	NSV	6363	No	--	--	--	No	Macronutrient
Manganese, Dissolved	-- - --	3 / 3	22.8	MR14-TW02-09D	NSV	-- / --	NSV	13.9	NSV	214	No	--	--	--	No	Consistent with background
Mercury, Dissolved	0.20 - 0.20	0 / 3	--	--	0.77	-- / --	0.26	0.10	0.13	0.10	Yes	--	--	--	No	Not detected
Nickel, Dissolved	2.50 - 2.50	2 / 3	1.35	MR14-TW02-09D	52.0	0 / 3	0.026	1.13	0.022	7.97	No	--	--	--	No	Consistent with background
Potassium, Dissolved <sup>3</sup>	-- - --	3 / 3	1,750	MR14-TW03-09D	NSV	-- / --	NSV	1,357	NSV	3277	No	--	--	--	No	Macronutrient
Selenium, Dissolved	1.25 - 1.25	0 / 3	--	--	5.00	-- / --	0.25	0.63	0.13	3.14	Yes	--	--	--	No	Not detected
Silver, Dissolved	1.25 - 1.25	0 / 3	--	--	0.012	-- / --	104	0.63	52	0.77	Yes	--	--	--	No	Not detected
Sodium, Dissolved <sup>3</sup>	-- - --	3 / 3	13,400	MR14-TW01-09D	NSV	-- / --	NSV	11,803	NSV	22508	No	--	--	--	No	Macronutrient
Thallium, Dissolved	2.00 - 2.00	0 / 3	--	--	4.00	-- / --	0.50	1.00	0.25	3.78	Yes	--	--	--	No	HQ less than one, not detected
Vanadium, Dissolved	3.12 - 3.12	2 / 3	2.33	MR14-TW02-09D	NSV	-- / --	NSV	1.94	NSV	4.72	No	--	--	--	No	Consistent with background
Zinc, Dissolved	5.00 - 5.00	0 / 3	--	--	120	-- / --	0.042	2.50	0.021	42	Yes	--	--	--	No	HQ less than one, not detected

NOTES

- 1 - Count of detected samples exceeding or equaling Screening Value
  - 2 - Shaded cells indicate hazard quotient based on reporting limits
  - 3 - Macronutrient - Not considered to be a contaminant of potential concern (COPC)
- HQ - Hazard Quotient  
 NSV - No Screening Value  
 UG/L - Micrograms per liter  
 Generated by: Sara Kent  
 Checked by: Kelly Taylor