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LETTER AND U S EPA CONCURRENCE AND ATTACHED ARARS TABLES AND REDLINE COMMENTS ON THE DRAFT ENGINEERING EVALUATION/COST ANALYSIS UXO-14 FORMER INDOOR PISTOL RANGE RR-53 MCB CAMP LEJEUNE NC
8/7/2012
U S EPA REGION IV

From: "Gena Townsend" <Townsend.Gena@epamail.epa.gov>
To: "Henderson, Kimberly/VBO" <Kimberly.Henderson@CH2M.com>
Cc: <charity.rychak@usmc.mil>; "Hockett, Daniel/CLT" <Daniel.Hockett@CH2M.com>; <david.t.cleland@navy.mil>; <martha.morgan@ncdenr.gov>; "Louth, Matt/VBO" <Matt.Louth@CH2M.com>
Sent: Tuesday, August 07, 2012 1:43 PM
Attach: UXO-014 EECA_080312_RTCs_Redline.doc; Table C-1 UXO-014 Action-specfic ARARs_080312_redline.doc; Table C-3 UXO-014 Chemical-specfic ARARs_080312_redline.doc
Subject: Re: Final UXO-14 EE/CA for Review

Hi All,

EPA has concluded its review of the RTC, Redline and Final version of UXO-14 EE/CA and has no additional comments. The document can be prepared for print.

Gena D. Townsend
US EPA
61 Forsyth Street, SW
Atlanta, Georgia 30303
Tel. No: (404) 562-8538
Townsend.Gena@epa.gov

---08/07/2012 10:10:00 AM---Hi Team, The final EE/CA for UXO-14 is posted on the web site in the document review folder here: ht

From: <Kimberly.Henderson@CH2M.com>
To: <charity.rychak@usmc.mil>, Gena Townsend/R4/USEPA/US@EPA, <david.t.cleland@navy.mil>, <martha.morgan@ncdenr.gov>
Cc: <Daniel.Hockett@CH2M.com>, <Matt.Louth@CH2M.com>
Date: 08/07/2012 10:10 AM
Subject: Final UXO-14 EE/CA for Review

Hi Team,
The final EE/CA for UXO-14 is posted on the web site in the document review folder here: http://lejeune.lantops-ir.org/Document%20Review/default.aspx for your final review and approval before we go to print and add it to the Administrative Record in preparation for the public meeting on August 16th. All comments received to-date have been incorporated as shown in the attached redline files.
Thanks!
Kim*(See attached file: UXO-014 EECA_080312_RTCs_Redline.doc)(See attached file: Table C-1 UXO-014 Action-specfic ARARs_080312_redline.doc)(See attached file: Table C-3 UXO-014 Chemical-specfic ARARs_080312_redline.doc)*

Final

Engineering Evaluation/Cost Analysis
UXO-14 – Former Indoor Pistol Range RR-53

Marine Corps Installations East –
Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order WE43

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Prepared for

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Prepared by

11301 Carmel Commons Blvd., Suite 304
Charlotte, North Carolina
NC Engineering License #F-0699

Executive Summary

This report presents an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) at the Site Unexploded Ordnance (UXO) – 14 Former Indoor Pistol Range, RR-53, at Marine Corps Installations East - Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) in Onslow County, North Carolina (**Figure 1-1**). The Former Indoor Pistol Range is located west of Powder Lane in the Stones Bay area, on level terrain consisting of maintained grass and a loose sandy area in the vicinity of the former building footprint (**Figures 1-2** and **1-3**). This EE/CA addresses the impacted surface soil in the vicinity of the Former Indoor Pistol Range.

Previous site investigations identified potential unacceptable risks to human health and the environment posed by exposure to constituents of concern (COCs), lead and antimony, in impacted surface soil. The removal area is approximately 0.16 acre to a depth of 1 foot below ground surface (bgs), with an estimated volume of approximately 260 cubic yards ( ). The purpose of this EE/CA is to develop and analyze removal action alternatives for contaminant mass removal or treatment at the identified removal area. Three alternatives were evaluated:

1. Alternative 1—No Action
2. Alternative 2—Excavation and Offsite Disposal
3. Alternative 3—*In Situ* Soil Stabilization with Excavation and Offsite Disposal

Each technology was evaluated based on effectiveness, implementability, and cost, as summarized in **Table E-1.** The technology to be implemented for the Former Indoor Pistol Range NTCRA will be chosen by the Partnering Team, based on information presented in this EE/CA. The Partnering Team is composed of representatives from MCIEAST-MCB CAMLEJ, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division, the North Carolina Department of Environment and Natural Resources (NCDENR), and the United States Environmental Protection Agency (USEPA) Region 4.

TABLE E-1

Summary of Alternative Evaluation

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation and Offsite Disposal	Alternative 3 *In Situ* Soil Stabilization with Excavation and Offsite Disposal
Effectiveness			
Overall protection of human health and the environment	Does not meet RAOs	Meets RAOs through removal of soil from the site.	Meets RAOs through removal of the soil from the site.
Compliance with ARARs	Does not ~~meet~~ trigger ARARs	Implementation would require compliance with location- and action-specific ARARs. Includes requirements relating to stormwater runoff, dust emissions, management of hazardous and non-hazardous waste, and onsite staging piles.	Implementation would require compliance with location- and action-specific ARARs. Includes requirements relating to stormwater runoff, dust emissions, management of non-hazardous waste, and onsite staging piles.
Long-term effectiveness and permanence	Not effective in the long-term.	All soil with COCs ~~exceeding site cleanup levels~~above RAOs would be removed from site. Residual site risk is acceptable ~~for unlimited use/unrestricted exposure (UU/UE)~~.	All soil with COCs ~~exceeding site cleanup levels~~above RAOs would be removed from the site. Residual site risk is acceptable.
Reduction of toxicity, mobility, or volume through treatment	Does not reduce toxicity, mobility, and volume.	~~Treatment is not included; however, r~~Reduces toxicity, mobility, and volume through soil removal. Contaminants are not destroyed, but rather moved to an appropriate permitted disposal facility.	Reduces toxicity, mobility, and volume through ~~treatment~~soil removal. Stabilization ~~and subsequent~~reduces lead mobility in soil. Contaminants are not destroyed, but rather moved to an appropriate permitted disposal facility. ~~removal would reduce COC mobility in soil thus meeting criteria.~~
Short-term effectiveness	Not effective in the short-term.	Potential risks to site workers and the nearby community due to construction activity and increased truck traffic. Potential dust emission issues associated with excavation may require engineering controls. Action would require 2 weeks in the field to complete. Potential environmental impact due to transportation of investigation-derived waste (IDW) to disposal facility.	Potential risks to site workers and the nearby community due to construction activity and increased truck traffic. Potential dust emission issues associated with excavation and reagent mixing may require engineering controls. Action would require up to 3 weeks in the field to complete. Potential environmental impact due to transportation of investigation-derived waste (IDW) to disposal facility.
Implementability			
Technical Feasibility	Feasible	Excavation is a standard and reliable technology. Monitoring the technical aspects is easily done.	Excavation and in situ stabilization are reliable technologies. Monitoring the technical aspects is easily done.
Administrative Feasibility	Feasible	Waste being disposed is considered hazardous and would require additional permitting.	Treated waste is non-hazardous, and additional permitting is not necessary for transport or disposal.
Availability of Services and Materials	Not applicable	Services and materials are readily available. Limited number of disposal facilities.	Services and materials are readily available.
State and Community Acceptance	Unlikely	To be determined	To be determined

TABLE E-1

Summary of Alternative Evaluation

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation and Offsite Disposal	Alternative 3 *In Situ* Soil Stabilization with Excavation and Offsite Disposal
Cost			
Capital Cost	**$0**	**$387,000**	**$296,000**

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Acronyms and Abbreviations

µg/L	microgram per liter
ARAR	applicable or relevant and appropriate requirement
ASR	Archive Search Report
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CSM	Conceptual Site Model
CTO	Contract Task Order
°F	degree Fahrenheit
EE/CA	Engineering Evaluation/Cost Analysis
ESI	Expanded Site Investigation
ERS	Ecological Risk Screening
FS	Feasibility Study
GW	groundwater
HHRS	Human Health Risk Screening
HI	hazard index
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IR	Installation Restoration
LUC	land use control
MCIEAST-MCB CAMLEJ	Marine Corps Installations East - Marine Corps Base Camp Lejeune
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
MILCON	military construction
MMRP	Military Munitions Response Program
NA	not analyzed
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NC SSL	North Carolina Soil Screening Level
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards
NCP	National Oil and Hazardous Substance Pollutions Contingency Plan
NTCRA	Non-time-critical Removal Action
O&M	operation and maintenance
PA/SI	Preliminary Assessment/Site Inspection
PRA	Preliminary Range Assessment
RAGS	Risk Assessment Guidance for Superfund
RAO	removal action objective
RCRA	Resource Conservation and Recovery Act

RI	Remedial Investigation
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act of 1986
SRG	Site Remediation Goal
TAL	Target Analyte List
TBC	to-be-considered
TCLP	Toxicity Characteristic Leaching Procedure
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UU/UE	unlimited use/unrestricted exposure
UXO	Unexploded Ordnance
	cubic yard

SECTION 1

Introduction

This report presents an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) at Site Unexploded Ordnance (UXO) – 14. UXO-14 is located west of Powder Lane in the Stones Bay area of Marine Corps Installations East - Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) in Onslow County, North Carolina (**Figures 1-1** and **1-2**). UXO-14 includes the Former Indoor Pistol Range, also known as RR-53 (Archive Search Report [ASR] #2.199) and the Former Gas Chamber area (ASR #2.200) (**Figure 1-3**). The Former Gas Chamber was recommended for no further action based on the results of the Preliminary Assessment/Site Inspection (PA/SI) (CH2M HILL, 2011a) and the Expanded Site Investigation (ESI) (CH2M HILL, 2011b). However, these previous investigations identified potential unacceptable risks to human health and the environment posed by exposure to lead and antimony in surface soil at the Former Indoor Pistol Range. This EE/CA presents removal alternatives to address lead and antimony in surface soil at the Former Indoor Pistol Range. The actions are intended to mitigate the unacceptable risks and are evaluated with respect to effectiveness, implementability, and cost. This EE/CA was prepared by CH2M HILL under the Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division, Contract N62470-11-D-8012, Contract Task Order (CTO) WE43.

1.1 Regulatory Background

This document is issued by the Department of the Navy (Navy), the lead agency responsible for remediation of the Former Indoor Pistol Range, with the assistance of the United States Environmental Protection Agency (USEPA) Region 4 and the North Carolina Department of Environment and Natural Resources (NCDENR), under Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA).

A removal action is being considered for the portion of the Former Indoor Pistol Range where lead and antimony have been identified above the Site Remediation Goals (SRGs). This removal action is not time-critical. NTCRAs are defined in Title 40 of the Code of Federal Regulations (CFR) Section 300.415(b)(4) as actions pertaining to a less imminent threat to human health and the environment and that have planning periods of 6 months or more.

Section 104 of CERCLA and SARA allows an authorized agency to take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release relating to hazardous substances, pollutants, or contaminants at any time, or to take any other response measures consistent with 40 CFR 300 of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), as deemed necessary to protect public health or welfare and the environment.

The NCP provides regulations for implementing CERCLA and SARA and regulations specific to removal actions. The NCP defines a removal action as:

> *[…] cleanup or removal of released hazardous substances from the environment, such actions as may be necessary to monitor, assess, and evaluate the threat of release of hazardous substances; the disposal of removed material; or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release.*

40 CFR Section 300.415 requires the lead agency to conduct an EE/CA when an NTCRA is planned for a site. The goals of an EE/CA are to identify the objectives of the removal action and to analyze the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives. An EE/CA documents the removal action alternatives and selection process.

Community involvement requirements for NTCRAs include preparing an EE/CA and making it available for public review and comment for a period of 30 days. An announcement of the 30-day public comment period on the EE/CA is required in a local newspaper. Written responses to significant comments will be summarized in an Action Memorandum and included in the Administrative Record.

1.2 Purpose and Objectives

The objective of this EE/CA is to evaluate the removal alternatives to address the potential risks posed by lead and antimony in surface soil at the UXO-14 Former Indoor Pistol Range Site, in preparation for site closeout under CERCLA. An EE/CA must be completed for all NTCRAs under CERCLA, as required by section 300.415(b)(4)(i) of the NCP. An EE/CA serves an analogous function to the Remedial Investigation/Feasibility Study (RI/FS) conducted for removal actions, but is more focused and streamlined.

Submittal of this document fulfills the requirements for NTCRAs defined by CERCLA, SARA, and the NCP. This EE/CA has been prepared in accordance with USEPA's guidance document *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, PB93-963402, August 1993. Additionally, this EE/CA shall:

1. Satisfy environmental review and public information requirements for removal actions.
2. Satisfy Administrative Record requirements for improved documentation of the removal action selection.
3. Provide a framework for evaluating and selecting alternative technologies.

1.3 Organization of the EE/CA

The following information is presented within this EE/CA:

- Section 2—Site Characterization
- Section 3—Identification of Removal Action Objectives
- Section 4—Identification of Removal Action Alternatives
- Section 5—Detailed Analysis of Removal Action Alternatives
- Section 6—Comparative Analysis of Removal Action Alternatives
- Section 7—References

SECTION 2

Site Characterization

This section contains information on site description, site history, previous investigations and the nature and extent of contamination, risk screening, and determination of the removal action area.

2.1 Site Description

MCIEAST-MCB CAMLEJ is located in Onslow County, North Carolina, covers approximately 236 square miles, and is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean (**Figure 1-1**). The generally flat topography of MCIEAST-MCB CAMLEJ is typical of the seaward portions of the North Carolina coastal plain. Elevations vary from sea level to 72 ft above mean sea level (msl), although the elevation of the majority of MCIEAST-MCB CAMLEJ lies between 20 and 40 ft above msl.

UXO-14 is located in the southwestern portion of MCIEAST-MCB CAMLEJ in the Stones Bay area (**Figure 1-2**). The eastern area of Site UXO-14, the Former Indoor Pistol Range area (ASR #2.199), is comprised of level terrain consisting of maintained grass and a loose sandy area representing the former building footprint. Concrete and construction debris is stockpiled within the Former Indoor Pistol Range area.

2.1.1 Soil and Lithologic Information

Soil cores from borings with depths ranging up to 15 feet below ground surface (bgs) were inspected as part of the PA/SI and provided information regarding site-specific geology. Shallow deposits at the site consist of discontinuous layers of fine-grained sediments consistent with the undifferentiated Formation (Cardinell et al., 1993). Analysis of soil boring logs collected from ground surface to 15 feet bgs indicate sediments of predominantly fine-grained sand interspersed with discontinuous layers of clayey sand and sandy clay (CH2M HILL, 2011a).

2.1.2 Hydrologic and Hydrogeologic Information

Stormwater runoff flows west, eventually discharging to a wetland located west of the site. In general, high rates of infiltration are expected across most of site and erosion at the site is expected to be minimal due to the grassy cover and relatively flat terrain.

The water table of the surficial aquifer is present approximately 5 to 8 feet bgs. Site-specific hydrogeologic information was derived from the installation of four temporary monitoring wells during the PA/SI. Based on groundwater elevation data collected in December 2009, groundwater flow in the surficial aquifer generally flows southwest towards an unnamed tributary of Stones Creek in the vicinity of the Former Indoor Pistol Range (**Figure 1-2**) (CH2M HILL, 2011a).

2.1.3 Surrounding Land Use and Populations

The majority of the area south and west of the Former Indoor Pistol Range is wooded. To the east and north are military buildings, including a woodworking shop with various supporting outbuildings. There are no known current plans for military construction (MILCON) activities to occur in the vicinity of the Former Indoor Pistol Range upon completion of the NTCRA.

There are no water supply wells within 1,500 feet of UXO-14. The closest water supply well is located approximately 10,000 feet off-Base, to the southwest of the Former Indoor Pistol Range area of Site UXO-14.

Potable water to MCIEAST-MCB CAMLEJ and the surrounding residential area is provided by water supply wells. Although freshwater is present within the surficial aquifer, only a deeper aquifer is used by MCIEAST-MCB CAMLEJ as a water supply source (Cardinell, et al., 1993). No water supply wells exist between the Former Indoor Pistol Range and Stones Creek, which is the nearest likely groundwater discharge point (**Figure 1-2**). All the land between the Former Indoor Pistol Range and Stones Creek is owned by MCIEAST-MCB CAMLEJ.

2.1.4 Sensitive Ecosystems

No rare species or sensitive ecosystems have been identified within the Former Indoor Pistol Range area of Site UXO-14.

2.1.5 Meteorology

Mild winters and hot, humid summers characterize the MCIEAST-MCB CAMLEJ area climate. Winters are usually short and mild with occasional and short-duration cold periods. Summers are long, hot, and humid. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 to 53 degrees Fahrenheit (°F) in the winter months to 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, Inc., 1983).

2.2 Site History

A detailed review of existing information was conducted to investigate historical activities that could have resulted in the releases of hazardous substances within the area of investigation. This review included interviews with current and former site personnel. Information obtained from this effort is documented in the Archival Records Search Report presented in the PA/SI report (CH2M HILL, 2011a), and is summarized below.

According to the *Range Identification and Preliminary Range Assessment* (PRA), the Former Indoor Pistol Range was located at former Building RR-53, illustrated on Plate 21 of the PRA, and appeared on base maps from 1950 through 1996 (United States Army Corps of Engineers [USACE], 2001). The range, oriented east to west, was used for small arms training from 1950 until it was demolished around 1996 (Richardson, 2008). Appendix A-1 of the PRA describes small arms ammunition as 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" (USACE, 2001). The PRA does not indicate the quantity of small arms ammunitions used at the Former Indoor Pistol Range.

For typical rifle and pistol ranges, most training is conducted with fixed or stationary targets at known distances, resulting in the formation of "bullet pockets" at the base of the back wall or berm. The high-impact energy of these high-speed rounds with the rounds accumulated in the bullet pockets results in significant fragmentation and ricochet (Interstate Technology & Regulatory Council [ITRC], 2003). This leads to a buildup of metals, such as lead and antimony in one general area, typically at one end, or both, if the shooting direction was ever switched, of the former facility footprint.

2.3 Summary of Previous Investigations

Two site investigations were conducted at Site UXO-14: the PA/SI in 2009 (CH2M HILL, 2011a) and the ESI in 2011 (CH2M HILL, 2011b). The results for these investigations pertaining to the Former Indoor Pistol Range area of Site UXO-14 are discussed in further detail in the sections below.

2.3.1 Preliminary Assessment/Site Inspection (CH2M HILL, 2011a)

In 2009, a PA/SI was conducted to evaluate the potential presence of munitions constituents in environmental media resulting from historical activities, and to evaluate whether additional investigation and/or remediation activities are necessary. The PA/SI approach consisted of collecting 12 surface soil samples from ground surface to a depth of 2 inches, three subsurface soil samples from 2 to 3 feet bgs, and three groundwater samples from the surficial aquifer.

Surface and subsurface soil samples were analyzed for Target Analyte List (TAL) metals using SW-846 USEPA Methods 6010B and 7471B. Groundwater samples were analyzed for total and dissolved metals (SW-846 USEPA Method 6010B). The analytical results for each media are discussed below.

Surface Soil

Antimony, arsenic, chromium, iron, lead, and mercury were detected in at least one of the 12 surface soil samples in exceedance of one of the screening criteria listed in **Table 2-1** below. These exceedance data are depicted on **Figure 2-1** and summarized in **Table 2-2,** and the complete results are included in the PA/SI Table 4-1 included in **Appendix A** (CH2M HILL, 2011a).

TABLE 2-1
PA/SI Surface Soil Screening Levels

Contaminant	MCIEAST-MCB CAMLEJ Background Threshold Value – Undeveloped Sand	NC SSLs (February 2012)	Adjusted Industrial Soil RSLs (June 2011)	Adjusted Residential Soil RSLs (June 2011)
Antimony	0.972	0.9	41	3.1
Arsenic	0.713	5.8	1.6	0.39
Chromium	13.3	3.8	5.6	0.29
Iron	3,950	150	72,000	5,500
Lead	20.9	270	800	400
Mercury	0.0804	1	31	2.3

Notes:
Values in milligrams per kilogram (mg/kg)

TABLE 2-2
PA/SI Surface Soil Screening Results Summary

Contaminant	Frequency of Exceedances	Maximum Concentration (mg/kg)	Maximum Concentration Location
Antimony	5/12	387	SS12
Arsenic	6/12	2.7	SS12
Chromium	12/12	3.76	SS01
Iron	12/12	1,470	SS01
Lead	12/12	35,500	SS12
Mercury	1/12	1.08	SS02

Subsurface Soil

Antimony, chromium, iron, lead, and zinc were detected in at least one of the three subsurface soil samples in exceedance of one of the screening criteria listed in **Table 2-3** below. These data are depicted on **Figure 2-2**, summarized in **Table 2-4**, and the complete results are included in the PA/SI Table 4-2 in **Appendix A** (CH2M HILL, 2011a).

TABLE 2-3
PA/SI Subsurface Soil Screening Levels

Contaminant	MCIEAST-MCB CAMLEJ Background Threshold Value – Undeveloped Sand	NC SSLs (February 2012)	Adjusted Industrial Soil RSLs (June 2011)	Adjusted Residential Soil RSLs (June 2011)
Antimony	1.02	0.9	41	3.1
Chromium	17.8	3.8	5.6	0.29
Iron	5,400	150	72,000	5,500
Lead	6.94	270	800	400
Zinc	5.54	1,200	31,000	2,300

Notes:
Values in milligrams per kilogram (mg/kg)

TABLE 2-4
PA/SI Subsurface Soil Screening Results Summary

Contaminant	Frequency of Exceedances	Maximum Concentration (mg/kg)	Maximum Concentration Location
Antimony	1/3	2.62	IS01
Chromium	3/3	1.06	IS01
Iron	3/3	370	IS01
Lead	1/3	290	IS01
Zinc	1/3	9.98	IS01

Groundwater

Arsenic, chromium, copper, and iron were detected in at least one of three groundwater samples in exceedance of one of the screening criteria listed in **Table 2-5** below. These data are depicted on **Figure 2-3**, summarized in **Table 2-6**, and the complete results are included in the PA/SI Table 4-3 of **Appendix A** (CH2M HILL, 2011a).

TABLE 2-5
PA/SI Groundwater Screening Levels

Contaminant	MCIEAST-MCB CAMLEJ Background Threshold Value	NCGWQS (January 2010)	Adjusted Tap Water RSLs (April 2012)
Arsenic	9.79	10	0.045
Chromium	16.9	10	0.031
Copper	6.59	1,000	620
Iron	16,100	300	1,100

Notes:
Values in micrograms per liter (µg/L)

TABLE 2-6
PA/SI Groundwater Screening Results Summary

Contaminant	Frequency of Exceedances	Maximum Concentration (µg/L)	Maximum Concentration Location
Arsenic	2/3	4.09	TW02
Chromium	3/3	2	TW01
Copper	1/3	103	TW02
Iron	3/3	2,910	TW02

These analytical data results were then used to conduct an initial human health and ecological risk screening, which is discussed in greater detail in Section 2.4 below. Based on the initial results of the PA/SI risk screenings, an ESI was recommended to delineate the extent of identified impacts in surface and subsurface soil, primarily due to the risks associated with antimony, lead, and mercury at the Former Indoor Pistol Range area of Site UXO-14. No unacceptable risks due to exposure to groundwater were identified.

2.3.2 Expanded Site Investigation (CH2M HILL, 2011b)

Based on the results and recommendations of the PA/SI, an ESI was conducted to evaluate the distribution of and potential unacceptable human health and ecological risks associated with antimony, lead, and mercury in soil at the Former Indoor Pistol Range by collecting and evaluating additional surface and subsurface soil samples. The ESI approach consisted of collecting 14 surface soil samples from ground surface to a depth of 2 inches and seven subsurface soil samples at depths ranging from 5 to 8 feet bgs. Surface and subsurface soil samples were analyzed for the metals antimony, lead, and mercury using SW-846 USEPA Methods 6010B and 7471B. The analytical results for each media are discussed below.

Surface Soil

Antimony, lead, and mercury were each detected in at least one of the 14 samples in exceedance of one of the screening criteria listed in **Table 2-7** below. These exceedance data are depicted on **Figure 2-1**, summarized in **Table 2-8,** and included in Table 4-2 from the ESI in **Appendix A** (CH2M HILL, 2011b).

TABLE 2-7
ESI Surface Soil Screening Levels

Contaminant	MCIEAST-MCB CAMLEJ Background Threshold Value – Undeveloped Sand	NC SSLs (February 2012)	Adjusted Industrial Soil RSLs (June 2011)	Adjusted Residential Soil RSLs (June 2011)
Antimony	0.972	0.9	41	3.1
Lead	20.9	270	800	400
Mercury	0.0804	1	31	2.3

Notes:
Values in milligrams per kilogram (mg/kg)

TABLE 2-8
ESI Surface Soil Screening Results Summary

Contaminant	Frequency of Exceedances	Maximum Concentration (mg/kg)	Maximum Concentration Location
Antimony	3/14	2.5 J	SS23
Lead	12/14	886 J	SS31
Mercury	1/14	0.089	SS24

Subsurface Soil

Antimony and lead were each detected in at least one of the seven subsurface soil samples in exceedance of one of the screening criteria listed in **Table 2-9** below. These exceedance data are depicted on **Figure 2-2**, summarized in **Table 2-10,** and included in Table 4-4 from the ESI in **Appendix A** (CH2M HILL, 2011b).

TABLE 2-9
ESI Subsurface Soil Screening Levels

Contaminant	MCIEAST-MCB CAMLEJ Background Threshold Value – Undeveloped Sand	NC SSLs (February 2012)	Adjusted Industrial Soil RSLs (June 2011)	Adjusted Residential Soil RSLs (June 2011)
Antimony	1.02	0.9	41	3.1
Lead	6.94	270	800	400

Notes:
Values in milligrams per kilogram (mg/kg)

TABLE 2-10
ESI Subsurface Soil Screening Results Summary

Contaminant	Frequency of Exceedances	Maximum Concentration (mg/kg)	Maximum Concentration Location
Antimony	1/7	0.842 J	IS07
Lead	5/7	71.5	IS07

2.4 Risk Screening Summary

During the PA/SI, human health and ecological risk evaluations were conducted to identify potential risks posed to various receptors from exposure to soil and groundwater at the Former Indoor Pistol Range. These evaluations were then updated during the ESI. The Conceptual Site Model (CSM) illustrated on **Figure 2-4** depicts possible exposure scenarios for human and ecological receptors.

2.4.1 Human Health Risk Screening

A Human Health Risk Screening (HHRS) was conducted to evaluate the potential for unacceptable risks to humans from exposure to soil and groundwater at the Former Indoor Pistol Range. The HHRS indicated that exposure to groundwater and subsurface soil would not result in any unacceptable risks to human health, but there is potential unacceptable risk associated with exposure to lead and antimony in surface soil. The data evaluated during the HHRS are presented in Appendix E of the ESI (CH2M HILL, 2011b).

2.4.2 Ecological Risk Screening

An Ecological Risk Screening (ERS) was conducted to evaluate the potential for unacceptable risks to ecological receptors from exposure to soil and groundwater at the Former Indoor Pistol Range. The data evaluated during the ERS are presented in Appendix F of the ESI (CH2M HILL, 2011b). The results of the ERS indicated that exposure to groundwater would not result in any unacceptable risks to ecological receptors.

Antimony and lead in surface and subsurface soil were identified as potentially posing unacceptable risks to lower trophic level receptors, while lead was identified in surface soil as potentially posing unacceptable risks for upper trophic level receptors. However, only one subsurface soil sample contained concentrations of these analytes greater than base background levels. Thus, subsurface soil contamination is considered isolated and limited in extent and does not warrant remedial action. Additionally, antimony is not considered to bioaccumulate; therefore, risk to birds and mammals from exposure to antimony is not considered to be significant. Consequently, lead in surface soil is considered to pose an unacceptable risk to ecological receptors.

2.4.3 Site-specific Remediation Goals

In order to address the potentially unacceptable risks from exposure to lead and antimony in surface soil, site-specific risk-based clean-up levels, or SRGs, were developed. The SRGs were developed for the most conservative potential future use of the site which would be residential. As discussed above, the HHRS identified antimony and lead in surface soil as posing potential unacceptable risks to human receptors. Therefore, human health risk-based SRGs were calculated for antimony and lead in surface soil for future residential land use.

The potential unacceptable risks associated with antimony are based on non-carcinogenic effects as antimony is not considered a carcinogen. Therefore, the residential use-based SRG for antimony was calculated for a child resident based on a target non-cancer hazard. The SRG was calculated using standard default EPA exposure assumptions, and the calculation is shown in Table B-1 in **Appendix B**. The antimony SRG was calculated for target non-cancer hazard indices of 0.1, 0.5, and 1; however, as antimony was the only non-carcinogenic constituent posing a potential unacceptable risk, the SRG was based on the target hazard index of 1.

The lead SRG was calculated using the Integrated Exposure Uptake Biokinetic (IEUBK) model for the residential child and the results are shown in Table B-2 in **Appendix B**. The IEUBK model was run using all of the default model values except for the default groundwater concentration. The maximum detected concentration of lead in groundwater at UXO-14 (0.98 μg/L from sample MR14-TW01-9D) was used as the groundwater input concentration.

The calculated SRGs for antimony and lead that would allow for unlimited use/unrestricted exposure (UU/UE) are as shown in **Table 2-11** below. Background values are also provided for comparison.

TABLE 2-11
Site Specific Remediation Goals

Contaminant	MCIEAST-MCB CAMLEJ Background Threshold Value – Undeveloped Sand	Site Specific Remediation Goal
Antimony	0.972	31
Lead	20.9	443

Notes:
Values in milligrams per kilogram (mg/kg)

Additionally, lead in surface soil is considered to pose an unacceptable risk to ecological receptors. Application of the SRG for lead would be protective of ecological receptors for several reasons. First, the primary risk posed by these analytes is to lower and upper trophic level receptors exposed to surface soils from 0 to 1 foot bgs. The excavation would remove all soils between 0 and 1 foot bgs that contained lead and antimony at concentrations greater than the human health SRGs. This area would then be backfilled with clean fill and the exposure pathway to subsurface soils would be eliminated. Second, the average concentrations of lead located outside the proposed

excavation area are not likely to pose risk to birds and mammals foraging in the area. The average residual lead concentration (178 mg/kg) is less than the concentration considered to pose no risk to populations based on a lowest observed adverse effect level for the most sensitive species evaluated, the mourning dove (338 mg/kg). While some elevated lead concentrations may remain in soils outside the proposed excavation area, they are isolated and very limited in extent and would not be considered to pose a risk to populations of ecological receptors. **Figure 2-1** depicts the highest overall concentrations of lead and antimony in surface soil that were detected during the PA/SI and ESI field investigations. **Figure 2-5** depicts two separate removal areas, which represent exceedances of the SRGs at the UXO-14 Former Indoor Pistol Range. These are the areas that will be addressed during the NTCRA.

2.5 Determination of Removal Area

Based on analytical data and the results of the HHRS and ERS, an area of the site was identified as posing unacceptable risks to humans and the environment due to concentrations of lead and/or antimony in surface soil. This area identified for action under this NTCRA is based on exceedances of the SRGs. A total of 0.16 acre (roughly 7,000 square feet) of impacted surface soil to a depth of 1 foot bgs is recommended for action, as illustrated by the proposed removal action areas on **Figure 2-6**. The volume of soil is estimated to be approximately 260 cubic yards (). Confirmation samples will be collected at the limits of the removal area (side walls and base, if applicable) for any removal action involving excavation to confirm that the full extent of impacted soil is addressed.

SECTION 3

Identification of Removal Action Objectives

This section identifies the objectives for the NTCRA at the Former Indoor Pistol Range. The objectives for the proposed removal action area are based on the identified risks identified which were posed by exposure to lead and antimony in the surface soil.

The following are the removal action objectives (RAOs) for the NTCRA:

1. Prevent exposure to surface soils with lead and antimony concentrations exceeding the site-specific remediation goals.
2. Reduce the potential for COCs lead and antimony to migrate from surface soil to subsurface soil and groundwater.

3.1 Statutory Limits on Removal Actions

NCTRAs funded by the USEPA have a $2 million and a 12-month statutory limit pursuant to Section 104(c)(1) of CERCLA fund-financed removal actions, with statutory exemptions for emergencies and actions consistent with the removal action to be taken. This removal action will not be USEPA fund-financed; it will be financed by the Navy. The Defense Environmental Restoration Program (DERP) Manual does not limit the cost or duration of the removal action; however, cost-effectiveness is a recommended criterion for the evaluation of removal action alternatives.

3.2 Determination of Removal Action Scope

Potential risks have been identified in two areas around the footprint of the Former Indoor Pistol Range. The selected removal action is intended to be a corrective action implemented within the vicinity of the Former Indoor Pistol Range to reduce the amount of contaminant mass present, to the extent practicable, in order to minimize potential unacceptable risk to human health and the environment and reduce the potential for contaminant migration from soil to groundwater.

3.3 Determination of Removal Action Schedule

Implementation of the removal action is anticipated to require approximately 2 to 3 weeks based on which removal action is chosen. Factors that may affect the removal action schedule primarily relate to site conditions, requirements of the removal technologies, availability of vendors and supplies, MCIEAST-MCB CAMLEJ mission requirements, and inclement weather.

3.4 Applicable or Relevant and Appropriate Requirements

As required by Section 121 of CERCLA, removal actions carried out onsite under Section 104 or secured under Section 106 must attain the levels of standards of control for hazardous substances, pollutants, or contaminants specified by the applicable or relevant and appropriate requirements (ARARs) of federal and state environmental laws and state facility-siting laws unless waivers are obtained. The elements of the removal action, carried out offsite, are subject to all applicable regulations rather than ARARs. The requirements of CERCLA generally apply as a matter of law only to removal actions. However, as required by 40 CFR Section 300.415(j), ARARs will be identified and attained for removal actions to the extent practicable. The following three factors will be applied to determine whether the identification and attainment of ARARs is practicable in a particular removal situation:

1. Exigencies~~Demands~~ of the situation
2. Scope of the removal action
3. Effect of ARAR attainment on the statutory limits for removal action duration and cost

ARARs are identified by the USEPA as either being applicable to a situation or relevant and appropriate to it. These distinctions are critical to understanding the constraints imposed on response alternatives by environmental regulations other than CERCLA while operating onsite. The following definitions of ARARs are from the USEPA guidance (USEPA, 1988).

Applicable requirements, as defined in 40 CFR Section 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site.~~"Applicable requirements" are standards and other environmental protection requirements of federal or state law dealing with a hazardous substance, pollutant, contaminant, action being taken, location, or other circumstance at a CERCLA site.~~

"Relevant and appropriate requirements" are standards and environmental protection criteria of federal or state law that, although not "applicable" to a hazardous substance, pollutant, contaminant, action being taken, location, or other circumstance, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. The procedure to determine whether a requirement is relevant and appropriate is a two-step process. A requirement is "relevant" if it addresses problems or situations sufficiently similar to the circumstances of the proposed response action. A requirement is "appropriate" if it would also be well suited to the conditions of the site.

A requirement may be "relevant" to a particular situation but not "appropriate," given site-specific circumstances; such a requirement would not be an ARAR for the site. A requirement that is relevant and appropriate must be met as if it were applicable. Relevant and appropriate requirements that are more stringent than applicable requirements take precedence. However, more discretion is allowed in determining relevant and appropriate requirements than in determining applicable requirements.

"To-be-considereds" (TBCs) are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. TBCs are evaluated along with ARARs and may be implemented by USEPA when ARARs are not fully protective of human health and the environment.

Another factor in determining which response requirement must be met is whether the requirement is substantive or administrative. Onsite CERCLA response actions must meet substantive requirements of ARARs but not administrative requirements. This distinction applies to onsite actions only, as offsite response actions are subject to all applicable standards and regulations, including administrative requirements such as permits, rather than ARARs. Substantive requirements are those dealing directly with actions or with conditions in the environment. Administrative requirements implement the substantive requirements by prescribing procedures such as fees, permitting, and inspection that make substantive requirements effective.

Three classifications of requirements are defined by USEPA in the ARAR determination process: chemical-specific, location-specific, and action-specific. **Appendix C** contains the ARAR summary.

Chemical-specific ARARs are health- or risk-management-based numbers or methodologies that result in the establishment of numerical values for a given medium that would meet the NCP "threshold criterion" of overall protection of human health and the environment. These requirements generally set protective SRG concentrations for the COCs in the designated media, or set safe concentrations of discharge for response activity. Chemical-specific requirements are generally set for a single chemical or closely related group of chemicals and do not typically consider mixtures of chemicals. When chemical-specific requirements do not adequately protect human health or the environment, SRGs may be set below the TBC value.

Location-specific ARARs restrict response activities and media concentrations based on the characteristics of the surrounding environments. Location-specific ARARs may include restrictions on response actions within wetlands or floodplains, near locations of known endangered species, or on protected waterways.

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances.

Not all potential ARARs identified in **Appendix C** apply to every remedial alternative. A discussion concerning which ARARs may apply to each specific response action is included in Section 5. The work plan for the selected alternative will provide additional detail on how the ARARs for that action will be met.

SECTION 4

Identification of Removal Action Alternatives

General removal actions that could be used to satisfy RAOs include institutional controls, removal, containment, treatment, and disposal. In accordance with USEPA guidance (1993), treatment technologies are more favorable than containment. Technologies with demonstrated effectiveness in significantly reducing lead and antimony mass or mobility in soil include:

- Excavation and backfill
- Soil stabilization (*in situ* and *ex situ*)

4.1 Technology Descriptions

The following is a short description of the technologies considered for further evaluation.

Excavation and Backfill

Excavation and backfill involves the excavation of the removal area using conventional earth-moving equipment. The area of excavation is typically backfilled to original grade with imported clean fill or excavated soil that meets the SRGs. Excavation and backfill allows site closure or reuse within a short time frame, without long-term environmental monitoring.

All excavated soil would require disposal sampling in accordance with Resource Conservation and Recovery Act (RCRA) disposal requirements. The results of waste sampling would determine the final designation of the excavated soil as hazardous or non-hazardous. Non-hazardous soil would be transported to a regional Subtitle D landfill facility for disposal. Hazardous soil would be transported to a permitted, RCRA Subtitle C treatment, storage, or disposal facility.

Additional activities associated with excavation and backfill include: site surveying and clearing, construction of appropriate erosion and sediment controls to prevent contaminants from leaving the site, dust control, confirmation sampling on the sidewalls and base of the excavation, and restoration of excavated areas.

Soil Stabilization

Soil stabilization is a process by which material within the identified removal area are mixed with a reagent that chemically binds and immobilizes lead and other metals, such as antimony, in soil (USEPA, 2005). Lead binds readily with inorganic salts such as phosphate or sulfate and forms less soluble compounds, such as lead phosphate and lead sulfate. Lead is least soluble (and thereby immobile) when the pH of soil is maintained between 6 and 9 (ITRC], 2003). A buffering compound, such as lime or manganese oxide, reduces the leachability of lead. Reagents are typically buffered phosphate, sulfate, hydroxide, or carbonate compounds. Known soil stabilization reagents include Apatite, EcoBond, EnviroBlend, and Portland cement. EnviroBlend was the reagent identified for cost estimating purposes and its product information is included in **Appendix D**. The reagent would be applied to the ground surface and mixed into the shallow subsurface (*in situ*). Conventional construction equipment can be used to apply and mix the reagent. Material treated and excavated would be managed in accordance with RCRA disposal requirements. Additional activities associated with soil stabilization include: site surveying and clearing, dust control construction of erosion and sediment controls to prevent contaminants from leaving the site, confirmation sampling, and restoration of excavated and/or disturbed areas.

4.2 Development of Removal Action Alternatives

Three alternatives have been developed, drawing on the technologies described in Section 4.1. A discussion of each alternative is provided as follows.

4.2.1 Alternative 1—No Action

Alternative 1 implies that no treatment or removal work would be done. The no action alternative is the baseline against which the effectiveness of other removal action alternatives is compared. The area would be left as it currently exists, leaving the impacted surface soil in place. Under this alternative, no controls or removal technologies would be implemented. CERCLA (Section 121(c)), as amended by SARA (1986), requires that the site be reviewed every 5 years since the impacted surface soil remains onsite.

4.2.2 Alternative 2—Excavation and Offsite Disposal

Alternative 2 involves the excavation of roughly 260 of soil from the target removal area. Excavated soil would be transported offsite for treatment and disposal. The excavation would be backfilled, graded, and seeded to promote drainage.

Although it is assumed the soil will be classified as a characteristic hazardous waste for lead, waste disposal soil samples will be taken and analyzed to determine RCRA classification. Soil classified as hazardous would either be direct loaded into dump trucks or staged in roll-offs for transport to a permitted, RCRA Subtitle C treatment, storage, or disposal facility. ~~transported by roll-off to a permitted, RCRA Subtitle C treatment, storage, or disposal facility.~~ Any non-hazardous material would be disposed of at an approved Subtitle D landfill. For costing purposes, o~~O~~ffsite disposal of excavated material was assumed to~~would~~ require 27 roll-offs ~~(assuming~~at 15 tons ~~per truck)~~each~~.~~.

Confirmation samples would be collected from the side walls and base of the excavation and analyzed for lead and antimony and compared to the SRGs to verify that the horizontal and vertical extent of the contamination was removed. For this evaluation, the excavation area is assumed to be divided into 30-foot by 30-foot grids. A base sample will be composited from four aliquots collected within each grid. If the grid is along a sidewall, a sidewall sample will be composited from four aliquots collected within each grid. This is expected to result in the analysis of seven confirmation samples in the westernmost removal area (three base, four sidewall) and five samples in the eastern removal area to the east (one base, four sidewall).

All excavated soils would be managed in accordance with RCRA disposal requirements. ~~The rule of thumb entails collecting 1 sample per 500 tons of soil excavated for waste characterization.~~ An estimated 390 tons of soil would be excavated; and based on a rule of thumb that one sample per 500 tons be analyzed for Toxicity Characteristic Leaching Procedure (TCLP), only one TCLP sample was assumed for costing purposes. ~~An estimated 390 tons of soil would be excavated; therefore, only one sample will be analyzed for the Toxicity Characteristic Leaching Procedure (TCLP).~~ However, the frequency of representative waste characterization ~~via TCLP~~ sampling will ultimately be based on the sizes of the loads hauled for disposal and ~~adhere to~~ the requirements of the disposal facility. Samples for offsite disposal characterization will also be collected in accordance with the MCIEAST-MCB CAMLEJ Investigation and Remediation Waste Management Plan (CH2M HILL, 2011d) ~~and the requirements of the disposal facility~~.

The following components are also included in this alternative:

- Site survey of excavation boundary and utility location
- Construction of erosion and sediment controls
- Concrete and debris removal as non-hazardous waste prior to soil excavation
- Site restoration with grading, clean soil backfilling, and seeding

4.2.3 Alternative 3—*In Situ* Soil Stabilization with Excavation and Offsite Disposal

Alternative 3 involves *in situ* mixing of stabilization reagents to render the contaminated soil non-hazardous, followed by excavation of the treated material from the removal area. The stabilization reagents would be distributed across the removal area using a spreader truck, then tilled into the underlying soil to a depth of 1 foot bgs using conventional equipment. Approximately 270 of stabilized material would then be excavated and managed as non-hazardous waste and transported offsite for disposal. The excavation will be backfilled, graded, and seeded to promote drainage.

For Alternative 3, the primary purpose for a stabilization reagent would be to minimize lead leaching as evaluated by the TCLP method. Since antimony is not included in characteristic waste, the EnviroMag reagent will be used to stabilize the lead within the removal area, at a dose of 4 percent by weight. Since the reagent does not have an activation time, once it is mixed into the soil the TCLP sample can be immediately collected in preparation for subsequent excavation.

All excavated and treated soils would be analyzed to determine if soil has been rendered non-hazardous waste, in accordance with RCRA disposal requirements. An estimated 410 tons of soil would be excavated; and based on a rule of thumb that one sample per 500 tons be analyzed for TCLP, only one TCLP sample was assumed for costing purposes. However, the frequency of representative waste characterization ~~via TCLP~~ sampling will ultimately be based on the sizes of the loads hauled for disposal and ~~adhere to~~ the requirements of the disposal facility. Samples for offsite disposal characterization will also be collected in accordance with the MCIEAST-MCB CAMLEJ Investigation and Remediation Waste Management Plan (CH2M HILL, 2011d).

~~Approximately one sample would be collected per 500 tons of stabilized material for waste characterization. The estimated mass soil plus mixed in reagents is 410 tons; therefore, only one sample would need to be taken for TCLP analysis. Samples for offsite disposal characterization will be collected in accordance with the MCIEAST-MCB CAMLEJ Investigation and Remediation Waste Management Plan (CH2M HILL, 2011d) and the requirements of the disposal facility.~~ It is assumed that incorporation of the stabilization reagent will result in the characterization of all treated waste as non-hazardous. Non-hazardous material would either be direct loaded into dump trucks or staged in roll-offs for transport ~~transported offsite, requiring 28 roll-offs (assuming a maximum of 15 tons per roll-off) for~~ and disposal at an approved Subtitle D Landfill. If waste characterization indicates that excavated material remains hazardous, the material will be handled as such and disposed of according to RCRA hazardous waste requirements. For costing purposes, offsite disposal of excavated material was assumed to require 28 roll-offs at 15 tons each.

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Confirmation samples would be collected from the side walls and base of the excavation and analyzed for COCs and compared to the SRGs to verify that the horizontal and vertical extent of the contamination was removed. For this evaluation, it is assumed the excavation area will be divided into 30-foot by 30-foot grids. A base sample will be composited from four aliquots collected within each grid. If the grid is along a sidewall, a sidewall sample will be composited from four aliquots collected within each grid. This is expected to result in analysis of seven confirmation samples within the larger removal area (three base, four sidewall) and five samples from the smaller removal area (one base, four sidewall).

The following components are also included in this alternative:

- Site survey of excavation boundary and utility location
- Construction of erosion and sediment controls
- Concrete and debris removal as non-hazardous waste prior to soil stabilization mixing and excavation
- Site restoration by grading, soil backfill, and seeding

SECTION 5

Detailed Analysis of Removal Action Alternatives

The alternatives analysis uses the three main evaluation criteria of effectiveness, implementability, and cost in accordance with the USEPA guidance (1993). Each evaluation criterion is described in **Table 5-1.** Anticipated ARARs are listed in **Appendix C** and a breakdown of anticipated costs for each alternative is included in **Appendix E**. Additionally, a sustainability assessment was conducted using SiteWise, a stand-alone tool that assesses the environmental footprint of a remedial alternative to compare the overall life-cycle environmental impacts of each remedy (Battelle, 2010). The sustainability assessment does not replace any of the nine criteria; however, it provides an additional comparison criterion that may allow options with a smaller environmental impact to be selected when all other criteria are met. The results using the sustainability analysis tool SiteWise for each alternative are included in **Appendix F**. **Table 5-2** summarizes the evaluation for each alternative.

TABLE 5-1
Evaluation Criteria

Effectiveness	
Protection of human health and the environment	The assessment describes how the action achieves and maintains protection of human health and the environment and achieves site-specific objectives both during and after implementation.
Compliance with ARARs	An alternative is assessed in terms of its compliance with ARARs, or if a waiver is required, how it is justified.
Short-term effectiveness	An action is assessed in terms of its effectiveness in protecting human health and the environment during the construction and implementation of a remedy before response action objectives have been met. The duration of time until the response objectives are met and the environmental impact of each alternative are also factored into this criterion.
Long-term effectiveness and permanence	An action is assessed in terms of its long-term effectiveness in maintaining protection of human health and the environment after response action objectives have been met. The magnitude of residual risk and adequacy and reliability of post-removal site controls are taken into consideration.
Reduction of toxicity, mobility, or volume through treatment	An action is assessed in terms of anticipated performance of the specific treatment technologies it employs. Factors such as volume of materials destroyed or treated, the degree of expected reductions, the degree to which treatment is irreversible, and the type and quantity of remaining residuals are taken into consideration.
Implementability	
Technical feasibility	The ability of the technology to implement the remedy is evaluated.
Administrative feasibility	The administrative feasibility factor evaluates requirements for permits, zoning variances, impacts on adjoining property, and the ability to impose institutional controls.
Availability of services and materials	The availability of offsite treatment, storage and disposal capacity, personnel, services and materials, and other resources necessary to implement the alternative will be evaluated.
State and community acceptance	The acceptability of an alternative to the state agency and the community is evaluated.
Cost	
Direct and indirect capital costs	Includes costs for construction, equipment and materials, analytical services, engineering and design, and permits and licenses.

TABLE 5-2

Summary of Alternative Evaluation

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation and Offsite Disposal	Alternative 3 *In Situ* Soil Stabilization with Excavation and Offsite Disposal
Effectiveness			
Overall protection of human health and the environment	Does not meet RAOs	Meets RAOs through removal of soil from the site.	Meets RAOs through removal of the soil from the site.
Compliance with ARARs	Does not ~~meet~~ trigger ARARs	Implementation would require compliance with location- and action-specific ARARs. Includes requirements relating to stormwater runoff, dust emissions, management of hazardous and non-hazardous waste, and onsite staging piles.	Implementation would require compliance with location- and action-specific ARARs. Includes requirements relating to stormwater runoff, dust emissions, management of non-hazardous waste, and onsite staging piles.
Long-term effectiveness and permanence	Not effective in the long-term.	All soil with COCs above RAOs ~~exceeding site cleanup levels~~ would be removed from site. Residual site risk is acceptable ~~for UU/UE~~.	All soil with COCs ~~exceeding site cleanup levels~~above RAOs would be removed from the site. Residual site risk is acceptable.
Reduction of toxicity, mobility, or volume through treatment	Does not reduce toxicity, mobility, and volume.	Reduces toxicity, mobility, and volume through soil removal. Contaminants are not destroyed, but rather moved to an appropriate permitted disposal facility. ~~Treatment is not included; however, reduces toxicity, mobility, and volume through soil removal.~~	Reduces toxicity, mobility, and volume through soil removal. Stabilization reduces lead mobility in soil. Contaminants are not destroyed, but rather moved to an appropriate permitted disposal facility. ~~Reduces toxicity, mobility, and volume through treatment. Stabilization and subsequent removal would reduce COC mobility in soil thus meeting criteria.~~
Short-term effectiveness	Not effective in the short-term.	Potential risks to site workers and the nearby community due to construction activity and increased truck traffic. Potential dust emission issues associated with excavation may require engineering controls. Action would require 2 weeks in the field to complete. Potential environmental impact due to transportation of investigation-derived waste (IDW) to disposal facility.	Potential risks to site workers and the nearby community due to construction activity and increased truck traffic. Potential dust emission issues associated with excavation and reagent mixing may require engineering controls. Action would require up to 3 weeks in the field to complete. Potential environmental impact due to transportation of investigation-derived waste (IDW) to disposal facility.
Implementability			
Technical Feasibility	Feasible	Excavation is a standard and reliable technology. Monitoring the technical aspects is easily done.	Excavation and in situ stabilization are reliable technologies. Monitoring the technical aspects is easily done.
Administrative Feasibility	Feasible	Waste being disposed is considered hazardous and would require additional permitting.	Treated waste is non-hazardous, and additional permitting is not necessary for transport or disposal.
Availability of Services and Materials	Not applicable	Services and materials are readily available. Limited number of disposal facilities.	Services and materials are readily available.
State and Community Acceptance	Unlikely	To be determined	To be determined

TABLE 5-2

Summary of Alternative Evaluation

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation and Offsite Disposal	Alternative 3 *In Situ* Soil Stabilization with Excavation and Offsite Disposal
Cost			
Capital Cost	**$0**	**$387,000**	**$296,000**

5.1 Alternative 1—No Action

Effectiveness

Alternative 1, No Action, implies that no work would be done; therefore, this alternative is not capable of meeting the RAOs presented in Section 3. Alternative 1 does not address or mitigate the potential identified risks to human health and the environment or reduce the potential for horizontal and vertical migration and would therefore not be effective in the long-term.

This alternative would not involve any construction or operation and maintenance (O&M) activities and, therefore, would not involve any short-term risks and would not trigger any action-specific or location-specific ARARs that control such activities and no treatment would be implemented to reduce toxicity, mobility, or volume.

Implementability

Alternative 1, No Action, does not have construction or monitoring components and is therefore technically and administratively feasible. There are no implementability concerns posed by this remedy. State and community acceptance of this alternative is unlikely.

Cost

There are no costs posed by Alternative 1, no action.

5.2 Alternative 2—Excavation and Offsite Disposal

Effectiveness

Alternative 2, Excavation with Offsite Disposal, is considered protective of human health and the environment. Through physical removal of the soil, Alternative 2 is suitable for bulk removal of lead- and antimony-impacted surface soil above SRGs. Alternative 2 will require 2 weeks of field work to achieve RAOs.

Alternative 2 would have to comply with ARARs. All location-specific ARARs presented in **Appendix C** are applicable to Alternative 2. Action-specific ARARs applicable to Alternative 2 include requirements relating to the management of stormwater runoff from land-disturbing activities, the management of fugitive dust emissions, and the management of hazardous and non-hazardous waste onsite. Chemical-specific ARARs to be considered include the Risk Assessment Guidance for Superfund (RAGS) for antimony and lead, as these criteria were evaluated to identify the target treatment area and will be considered during the removal action to determine the extent of treatment.

Alternative 2 is effective in the long-term, as soil with concentrations above the SRGs would be physically removed and long-term environmental monitoring and LUCs would not be necessary. However, contaminants are not destroyed, but rather moved to a permitted facility. Alternative 2 eliminates toxicity, mobility, and volume of lead and antimony from the site through removal, but not treatment.

Alternative 2 would raise overall site risk for the period during which the action took place. Risks to site workers and the nearby community would increase due to construction activity and truck traffic. Engineering controls would be implemented to control dust and sediment and erosion control and to facilitate stormwater management. There would be an increase in truck traffic transporting the soil offsite for disposal that could cause a greater risk of injury or accidents. The health and safety issues with Alternative 2 are due to dust emissions, lead and antimony exposure, and heavy equipment used for excavation.

Implementability

Alternative 2, Excavation with Offsite Disposal, is technically feasible and easily implementable. Shallow subsurface utilities in the treatment area may be relocated or abandoned. Monitoring the removal effectiveness is easily completed. Services and materials associated with implementation of Alternative 2 are standard and readily available; however, there are a limited number of disposal facilities. State acceptance of this alternative is subject

to review. Community acceptance of this alternative is unknown and would be determined during the public comment period.

Cost

Alternative 2, Excavation with Offsite Disposal, is estimated to cost $387,000 (a -30 percent/+50 percent range of $271,000 to $580,000). This is equivalent to $1,476 per . There are no O&M costs associated with this alternative.

5.3 Alternative 3—*In Situ* Soil Stabilization with Excavation and Offsite Disposal

Effectiveness

Alternative 3, *In Situ* Soil Stabilization with Excavation and Offsite Disposal, is protective of human health and the environment. Through physical removal of the soil, Alternative 3 is suitable for bulk removal of lead- and antimony-impacted surface soil above the SRGs. Alternative 3 would require up to 3 weeks of field work to achieve RAOs.

Alternative 3 would have to comply with ARARs. All location-specific ARARs presented in **Appendix C** are applicable to Alternative 3. Action-specific ARARs applicable to Alternative 3 include requirements relating to the management of stormwater runoff from land-disturbing activities, the management of fugitive dust emissions, and the management of non-hazardous waste onsite. Because soil will be treated prior to excavation, requirements associated with the management of hazardous waste onsite are not applicable. Chemical-specific ARARs to be considered include the RAGS for antimony and lead, as these criteria were evaluated to identify the target treatment area and will be considered during the removal action to determine the extent of treatment.

Alternative 3 is effective and protective in the long-term, as the soil would be physically removed. However, stabilization does not destroy contaminants, but rather it makes them less mobile and reduces toxicity, making them a non-hazardous waste. Alternative 3 eliminates toxicity, mobility, and volume of lead and antimony from the site through treatment. Long-term environmental monitoring and LUCs would not be necessary.

Alternative 3 would raise overall site risk for the period during which the action took place. Risks to site workers and the nearby community would increase due to construction activity. Engineering controls would be implemented for dust control, sediment and erosion control, and stormwater management. There would be an increase in truck traffic that could cause a greater risk of injury or accidents. The health and safety issues with Alternative 3 are due to dust emissions, lead and antimony exposure, and heavy equipment used for excavation.

Implementability

Alternative 3, *In Situ* Soil Stabilization with Excavation and Offsite Disposal, is technically feasible and easily monitored. Shallow subsurface utilities in the excavation area may be relocated or abandoned. Treated material would need to be transported offsite for disposal. Services and materials associated with implementation of Alternative 3 are readily available. State acceptance of this alternative is subject to review. Community acceptance of this alternative is unknown and would be determined during the public comment period.

Cost

Alternative 3, *In Situ* Soil Stabilization with Excavation and Offsite Disposal, is estimated to cost $296,000 (a -30 percent/+50 percent range of $208,000 to $445,000). This is equivalent to $1,132 per . There are no O&M costs associated with Alternative 3.

SECTION 6

Comparative Analysis of Removal Action Alternatives

In this section, the alternatives are directly compared to one another based on their effectiveness, ease of implementation, and cost. This analysis clarifies which alternative is preferable in each category. Alternative 1 is not considered protective of human health or the environment and does not achieve the RAOs of this EE/CA because contamination would remain in place without administrative controls. For these reasons, Alternative 1 is not analyzed in the following sections.

6.1 Effectiveness

6.1.1 Protection of Human Health and the Environment

Alternatives 2 and 3 can achieve the RAOs specified in Section 3. Alternative 2 (Excavation and Offsite Disposal) and Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) are similar in protectiveness because they each involve the complete excavation and offsite transport of impacted soil, mitigating risks to human health and ecological receptors at the site.

6.1.2 Compliance with ARARs and Other Criteria, Advisories, and Guidance

Alternatives 2 and 3 comply with all ARARs. The ARARs are summarized in **Appendix C**.

Action-Specific ARARs

Alternatives 2 and 3 would be implemented in compliance with requirements relating to the management of stormwater runoff from land-disturbing activities, the management of fugitive dust emissions, and the management of non-hazardous solid waste onsite. If Alternate Design Criteria for construction management techniques, best management practices for sediment and erosion controls, and stormwater management measures, as specified in 15A North Carolina Administrative Code (NCAC) 02H.1008(h), are utilized, then the substantive requirements included in that provision will be met and documented either in a work plan or design document. Administrative reviews are not required for actions taken under CERCLA. Requirements pertaining to the management of fugitive dust emissions beyond the facility boundary specified in 15A NCAC 02D.0540 (g) will be met. Land-disturbing activities are exempt due to the size of the site; however, since soil is contaminated, dust will be controlled to prevent spread beyond the site boundary.

The alternatives will additionally be implemented in compliance with requirements regarding onsite staging, since each of these alternatives involves excavating material for onsite storage within roll-offs until the proper permitting can be obtained and the waste can be shipped to an appropriate disposal facility. Storage includes mixing, sizing, blending, or other similar physical operations, so long as the action is intended to prepare the waste for subsequent management or treatment. The substantive requirements regarding design, operation, and closure of waste staging areas associated with a corrective action will be met. Administrative reviews are not required for CERCLA actions, and a permit will not be required.

Alternative 2 (Excavation and Offsite Disposal) and potentially Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) may involve the excavation of hazardous waste; therefore, these alternatives would need to be implemented in accordance with requirements regarding hazardous waste management in containers onsite.

Location-Specific ARARs

Location-specific ARARs are applicable to Alternatives 2 and 3 based on the location of the treatment area near a wetland, within the Atlantic Migratory Flyway, and within the coastal zone. Since the site is located in the Atlantic Migratory Flyway, if migratory birds, or their nests or eggs are identified at the site, operations will not destroy the birds, nests, or eggs. Additionally, activities at UXO-14 that will affect North Carolina's coastal zone will be consistent to the maximum extent practicable with North Carolina's enforceable policies. Activities performed on-site and in compliance with CERCLA are not subject to administrative review; however, the substantive requirements of making a consistency determination will be met. None of the alternatives presented include the discharge of dredged material in a wetland. Activities at the Former Indoor Pistol Range that will affect North Carolina's coastal zone will be consistent to the maximum extent practicable with North Carolina's enforceable policies. Activities performed onsite and in compliance with CERCLA are not subject to administrative review; however, substantive requirements of making a consistency determination will be met.

Chemical-Specific ARARs

Chemical-specific ARARs will be considered for each of the alternatives presented. Human health risk-based SRGs were developed for antimony and lead to identify the NTCRA area.

Because Alternatives 3 will require treatment of soil before disposal in accordance with land disposal restrictions, the soil would no longer contain hazardous waste and would meet the UTS. To determine if the treated soil meets the standards of 40 CFR 268.40, a sample of the waste will be tested.

6.1.3 Long-term Effectiveness and Permanence

Alternatives 2 (Excavation and Offsite Disposal) and 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) are effective in the long-term as there will be no residual risk at their completion, since contaminants would be physically removed from the site.

6.1.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) would reduce toxicity, mobility, and volume through treatment since the full volume of soil would require *in situ* stabilization that would prevent leaching of site COCs thereby allowing the excavated material to be disposed of offsite as a non-hazardous waste. Although Alternative 2 (Excavation and Offsite Disposal) does not include treatment, it would reduce toxicity, mobility, and volume since the full volume of soil would be excavated and disposed of offsite.

6.1.5 Short-term Effectiveness

Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) has the highest short-term risk to workers, the community, and the environment based on the additional risk due to the use of heavy equipment to mix the stabilization agent. Alternatives 2 (Excavation and Offsite Disposal) and 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) have similar risks due to increased truck traffic since the full volume of excavated material would be transported offsite; however, Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) has a significantly lower environmental impact due to significantly further distance required for transportation of hazardous IDW offsite for Alternative 2 (Excavation and Offsite Disposal). Alternative 2 (Excavation and Offsite Disposal) would require 2 weeks in the field to complete whereas Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) would require up to 3 weeks in the field to complete.

6.2 Implementability

Both Alternatives 2 (Excavation and Offsite Disposal) and 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) are easily implementable and both are proven and reliable technologies, with equipment and materials readily available. Additionally, for both alternatives, all impacted soil would be removed from the site so no future actions for soil are anticipated. Alternative 2 (Excavation and Offsite Disposal) would be the easiest to implement, since Alternative 3 (*In Situ* Soil Stabilization with Excavation and Offsite Disposal) would require the additional *in*

situ soil stabilization step. Alternative 2 (Excavation and Offsite Disposal) may require additional administrative activities (such as manifesting) and transportation of hazardous waste to a disposal facility that will accept hazardous waste.

6.3 Cost of Alternatives

The cost estimates for the alternatives are provided in **Appendix E** and summarized in **Table 6-1**. Alternative 1, No Action, has no cost and is thereby the least expensive. Alternative 3, *In Situ* Soil Stabilization with Excavation and Offsite Disposal, has the lowest cost for a remedial action at $296,000 or $1,132 per . Alternative 2, Excavation and Offsite Disposal, has the highest overall cost at $387,000 or $1,476 per , primarily due to the significantly higher disposal costs for hazardous waste. Neither Alternative 2 nor Alternative 3 have long-term O&M costs, thus the total present worth is equal to the total capital costs for each.

TABLE 6-1
Cost Estimates for Removal Action Alternatives

Alternative	Capital Costs	-30%/+50%	Cost per
Alternative 1 - No Action	$0	$0	$0
Alternative 2 - Excavation and Offsite Disposal	$387,000	$271,000/$580,000	$1,476
Alternative 3 - *In Situ* Stabilization with Excavation and Offsite Disposal	$296,000	$208,000/$445,000	$1,132

Note:
presented herein are for comparison purposes on and are not a guarantee of fixed cost for the specific alternative. The cost estimate is accurate to -30 percent/+50 percent.

SECTION 7

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Figures

Appendix A
Historical Data Tables

Appendix B
Human Health Risk Screening Tables

Appendix C
Applicable or Relevant and Appropriate Regulations

Appendix D
EnviroBlend Product Information

Appendix E
Cost Estimates for Removal Action Alternatives

Appendix F
Sustainability Analysis Technical Memorandum

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirements	Prerequisite	Citation
General Construction Standards — All Land-disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing stormwater runoff from land-disturbing activities	Shall install erosion and sedimentation control devices and practices sufficient to retain the sediment generated by the land-disturbing activity within the boundaries of the tract during construction. ~~Shall take all reasonable measures to protect all public and private property from damage caused by such activities.~~	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land – **relevant and appropriate to alternatives 2 and 3**	
	Erosion and sedimentation control plan must address the following basic control objectives: (1) Identify areas subject to severe erosion, and offsite areas especially vulnerable to damage from erosion and sedimentation. (2) Limit the size of the area exposed at any one time. (3) Limit exposure to the shortest feasible time. (4) Control surface water runoff originating upgrade of exposed areas (5) Plan and conduct land-disturbing activity so as to prevent offsite sedimentation damage. (6) Include measures to control velocity of storm water runoff to the point of discharge.		15A NCAC 4B.0106
	Erosion and sedimentation control measures, structures, and devices shall be planned, designed, and constructed to provide protection from the runoff of 10-year storm.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land --**relevant and appropriate to alternatives 2 and 3**	15A NCAC 4B.0108
	Shall conduct activity so that the post-construction velocity of the 10-year storm runoff in the receiving watercourse to the discharge point does not exceed the parameters provided in this Rule.		15A NCAC 4B.0109
	Shall install and maintain all temporary and permanent		15A NCAC 4B.0113

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
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Action	Requirements	Prerequisite	Citation
	erosion and sedimentation control measures.		
	Erosion and sedimentation control measures, structures, and devices with High Quality Water (HQW) zones shall be planned, designed and constructed to provide protection from the runoff of the 25 year storm.		15A NCAC 4B.0124(b)
	Provisions for ground cover sufficient to restrain erosion must be provided for any portion of the land-disturbing activity with 15 working days or 60 calendar days following completion of the construction or development, which period is shorter.		15A NCAC 4B.0124(e)
	Implement good construction management techniques, best management practices for sediment and erosion controls, and storm water management measures in accordance with 15A NCAC 02H .1008 to ensure storm water discharges are in compliance.	Development activity (otherwise requiring a stormwater permit) within one mile of and draining to waters classified as High Quality Waters (HQW) — **relevant and appropriate to alternatives 2 and 3**	15A NCAC 02H .1008 and the substantive provisions of NC General Permit CNCG 0100000
Air Quality Emission Control Standards			
Managing fugitive dust emissions: Implement methods (e.g. wetting dry soils) to control dust emissions that could travel beyond the facility boundary.	Shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints, or visible emissions in excess of that allowed under paragraph (e) of this Rule.~~Requires plan outlining actions to control fugitive dust emissions from the site that could travel beyond the site boundary~~	Activities within facility boundary that will generate fugitive dust emissions~~Fugitive dust emissions that cause or contribute to substantive complaints~~ -- **relevant and appropriate to alternatives 2 and 3**	15A NCAC 02D .0540(a), (c), ~~and~~ (f), and (g)
Waste Characterization and Storage — Primary Wastes (i.e., excavated contaminated soils)			
Characterization of solid waste (e.g. contaminated soil and drums)	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4(b); and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(A) -**applicable**	40 CFR 262.11(a)

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirements	Prerequisite	Citation
	Must determine if waste is listed under 40 CFR Part 261; or		40 CFR 262.11(b)
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR part 261 by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261. Or according to an equivalent method approved by the Administrator under 40 CFR 260.21; or ~~(1)~~ (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or processes used.~~Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.~~	Generation of solid waste which is not excluded under 40 CFR 261.4(a) - **applicable**	40 CFR 262.11(c)
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous - **applicable**	40 CFR 262.11(d)
Storage of solid waste (e.g., contaminated soil)	All solid waste shall be stored in such a manner as to prevent the creation of a nuisance, insanitary conditions, or a potential public health hazard.	Generation of solid waste which is determined not to be hazardous-- **relevant and appropriate to alternatives 2 and 3**	15A NCAC 13B .0104(f)
	Containers for the storage of solid waste shall be maintained in such a manner as to prevent the creation of a nuisance or insanitary conditions. Containers that are broken or that otherwise fail to meet this rule shall be replaced with acceptable containers.		15A NCAC 13B .0104(e)
Characterization of hazardous waste	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat,	Generation of RCRA-hazardous waste for storage treatment or disposal – **applicable to alternative 2**	40 CFR 264.13(a)1)

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TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirements	Prerequisite	Citation
	store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.		
Determinations for management of hazardous waste	Must determine each EPA Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 *et seq*.. *Note:* This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of hazardous waste for storage treatment or disposal – **applicable to alternative 2**	40 CFR 268.9(a)
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST RORGS, POLYM of Section 268.42 Table 1) for storage, treatment or disposal – **applicable to alternative 2**	40 CFR 268.9(a)
	Must determine if the hazardous waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. *Note:* This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of hazardous waste for storage treatment or disposal – **applicable to alternative 2**	40 CFR 268.7(a) 15A NCAC 13A.0112
Temporary Accumulation of hazardous waste in containers	A generator may accumulate hazardous waste at the facility for up to 90 days provided that: • Waste is placed in containers that comply with 40 CFR 265.171-173; and	Accumulation of RCRA hazardous Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 – **applicable to alternatives 2 and 3**	40 CFR 262.34(a) 15A NCAC 13A.0107(c) only as it incorporates the following citations: 40 CFR 262.34(a)(1)(i)
	• The date upon which accumulation begins must be clearly marked and visible for inspection on each container.		40 CFR 262.34(a)(2)
	• Container is marked with the words “hazardous waste”		40 CFR 262.34(a)(3)

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirements	Prerequisite	Citation
Temporary on-site management of remediation waste in staging pile (e.g., excavated soils)	Staging pile must be designed to prevent or minimize releases of hazardous wastes and constituents into the environment, and minimize or adequately control cross-media transfer as necessary to protect human health and the environment (e.g. use of liners, covers, run-off/run-on controls).	Management of remediation waste in a staging pile **– applicable to alternative 2**	15A NCAC 13A.0109(s) only as it incorporates 40 CFR 264.554(d)(1) (ii)
	In setting standards and design criteria must consider the following factors: • Length of time pile will be in operation; • Volumes of waste you intend to store in the pile; • Physical and chemical characteristics of the wastes to be stored in the unit; • Potential for releases from the unit; • Hydrogeological and other relevant environmental conditions at the facility that may influence the migration of any potential releases; and Potential for human and environmental exposure to potential releases from the unit.	Storage of remediation waste in a staging pile – **applicable to alternative 2**	15A NCAC 13A.0109(s) only as it incorporates 40 CFR 264.554(d)(2)(i) – (vi)
	Must be closed within 180 days after the operating term by removing or decontaminating all remediation waste, contaminated containment system components, and structures and equipment contaminated with waste and leachate.	Management of remediation waste in staging pile in *previously contaminated area* – **applicable to alternative 2**	15A NCAC 13A.0109(s) only as it incorporates 40 CFR 264.554(j)(1)
	Must decontaminate contaminated sub-soils in a manner that EPA determines will protect human and the environment.		15A NCAC 13A.0109(s) only as it incorporates 40 CFR 264.554(j)(2)
Waste Treatment and Disposal – Primary Wastes (excavated contaminated soils)			

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirements	Prerequisite	Citation
Off-site disposal of solid waste (e.g., contaminated soil not considered RCRA hazardous waste)	Shall ensure that waste is disposed of at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal – **relevant and appropriate**	15A NCAC 13B.0106(b)
Off-site disposal of RCRA hazardous waste in a land-based unit (i.e., landfill)	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste - **applicable**	40 CFR 268.40(a) 15A NCAC 13A.0112
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards, found in 40 CFR 268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class 1 nonhazardous injection well –**applicable**	40 CFR 268.40(e) 15A NCAC 13A.0112
Off-site disposal of RCRA-*hazardous waste soil* in a land-based unit (i.e. landfill)	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or Must be treated according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA hazardous soils –**applicable**	40 CFR 268.49(b) 15A NCAC 13A.0112
Off-site disposal of RCRA *hazardous waste debris* in a land-based unit (i.e. landfill)	Must be treated prior to land disposal as provided in 40 CFR 268.45(a)(1)-(5) unless EPA determines under 40 CFR 261.3(f)(2) that the debris is no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standards provided in 40 CFR 268.40 for the waste contaminating the debris.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA- hazardous debris **-applicable**	40 CFR 268.45(a) 15A NCAC 13A.0112
Transportation of Wastes			
Transportation of hazardous waste *on-site*	The generator manifesting requirements of 40 CFR 262.20-262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property	40 CFR 262.20(f)

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
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Action	Requirements	Prerequisite	Citation
	263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	under the control of the same person, even if such contiguous property is divided by a public or private right-of-way -**applicable**	15A NCAC 13A.0107
Transportation of hazardous waste *off-site*	Must comply with the generator standards of Part 262 including 40 CFR 262.20-23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect 262.32 for marking, Sect. 262.33 for placarding.	Preparation and initiation of shipment of hazardous waste off-site **–applicable**	40 CFR 262.10(h) 15A NCAC 13A.0107
Transportation of hazardous materials *off-site*	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171-180 related to marking, labeling, placarding, packaging, emergency response, etc.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material -**applicable**	49 CFR 171.1(c)
Off-site transportation of samples (i.e. contaminated soils)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when : • The sample is being transported to a laboratory for the purpose of testing; or • The sample is being transported back to the sample collector after testing. • The sample is being stored by sampled collector before transport to a lab for testing	Samples of solid waste <u>or</u> a sample of water, soil for purpose of conducting testing to determine its characteristics or composition - **applicable**	40 CFR 261.4(d)(1)(i)-(iii) 15A NCAC 13A.0106
	In order to qualify for the exemption in paragraphs (d)(1)(i) and (ii), a sample collector shipping samples to a laboratory must: • Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements • Assure that the information provided in (1) thru (5) of this section accompanies the sample.		40 CFR 261.4(d)(2)(i)(A) and (B) 15A NCAC 13A.0106

TABLE C-1
Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirements	Prerequisite	Citation
	• Package the sample so that it does not leak, spill, or vaporize from its packaging.		

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
CWA = Clean Water Act of 1972
DEACT = deactivation
DOT = U.S. Department of Transportation
EPA = U.S. Environmental Protection Agency
HMR = Hazardous Materials Regulations
HMTA = Materials Transportation Act
LDR = Land Disposal Restrictions
NPDES = National Pollutant Discharge Elimination System
POTW = Publically Owned Treatment Works
RCRA = Resource Conservation and Recovery Act of 1976
TCLP = Toxicity Characteristic Leaching Procedure
UTS = Universal Treatment Standard

TABLE C-3
Chemical-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Assessment
UXO-014 Former Indoor Pistol Range
MCB CamLej, North Carolina

Media	Requirements	Prerequisite	Citation
Soil	U.S. Environmental Protection Agency (EPA) Risk Assessment Guidance for Superfund (RAGS). Chemical concentrations corresponding to fixed levels of human health risk (i.e., a hazard quotient of 1, or a lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration).	~~Chemical concentrations corresponding to fixed levels of human health risk (i.e., a hazard quotient of 1, or a lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration). Assessment of potential human health risks **to be considered for alternatives 1, 2, and 3.~~ Assessment of potential human health risks - **to be considered for alternatives 1, 2, and 3.**	Risk Assessment Guidance for Superfund (RAGS) - USEPA Tables only as they apply to lead (443 mg/kg) and antimony (31 mg/kg).
	Disposal of a RCRA hazardous-waste in a land-based unit if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils - **Applicable for alternatives 2 and 3.**	40 CFR 268.40(a) as it applies to lead. The Universal Treatment Standard for lead is 0.75 mg/L by TCLP.
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards, found in 40 CFR 268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well - **Applicable for alternatives 2 and 3.**	15A NCAC 13A.0112(c) only as it incorporates 40 CFR 268.40(e).

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