

FINAL FEASIBILITY STUDY REPORT

for
MRS-R04 (Range VII)
Former Conway Bombing and Gunnery Range
Horry County, South Carolina

Prepared for:



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Contract No. W912DY-04-D-0018
Task Order: 0012
Project No. I04SC002501

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October 12, 2012

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

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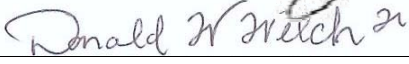
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ACRONYMS

AAB	Army Air Bases
AAF	Army Air Fields
ARAR	Applicable or Relevant and Appropriate Requirements
ASR	Archives Search Report
Ba	Barium
BGR	Bombing and Gunnery Range
bgs	below ground surface
BIP	blown-in-place
Cd	Cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DD	Decision Document
DGM	Digital Geophysical Mapping
DoD	Department of Defense
EC	Engineering control
EE/CA	Engineering Evaluation/Cost Analysis
EM	electromagnetic
EODT	EOD Technology, Inc.
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
ER	Engineering Regulation
ERA	Ecological Risk Assessment
ERM	Environmental Resources Management
ESA	Endangered Species Act
FS	Feasibility Study
FUDS	Formerly Used Defense Site
HA	Hazard Assessment
Hg	Mercury
HHRA	Human Health Risk Assessment
HTRW	Hazardous, Toxic and Radioactive Waste
IC	Institutional Control
kg	kilogram
LUC	Land Use Control
MAG	magnetometer
MC	Munitions Constituent
MCL	Maximum Contaminant Level



MD	Munitions Debris
MDAS	Material Documented as Safe
MDEH	Material Documented as an Explosive Hazard
MEC	Munitions and Explosives of Concern
mg	milligram
MG	Machine Gun
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
NCP	National Contingency Plan
NOFA	No Further Action
OB/OD	open burn/open detonation
Pb	Lead
PDT	project delivery team
PP	Proposed Plan
RAO	remedial action objectives
RI	Remedial Investigation
ROE	Rights of Entry
RSL	Regional Screening Levels
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SSL	soil screening level
TBC	To Be Considered
TCRA	Time Critical Removal Action
TPP	technical project planning
U.S.	United States
USACE	United States Army Corps of Engineers
USAESCH	United States Army Engineering and Support Center, Huntsville
USC	United States Code
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
Zn	Zinc

CHAPTER 1 EXECUTIVE SUMMARY

The purpose of this Feasibility Study (FS) for the former Conway Bombing and Gunnery Range (BGR) is not to select nor recommend the remedy to mitigate the hazards at the former Conway BGR, instead the purpose is to develop remedial alternatives and then to provide decision makers the information needed to select from among the developed alternatives. The FS process is designed to:

- Develop an appropriate range of potential alternatives to manage hazards and risks;
- Analyze the alternatives against the nine National Oil and Hazardous Substance Pollution Contingency Plan (NCP) (United States Environmental Protection Agency [USEPA], 1994b) criteria defined below; and
- Compare the alternatives against each other.

This FS has been developed as a separate document apart from the Remedial Investigation (RI) document.

1.1 BACKGROUND

1.1.1 The former Conway BGR was under military ownership from June 1940 until September 1948. Throughout the years of operation, several Army Air Fields (AAF) and Army Air Bases (AAB) utilized the former BGR for various types of airplanes and practice ordnances. Between January 1945 and September 1948, leases of 1,923 acres were terminated. Myrtle Beach AAF closed in 1947 and was declared surplus in February 1948. Land was returned to International Paper Company (34,685 acres) after the leases were terminated. The Conway BGR areas have been developed into recreational, commercial, and/or residential areas with plans for additional development.

1.1.2 During the RI, one area was recommended to be considered for further analysis in this Feasibility Study, MRS-R04 (Range VII). All MRS locations are shown on Figure 1-1. MRS-R04 (Range VII) specific location and RI results are shown on Figure 1-2.

The alternatives evaluated in this FS report will be applied to MRS-R04 (Range VII). Other MRSs at the Conway BGR are addressed separately, see Table 1-1.

1.1.3 The RI Report noted that the potential for a complete exposure pathway is unlikely for Unexploded Ordnance (UXO) for this MRS. However, the project delivery team (PDT) felt that

the historical presence of Munitions and Explosives of Concern (MEC) warrants further assessment. An FS was recommended to assess response action alternatives for managing exposures to potential explosive safety hazards associated with potential human and environmental receptor interaction (for both current and future land uses) with UXO for MRS-R04 (Range VII).

1.1.4 MRS-R04 (Range VII) was a skip bombing range used on former Conway BGR. This area had a low concentration of UXO recovered during past investigations. Munitions Debris (MD) was discovered at the surface down to approximately 8 feet below ground surface (bgs).

1.1.5 Land within the former Conway BGR is both privately and government owned. MRS-R04 (Range VII) has residential, forestry, hunting, and recreational usage. The projected land use is not expected to change.

1.2 REMEDIAL INVESTIGATION

The RI was designed to assess the extent of UXO and Munitions Constituents (MC) contamination at the former Conway BGR. During the RI, soil, sediment, and surface water samples were collected at the locations most likely to contain MC contamination, in an effort to characterize those areas within the former Conway BGR where UXO and Munitions Debris was previously discovered. The RI concluded (in a separate report) that no unacceptable risks exist as a result of MC contamination at those areas investigated during the RI. Therefore, MC will not be addressed in this FS. During previous investigations and removal operations across the Conway BGR UXO was encountered at a number of locations indicating that a UXO hazard exists in portions of the site. The RI did not reveal any UXO within MRS-R04 (Range VII); however, remnants of M38 100 lb sand filled practice bombs were discovered.

1.3 FEASIBILITY STUDY

1.3.1 Based on the results and recommendations of the RI, an FS was conducted for MRS-R04 (Range VII). The FS developed and assessed four different remedial alternatives for managing potential explosive safety hazard associated with potential UXO. The remedial action objective for the site is to prevent interaction between receptors and residual UXO at MRS-R04 (Range VII) of the former Conway BGR. The remedial action objective and development of alternatives is based on the assumption that the level of public access to the MRS will remain high. The four alternatives include the following:

- Alternative 1 – No Further Action (NOFA) Alternative to remediate UXO is conducted under this alternative.
- Alternative 2 – Institutional Controls (ICs)with Five-Year Reviews: Five-

Year reviews for military munitions response actions are conducted to determine if a response action continues to minimize explosive safety hazards and be protective of human, health, safety, and the environment.

- Alternative 3 –Surface Clearance for UXO with ICs and Five-Year Reviews: Five-Year Reviews for military munitions response actions are conducted to determine if a response action continues to minimize explosive safety hazards and be protective of human, health, safety, and the environment.
- Alternative 4 – Subsurface Removal of UXO with Surface Clearance, with ICs and Five-Year Reviews. Five-Year Reviews for military munitions response actions are conducted to determine if a response action continues to minimize explosive safety hazards and be protective of human, health, safety, and the environment.

1.3.2 A detailed analysis was completed for each alternative using nine evaluation criteria, as defined by CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (United States Code [USC], 1980.). The nine criteria are as follows:

- 1 Overall protection of human health and the environment
- 2 Compliance with applicable or relevant and appropriate requirements (ARARs)
- 3 Long-term effectiveness and permanence
- 4 Reduction of toxicity, mobility, or volume
- 5 Short-term effectiveness
- 6 Implementability
- 7 Cost
- 8 State acceptance
- 9 Community acceptance

1.4 DETAILED ANALYSIS SUMMARY

The purpose of the detailed analysis is to evaluate and compare the identified alternatives, so that a Proposed Plan (PP) can be prepared for regulatory agencies and public review. The alternatives are compared and evaluated with respect to nine evaluation criteria developed to address the statutory requirements and preferences of the CERCLA. Once the analysis is conducted, recommendations are made in the PP for the MRS. The preferred alternative will be presented in the PP that is issued for public comments.



TABLE 1-1: SUMMARY OF RESULTS AND RECOMMENDATIONS

MRS	Potential MEC Hazards	MEC (HA) Hazard Assessment Level (Current/Future)	MC Risks	Recommendation	Comments
MRS-R01 Range II	Unlikely	Not Assessed	No MC Release has occurred.	Further Investigation	MEC Nature and Extent not quantified
MRS-R02 Range III	Yes	1/1	No MC Release has occurred.	Further Investigation	The area was well delineated during previous investigations. Potential MEC hazards present.
MRS-R03 Range IV	Unlikely	1/1	No MC Release has occurred.	Further Investigation	Explosive safety hazard not anticipated.
MRS-R04 Range VII	Unlikely	2/2	No MC Release has occurred.	Feasibility Study	Explosive safety hazard not anticipated.
MRS-R05 Range XX	Unlikely	Not Assessed	No MC Release has occurred.	NOFA	Explosive safety hazard not anticipated.
MRS-R06 Strafing Range	Unlikely	Not Assessed	No MC Release has occurred.	NOFA	Explosive safety hazard not anticipated.
MRS-R07 Turret Range 1	Unlikely	Not Assessed	No MC Release has occurred.	NOFA	Explosive safety hazard not anticipated.
MRS-R08 Turret Range 2	Unlikely	Not Assessed	No MC Release has occurred.	NOFA	Explosive safety hazard not anticipated.
MRS-R09 MG/Rifle Range	Yes	1/1	Not assessed	Further Investigation	Potential MEC hazards present, based on previous investigations. No Rights of Entry (ROE) obtained during RI.

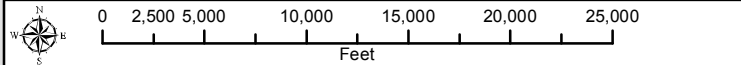
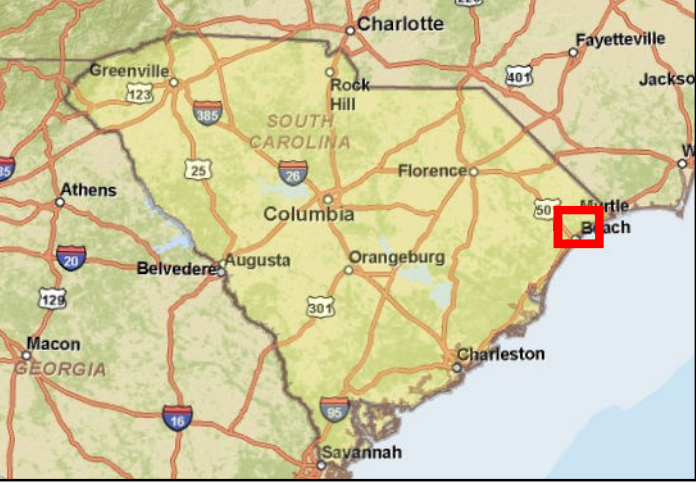
**Figure 1-1
MRS Location Map
Report for the Feasibility Study
at the Former Conway Bombing and Gunnery
Horry County, South Carolina**



Legend

ASR Supplement

- Range II (MRS-R01)
- Range III (MRS-R02)
- Range IV (MRS-R03)
- Range VII (MRS-R04)
- Range XX (MRS-R05)
- Strafing Range (MRS-R06)
- Turret Range 1 (MRS-R07)
- Turret Range 2 (MRS-R08)
- MG/Rifle Range (MRS-R09)
- Former Conway Bombing Range

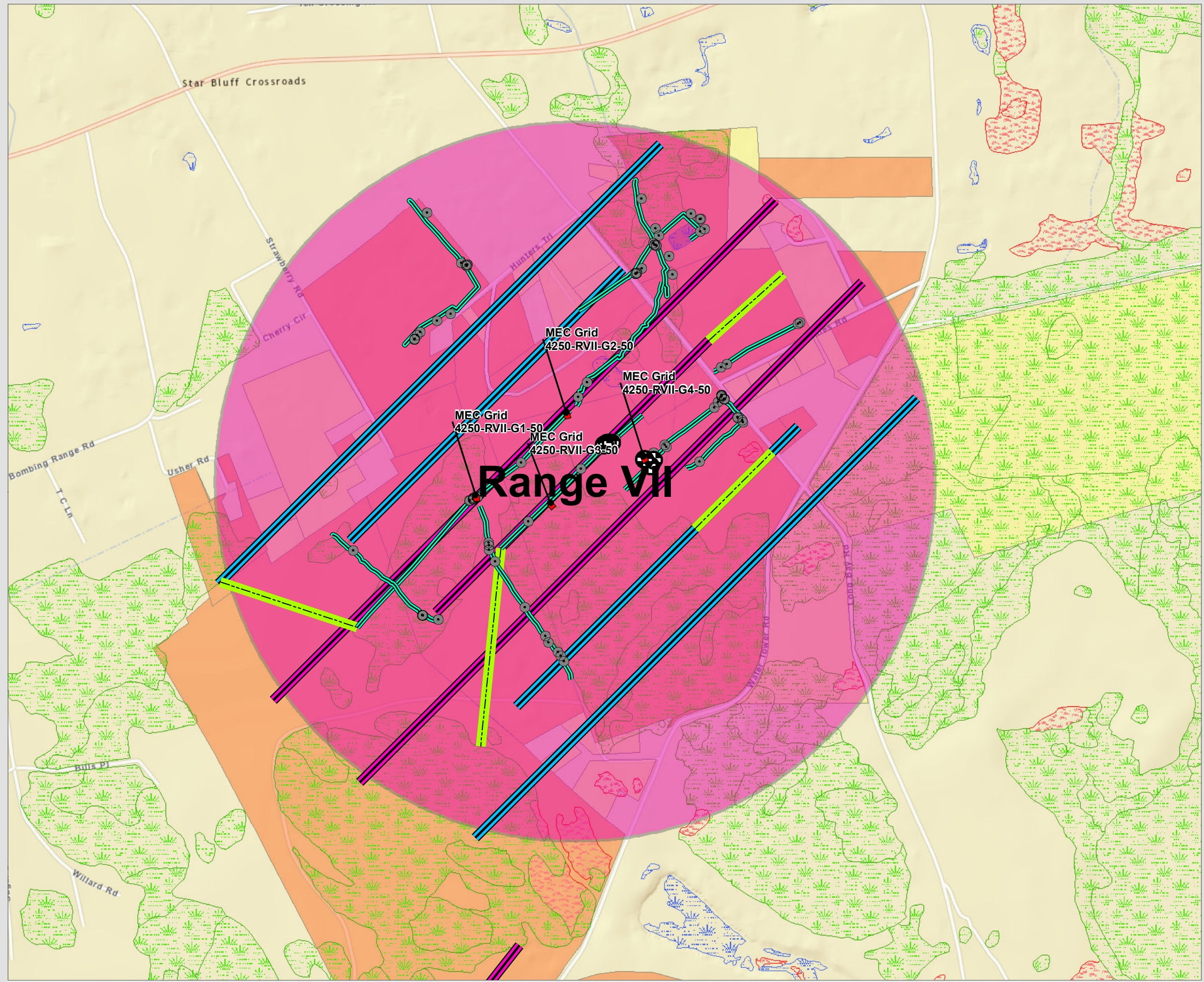


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Coordinate System: NAD 1983 StatePlane South Carolina FIPS 3900 Feet Intl		Horry County, South Carolina	



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**Figure 1-2: MRS-R04; Range VII
(104SC002501R04)
Report for the Feasibility Study
at the Former Conway Bombing and Gunnery
Horry County, South Carolina
(Results of the Remedial Investigation)**



Legend

MEC Field Grids
 (50ft x 50ft)

Intrusive Investigation Findings
 Anomaly
+ 100 Sandfilled Practice Bomb Debris

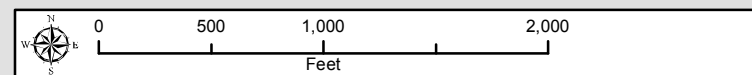
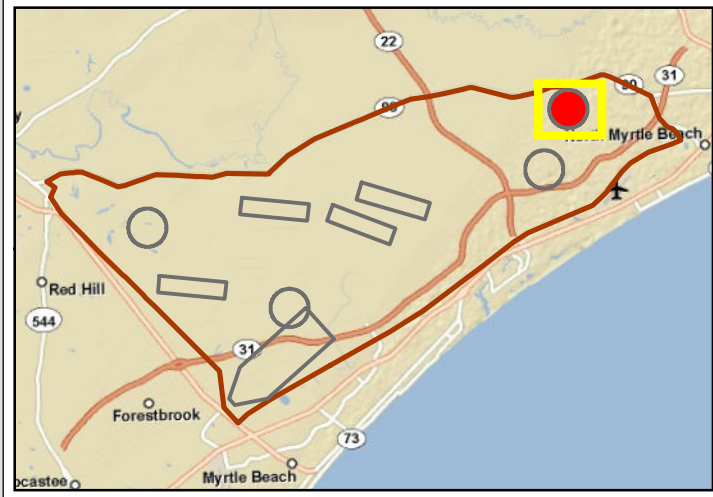
Intrusive Transects
 Transects

Proposed Transects
 Additional Added
 Opt
 Proposed

Range VII
 Range VII

Environmental Features
 Freshwater Emergent Wetland
 Freshwater Forested/Shrub Wetland
 Lake and Freshwater Pond

ROE Status
 ROE's Obtained
 ROE's Not Obtained



Author: TKM	Date: 5/17/2012	HB# 44630	Path: L:\Conway\Maps\RIFS\RIFS Report\FS Report\Fig 1-2 R04 RangeVII_Results.mxd
Coordinate System: NAD 1983 StatePlane South Carolina FIPS 3900 Feet Intl		Horry County, South Carolina	

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CHAPTER 2 INTRODUCTION

The former Conway BGR was under military ownership from June 1940 until September 1948. Throughout the years of operation, several AAF and AAB utilized the former BGR for various types of airplanes and practice ordnances. Between January 1945 and September 1948, leases of 1,923 acres were terminated. Myrtle Beach AAF closed in 1947 and was declared surplus in February 1948. Land was returned to International Paper Company (34,685 acres) after the leases were terminated. The subject of this RI (MRS-R04, Range VII) is approximately 649 acres and is in the northeast part of the Former Conway BGR. The Conway BGR areas have been developed into recreational, commercial, and/or residential areas with plans for additional development. The only documented munitions used at the Conway BGR were by the U.S. military.

Over the last several years, investigated areas within the former Conway BGR were organized in a variety of manners to accommodate the specific investigative efforts beginning with the Archives Search Report (ASR) 1995 (United States Army Corps of Engineers [USACE], 1995) and 2002 field efforts of the Engineering Evaluation / Cost Analysis (EE/CA) (Parsons, 2003).

As presented in Chapter 5 of the RI Report, recommended MRS were developed as a result of the RI (RI Report, Figures 5-1 through 5-3). These are:

- MRS-R01 (Range II)
- MRS-R02 (Range III)
- MRS-R03 (Range IV)
- MRS-R04 (Range VII)
- MRS-R05 (Range XX)
- MRS-R06 (Strafing Range)
- MRS-R07 (Turret Range 1)
- MRS-R08 (Turret Range 2)
- MRS-R09 (Machine Gun (MG)/Rifle Range)

MRS R05, R06, R07 and R08 were recommended NOFA in the RI report. MRS R01, R02, R03 and R09 were recommended for further investigation. MRS-R04 (649 acres) was recommended for evaluation in an FS.

The alternatives evaluated in this FS report will be applied only to MRS-R04.

2.1 PURPOSE

2.1.1 The purpose of the Feasibility Study is to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site. The FS is the mechanism for the development, screening and detailed evaluation of alternative remedial actions. The FS process is designed to:

- Develop an appropriate range of potential alternatives to manage hazards and potential explosive safety hazards;
- Analyze the alternatives against the nine NCP criteria (USEPA, 1994b) defined below; and
- Compare the alternatives against each other.

2.1.2 CERCLA contains several statutory provisions with which all remedies must comply. These include protection of human health and the environment, compliance with ARARs, cost effectiveness, and a preference for permanence and for treatment that reduces toxicity, mobility, or volume. To satisfy these CERCLA requirements, NCP Section 300.430 identifies nine criteria against which potential remedies are judged, as summarized in Table 2-1.

2.2 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

The results of the RI are contained in Chapter 8 of the RI Report. Please refer to that chapter for a summary of the UXO source characteristics and exposure pathways. Chapter 7 of the RI Report contains a risk assessment for MC and the MEC hazard assessment (HA) for UXO. The MEC HA is a tool that evaluates baseline explosive hazards to people based on current or reasonably anticipated land use activities. It can also be used to evaluate the relative reduction of explosive hazards to people from different removal or remedial actions. The MEC HA methodology is a collaborative process that draws on the collective experience and understanding of project team members and stakeholders. The MEC HA Rating for MRS-R04 of “2” represents a relatively low potential explosive safety hazard level.

Chapters 7 and 8 of the RI concluded there were no unacceptable risks associated with MC for either human health or ecological receptors. Therefore, MC remedial action will not be necessary and will not be discussed in this FS. Table 2-2 shows the results of the MC risk assessment conducted during the RI for MRS-R04 (Range VII).

Potential explosive safety hazards associated with potential residual UXO is potentially present relative to human health and safety within MRS-R04 (Range VII). Table 2-3 shows the results of the MEC HA for UXO conducted during the RI for MRS-R04 (Range VII) for both the current and future land uses. The MEC HA for MRS-R04 is in Appendix B of this FS Report.

TABLE 2-1: NINE CRITERIA FOR DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Threshold Criteria	1. Overall protection of human health and the environment; 2. Compliance with ARARs
Primary Balancing Criteria	3. Long-term effectiveness and permanence; 4. Reduction of toxicity, mobility, or volume through treatment; 5. Short-term effectiveness; 6. Implementability; 7. Cost
Modifying Criteria	8. State acceptance; 9. Community acceptance

TABLE 2-2: MC RESULTS SUMMARY, MRS-R04

MRS-R04 (Range VII)				
Soil (Metals) Summary				
Analyte	No. of Times Sampled	No. of Detections	No. of Times Detected above Regional Screening Level (RSL)	Maximum milligram/kilogram (mg/kg)
Barium (Ba)	6	6/6	0/6	18.1
Cadmium (Cd)	6	0/6	0/6	ND
Lead (Pb)	6	6/6	0/6	11.3
Mercury (Hg)	6	6/6	0/6	0.0502
Zinc (Zn)	6	6/6	0/6	13.7

TABLE 2-3: MEC HA SUMMARY

MRS	MEC HA (Hazard Level) Current/Future
MRS-R04 (Range VII)	2/2

CHAPTER 3

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

The process used for developing and screening technologies includes establishing remedial action objectives (RAOs) and developing general response objectives. The following sections provide details regarding the RAOs, general response objectives, and remedial technologies.

3.1 REMEDIAL ACTION OBJECTIVES

3.1.1 RAOs address the goals for reducing the UXO hazards to ensure protection of human health and safety. The RAOs are intended to be as specific as possible but not so specific that the range of alternatives that can be developed is unduly limited. The objective is to minimize the level of potential explosive safety hazards, however because there are no formal clean-up standards for MEC and the RI determined there is no risk from MC and that the only MEC hazard is from UXO, only a single RAO has been developed that is applicable for MRS-R04 (Range VII).

3.1.2 Analysis of the RI results and the anticipated future site activities concluded that there is a potential for unacceptable human health and safety hazards due to residual UXO remaining in MRS-R04 (Range VII); therefore, UXO hazards are addressed in this FS for MRS-R04 (Range VII).

3.1.3 MRS-R04 (Range VII) has relatively unrestricted access. Land within the former Conway BGR is predominantly privately owned. MRS-R04 (Range VII) is currently being used for residential, leased logging, hunting, and, recreational activities. The projected land use is not expected to change. Because of the potential for UXO to become exposed due to these activities, both surface and subsurface exposure pathways are considered potentially complete at MRS-R04 (Range VII).

3.1.4 The RAO for MRS-R04 is to minimize the health and safety hazards to the public, residents, and workers, due to potential exposure to residual UXO.

3.2 GENERAL RESPONSE ACTIONS

3.2.1 General response actions are selected to satisfy the RAO for the MRS. The general response actions selected for this FS include the following:

- NOFA;
- UXO Removal; and
- ICs

3.2.2 The general response actions identified above with the exception of NOFA may be employed as standalone activities or combined in developing remedial action alternatives.

3.2.3 Response actions under Formerly Used Defense Sites (FUDS) for Hazardous, Toxic and Radioactive Waste (HTRW) and Military Munitions Response Program (MMRP) must be conducted in accordance with CERCLA and the NCP. During the FS, the initial list of ARARs is refined based upon site characterization information and action specific ARARs need to be identified for each alternative undergoing screening and detailed analysis. ARARs consist of promulgated statutory and regulatory requirements that are substantive in nature. For remedial actions, ARARs must be complied with for all hazardous substances remaining on-site at the end of the response as well as for all actions taken as part of the response actions.

3.2.4 Chemical-specific ARARs are promulgated health-based or risk-based numerical values that establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment. No chemical-specific ARARs have been identified for the former Conway BGR. When ARARs do not exist for a particular chemical or remedial activity, other criteria, advisories, and guidance referred to as To Be Considered (TBC) are useful in designing and selecting a remedial alternative. No Chemical-Specific TBCs have been identified for the Conway BGR. However, as previously stated, the RI concluded no unacceptable risks for either humans or ecological receptors exist due to MC related chemicals. Therefore, MC will not be addressed in the remainder of the FS.

3.2.5 Location-specific ARARs generally are restrictions placed on the concentration of hazardous substance or the conduct of activities solely because they are in special locations (such as a wildlife refuge or national park). According to an environmental review conducted by the South Carolina Department of Natural Resources (SCDNR) there is one animal considered to be endangered and one threatened species documented in the Horry County area. However, none were encountered during the RI field activities at the former Conway BGR. The ARARs for this site are listed in Table 3-1. Additional discussions regarding the presence of these threatened and endangered species within the former Conway BGR can be found in Chapter 2 of the RI. There was one plant considered to be endangered and one threatened plant species in the area according to the SCDNR website (<http://www.dnr.sc.gov/species/index.html>). In addition SCDNR Managed Lands have Lewis Ocean Bay Heritage Preserve/Wildlife Management Area documented within Horry County; however, MRS-R04 lies outside the preserve's boundaries.

3.2.6 Action-specific ARARs are usually technology or activity-based requirements or limitations placed on actions taken with respect to remedial/removal actions, or requirements to conduct certain actions to address particular circumstances at a site. Action-specific ARARs

pertaining to possible consolidation shots and moving munitions to designated areas for demolition for the various alternatives have been identified for the former Conway BGR. The governing document for this action-specific is portions of RCRA Subpart X, Miscellaneous treatment units open burn/open detonation (OB/OD).

3.3 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

The USEPA has established guidelines for the types of remedial alternatives that should be developed during the detailed analysis stage; they are listed in the NCP (40 CFR 300.430(a)(1)) and are summarized as follows:

- Use treatment to address the principal threats posed by a site, wherever practicable.
- Use engineering controls (ECs) for low, long-term threats or where treatment is impracticable.
- Use a combination of methods, as appropriate, to achieve protection of human health and the environment.
- Use ICs to supplement engineering controls to prevent or limit exposure to hazardous substances, pollutants, or contaminants. The use of ICs shall not substitute for active response measures as the sole remedy unless such active measures are determined not to be practicable.
- Consider using innovative technologies.
- Consider using presumptive remedies.
- Consider monitored natural attenuation for MC constituents.

Note: ECs and ICs are subsets of Land Use Controls (LUCs).

NCP guidance further states that “the development and evaluation of alternatives shall reflect the scope and complexity of the remedial action under consideration” (40 CFR 300.430(e)). Land use is also a consideration in developing alternatives. Due to these factors, only a limited number of alternatives are considered for this FS. In addition to NOFA and IC actions (fencing/signage, education), remedial technologies associated with UXO potentially remaining at the MRS include detection, recovery, and disposal. The following sections discuss available and applicable processes for UXO detection, recovery, and disposal.

3.3.1 Detection Technologies

3.3.1.1 Detection methods consist primarily of using geophysical instruments such as metal detectors and magnetometers. As shown during the Time Critical Removal Action (TCRA) (Parsons, 2002) and EE/CA (Parsons, 2003), munitions are readily detected using geophysical techniques; subsequently, the techniques implemented at the site during the previous

investigations are considered the most effective means for locating UXO (at this MRS). Time-domain electromagnetic induction metal detectors (i.e., Geonics EM61 Mk2) were successfully used during the previous investigations for digital geophysical mapping. In addition, handheld flux-gate magnetometers (i.e., Schonstedt GA-52Cx) were successfully used to “mag-and-dig” on transects. A high degree of confidence should be expected for successful detection with these methods. However, it should be noted that there are limitations to their detection capabilities such as the depth of detection which varies depending on the technology and size of the munitions, and interference from utilities, structures, and other metal in the vicinity.

3.3.1.2 Although these geophysical instruments can be successful in finding subsurface targets which have similar properties as UXO, only a small percentage of the anomalies identified result in actual UXO. There is a variation in percentages depending on location, e.g. target areas versus range fans, etc. Innovative technologies (e.g. Advanced Geophysical Classification) are currently being developed to reduce the amount of non-hazardous items selected for excavation.

3.3.1.3 There are numerous swamps, bogs, streams and other marshy environments at MRS-R04, which present challenges to future remediation efforts. The marshy environments can restrict access to large areas of the MRS-R04 due to high water levels and semi-fluid substrates. In order to address these marshy areas at MRS-R04 equipment such as amphibious vehicles would need to be used during the brush cutting, surveying, geophysical surveying and intrusive operations. An amphibious vehicle such as an Argo, Marsh Master, or equivalent could be utilized to aid in brush cutting in marshy environments and possibly towing an electromagnetic (EM) or magnetometer (MAG) towed array that could float behind the amphibious vehicle during future geophysical surveying operations.

3.3.2 Removal Technologies

3.3.2.1 Removal technologies include hand excavation, equipment assisted excavation, and mass excavation and sifting (using heavy equipment). Due to the presence of heavy vegetation in some areas of MRS-R04 and the lack of large numbers of UXO, the use of heavy equipment is not considered preferred, but can be employed with discretion. Also, heavy equipment would create an unnecessary amount of land disturbance.

3.3.2.2 Hand excavation is considered the industry standard for anomaly recovery and can be done affectively. Hand excavation was conducted during the previous investigations. Hand excavations were supported by limited mechanical excavation for specific sites where the density of targets made hand-excavation impractical.

3.3.3 Disposal Technologies

Disposal technologies include blow in place (BIP) and consolidated shot and blow. For BIP, each munition is individually destroyed in place; whereas, the consolidated shot can be used for munitions that are “acceptable to move.” Previous investigations/removal actions used the consolidated shot approach for the majority of UXO that was found because they were acceptable to move. Munitions that were not acceptable to move were destroyed using the BIP method. The resulting Material Documented as Safe (MDAS) is shipped away to be destroyed IAW USACE guidelines in order to prevent the MDAS from being encountered again as suspected Material Documented as an Explosive Hazard (MDEH).

TABLE 3-1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Requirement	Citation	Description	Type
Endangered Species Act (ESA) (Specifically for Red Cockaded Woodpecker)	16 United States Code (U.S.C.) 1533 (USC, 2007a)	Prohibits federal actions from modifying critical habitats or jeopardizing the continued existence of protected, endangered, or threatened species.	Action- specific
Resource Conservation and Recovery Act (RCRA)	Subpart X, Miscellaneous treatment units Open Burn/Open Detonation (OB/OD).	Consolidation shots and moving munitions to designated areas for demolition for the various alternatives.	Action- specific
Protection of Wetlands, Clean Water Act	(33 U.S.C. Part 1344), Section 404.	Regulates the discharge of dredged or fill material into waters of the United States, including wetlands.	Action- specific

CHAPTER 4 DEVELOPMENT OF ALTERNATIVES

4.1 DEVELOPMENT OF ALTERNATIVES

Based on the RAO for the MRS, the general response actions, and available detection, removal, and disposal technologies for UXO, the following alternatives were developed for consideration:

- Alternative 1: NOFA
- Alternative 2: ICs and Five-Year Reviews
- Alternative 3: Surface Clearance with ICs and Five-Year Reviews
- Alternative 4: Subsurface Removal with Surface Clearance, ICs and Five-Year Reviews.

Table 4-1 provides a summary of alternatives considered for initial screening for MRS-R04.

4.2 ALTERNATIVE DESCRIPTIONS

4.2.1 Alternative 1: NOFA

The NOFA alternative means that a remedy will not be necessary to reduce the potential safety hazards posed by UXO. This alternative, if implemented, would involve continued use of the MRS in its current condition. This alternative will be considered for MRS-R04 (Range VII) since it provides a baseline for comparing other alternatives.

4.2.2 Alternative 2: ICs with Five-Year Reviews

4.2.2.1 Alternative 2 will be considered for MRS-R04 (Range VII). This alternative consists of posting signage (in addition to that already in place), public education and constructing kiosks to educate the public on MEC hazards. The principal vehicle for public education will be pamphlets with appropriate information addressing the potential munitions hazards, identification, restrictions, and safety and notification procedures. Additionally, information will be provided advising the reader how to access the public web site for the former Conway BGR and the location of the physical repository for the administrative records. Therefore, fencing and gating for the purpose of controlled access based on potential UXO exposure within the FUDS boundaries is not considered a part of the ICs. This exclusion is not intended to conflict with any access controls already in place for purposes other than potential explosive safety hazards associated with UXO. Any physical access controls employed to restrict access to the prior bombing range is not within the scope of this discussion. The signage would provide warnings and specific restrictions due to a history of munitions use in that area. Additional LUCs such as fencing, access restrictions, and deed restrictions were considered, but are not evaluated herein. This is because the government no longer owns or controls the property.

4.2.2.2 Signage would help to reinforce the link between appropriate access and safety and would provide a deterrent for inappropriate activity. Annual maintenance would be conducted to replace and repair damaged signs.

4.2.2.3 Five-Year Reviews, as outlined in Section 121(c) of CERCLA, as amended by Superfund Amendments and Reauthorization Act (SARA), and Section 300.430 (f) (4) (ii) of the NCP, are required for sites (at least every five years) where hazardous substances, pollutants, or contaminants remain at a site above levels that allow unlimited use and unrestricted exposure following the completion of remedy. Five-Year Reviews would be conducted to 1) ensure that public health, safety, and the environment are being protected by the response actions implemented; 2) verify the integrity of any site controls; 3) determine if new information has become available that may warrant further action; 4) determine if there is an immediate threat to the public or environment that may require an accelerated response; and 5) review decisions for technical impracticability to determine if new technology will address potential UXO safety hazards. Data gathered during the review process would be used to determine if further action needs to be taken to protect public safety and the human environment. If no changes have taken place, the site would continue to be monitored at the specified intervals. At the completion of the review, a Five-Year Review Report would be prepared and a public notice would be placed in the local newspaper concerning the continued effectiveness of the remedy. Five-Year Reviews would be conducted to determine if the response action continues to minimize explosives safety hazards and continues to be protective of human health, safety, and the environment.

4.2.3 Alternative 3: Surface Clearance with ICs and Five-Year Reviews

4.2.3.1 This alternative uses a combination of activities to achieve a reduction in the UXO hazards and also minimizes receptor interaction. The activities consist of UXO removal from the ground surface only, with ICs and Five-Year Reviews as described in Alternative 2. Alternative 3 will be considered for initial screening for MRS-R04 (Range VII).

4.2.3.2 UXO removal would be conducted by trained UXO technicians in those areas not cleared during previous investigations. The objective of the UXO surface clearance is to reduce the potential explosive safety hazards and minimize receptor interactions. UXO removal operations will identify and remove UXO on the ground surface.

4.2.3.3 Five-Year Reviews would be conducted to ensure that the educational awareness program continues to minimize explosives safety hazards and continues to be protective of human health, safety, and the environment.

4.2.4 Alternative 4: Subsurface Removals with Surface Clearance, ICs and Five-Year Reviews

4.2.4.1 This alternative uses a combination of activities to achieve a reduction in the UXO hazards and also minimizes receptor interaction. The activities consist of UXO subsurface removal, ICs, and Five-Year Reviews. Surface clearance is a concurrent activity associated with the subsurface removal operations. Alternative 4 will be considered for initial screening for MRS-R04 (Range VII).

4.2.4.2 UXO removal would be conducted by trained UXO technicians in those areas not cleared during previous investigations. The objective of the UXO removal is to identify and remove UXO on the ground surface and in the subsurface. Geophysical data would be collected over the entire accessible area and metallic anomalies would be identified for intrusive excavation. Depth of clearance is typically predetermined to be the detection depth of the geophysical instruments. However, the maximum depth of subsurface UXO encountered in previous investigations at the Conway BGR, not within MRS-R04 have been 8 feet bgs (USAE, 2005). Engineering controls or evacuation may be needed when working close to occupied areas, e.g. residential housing, facilities, etc. If UXO is encountered, it is anticipated that the munitions would be destroyed using blow in place procedures. Munitions that are acceptable to move could be moved to a nearby designated area for demolition. All MDAS would be certified, containerized, and shipped to an offsite smelter for destruction.

4.2.4.3 Residual UXO may exist in the paved areas after implementation of this alternative. Vegetation would be cleared to allow access for the geophysical instruments. Smaller geophysical instruments, such as handheld metal detectors may be used for areas near structures and where access is difficult.

4.2.4.4 During the removal action, soil samples will be collected at demolition sites and near UXO finds. If a risk-based criteria exceedance is identified, a thin layer of soil will be removed from the immediate vicinity of the detonation for offsite disposal. Confirmation sampling will be used to verify that the MC has been removed. Risk based screening levels and criteria for soil removal would be developed during the remedial design phase prior to the removal action. Potential sources to use for risk-based criteria include EPA regional screening levels and establishing site-specific soil screening levels (SSLs) using EPA Soil Screening Guidance.

4.2.4.5 Although depth to detection of specific equipment can vary, the approximate depth of clearance is expected to be between 1 and 6 feet based on previous investigations and removals performed on the Former Conway BGR; however, individual items have been located and removed at depths up to 8 feet bgs on this MRS, and up to 18 feet bgs on another MRS at the

former Conway BGR. It should be noted that these depths represent unusual situations, and reliable detection of munitions in MRS-R04 is unlikely beyond 4 to 6 feet bgs with present technology.

4.2.4.6 The completion of the UXO removal would result in a significant reduction in UXO hazards; however, some munitions may be missed and munitions under existing structures such as roads, buildings, sidewalks, and paved parking areas will not be cleared.

4.2.4.7 Educational awareness, pamphlets, training, etc., similar to that described under Alternative 2, would provide additional protection by providing information to the public concerning UXO hazards at the site.

4.2.4.8 In addition to ICs, a Five-Year Review (as described under Alternative 2) would be required under Alternative 4 to monitor and review the effectiveness of the alternative.

4.3 APPLICATION OF SCREENING CRITERIA BY ALTERNATIVE

4.3.1 This section discusses the performance of the four alternatives described in Section 4.2 relative to identified screening criteria. The screening criteria include the following:

- **Effectiveness** – the degree to which an alternative reduces the mobility or volume through treatment; minimizes residual potential explosive safety hazards; and affords long-term protection.
- **Implementability** – the technical and administrative feasibility of implementing the alternative.
- **Cost** – the costs of construction and any long-term costs to operate and maintain.

The detailed analysis and evaluation in Chapter 5 will compare additional criteria for each of the alternatives.

4.3.2 NOFA (Alternative 1) does not provide long-term protection of human health and environment, as it does not further reduce potential explosive safety hazards or afford long-term protection. This alternative does meet the effectiveness screening criterion for MRS-R04 (Range VII). The screening criteria for implementability and cost would be met by this alternative since there would be no action and no cost.

4.3.3 ICs with Five-Year Reviews (Alternative 2) will mitigate possible receptor interaction, thus reducing the potential for exposure pathway completion and minimizing potential explosive

safety hazards. This alternative is not effective in terms of reducing mobility or volume through treatment. Implementation is technically and administratively feasible, and the services and materials necessary to implement such are readily available. Long term effectiveness will be maintained through sign and kiosk maintenance, occasional UXO avoidance classes, and with Five-Year Reviews. Alternative 2 will be retained for MRS-R04 (Range VII).

4.3.4 Surface Clearance with ICs and Five-Year Reviews (Alternative 3) will reduce potential explosive safety hazards to human health to a limited degree. Implementation of this alternative will provide long-term effectiveness through the process of Five-Year Reviews. The reduction of the mobility or volume of potential UXO is limited to the ground surface only. This alternative can readily be implemented. Costs are presented in Chapter 5 of this document. Surface Clearance with ICs and Five-Year Reviews will be retained for further evaluation based on the attainability of the effectiveness, implementability, and cost screening requirements. Alternative 3 will be retained for MRS-R04 (Range VII).

4.3.5 Subsurface Removal with Surface Clearance, ICs and Five-Year Reviews (Alternative 4) would meet the effectiveness criteria for residual UXO currently within an MRS. Hand removal is currently the most widely used method for removal of UXO but, hand digging and removal can be difficult and time consuming. There will be a reduction in mobility and volume of UXO through its removal. Implementation is technically and administratively feasible, and the skilled labor (i.e., UXO Technicians) to implement such a remedy is generally available. The cost for implementing an UXO removal is presented in Chapter 5 and is based on the costs associated with previous investigations. Implementation of this alternative will provide long-term effectiveness ICs, and Five-Year Reviews. The alternative will be retained for further evaluation based on its ability to reduce the mobility or volume of potential UXO, implementability, and cost screening requirements. Alternative 4 will be retained for MRS-R04 (Range VII).

TABLE 4-1: SUMMARY OF ALTERNATIVES CONSIDERED FOR INITIAL SCREENING FOR MRS-R04 (RANGE VII)

MRS	Alternative 1 NOFA	Alternative 2 ICs, 5-Year Reviews	Alternative 3 Surface Clearance, ICs, 5-Year Reviews	Alternative 4 UXO Subsurface Removal w/Surface Clearance, ICs, 5-Year Reviews
MRS-R04 (Range VII)	Considered	Considered	Considered	Considered

CHAPTER 5 DETAILED ANALYSIS OF ALTERNATIVES

5.1 INTRODUCTION

5.1.1 The purpose of the detailed analysis is to evaluate and compare the identified alternatives and present a Proposed Plan for regulatory agencies and public review. The alternatives identified for the detailed analysis include the following:

- Alternative 1: NOFA
- Alternative 2: ICs with Five-Year Reviews
- Alternative 3: Surface Clearance with ICs and Five-Year Reviews
- Alternative 4: Subsurface Removal with Surface Clearance, ICs, and Five-Year Reviews

A detailed description of each alternative is provided in Chapter 4.

5.1.2 The alternatives are compared and evaluated with respect to nine evaluation criteria developed to address the statutory requirements and preferences of CERCLA. The nine criteria are as follows:

- 1 Overall protection of human health and the environment
- 2 Compliance with ARARs
- 3 Long-term effectiveness and permanence
- 4 Reduction of toxicity, mobility, or volume
- 5 Short-term effectiveness
- 6 Implementability
- 7 Cost
- 8 State acceptance
- 9 Community acceptance

Note that state acceptance and community acceptance of the remedy are based on the degree of assumed acceptance from the local public and from state agencies regarding the implementation of alternatives. These two criteria can play a role in weighing the balance between remedies that are otherwise cost effective and meet other criteria. These criteria cannot be fully evaluated and assessed until comments on the FS and the Proposed Plan are received; however, the technical project planning (TPP) process and other public involvement helps foster an understanding of these factors.

5.1.3 Each of the four alternatives are analyzed individually against each criterion and then compared against one another to determine their respective strengths and weaknesses and to identify the key trade-offs. The alternatives identified as the most practicable solution in reducing the UXO exposure hazard were selected with respect to each evaluation criteria. The following sections describe each of the evaluation criteria and the evaluation process used for performing the analysis.

5.2 EVALUATION CRITERIA

Alternatives are compared and evaluated with the NCP criteria, including threshold criteria, balancing criteria, and modifying criteria. The following sections describe the factors and each of the criteria.

5.2.1 Threshold Criteria

Threshold criteria (i.e., protectiveness, compliance with ARARs) are requirements that each alternative must meet or have specifically waived to be eligible for selection.

5.2.1.1 Overall Protection of Human Health and the Environment

The selected alternative must adequately protect human health and the environment from unacceptable hazards posed by UXO. In addition, the RAO needs to be achieved by the remedy. The overall protectiveness to human health and the environment was evaluated based on the effect each alternative has on the exposure hazard (UXO) and environment. Exposure involves three components: the UXO source characteristics, the receptor, and interaction between them. All three components are required for a safety threat from UXO to exist. The protectiveness criteria also considers the environmental impact that implementation of an alternative has on the existing environmental/ecological factors at the MRS.

5.2.1.2 Compliance with ARARs and TBCs

The NCP requires that all project sites meet ARARs (or that an ARAR waiver be obtained) and TBCs, hence, the ability of an alternative to meet ARARs and TBCs is evaluated. During the RI phase, the Endangered Species Act (ESA) (USC, 2007), Clean Water Act, Section 404, and RCRA Subpart X were determined to be the only ARARs applicable. Based on the risk assessment conclusions in Chapter 7 of the RI, TBCs have been determined to be non-applicable for this evaluation. However, pertinent sections of the ESA are applicable due to the presence of the red cockaded woodpecker. Specifically, Section 16 USC 1538 (a) (1) (B) “prohibit” requirements for the endangered species. The possibility of consolidation shots and moving munitions to designated areas for demolition for the various alternatives are governed for this action-specific ARAR in portions of RCRA Subpart X, Miscellaneous treatment units OB/OD. Applicable sections of the Clean Water Act, Section 404 must be complied with if onsite actions

place fill or dredged material into wetlands onsite. The compliance of ARARs for each individual alternative is discussed in Section 5.3 Individual Analysis if applicable.

5.2.2 Balancing Criteria

Primary balancing criteria (i.e., long-term effectiveness, reduction of potential explosive safety hazards, short-term effectiveness, implementability, and cost) form the basis for comparison among alternatives that meet the threshold criteria. CERCLA requires that alternatives be developed for treating principal threats at the project site through reductions in toxicity, mobility, or volume. In addition, remedies are required to be permanent (e.g., removal of UXO), to the maximum extent practicable, and to be cost effective. The five balancing criteria described below are weighed against each other to determine which remedies are cost effective and are “permanent.” The NCP explains that in general, preferential weight is given to alternatives that offer advantages in terms of the reduction of toxicity, mobility, or volume through treatment, and that achieve long-term effectiveness and permanence. However, the NCP also recognizes that some contamination problems will not be suitable for treatment and permanent remedies. The balancing process takes that preference into account, and weighs the proportionality of costs to effectiveness to select one or more remedies that are cost effective. The final risk management decision in the Decision Document (DD) is one that determines which cost-effective remedy offers the best balance of all factors to achieve permanence to the maximum extent practicable.

5.2.2.1 Long-term Effectiveness and Permanence

The permanence criterion evaluates the degree to which an alternative permanently reduces or eliminates the potential for UXO exposure hazard. This criterion also evaluates the magnitude of residual potential explosive safety hazards with the alternative in place, and the effectiveness of controls to manage the residual potential explosive safety hazards.

5.2.2.2 Short-term Effectiveness

The short-term effectiveness criterion addresses the potential consequences and risks of an alternative during the implementation phase. Alternatives were evaluated for their effects on human health and the environment prior to the remedy being completed. Short-term risks address adverse impacts to the workers and community during the construction and implementation phases of the remedy.

5.2.2.3 Reduction of Toxicity, Mobility or Volume

This criterion addresses the statutory preference for selecting remedies that permanently and significantly reduce mobility or volume of the hazardous substances. This preference is satisfied when the principal threats at a site are reduced through destruction or removal of UXO. For MMRP Projects, non-removal alternatives have negligible impact in reducing sources or

associated exposure hazards.

5.2.2.4 Implementability

The implementability criterion evaluates the alternative's technical and administrative implementability for a specific cleanup. The evaluation includes consideration of whether the alternative is technically possible; availability of necessary on-site and off-site facilities, services, and materials; administrative and regulatory requirements; and monitoring requirements.

5.2.2.5 Cost

The cost criterion evaluates the financial cost to implement the alternative. This includes direct, indirect, and long-term operation and maintenance costs (30-year duration). Direct costs are those costs associated with the implementation of the alternative. Indirect costs are those costs associated with administration, oversight, and contingencies. Cost estimates presented are order-of-magnitude level estimates based on a variety of information, including productivity estimates (based on site conditions), cost estimating guides, and prior experience at the site. The actual costs will depend on true labor rates, actual weather conditions, final project scope, and other variable factors.

5.2.3 Modifying Criteria

The community and state acceptance criteria are based on the degree of assumed acceptance from the local public and from state agencies regarding the implementation of alternatives. The degree of community participation and specific concerns voiced during the previous investigations provide an indication of community acceptance. These criteria cannot be fully evaluated and assessed until comments on the FS and the Proposed Plan are received.

5.3 INDIVIDUAL ANALYSIS OF ALTERNATIVES

5.3.1 Alternative 1 –NOFA

5.3.1.1 Description

The NOFA alternative does not implement any response or remedy. The NOFA alternative provides a baseline for the site under known or reasonable expected future conditions. NOFA provides the baseline with comparison of other alternatives. Because no remedial activities would be implemented with the NOFA alternative, long-term human health and environmental risks for the site would essentially be the same as those identified in the baseline risk assessment.

5.3.1.2 Assessment

Threshold Criteria

Alternative 1 provides no reduction in potential explosive safety hazards due to UXO. There

will be no changes in protectiveness for human health and the environment. Existing exposure pathways will be unchanged.

There are no ARARs associated with Alternative 1 that would restrict or modify its implementation.

Balancing Criteria

The NOFA alternative includes no controls for exposure and no long-term management measures. All current and potential future potential explosive safety hazards would continue under this alternative.

This alternative provides no reduction in mobility or volume of UXO.

There would be no additional potential explosive safety hazards posed to workers or the environment as a result of this alternative being implemented, since no action would be taken.

There are no implementability concerns posed by this remedy, since no action would be taken.

The present worth cost and capital cost of Alternative 1 are estimated to be \$0, since there would be no action.

5.3.1.3 Summary

Alternative 1 does not reduce the potential exposure hazard from current levels. There would be no additional protection to human health in the MRS as Alternative 1 does not implement a remedy to reduce potential future UXO exposure. In addition, there is no reduction in mobility or volume. Uncertainty exists about the long-term effectiveness of this approach for potential explosive safety hazard management. No costs are associated with this alternative.

5.3.2 Alternative 2 –ICs with Five-Year Reviews

5.3.2.1 Description

Alternative 2 will be considered for MRS-R04 (Range VII). The ICs consist of pamphlets, internet, kiosks, signage, and training. The pamphlets would be printed to include the web-site information, library repository location, pictures of munitions likely to be encountered, and instructions of what to do if MEC is encountered. The signs may indicate that access is restricted due to a history of munitions use in that area. However the signage would only serve as a warning and does not restrict access to the areas. Training would consist of occasional classes for UXO awareness. Annual maintenance would be conducted to replace and repair damaged signs.

5.3.2.2 Assessment

Threshold Criteria

Implementation of signs around an MRS meets the overall protection threshold factor. ICs would result in educational awareness to the human receptor interaction and the possibility of reducing exposure to UXO. Although protective of human health because exposure to UXO is reduced through educational awareness, Alternative 2 cannot completely control human behavior, e.g. voluntary compliance, or restrict access to residual UXO. Interaction with UXO can occur because the source remains and access is still possible. The signage may create an “attractive nuisance” wherein persons become interested in seeing what is in the area.

There are no ARARs associated with Alternative 2 that would restrict or modify its implementation.

Balancing Criteria

No UXO would be removed; therefore, potential explosive safety hazards would not be managed by source removal but through controls to limit or mitigate an exposure pathway (i.e., receptor interaction). Controls for exposure would include long-term management measures such as five-year reviews of the effectiveness of controls. Long-term management would also include consistent supply of pamphlets, internet, and sign maintenance.

This alternative provides no reduction in mobility or volume of UXO.

There would be no additional potential explosive safety hazards posed to the community as a result of this alternative being implemented. Due to the potential subsurface UXO, there would be some short-term potential explosive safety hazards associated with signage installation (if required).

The long-term effectiveness for the alternative could be impacted if a land use change occurs. Such a change should be identified during the five year reviews.

Implementability concerns are minimal. Administratively, it is solely the landowner’s option to allow the installation of signage in the area.

The total 30-year present worth cost of this alternative for MRS-R04 (Range VII) is estimated to be \$170,212 which includes an initial capital cost of \$27,000 and annual maintenance and recurring five-year review costs of \$113,500. The capital cost is primarily for the initial pamphlets, additional signs and internet maintenance.

5.3.2.3 Summary

The RAO is achieved through implementation of this alternative through decreased human receptor interaction by educational awareness. However, this alternative provides no reduction in mobility or volume of UXO. The cost associated with implementing this alternative is relatively low when compared to the other alternatives.

5.3.3 Alternative 3 – Surface Clearance with ICs and Five-Year Reviews

5.3.3.1 Description

This alternative is comprised of Surface Clearance and ICs listed in Alternatives 2, coupled with Five-year Reviews. The surface clearance would be considered for MRS-R04 (Range VII). A Five-Year review (as described under Alternative 2) would be required for Alternative 3 to review the effectiveness of the alternative.

5.3.3.2 Assessment

Threshold Criteria

Since the risk assessment concluded that there is potential for human receptors to come into contact with UXO, a complete exposure pathway (subsurface UXO) is still possible under Alternative 3. Potential explosive safety hazards would be managed by limited source removal of the surface UXO. ICs may mitigate interaction activities with residual UXO; however, Alternative 3 cannot completely control behavior.

The ARARs associated with Alternative 3 that would restrict or modify its implementation is the ESA concerning Red Cockade Woodpeckers, Protection of Wetlands through Section 404 of the Clean Water Act, and RCRA Subpart X concerning consolidated shots and designated demolition areas. The surface clearance would not entail damaging or destroying the woodpeckers or their habitats. However, areas where underbrush is too dense to walk other mechanisms will be utilized to eliminate underbrush only allowing the trees to remain. Prior to any brush cutting necessary coordination with the appropriate agencies will be conducted to minimize impacts to wildlife and wetlands.

Balancing Criteria

Institutional Controls, including UXO education and awareness will reduce the residual hazards associated with UXO by modifying the receptor's behavior to any UXO encounters. ICs will continue to be effective as long as they are maintained. Controls for exposure would include long-term management measures such as reassessment of the effectiveness of controls during five-year reviews.

This alternative provides some reduction in mobility and volume of UXO. The removal of source material from the surface only means that some munitions may be missed and subsurface UXO will remain.

Similar to the tasks undertaken in support of the EE/CA and RI/FS field activities, there would be some potential explosive safety hazards posed to the field crew by implementing this alternative. The removal would be performed by qualified UXO technicians; however, there is potential to cause an accidental detonation as part of the remedy.

Alternative 3 (Surface Clearance) can be readily implemented from a technical perspective. This type of remedy is effective and is similar to previous clearance and removal activities. ICs are compatible with the clearance operations and implementable.

For MRS-R04 (Range VII), the 30-year total present worth cost of this alternative is estimated to be \$2,600,000 which includes \$2,420,000 to conduct the UXO clearance operations, \$27,000 to initiate the ICs, and \$113,500 for annual maintenance and recurring Five-year Reviews.

5.3.3.3 Summary

Implementation of this alternative does achieve the RAO at the MRS but this alternative does not provide highest level of potential explosive safety hazard reduction for the protection of human health.

5.3.4 Alternative 4 – Subsurface Removal with Surface Clearance, ICs, and Five-Year Reviews

5.3.4.1 Description

This alternative uses a combination of activities to achieve a reduction in the UXO hazard and also minimizes receptor interaction. The activities consist of a subsurface UXO removal, ICs, and Five-year Reviews. A detailed description of each of these components is included in Chapter 4. This alternative will be evaluated for MRS-R04 (Range VII).

5.3.4.2 Assessment

Threshold Factors

A high level of overall protectiveness of human health and the environment would be achieved with Alternative 4 through source removal of UXO (surface and subsurface). Alternative 4 would significantly reduce the UXO hazard, but it would not completely eliminate hazards since there would be no way to know if all UXO has been removed. This alternative would afford the greatest protection to the potential receptors.

The ARARs associated with Alternative 4 that would restrict or modify its implementation is the ESA concerning Red Cockade Woodpeckers, Protection of Wetlands through Section 404 of the Clean Water Act, and RCRA Subpart X concerning consolidated shots and designated demolition areas. The subsurface clearance brush clearing would have stipulation for cutting trees of a certain diameter eliminating the possibility of damaging or destroying the woodpeckers or their habitats. Prior to any brush cutting necessary coordination with the appropriate agencies will be conducted to minimize impacts to wildlife and wetlands.

Balancing Factors

Alternative 4 would meet the long-term effectiveness and permanence criteria through source removal of UXO in the MRS. The residual potential explosive safety hazards associated with UXO that is not located during the removal action is addressed through the ICs ensuring the receptors the possibility of UXO residual exist according to the current and future land usage.

There would be significant reduction of mobility and volume through removal of source material; however, some munitions may be missed and munitions under existing structures such as roads, buildings, sidewalks, and paved parking areas will not be cleared.

Similar to the tasks undertaken in support of the previous investigations, there would be some potential explosive safety hazards for the field crew by implementing this alternative. The removal would be performed by qualified UXO technicians; however, there is potential to cause an accidental detonation as part of the remedy.

Alternative 4 would be readily implemented from a technical perspective. This type of remedy is effective and is similar to previous intrusive clearance activities performed in other MRSs at Conway.

The total 30-year present worth cost of this alternative is MRS-specific since costs are based on the total number of acres that would require clearance. It should also be noted that costs associated with five-year reviews are variable since this review process does not begin until the removal action is complete, and each MRS varies in terms of the length of time required to complete the removal action. In addition, the budgets associated with education vary because additional public meeting funding is included in the removal action budget.

For MRS-R04 (Range VII), the 30-year total present worth cost of this alternative is estimated to be \$4,460,000 which includes \$4,300,000 to conduct the UXO clearance operations, \$27,000 to initiate the ICs, and \$113,500 for annual maintenance and recurring Five-Year Reviews.

5.3.4.3 Summary

The RAO is achieved through implementation of this alternative, and this alternative provides overall protection of human health and the environment. The balancing factors of long-term effectiveness, permanence, and reduction of mobility or volume would be achieved through UXO source removal. Alternative 4 would be readily implemented from a technical perspective; however, there would be some potential explosive safety hazards posed to the field crew by implementing this alternative.

5.4 COMPARATIVE ANALYSIS OF ALTERNATIVES

In the following analysis, the alternatives are evaluated in relation to one another for each of the evaluation criteria to identify the relative advantages and disadvantages of each alternative in terms of the threshold and balancing criteria. Table 5.1 summarizes the evaluation, and a supporting cost data is provided in Appendix A. Details regarding the comparative analysis are provided in the following sections.

5.4.1 Overall Protection of Human Health and the Environment

5.4.1.1 The protectiveness criterion was evaluated in terms of possible future human interaction with UXO. Although MRS-R04 (Range VII) has UXO-related potential explosive safety hazards, none of the alternatives can totally eliminate the hazard. An environmental protectiveness factor was included in the evaluation based on the effects that implementation of an alternative would have on the existing environment and ecology. Each alternative was evaluated in terms of whether it would reduce the amount of UXO relative to the other three alternatives within MRS-R04 (Range VII).

- Alternatives 1 and 2 provide the least overall protection of human health because they do not remove or restrict access to potential UXO.
- Alternative 2 provides limited protection by potentially mitigating receptor interactions with potential UXO.
- Alternative 3 provides a limited level of protection in that a surface clearance removes UXO from the surface only. UXO can potentially “resurface” via natural mechanical processes (erosion) or human intrusive activities.
- Alternative 4 provides the best overall protection in terms of protecting human health by permanently removing hazardous sources both above ground and subsurface.

5.4.2 Compliance with ARARs and TBCs

The evaluation of the ability of the alternatives to comply with ARARs included a review of the

action and location-specific ARARs discussed earlier in the report.

- Alternatives 1 and 2 have no ARARs associated with them (e.g. no impact to Endangered species or Wetlands and munitions activities)
- Alternatives 3 and 4 have the ARARs associated with the red cockaded woodpecker on the ESA, compliance with CWA on the wetlands, and destroying and handling munitions under RCRA Subpart X. Compliance of the location-specific ARARs will be ensured by having an assessment completed by the USFWS for the endangered species and the USACE assess the wetland areas and collaboration on mitigation measures. The action-specific ARARs include the consolidate shots and possibility of moving munitions to a designated demolition area. These impacts will be mitigated in the Remedial Design through implementation of best management practices.
- No TBCs have been identified for this site.

5.4.3 Long-term Effectiveness and Permanence

The permanence criterion evaluates the degree to which an alternative permanently reduces or eliminates the potential for UXO exposure hazard.

- Alternative 1 provides no controls for exposure and no long-term management measures. All current and potential future potential explosive safety hazards would continue under this alternative.
- Alternative 2 leaves UXO in place and relies on education and awareness to mitigate receptor interaction but can't prevent interaction.
- Although Alternative 3 can offer limited long term effectiveness by permanently removing existing hazard sources from the ground surface, subsurface UXO may remain.
- Alternative 4 was determined to provide the best long-term effectiveness and permanence based on the ability to significantly reduce UXO in the MRS.
- All alternatives except Alternative 1 require Five-Year Reviews to verify that the remedies remain effective.

5.4.4 Short-term Effectiveness

Short term effectiveness addresses the hazards generated by the act of implementing the alternative, generally creating short term hazards to site workers and environmental protectiveness. This was assessed for the possible detrimental impact an alternative would have on the existing environment and ecology.

- Alternatives 1 and 2 present no significant short-term impacts or adverse impacts on workers or the public. And have no detrimental effect on the environment. However, these Alternatives would not remove UXO from the MRS which would not limit interaction between the existing environment and ecology and UXO.
- Alternative 3 exposes workers and the public to limited short-term potential explosive safety hazards during clearance operations and may temporarily disrupt movement of animals by providing a noise nuisance during operations, and might also disturb but not destroy habitat to the ecological receptors in the area.
- Alternative 4 requires typical short term exposures to potential explosive safety hazards to UXO technicians during intrusive operations. However, such exposures are inherent to the profession. Alternative 4 could also cause habitat disruption due to vegetation and brush removal. Intrusive excavation and demolitions would also cause disruptions. Environmental protection can be addressed with stipulations in place to eliminate destroying any possible endangered species habitat in the area after an assessment is completed by the governing agencies for endangered species and wetland.

5.4.5 Reduction of Toxicity, Mobility or Volume

For reduction of mobility or volume of UXO (toxicity is not addressed due to the absence of unacceptable MC risks),

- Alternatives 1 and 2 offer no reduction in mobility or volume of UXO.
- Alternative 3 provides a limited reduction in mobility and volume. Policy prohibits the USACE from destroying any paved surfaces, e.g. roads, driveways, sidewalks, etc. during reacquisition or removal operations. Therefore, residual UXO may exist in these paved areas after implementation of this alternative. No alternative completely removes all of the UXO at the site.
- Alternative 4 is the most effective alternative in terms of reducing mobility and volume of UXO in that it removes all detectable UXO from both the surface and subsurface within the MRS.

5.4.6 Implementability

Implementability addresses the technical and administrative feasibility of conducting the alternative.

- Alternative 1 and Alternative 2 were determined to be the easiest to implement. Alternative 1 is both technically and administratively feasible, and no services or materials are necessary for implementation. Alternative 2 is also both technically and administratively feasible, with public awareness already in place from previous investigations.
- Alternative 3 is both technically and administratively feasible but would require specialized personnel. The right of entries must be obtained within the areas of interest to perform the surface clearance. The lack of ROEs would make the implementability of this Alternative impossible.
- Alternative 4 is technically and administratively feasible but require specialized personnel. The right of entries must be obtained within the areas of interest to perform the surface and subsurface clearance. The lack of ROEs would make the implementability of this Alternative impossible. Alternatives 3 and 4 also require the development of detailed work plans.

5.4.7 Cost

5.4.7.1 The cost criterion evaluates the financial cost to implement the alternative. The cost criterion includes direct implementation, long-term operation, and maintenance costs. Direct costs are those costs associated with the implementation of the alternative. These costs were adapted from costs associated with similar activities on the former Conway BGR and cost estimates prepared for other sites.

5.4.7.2 The actual costs will depend on true labor rates, actual site conditions, final project scope, and other variable factors. The alternative with the lowest cost to implement would be Alternative 1, which requires no action; therefore, no costs are incurred. Alternative 2 requires relatively low costs compared to Alternatives 3 and 4, which are the most costly to implement.

5.4.7.3 Costs range from \$0 (Alternative 1) to over \$4.4 million (Alternative 4). Alternative 4 has the highest cost primarily because of the costs incurred during the mag-and-dig, Digital Geophysical Mapping (DGM), and intrusive investigation over such a large area. Table 5-1 summarizes costs for all alternatives, and Appendix A provides additional cost information.

5.4.8 State Acceptance

The State has reviewed the Draft Final FS for MRS-R04, and has concurred with the analysis; however, they disagree that Alternative 1 (NOFA) is an acceptable remedial action for the MRS. The State regulator review of the Draft Final FS is provided in Appendix C.

5.4.9 Community Acceptance

Community acceptance cannot be fully evaluated and assessed until comments on the Proposed Plan are received. The community acceptance is yet to be determined, however it is anticipated that Alternative 1 would not be acceptable to the community due to lack of hazard reduction.

5.4.10 Summary of Comparative Analysis

5.4.10.1 The four alternatives were evaluated in terms of seven criteria. Table 5-1 summarizes the evaluation of possible solutions for reducing the potential UXO exposure hazard at the MRS. In some cases, more than one alternative was identified within the same evaluation category, indicating that those alternatives have similar compliance with the criterion.

5.4.10.2 The following conclusions were derived from the comparative analysis:

- Alternative 1 is not effective in reducing exposures to potential explosive safety hazards and has no long-term permanence.
- Alternative 2 is considered to be effective in reducing human exposure to UXO for MRS-R04 (Range VII).
- Alternative 3 provides limited reduction in mobility and volume, with no long-term permanence. State and community acceptance will require additional education efforts.
- Alternative 4 achieves the balancing factors of long-term effectiveness, permanence, and reduction of mobility and volume through UXO source removal.

TABLE 5-1: EVALUATION OF REMEDIAL ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Criteria	No Further Action (NOFA)	ICs (Standalone) with 5-Year Reviews	UXO Surface Clearance with ICs and 5-Year Reviews	UXO Subsurface Removal with ICs and 5-Year Reviews
Protectiveness	Least protective alternative. No source reduction. No reduction of future exposures to potential explosive safety hazards.	No source reduction. Signs and education can mitigate interaction with UXO, thus reducing exposures to potential explosive safety hazards. Voluntary compliance required.	UXO removal (limited source reduction). Provides protectiveness through hazard source removal and voluntary compliance.	UXO removal (significant source reduction). Provides protectiveness through hazard source reduction and voluntary compliance.
ARAR Compliance	No ARARs associated with the alternative.	No ARARs associated with the alternative.	Pertinent sections of the Endangered Species Act and Protection of Wetlands Act. Prior to any brush cutting necessary coordination with the appropriate agencies will be conducted to minimize impacts to wildlife and wetlands	Pertinent sections of the Endangered Species Act and Protection of Wetlands Act. Prior to any brush cutting necessary coordination with the appropriate agencies will be conducted to minimize impacts to wildlife and wetlands.
Long-Term Effectiveness and Permanence	No UXO-related reduction of exposures to potential explosive safety hazards, and no long-term effectiveness.	No reduction of UXO hazards, but can be effective at reducing possible receptor interaction.	Limited effectiveness because of hazard reduction and reduced receptor interaction	Reduction of UXO
Short-term Effectiveness	No short-term impacts on workers or public.	No short-term impacts on workers or public.	Public access prohibited during removal work.	Public access prohibited during removal work.
Reduction of Toxicity, Mobility or Volume	No reduction of source.	No reduction of source.	Limited reduction in source. UXO hazards are removed from surface areas.	Significant reduction in source.
Implementability	Readily implemented. No action required.	Signs can be installed for specific areas.	Similar operations were conducted during previous clearance Implementable.	Similar operations were conducted during previous clearance Implementable.
Cost	\$0 No cost.	\$170,000 Comparatively little cost.	\$2,600,000 Costs high but justifiable for locations with significant UXO hazards. Costs developed for 30 years.	\$4,460,000 Costs high but justifiable for locations with significant UXO hazards. Costs developed for 30 years.



*Feasibility Study Report
for MRS-R04, Former Conway Bombing and Gunnery Range
Horry County, South Carolina*

State Acceptance	With the exception of Alternative 1, the State has concurred.
Community Acceptance	Community acceptance will be assessed after the public comment period

CHAPTER 6 REFERENCES

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APPENDIX A

COST ANALYSIS OF ALTERNATIVES

for the
Feasibility Study Report
MRS-R04 (Range VII)
Former Conway Bombing and Gunnery Range
Horry County, South Carolina

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Contract No. W912DY-04-D-0018
Task Order: 0012
Project No. I04SC002501

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October 2012



Appendix A Cost Estimating Summary

Alternative Remedial Actions

Alternative 1: NOFA

Applicable to MRS-R04 Range VII = \$0

Alternative 2: ICs with 5-Year Reviews

MRS-R04 Range VII 30 yr cost \$170,212.00

Alt. 2 Assumptions:

1. Annual sign maintenance est. @ 10% on initial costs.
2. Training class cost.
3. Internet site will be set up to be used for information outreach, etc.
4. Training classes for residents/community and 5-Year Reviews are conducting concurrently.
5. USACE oversight not included.

Alternative 3: Surface Clearance with ICs and 5-Year Reviews

MRS-R04 Range VII - \$ 2,600,000.00

Alt. 3 Assumptions:

- A. Removal operations (including brush cutting and survey) estimated for 649 acres
- B. Assume 100,000 square feet per team per day = 283 team days
- C. 71 days per team = 14.5 weeks of Clearance per team
- D. 4 – 7 man team = (4) Tech III, (8) Tech II, (16) Tech I, SUXOS, UXOSO, UXOQC and FOA

Alternative 4: Subsurface Removal with Surface Clearance and ICs and 5-Year Reviews

MRS-R04 Range VII - \$ 4,460,000.00

Alt. 4 Assumptions:

- A. Removal operations (including brush cutting and survey) estimated for 649 acres
- B. Same assumptions for ICs as with Alt. 2
- C. Assume 50,000 square feet per team per day = 566 team days
- D. 142 days per team = 28.5 weeks of Clearance
- E. 4 – 7 man team = (4) Tech III, (8) Tech II, (16) Tech I, SUXOS, UXOSO, UXOQC and FOA



Alternative 2 - Institutional Controls with Five Year Reviews

Year	Capitla Cost (\$)	Annual O&M Cost (\$)	Perodic Cost (\$) Training Class and 5 Year Review	Total Cost + 0% Tax (\$)	Discount Factor at 7%	Present Value at 7%	Year
0	\$26,700			\$26,700	1.000	\$26,700	0
1		\$2,670		\$2,670	0.935	\$2,496	1
2		\$2,670		\$2,670	0.873	\$2,331	2
3		\$2,670		\$2,670	0.816	\$2,179	3
4		\$2,670		\$2,670	0.763	\$2,037	4
5		\$2,670	\$25,000	\$27,670	0.713	\$19,729	5
6		\$2,670		\$2,670	0.666	\$1,778	6
7		\$2,670		\$2,670	0.623	\$1,663	7
8		\$2,670		\$2,670	0.523	\$1,396	8
9		\$2,670		\$2,670	0.544	\$1,452	9
10		\$2,670	\$25,000	\$27,670	0.508	\$14,056	10
11		\$2,670		\$2,670	0.475	\$1,268	11
12		\$2,670		\$2,670	0.444	\$1,185	12
13		\$2,670		\$2,670	0.415	\$1,108	13
14		\$2,670		\$2,670	0.388	\$1,036	14
15		\$2,670	\$25,000	\$27,670	0.362	\$10,017	15
16		\$2,670		\$2,670	0.339	\$905	16
17		\$2,670		\$2,670	0.317	\$846	17
18		\$2,670		\$2,670	0.296	\$790	18
19		\$2,670		\$2,670	0.277	\$740	19
20		\$2,670	\$25,000	\$27,670	0.258	\$7,139	20
21		\$2,670		\$2,670	0.242	\$646	21
22		\$2,670		\$2,670	0.226	\$603	22
23		\$2,670		\$2,670	0.211	\$563	23
24		\$2,670		\$2,670	0.197	\$526	24
25		\$2,670	\$25,000	\$27,670	0.184	\$5,091	25
26		\$2,670		\$2,670	0.172	\$459	26
27		\$2,670		\$2,670	0.161	\$430	27
28		\$2,670		\$2,670	0.15	\$401	28
29		\$2,670	\$25,000	\$27,670	0.141	\$3,901	29
Total	\$26,700	\$77,430	\$104,130	\$254,130		\$113,475	
Total Cost + 0% Tax (\$)						\$254,130	
Lower End of TPV Range at -35%						\$73,759	
Upper End of TPV Range at +50%						\$170,212	



PRICING SUMMARY FOR ALTERNATIVES 3 AND 4 REMOVAL ACTIONS

Task, Title, Type, Description	Unit	Quantity	Unit Price	Price
Work Plan	EA	1	N/A	\$ 16,000.00
Range VII MRS-R04 Surface Clearance	EA	1	N/A	\$ 2,420,000.00
Range VII MRS-R04 Subsurface Clearance	EA	1	N/A	\$ 4,300,000.00
Reporting Range VII MRS-R04	EA	1	N/A	\$ 25,000.00

	MRS-R04 Surface Clearance	MRS-R04 Subsurface Clearance
	Planning	Planning
Total Cost:	\$16,109.14	\$16,109.14
Total Hours:	196	196
Total Labor:	\$14,215.48	\$14,215.48
Total Travel:	\$0.00	\$0.00
Total ODC's	\$1,893.66	\$1,893.66
	Brush Clearing	Brush Clearing
Total Cost:	\$486,750.00	\$486,750.00
	Survey	Survey
Total Cost:	\$64,900.00	\$64,900.00
	Clearance	Clearance
Total Cost:	\$1,896,216.45	\$3,716,759.31
Total Hours:	19,626	38,739
Total Labor:	\$1,235,769.68	\$2,444,379.96
Total Travel:	\$505,595.20	\$977,944.00
Total ODC's	\$154,851.57	\$294,435.35
	Reporting	Reporting
Total Cost:	\$24,671.10	\$24,671.10
Total Hours:	219	219
Total Labor:	\$18,914.35	\$18,914.35
Total Travel:	\$540.51	\$540.51
Total ODC's	\$1,420.25	\$1,420.25

APPENDIX B
MEC HA
for the
Feasibility Study Report
MRS-R04 (Range VII)
Former Conway Bombing and Gunnery Range
Horry County, South Carolina

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Project No. I04SC002501

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October 2012

MEC HA Workbook v1.02

December-07

Overview

This workbook is a tool for project teams to assess explosive hazards to human receptors at munitions response sites (MRSs) following the Munitions and Explosives of Concern Hazard Assessment (MEC HA) methodology. The MEC HA allows a project team to evaluate potential explosive hazard associated with a site, given current site conditions, under various cleanup, land use activities, and land use control alternatives. A complete description of the methodology can be found in the MEC HA Guidance (Public Review Draft, November 2006). Please reference this guidance when completing the worksheets.

Instructions

1. Open this file. Enable macros if prompted to do so. This spreadsheet will not work if your security setting is set to 'high' or 'very high'. To change your security level, go to the menu bar and select Tools/Macro/Security. Then close and reopen this spreadsheet.
2. This MS Excel workbook contains 9 worksheets, designed to be used in order. After the '*Instructions*' sheet, the first 5 sheets ask for information about the following topics:

Summary Info - General information regarding the site.

Munitions/Explosive Info - MECs and bulk explosives present at the site.

Current and Future Activities - Current land use activities as well as planned future activities, if any.

Remedial-Removal Action - General information regarding remediation/removal alternatives being considered for the site.

Post-Response Land Use - Land use activities associated with the alternatives listed in the 'Remedial-Removal Action' sheet.

The remaining 3 sheets calculate and summarize the scores. The **Input Factors** sheet performs the Input Factor Score calculations, which are summarized in the **Scoring Summaries** sheet. The **Hazard Level** sheet presents the Hazard Level Category for current use activities, future use activities, and each response alternative based on the respective scores.

3. Starting with the *Summary Info* sheet, fill in any yellow cells. Some cells have drop-down lists from which you can select an answer. Select the cell. A down arrow to the right indicates that a drop-down list is available. Yellow buttons can be used to enter reference information. Blue cells can be used for any general comments you wish to make. Any faded cells can be ignored--these are questions that the spreadsheet has determined are not relevant for your situation.

The computer will calculate information based on your inputs. Calculated information will appear as red text.

4. The MEC HA menu bar can be used to navigate to different worksheets.

VII. Migration Potential Input Factor Categories

1. Is there any physical or historical evidence of the presence of natural forces that could lead to the migration of subsurface MEC items to the surface, or move surface MEC items to a different location on the site? **No** Study to be conducted in 2008

If "yes", describe the nature of natural forces. Indicate key areas of potential migration (e.g., overland water flow) on a map as appropriate (attach a map to the bottom of this sheet, or as a separate worksheet).

The following table is used to determine scores associated with the migration potential:

	Baseline Conditions	Surface Clean-Up	Subsurface Clean-Up
Possible	30	30	10
Unlikely	10	10	10

2. Based on Question VII.1 above, migration potential is 'Unlikely.'

Score: 10

Baseline Conditions: 10

Surface Clean-up: 10

Subsurface Clean-up: 10

Reference(s) for above information:

MEC HA

- Introduction/Help
- Summary Information
- Data Tables 1, 2: Munitions, Bulk Explosive Information
- Data Tables 3, 4: Current and Future Activities
- Data Table 5: Remedial-Removal Action
- Data Table 6: Post-Response Land Use
- Input Factors
- Scoring Summaries
- Assessment Summary

5. Small red triangles in the upper-right corners indicate that help text is available by putting the mouse cursor on that cell.

	C	D	E	F	G	H
	Used Munitions Information					
	ar, Munition Size	Munition Size Units	Mark/ Model	Fi		Fuzing Ty

Enter the Mark/Mod
(if available) of the
most hazardous
munition within the
site of this type and
size.

MEC HA Summary Information

Site ID:
Date:

Comments

Please identify the single specific area to be assessed in this hazard assessment. From this point forward, all references to "site" or "MRS" refer to the specific area that you have defined.

A. Enter a unique identifier for the site:

Range Identification:

Provide a list of information sources used for this hazard assessment. As you are completing the worksheets, use the "Select Ref(s)" buttons at the ends of each subsection to select the applicable information sources from the list below.

Ref. No. Title (include version, publication date)

- | | |
|----|--|
| 1 | Archives Search Report - Findings |
| 2 | Archives Search Report - Conclusions and Recommendations |
| 3 | SSFR, OE Investigation and Removal, September 12, 2008 |
| 4 | Phase III Target Anomaly Removal Report, August 2005 |
| 5 | Engineering Evaluation/Cost Analysis (EECA), Septemeber 2003 |
| 6 | Time Critical Removal Action (TCRA), Septemeber 2002 |
| 7 | TM 9-1904, Ammunition Inspection Guide, March 1944 |
| 8 | NAVSEA OP 1664 VOL 2, U.S. Explosive Ordnance, February 1954 |
| 9 | TM 9-1984, Disposal of American and Allied Bomb Fuzes, November 1942 |
| 10 | Complete Round Chart #5981, October 1944 |
| 11 | googleearth.com |
| 12 | RI/FS, Former Conway Bombing and Gunnery Range, EODT 2011 |

B. Briefly describe the site:

1. Area (include units):

2. Past munitions-related use:

Target Area

3. Current land-use activities (list all that occur):

Recreational (Golf Course/parks) and residential.

4. Are changes to the future land-use planned?

5. What is the basis for the site boundaries?

Site boundaries were based on the Archives Search Report dated, 2004 and boundaries were modified based on historical MEC finds.

6. How certain are the site boundaries?

Reference(s) for Part B:

- Archives Search Report - Findings
- Archives Search Report - Conclusions and Recommendations
- SSFR, OE Investigation and Removal, September 12, 2008
- Phase III Target Anomaly Removal Report, August 2005
- Engineering Evaluation/Cost Analysis (EECA), Septemeber 2003
- Time Critical Removal Action (TCRA), Septemeber 2002

Select Ref(s)

C. Historical Clearances

1. Have there been any historical clearances at the site?

No, none

2. If a clearance occurred:

a. What year was the clearance performed?

2002, 2003, 2005, 2008

b. Provide a description of the clearance activity (e.g., extent, depth, amount of munitions-related items removed, types and sizes of removed items, and whether metal detectors were used):

located, identified and destroyed were: 1544ea M54 41b Incendiary Bombs, 44ea M38A2 100lb Practice Bombs, 1ea 2.75" Rocket, 2ea M1A1 Spotting Charge, 37ea M48 20lb Practice Bombs, 2ea

Reference(s) for Part C:

- SSFR, OE Investigation and Removal, September 12, 2008
- Phase III Target Anomaly Removal Report, August 2005
- Engineering Evaluation/Cost Analysis (EECA), Septemeber 2003
- Time Critical Removal Action (TCRA), Septemeber 2002

Select Ref(s)

D. Attach maps of the site below (select 'Insert/Picture' on the menu bar.)

Site ID: **Range VII**
Date: **1/9/2012**

Cased Munitions Information

Item No.	Munition Type (e.g., mortar, projectile, etc.)	Munition Size	Munition Size Units	Mark/ Model	Energetic Material Type	Is Munition Fuzed?	Fuzing Type	Fuze Condition	Minimum Depth for Munition (ft)	Location of Munitions	Comments (include rationale for munitions that are "subsurface only")
1	Bombs	8.13	inches	M38	Spotting Charge	No	Impact	UNK	3	Surface and Subsurface	
2	Bombs	8.13	inches	M38	Spotting Charge	No	Impact	UNK	7	Surface and Subsurface	
3	Bombs	8.13	inches	M38	Spotting Charge	No	Impact	UNK	5	Surface and Subsurface	
4	Bombs	8.13	inches	M38	Spotting Charge	No	Impact	UNK	8	Surface and Subsurface	
5	Bombs	8.13	inches	M38	Spotting Charge	No	Impact	UNK	5	Surface and Subsurface	
6	Bombs	8.13	inches	M38	Spotting Charge	No	Impact	Unarmed	2	Surface and Subsurface	

Reference(s) for table above:

- SSFR, OE Investigation and Removal, September 12, 2008**
- Phase III Target Anomaly Removal Report, August 2005**
- Engineering Evaluation/Cost Analysis (EECA), Septemeber 2003**
- Time Critical Removal Action (TCRA), Septemeber 2002**
- TM 9-1904, Ammunition Inspection Guide, March 1944**
- NAVSEA OP 1664 VOL 2, U.S. Explosive Ordnance, February 1954**
- TM 9-1984, Disposal of American and Allied Bomb Fuzes, November 1942**
- Complete Round Chart #5981, October 1944**

Select Ref(s)

Bulk Explosive Information

Item No.	Explosive Type	Comments
1	N/A	
2		
3		
4		
5		
6		
7		
8		
9		
10		

Reference(s) for table above:

Select Ref(s)

DO NOT EDIT. Used to calculate scores.

Fuze		Munitions		IF1 Score
Condition Unarmed? (1=yes, 0=no)	Fuzed? (1=yes, 0=no)	Munitions Size in mm	For MEC List	
0	0	8.13	Item #1. Bombs (8.13inches, Spotting Charge)	1
0	0	8.13	Item #2. Bombs (8.13inches, Spotting Charge)	1
0	0	8.13	Item #3. Bombs (8.13inches, Spotting Charge)	1
0	0	8.13	Item #4. Bombs (8.13inches, Spotting Charge)	1
0	0	8.13	Item #5. Bombs (8.13inches, Spotting Charge)	1
1	0	8.13	Item #6. Bombs (8.13inches, Spotting Charge)	1
0			Max Hazard:	#REF!

Site ID: **Range VII**
Date: **1/9/2012**

Activities Currently Occurring at the Site

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours per year a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1	Residential	2,000	4,380	8,760,000	6	Represents high rate of development
2	Commercial	1,000	104	104,000	0	Average of shoppers and workers
3	Parks/Recreation	500	50	25,000	0	
4						
5						
6						
7						
8						
9						
10						
11						
12						
Total Potential Contact Time (receptor hrs/yr):				8,889,000		
Maximum intrusive depth at site (ft):					6	

Reference(s) for table above:
Archives Search Report - Findings
Archives Search Report - Conclusions and Recommendations
SSFR, OE Investigation and Removal, September 12, 2008
googleearth.com

Select Ref(s)

Activities Planned for the Future at the Site (If any are planned: see 'Summary Info' Worksheet, Question 4)

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours per year a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1	Continued Residential and Commercial Development	500	2,000	1,000,000	6	Represents additional receptors in the MRS
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
Total Potential Contact Time (receptor hrs/yr):				1,000,000		
Maximum intrusive depth at site (ft):					6	

Reference(s) for table above:
Archives Search Report - Findings
Archives Search Report - Conclusions and Recommendations
SSFR, OE Investigation and Removal, September 12, 2008
googleearth.com

Select Ref(s)

Site ID: **Range VII**
Date: **1/9/2012**

Planned Remedial or Removal Actions

Response Action No.	Response Action Description	Expected Resulting Minimum MEC Depth (ft)	Expected Resulting Site Accessibility	Will land use activities change if this response action is implemented?	What is the expected scope of cleanup?	Comments
1	No Further Action (NOFA)		Full Accessibility	No	No MEC cleanup	
2	Institutional Controls (LUC'S)		Full Accessibility	No	No MEC cleanup	
3	Surface Clearance		Full Accessibility	No	cleanup of MECs located on the surface only	
4	Surface/SubSurface Clearance		Full Accessibility	No	cleanup of MECs located both on the surface and subsurface	
5						
6						

For those alternatives where you answered 'No' in Column E, are land-use activities to be assessed against current or future land uses?

Future	
--------	--

Reference(s) for table above:

RI/FS, Former Conway Bombing and Gunnery Range, EODT 2011

Select Ref(s)

Site ID: **Range VII**
Date: **1/9/2012**

This worksheet needs to be completed for each remedial/removal action alternative listed in the 'Remedial-Removal Action' worksheet that will cause a change in land use.

Land Use Activities Planned After Response Alternative #1: No Further Action (NOFA)

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1					0	
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
Total Potential Contact Time (receptor hrs/yr):						
Maximum intrusive depth at site (ft):					0	

Reference(s) for table above:
Archives Search Report - Findings
Archives Search Report - Conclusions and Recommendations
SSFR, OE Investigation and Removal, September 12, 2008
googleearth.com
RI/FS, Former Conway Bombing and Gunnery Range, EODT 2011

Select Ref(s)

Land Use Activities Planned After Response Alternative #2: Institutional Controls (LUC'S)

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
Total Potential Contact Time (receptor hrs/yr):						
Maximum intrusive depth at site (ft):						

Reference(s) for table above:

Select Ref(s)

Land Use Activities Planned After Response Alternative #3: Surface Clearance

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1					0	
2	Maintenance	100	1		2	
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Total Potential Contact Time (receptor hrs/yr):
Maximum intrusive depth at site (ft):

Reference(s) for table above:

Select Ref(s)

Land Use Activities Planned After Response Alternative #4: Surface/SubSurface Clearance

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Total Potential Contact Time (receptor hrs/yr):
Maximum intrusive depth at site (ft):

Reference(s) for table above:

Select Ref(s)

Land Use Activities Planned After Response Alternative #5:

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
Total Potential Contact Time (receptor hrs/yr):						
Maximum intrusive depth at site (ft):						

Reference(s) for table above:

Select Ref(s)

Land Use Activities Planned After Response Alternative #6:

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
Total Potential Contact Time (receptor hrs/yr):						
Maximum intrusive depth at site (ft):						

Reference(s) for table above:

Select Ref(s)

Site ID: **Range VII**
Date: **1/9/2012**

Energetic Material Type Input Factor Categories

The following table is used to determine scores associated with the energetic materials. Materials are listed in order from most hazardous to least hazardous.

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
High Explosive and Low Explosive Filler in Fragmenting Rounds	100	100	100
White Phosphorus	70	70	70
Pyrotechnic	60	60	60
Propellant	50	50	50
Spotting Charge	40	40	40
Incendiary	30	30	30

M38 100lb practice bomb

Score

40

Baseline Conditions:	100
Surface Cleanup:	40
Subsurface Cleanup:	40

Location of Additional Human Receptors Input Factor Categories

1. What is the Explosive Safety Quantity Distance (ESQD) from the Explosive Siting Plan or the Explosive Safety Submission for the MRS?
2. Are there currently any features or facilities where people may congregate within the MRS, or within the ESQD arc?
3. Please describe the facility or feature.

0 feet

Residential subdivisions, Recreation Parks and continued Commercial/residential constructor

MEC Item(s) used to calculate the ESQD for current use activities

Select MEC(s)

Item #1 M38 100lb practice bomb

The following table is used to determine scores associated with the location of additional human receptors (current use activities):

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Inside the MRS or inside the ESQD arc	30	30	30
Outside of the ESQD arc	0	0	0

4. Current use activities are 'Inside the MRS or inside the ESQD arc', based on Question 2.'

Score

Baseline Conditions:	30
Surface Cleanup:	30
Subsurface Cleanup:	30

5. Are there future plans to locate or construct features or facilities where people may congregate within the MRS, or within the ESQD arc?

6. Please describe the facility or feature.

Unknown at this time, Commercial and Residential development has continued in the Carolina Forest Area.

MEC Item(s) used to calculate the ESQD for future use activities

Select MEC(s)

Item #1 M38 100lb practice bomb

The following table is used to determine scores associated with the location of additional human receptors (future use activities):

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Inside the MRS or inside the ESQD arc	30	30	30
Outside of the ESQD arc	0	0	0

7. Future use activities are 'Inside the MRS or inside the ESQD arc', based on Question 5.'

Score

Baseline Conditions:	30
Surface Cleanup:	30
Subsurface Cleanup:	30

Comments

Comments section with multiple empty rows for text input.

Potential Contact Hours Input Factor Categories

The following table is used to determine scores associated with the total potential contact time:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup	
Many Hours	≥1,000,000 receptor-hrs/yr	120	90	30	
Some Hours	100,000 to 999,999 receptor hrs/yr	70	50	20	
Few Hours	10,000 to 99,999 receptor-hrs/yr	40	20	10	
Very Few Hours	<10,000 receptor-hrs/yr	15	10	5	

Current Use Activities:

Input factors are only determined for baseline conditions for current use activities. Based on the 'Current and Future Activities' Worksheet, the Total Potential Contact Time is: **8,889,000** receptor hrs/yr
Based on the table above, this corresponds to a input factor score for baseline conditions of **120** Score

Future Use Activities:
Input factors are only determined for baseline conditions for future use activities. Based on the 'Current and Future Activities' Worksheet, the Total Potential Contact Time is: **1,000,000** receptor hrs/yr
Based on the table above, this corresponds to a input factor score of: **120** Score

Response Alternative No. 1: No Further Action (NOFA)

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.
Total Potential Contact Time based on the contact time listed for future use activities (see 'Current and Future Activities' Worksheet) **1,000,000**
Based on the table above, this corresponds to input factor scores of: **Score**

- Baseline Conditions: **120**
- Surface Cleanup: **90**
- Subsurface Cleanup: **30**

Response Alternative No. 2: Institutional Controls (LUC'S)

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.
Total Potential Contact Time based on the contact time listed for future use activities (see 'Current and Future Activities' Worksheet) **1,000,000**
Based on the table above, this corresponds to input factor scores of: **Score**

- Baseline Conditions: **120**
- Surface Cleanup: **90**
- Subsurface Cleanup: **30**

Response Alternative No. 3: Surface Clearance

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.
Total Potential Contact Time based on the contact time listed for future use activities (see 'Current and Future Activities' Worksheet) **1,000,000**
Based on the table above, this corresponds to input factor scores of: **Score**

- Baseline Conditions: **120**
- Surface Cleanup: **90**
- Subsurface Cleanup: **30**

Response Alternative No. 4: Surface/SubSurface Clearance

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.
Total Potential Contact Time based on the contact time listed for future use activities (see 'Current and Future Activities' Worksheet) **1,000,000**
Based on the table above, this corresponds to input factor scores of: **Score**

- Baseline Conditions: **120**
- Surface Cleanup: **90**
- Subsurface Cleanup: **30**

Response Alternative No. 5:

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

Total Potential Contact Time
Based on the table above, this corresponds to input factor scores of: **Score**

- Baseline Conditions:
- Surface Cleanup:
- Subsurface Cleanup:

Response Alternative No. 6:

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

Total Potential Contact Time
Based on the table above, this corresponds to input factor scores of: **Score**

- Baseline Conditions:
- Surface Cleanup:
- Subsurface Cleanup:

Amount of MEC Input Factor Categories

The following table is used to determine scores associated with the Amount of MEC:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Target Area	Areas at which munitions fire was directed	180	120	30
OB/OD Area	Sites where munitions were disposed of by open burn or open detonation methods. This category refers to the core activity area of an OB/OD area. See the "Safety Buffer Areas" category for safety fans and kick-outs.	180	110	30
Function Test Range	Areas where the serviceability of stored munitions or weapons systems are tested. Testing may include components, partial functioning or complete functioning of stockpile or developmental items.	165	90	25
Burial Pit	The location of a burial of large quantities of MEC items.	140	140	10
Maneuver Areas	Areas used for conducting military exercises in a simulated conflict area or war zone	115	15	5
Firing Points	The location from which a projectile, grenade, ground signal, rocket, guided missile, or other device is to be ignited, propelled, or released.	75	10	5
Safety Buffer Areas	Areas outside of target areas, test ranges, or OB/OD areas that were designed to act as a safety zone to contain munitions that do not hit targets or to contain kick-outs from OB/OD areas.	30	10	5
Storage	Any facility used for the storage of military munitions, such as earth-covered magazines, above-ground magazines, and open-air storage areas.	25	10	5
Explosive-Related Industrial Facility	Former munitions manufacturing or demilitarization sites and TNT production plants	20	10	5

Select the category that best describes the ***most hazardous*** amount of MEC: ***Score***

- Target Area **180**
- Baseline Conditions: **120**
- Surface Cleanup: **30**
- Subsurface Cleanup: **30**

Minimum MEC Depth Relative to the Maximum Intrusive Depth Input

Factor Categories
Current Use Activities

The shallowest minimum MEC depth, based on the 'Cased Munitions Information' Worksheet:
The deepest intrusive depth:
The table below is used to determine scores associated with the minimum MEC depth relative to the maximum intrusive depth:

2 ft
6 ft

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.	240	150	95
Baseline Condition: MEC located surface and subsurface, After Cleanup: Intrusive depth does not overlap with subsurface MEC.	240	50	25
Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	N/A	95
Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth does not overlap with minimum MEC depth.	50	N/A	25

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth will overlap after cleanup. MECs are located only subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.' For 'Current Use Activities', only Baseline Conditions are considered.

150 Score

Future Use Activities

Deepest intrusive depth:

6 ft

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth overlaps. MECs are located only subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.'. For 'Future Use Activities', only Baseline Conditions are considered.

150 Score

Response Alternative No. 1: No Further Action (NOFA)

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet):

2 ft

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.

Maximum Intrusive Depth, based on the maximum intrusive depth listed for future use activities (see 'Current and Future Activities' Worksheet)

6 ft

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth overlaps. MECs are located only subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.'

Score

150

Baseline Conditions:
Surface Cleanup:
Subsurface Cleanup:

Response Alternative No. 2: Institutional Controls (LUC'S)

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet):

2 ft

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.

Maximum Intrusive Depth, based on the maximum intrusive depth listed for future use activities (see 'Current and Future Activities' Worksheet)

6 ft

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth overlaps. MECs are located only subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.'

Score

150

Baseline Conditions:
Surface Cleanup:
Subsurface Cleanup:

Response Alternative No. 3: Surface Clearance

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet):

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.

Maximum Intrusive Depth, based on the maximum intrusive depth listed for future use activities (see 'Current and Future Activities' Worksheet)

2 ft

6 ft

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth overlaps. MECs are located only subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.'

Score

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

N/A

Response Alternative No. 4: Surface/SubSurface Clearance

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet):

Based on the 'Planned Remedial or Removal Actions' Worksheet, land use activities will not change if this alternative is implemented.

Maximum Intrusive Depth, based on the maximum intrusive depth listed for future use activities (see 'Current and Future Activities' Worksheet)

0 ft

6 ft

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth overlaps. MECs are located only subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.'

Score

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

95

Response Alternative No. 5:

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet):

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

ft

Maximum Intrusive Depth

ft

Not enough information has been entered to calculate this input factor.

Score

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

Response Alternative No. 6:

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet):

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

ft

Maximum Intrusive Depth

ft

Not enough information has been entered to calculate this input factor.

Score

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

Migration Potential Input Factor Categories

Is there any physical or historical evidence that indicates it is possible for natural physical forces in the area (e.g., frost heave, erosion) to expose subsurface MEC items, or move surface or subsurface MEC items?

No

If "yes", describe the nature of natural forces. Indicate key areas of potential migration (e.g., overland water flow) on a map as appropriate (attach a map to the bottom of this sheet, or as a separate worksheet).

The following table is used to determine scores associated with the migration potential

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Possible	30	30	10
Unlikely	10	10	10

Based on the question above, migration potential is 'Unlikely.'

Score

Baseline Conditions:

10

Surface Cleanup:

10

Subsurface Cleanup:

10

Reference(s) for above information:

Select Ref(s)

MEC Classification Input Factor Categories

Cased munitions information has been inputted into the 'Munitions, Bulk Explosive Info' Worksheet; therefore, bulk explosives do not comprise all MECs for this MRS.

The 'Amount of MEC' category is 'Target Area'. It cannot be automatically assumed that the MEC items from this category are DMM. Therefore, the conservative assumption is that the MEC items in this MRS are UXO.

Has a technical assessment shown that MEC in the OB/OD Area is DMM?

No

Are any of the munitions listed in the 'Munitions, Bulk Explosive Info' Worksheet:

- Submunitions
- Rifle-propelled 40mm projectiles (often called 40mm grenades)
- Munitions with white phosphorus filler
- High explosive anti-tank (HEAT) rounds
- Hand grenades
- Fuzes
- Mortars

None of the items listed in the 'Munitions, Bulk Explosive Info' Worksheet were identified as 'fuzed'.

The following table is used to determine scores associated with MEC classification categories

	UXO	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
UXO Special Case		180	180	180
UXO		110	110	110
Fuzed DMM Special Case		105	105	105
Fuzed DMM		55	55	55
Unfuzed DMM		45	45	45
Bulk Explosives		45	45	45

Based on your answers above, the MEC classification is 'UXO'.

Score

Baseline Conditions:

110

Surface Cleanup:

110

Subsurface Cleanup:

110

MEC Size Input Factor Categories

The following table is used to determine scores associated with MEC Size:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Small	Any munitions (from the 'Munitions, Bulk Explosive Info' Worksheet) weigh less than 90 lbs; small enough for a receptor to be able to move and initiate a detonation	40	40	40
Large	All munitions weigh more than 90 lbs; too large to move without equipment	0	0	0

Based on the definitions above and the types of munitions at the site (see 'Munitions, Bulk Explosive Info' Worksheet), the MEC Size Input Factor is:

Small

Score

Baseline Conditions:

40

Surface Cleanup:

40

Subsurface Cleanup:

40

Scoring Summary

Site ID: Range VII		a. Scoring Summary for Current Use Activities	
Date:	1/9/2012	Response Action Cleanup:	No Response Action
Input Factor	Input Factor Category	Score	
I. Energetic Material Type		100	
II. Location of Additional Human Receptors	Inside the MRS or inside the ESQD arc	30	
III. Site Accessibility	Full Accessibility	80	
IV. Potential Contact Hours	≥1,000,000 receptor-hrs/yr	120	
V. Amount of MEC	Target Area	180	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	
VII. Migration Potential	Unlikely	10	
VIII. MEC Classification	UXO	110	
IX. MEC Size	Small	40	
		Total Score	820
		Hazard Level Category	2

Site ID: Range VII		b. Scoring Summary for Future Use Activities	
Date:	1/9/2012	Response Action Cleanup:	No Response Action
Input Factor	Input Factor Category	Score	
I. Energetic Material Type		100	
II. Location of Additional Human Receptors	Inside the MRS or inside the ESQD arc	30	
III. Site Accessibility	Full Accessibility	80	
IV. Potential Contact Hours	≥1,000,000 receptor-hrs/yr	120	
V. Amount of MEC	Target Area	180	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	
VII. Migration Potential	Unlikely	10	
VIII. MEC Classification	UXO	110	
IX. MEC Size	Small	40	
		Total Score	820
		Hazard Level Category	2

Site ID: Range VII		c. Scoring Summary for Response Alternative 1: No Further Action (NOFA)	
Date:	1/9/2012	Response Action Cleanup:	No MEC cleanup
Input Factor	Input Factor Category	Score	
I. Energetic Material Type		100	
II. Location of Additional Human Receptors	Inside the MRS or inside the ESQD arc	30	
III. Site Accessibility	Full Accessibility	80	
IV. Potential Contact Hours	≥1,000,000 receptor-hrs/yr	120	
V. Amount of MEC	Target Area	180	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	
VII. Migration Potential	Unlikely	10	
VIII. MEC Classification	UXO	110	
IX. MEC Size	Small	40	
		Total Score	820
		Hazard Level Category	2

Site ID: Range VII		d. Scoring Summary for Response Alternative 2: Institutional Controls (LUC'S)	
Date:	1/9/2012	Response Action Cleanup:	No MEC cleanup
Input Factor	Input Factor Category	Score	
I. Energetic Material Type		100	
II. Location of Additional Human Receptors	Inside the MRS or inside the ESQD arc	30	
III. Site Accessibility	Full Accessibility	80	
IV. Potential Contact Hours	≥1,000,000 receptor-hrs/yr	120	
V. Amount of MEC	Target Area	180	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	
VII. Migration Potential	Unlikely	10	
VIII. MEC Classification	UXO	110	
IX. MEC Size	Small	40	
		Total Score	820
		Hazard Level Category	2

Site ID: Range VII		e. Scoring Summary for Response Alternative 3: Surface Clearance	
Date:	1/9/2012	Response Action Cleanup:	cleanup of MECs located on the surface only
Input Factor	Input Factor Category	Score	
I. Energetic Material Type		40	
II. Location of Additional Human Receptors	Inside the MRS or inside the ESQD arc	30	
III. Site Accessibility	Full Accessibility	80	
IV. Potential Contact Hours	≥1,000,000 receptor-hrs/yr	90	
V. Amount of MEC	Target Area	120	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	N/A	
VII. Migration Potential	Unlikely	10	
VIII. MEC Classification	UXO	110	
IX. MEC Size	Small	40	
		Total Score	520
		Hazard Level Category	4

Site ID: Range VII		f. Scoring Summary for Response Alternative 4: Surface/SubSurface Clearance	
Date:	1/9/2012	Response Action Cleanup:	cleanup of MECs located both on the surface and subsurface
Input Factor	Input Factor Category	Score	
I. Energetic Material Type		40	
II. Location of Additional Human Receptors	Inside the MRS or inside the ESQD arc	30	
III. Site Accessibility	Full Accessibility	80	
IV. Potential Contact Hours	≥1,000,000 receptor-hrs/yr	30	
V. Amount of MEC	Target Area	30	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	95	
VII. Migration Potential	Unlikely	10	
VIII. MEC Classification	UXO	110	
IX. MEC Size	Small	40	
		Total Score	465
		Hazard Level Category	4

Site ID:	Range VII	5. Scoring Summary for Response Alternative 5:	
Date:	1/9/2012	Response Action Cleanup:	
Input Factor		Input Factor Category	Score
I. Energetic Material Type			
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	
III. Site Accessibility			
IV. Potential Contact Hours			
V. Amount of MEC		Target Area	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth			
VII. Migration Potential		Unlikely	
VIII. MEC Classification		LXO	
IX. MEC Size		Small	
		Total Score	
		Hazard Level Category	

Site ID:	Range VII	6. Scoring Summary for Response Alternative 6:	
Date:	1/9/2012	Response Action Cleanup:	
Input Factor		Input Factor Category	Score
I. Energetic Material Type			
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	
III. Site Accessibility			
IV. Potential Contact Hours			
V. Amount of MEC		Target Area	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth			
VII. Migration Potential		Unlikely	
VIII. MEC Classification		LXO	
IX. MEC Size		Small	
		Total Score	
		Hazard Level Category	

MEC HA Hazard Level Determination		
Site ID: Range VII		
Date: 1/9/2012		
	Hazard Level Category	Score
a. Current Use Activities	2	820
b. Future Use Activities	2	820
c. Response Alternative 1: No Further Action (NOFA)	2	820
d. Response Alternative 2: Institutional Controls (LUC'S)	2	820
e. Response Alternative 3: Surface Clearance	4	520
f. Response Alternative 4: Surface/SubSurface Clearance	4	465
g. Response Alternative 5:		
h. Response Alternative 6:		
Characteristics of the MRS		
Is critical infrastructure located within the MRS or within the ESQD arc?	No	
Are cultural resources located within the MRS or within the ESQD arc?	No	
Are significant ecological resources located within the MRS or within the ESQD arc?	No	

APPENDIX C
STATE REGULATOR REVIEW
OF DRAFT FINAL FS
for the
Feasibility Study Report
MRS-R04 (Range VII)
Former Conway Bombing and Gunnery Range
Horry County, South Carolina

Prepared for:



U.S. Army Engineering and Support Center
Attn: CEHNC-OE-DC (Ms. Chris Cochrane)
4820 University Square
Huntsville, Alabama 35816-1822

U.S. Army Corps of Engineers, Charleston District
Attn: Mr. Shawn Boone
69A Hagood Avenue
Charleston, South Carolina 29403-0919

Contract No. W912DY-04-D-0018
Task Order: 0012
Project No. I04SC002501

Prepared by:
EOD Technology, Inc.
2229 Old Highway 95
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October 2012

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Promoting and protecting the health of the public and the environment

August 22, 2012

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Mr. Shawn Boone
U.S. Army Corps of Engineers
69-A Hagood Ave.
Charleston, S.C. 29403

Re: Feasibility Study-Draft Final
Former Conway Bombing and Gunnery Range
Conway, South Carolina

Dear Mr. Boone:

The South Carolina Department of Health and Environmental Control (Department) has completed its review of the Draft Final Feasibility Study for Conway Bombing and Gunnery Range and has the following comments:

- 1.) Since this Feasibility Study (FS) is not for the entire Conway Bombing and Gunnery Range and only covers MRS –R04 (Range VII), it is recommended that the title be changed.
- 2.) The Department is aware that the final remedy will be selected at a future date. Since MEC has been discovered at MRS-R04, the Department does not concur with the Alternative 1 (NDAI) at this time.

If you have any further question or comments, feel free to contact me at (803)896-4188.

Sincerely,

Susan Byrd, FUDS Project Manager
Division of Waste Management
Bureau of Land and Waste Management

C.c. LWM File #56838

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Promoting and protecting the health of the public and the environment

August 22, 2012

Mr. Shawn Boone
U.S. Army Corps of Engineers
69-A Hagood Ave.
Charleston, S.C. 29403

Re: Remedial Investigation- Final
Former Conway Bombing and Gunnery Range
Conway, South Carolina
Document dated July 31, 2012

Dear Mr. Boone:

The South Carolina Department of Health and Environmental Control (Department) has completed its review of the Final Remedial Investigations (RI) for Conway Bombing and Gunnery Range and has no additional comments at this time. We look forward to providing input in the future investigations required to fill the existing RI data gaps. If you have any further question or comments, feel free to contact me at (803)896-4188.

Sincerely,

Susan Byrd, FUDS Project Manager
Division of Waste Management
Bureau of Land and Waste Management

C.c. LWM File #56838