

**ENGINEERING EVALUATION/COST ANALYSIS
ACTION MEMORANDUM
for Three Munitions Response Sites
South Test Area/Bomb Test Area, Static Test Area, and Ground Signal Test Area**

**LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS**

**Contract Number W912BV-04-D-2019
Task Order DY-04**

Prepared for:



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U.S. ARMY CORPS OF ENGINEERS
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KARNACK, TEXAS**

The following document, Engineering Evaluation/Cost Analysis Action Memorandum for Longhorn Army Ammunition Plant, Karnack, Texas, was prepared and reviewed by the following persons, technically qualified to perform the work:

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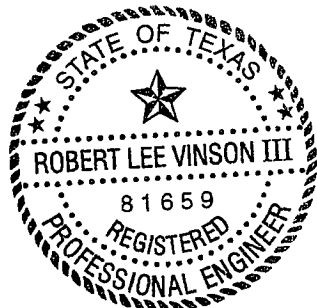
PROFESSIONAL ENGINEER'S CERTIFICATION

The Engineering Evaluation/Cost Analysis Action Memorandum for Longhorn Army Ammunition Plant, Karnack, Texas, was prepared for the U.S. Army Corps of Engineers Fort Worth District under my direction and supervision. I hereby certify that, within the scope of work and limitations stated herein, all data contained in this memorandum are true and correct to the best of my knowledge and belief as of the date of this document.

By: 

Date: 29 November 2007

Robert L. Vinson III, P.E.
Texas Licensed Professional Engineer, 81659



DECLARATION

This Engineering Evaluation/Cost Analysis Action Memorandum represents the selected munitions response for the three Munitions Response Sites (MRS), Site 27 - South Test Area/Bomb Test Area (LHAAP-001-R), Site 53 - Static Test Area (LHAAP-002-R), Site 54 - Ground Signal Test Area (LHAAP-003-R) at the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas.

The U.S. Army Base Realignment and Closure (BRAC) Division is the lead Department of Defense (DoD) organization for execution and oversight of the munitions response at the LHAAP. The U.S. Army Environmental Command, under the Military Munitions Response Program, provides funding for LHAAP-related munitions response actions. The U. S. Army Corps of Engineers (USACE), Fort Worth District, is the contracting agency and technical manager for this project and, as such, has responsibility for the site-specific project management and execution.

CAPE, Inc. developed this Action Memorandum in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, to be consistent with the National Contingency Plan. This decision document has been prepared based on the administrative records developed for the three project MRS. The U.S. Army approves the following munitions response actions for the three MRS as the most appropriate response for each MRS:

- Site 27 - Surface removal with subsurface removal to depth in the Open Burn/Open Detonation Area, with selected land use controls (LUCs)
- Site 53 - No action
- Site 54 - Surface removal, with selected LUCs.

This document has been approved by the undersigned.

Thomas Lederle
Industrial Branch Chief
BRAC Division, ASCIM
United States Army

Date

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- Site 53 - No action
- Site 54 - Surface removal, with selected LUCs.

This document has been approved by the undersigned.



Thomas Lederle
Industrial Branch Chief
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United States Army

5 Dec 2007

Date

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LIST OF ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
BRAC	U.S. Army Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLNWR	Caddo Lake National Wildlife Refuge
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
HRR	historical record review
LHAAP	Longhorn Army Ammunition Plant
LHAAP-001-R	Site 27 – South Test Area/Bomb Test Area
LHAAP-002-R	Site 53 – Static Test Area
LHAAP-003-R	Site 54 – Ground Signal Test Area
LUC	land use control
MC	munitions constituent
MD	munitions debris
MEC	Munitions and Explosives of Concern
mm	millimeter
MPPEH	material potentially presenting explosive hazard
MRS	Munitions Response Site
NA	No Action
OB/OD	open burn/open detonation
OERIA	Ordnance and Explosives Risk Impact Assessment
RAB	Restoration Advisory Board
SI	site inspection
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Services
UXO	unexploded ordnance
WP	white phosphorus

1. INTRODUCTION

This Action Memorandum documents the U.S. Army's decision to implement the recommended response alternatives outlined in the Final Engineering Evaluation/Cost Analysis (EE/CA) Report (CAPE, 2007) for three Munitions Response Sites (MRS) at the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. The following three MRSs encompass a total of approximately 186 acres:

- Site 27 – South Test Area/Bomb Test Area (LHAAP-001-R) – 79 acres
- Site 53 – Static Test Area (LHAAP-002-R) – 27 acres
- Site 54 – Ground Signal Test Area (LHAAP-003-R) – 80 acres.

1.1. Site Location and Background

The former LHAAP is located in east-central Texas in the northeastern corner of Harrison County, approximately 14 miles northeast of Marshall, Texas, and approximately 40 miles west of Shreveport, Louisiana. The former LHAAP property occupies approximately 8,000 acres. LHAAP was established in October 1942 with the primary mission of producing trinitrotoluene (TNT) flake. TNT production continued until August 1945, when the plant went on standby status. Pyrotechnic ammunition (e.g., photoflash bombs, simulators, hand signals, and tracer ammunition) were manufactured at LHAAP from 1952 until 1956.

The LHAAP rocket motor facility began operation in November 1955. Production of rocket motors continued to be the primary mission of LHAAP until 1965, when the production of pyrotechnic and illuminating ammunition was reestablished. Through 1994, operations consisted of producing pyrotechnic and propellant mixtures; loading, assembling, and packing activities; accommodating receipt and shipment of containerized cargo; and maintenance or layaway of standby facilities and equipment as they applied to mobilization planning.

LHAAP was also responsible for static firing and elimination of Pershing I and II rocket motors in compliance with the Intermediate-Range Nuclear Force Treaty in effect between the United States and the former Union of Soviet Socialist Republics. LHAAP was declared excess to the U.S. Army's needs and placed in inactive status in 1997. The initial 5,032 acres were transferred to U.S. Fish and Wildlife Services (USFWS) in May 2004. Subsequent transfers increased the total acreage transferred to USFWS to more than 6,000 acres.

The U.S. Army has sponsored numerous studies and investigations at LHAAP. These date back to the early 1980s. The most recent study was a site inspection (SI) of the three MRS that was completed in June 2005. The SI Report included a comprehensive historical record review (HRR) of LHAAP's former operations. The SI Report identified the three MRS locations.

These three sites are slated for transfer to the USFWS. A comprehensive HRR confirmed the historical presence of Munitions and Explosives of Concern (MEC) at all three MRS. The SI Report recommended further investigation of these MRS. The SI Report also

identified data gaps in earlier soil sampling in that no analysis for the munitions constituent (MC) white phosphorus (WP) was performed for Sites 27 and 54, and no analysis for any MC, including WP, was performed in the scarred areas at Site 53. LHAAP's mission included production of illumination-type military munitions, and the HRR identified demilitarization and demolition of leaking military munitions containing a WP fill. Accordingly, field activities were included in this project to characterize unexploded ordnance (UXO), discarded military munitions (DMM) and MC at each MRS and to address the data gaps.

Primary tasks of the EE/CA included physical investigation of each MRS, intrusive investigation to determine the characteristics of anomalies identified by the geophysical investigation, evaluation of the potential explosives hazards (i.e., MEC) associated with each MRS, and preparation of an EE/CA Report. Information gathered during the project was used to evaluate potential risks associated with the three MRSs and recommend response actions.

1.2. Current and Future Land Use

The LHAAP acreage that was previously transferred to USFWS is part of the Caddo Lake National Wildlife Refuge (CLNWR). The U.S. Army holds the remaining land, including the three MRS, while environmental restoration takes place in preparation for transfer to the USFWS.

Presently, the general public does not have unrestricted access to the refuge or to the MRSs located inside the refuge. The Refuge Manager currently allows only USFWS-led car tours of the refuge. The U.S. Army does not grant MRS access to the general public. Physical controls at the MRSs consist of gated access roads with restricted access warning signs at the gates. The former LHAAP's perimeter fence remains in place around the refuge; however, the boundary along Caddo Lake is unfenced. Due to the physical restraints in place, trespassing is possible.

The reasonably anticipated future land use for the three MRS, once transferred to USFWS, is incorporation into the existing wildlife refuge. Once transferred, the use will be consistent with the rest of the refuge and the "big six" activities (i.e., hunting, fishing, wildlife observation, wildlife photography, wildlife education, and wildlife interpretation).

2. STATEMENT OF BASIS AND PURPOSE

This decision document presents the U.S. Army's (U.S. Army Base Realignment and Closure (BRAC) Division) selected munitions response for the three LHAAP MRS (Sites 27, 53, and 54). The BRAC division is the lead DoD organization for execution and oversight of response actions at the LHAAP. The Army Environmental Command (AEC) funds LHAAP-related work under the Military Munitions Response Program. The U.S. Army Corps of Engineers (USACE) Fort Worth District is the contracting agency and technical manager for this project, and as such has responsibility for the site-specific project management and execution.

The response action alternatives that will be implemented at the three MRSs were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Contingency Plan (40 Code of Federal Regulations Part 300).

The selected actions are supported by documents contained in the Administrative Record for the sites that is available at Marshall Public Library. The U.S. Army will implement the following response actions:

- At Site 27, South Test Area/Bomb Test Area (LHAAP-001-R) - Surface removal will be performed over approximately 79 acres. In addition, subsurface removal to depth will be performed in the approximately 11-acre former Open Burn/Open Detonation (OB/OD) Area. Select land use controls (LUCs) will be implemented. These include posting UXO warning signs around the perimeter of the MRS, continuing the existing UXO education programs provided to authorized workers (i.e., USFWS's staff) and refuge visitors, only allowing future public uses that are consistent with the "big six" activities (i.e., hunting, fishing, wildlife observation, wildlife photography, wildlife education, and wildlife interpretation), and incorporating land use and dig restrictions into transfer documents. Implementation of this munitions response action requires recurring 5-year reviews for a minimum of 30 years.
- At Site 53, Static Test Area (LHAAP-002-R) - No response action will be performed. No MEC was found at Site 53 during the EE/CA investigation, and environmental sampling results at the site indicated that there is no risk to human health and safety from MC; therefore, no action is required.
- At Site 54, Ground Signal Test Area (LHAAP-003-R), surface removal will be performed over approximately 80 acres. Select LUCs will be implemented. These include placing UXO warning signs around the perimeter of the site, continuing the existing UXO education programs provided to authorized workers (USFWS staff) and refuge visitors, only allowing future public use that are consistent with the "big six" activities, and incorporating land use and dig restrictions into transfer documents. Implementation of this response action requires recurring 5-year reviews for a minimum of 30 years.

The U.S. Army BRAC division, the U.S. Environmental Protection Agency (EPA), the Texas Commission on Environmental Quality (TCEQ), USFWS, and the USACE concur with the selected alternatives.

3. PROJECT JUSTIFICATION

The results of the Site Inspection in 2005 and the EE/CA investigation in 2006 indicate that MEC is present at the surface at Site 27 and Site 54. MEC presents a potential hazard to human health and safety from explosions. Though the general public does not have unrestricted access to the MRSs, current physical controls do not prevent access by trespassers. In addition, these MRS will likely be incorporated into the existing wildlife refuge, where reasonably anticipated uses may include hunting, fishing, wildlife observation, wildlife photography, wildlife education, and wildlife interpretation.

4. ALTERNATIVES CONSIDERED

In general, the following four response action alternatives were evaluated in the EE/CA Report for Sites 27 and 54. Due to conditions at Site 27, hybrids of Alternative 3 were considered. Because no UXO, DMM or MC (at unacceptable concentrations in soil samples) were detected at Site 53, there is no risk to human health and safety; therefore, the No Action (NA) alternative was the only alternative considered. The alternatives were evaluated for effectiveness, implementability, and cost.

4.1. Alternative 1 – No Action (NA)

The NA alternative provides a baseline for comparison of other risk-reduction alternatives. No alternative technology is associated with this alternative, and no risk-reduction measure resulting in the treatment, containment, removal of, or limited exposure to UXO, DMM or MC will take place.

The NA alternative is appropriate for sites where no UXO, DMM or MC has been found; where there is no documented evidence of munitions-related activities (e.g., live-fire training, disposal by burial or other means); or where the nature and extent of any potential exposure (e.g., exposure to small arms ammunition) poses minimal threat to those who may encounter military munitions.

4.2. Alternative 2 – LUCs Only

LUCs are response actions that are intended to mitigate any residual risk remaining after completion of a munitions response actions. Selected LUCs may be also be used to supplement a munitions response. As a stand-alone response action, LUCs do not result in the removal of any UXO, DMM or MC present. To the extent the controls are effective and maintained, the potential threat to human safety is reduced. The level of protection is greater than that provided by Alternative 1 (NA) because informing the public of the hazards associated with military munitions reduces the likelihood that an encounter with a military munition will result in an action that would cause a detonation or other exposures. Because any UXO, DMM

or MC present at the MRS would remain in place and no long-term change to the MRS's conditions occurs, this alternative requires future efforts and oversight by regulatory and governmental agencies.

LUCs may include legal mechanisms, physical controls, and educational programs. Legal mechanisms may include restrictive language, such as restricted access or use, as part of transfer documents. Administrative mechanisms are related to legal mechanisms and may include dig restrictions, notices, adopted local land use plans and ordinances, construction permitting, or other land use management systems that ensure compliance with use restrictions.

Physical controls may include engineered barriers and signs. Barriers limit or restrict access and possible exposure to MEC, while signs alert individuals to the former use and dangers at the site. Signs can provide information regarding the nature of the hazard, how to avoid the hazard, and also provide a contact for additional information. Signs deter access to a site and give notice so inappropriate uses at the site are avoided. A sign has the added benefit of providing information to the public on the nature of the hazard found at a site. More specifically, UXO warning signs provide hazard communication before entering wooded areas from roadways.

Educational and notification programs are designed as an integral part of LUCs. Explosives safety educational programs are based on the Army's 3Rs (Recognize, Retreat, Report) message that is intended to inform the people what to do should they encounter or suspect they have encountered a military munition. Informational pamphlets can warn the public that they may encounter military munitions and of the associated explosive hazards based on the historical context of munitions-related activities that occurred at LHAAP. An effective informational pamphlet contains photographs or drawings of typical military munitions that the public might encounter and areas in which such encounters are most likely to occur. (See www.denix.osd.mil/uxosafety.)

Informational pamphlets can also be developed and distributed to support safety briefings or speaking engagements and are effective as stand-alone educational materials. Informational pamphlets can be mailed to residents in the vicinity of an MRS or they can be distributed from central locations such as libraries. A telephone number for the appropriate local authority would be included in the informational pamphlet.

Formal education seminars may include periodic community education classes. Classes can be given to different audiences, including local government regulatory and emergency response personnel, property and adjacent property owners, and children at local schools. Training seminars can be tailored to address the specific concerns of the audience and can be an effective method to educate the audience on the nature and extent of the potential hazards associated with MEC and precautions to take in the event a person comes in contact with MEC.

4.3. Alternative 3 – Surface Removal with Selected LUCs

Removal actions are designed to locate and remove MEC detected, thus reducing the explosive hazards to the future land users. Surface removal involves personnel who meet Department of Defense Explosives Safety Board-requirements for training and experience. These personnel are trained to recognize, handle, and dispose of MEC. These personnel visually inspect the MRS's surface area and remove any MEC and inspect and remove any material potentially presenting explosive hazard (MPPEH) (e.g., munitions and range-related debris) that is visible on-the-ground surface. (A situation in which UXO, DMM are: (a) entirely or partially exposed above the ground surface (i.e., the top of the soil layer); or (b) entirely or partially exposed above the surface of a water body (e.g., because of tidal activity).) MEC recovered during surface removal may be detonated in place or moved to an area specifically designated for destruction of recovered MEC. Any MPPEH (e.g., munitions debris) documented as safe will be handled as scrap metal and transported to a scrap metal recycler.

This alternative is effective for minimizing the risk of incidental contact with any military munitions (i.e., UXO or DMM) potentially present in areas where intrusive activities are not likely. Site preparation activities are required in some areas and include brush removal to perform a visual survey. The efforts associated with this alternative vary, depending upon topography and ground cover (vegetative and pavement).

Surface removal is appropriate where UXO or DMM are confirmed to be present on-the-surface of an MRS or where surface inspections of an MRS have not been performed. Because this alternative only addresses MEC found on the MRS's surface, there is a possibility of future impacts to human health and the environment from any subsurface MEC potentially present. Therefore, selected LUCs are often required to supplement this alternative. Typical LUCs may include dig restrictions and posting of UXO warning signs.

For Site 27, two hybrids of this alternative were considered because this MRS contains an OB/OD Area of approximately 11 acres. One alternative included surface removal and selected LUCs to include fencing of the OB/OD Area with signs. The other hybrid alternative included surface removal with selected LUCs combined with a subsurface removal to depth in the OB/OD Area.

4.4. Alternative 4 – Subsurface Removal with Selected LUCs

This alternative involves all activities necessary to locate, excavate, and remove MEC to a depth consistent with the expected future land use. Removal depth is dictated by the type of military munitions known to be present, the detection technology and the depth of detection technically at the time of removal. This alternative is an effective solution for reducing the risk of exposure by reducing the potential for direct contact with MEC.

Activities include vegetation clearance as necessary for the protection of response personnel and to allow the conduct of geophysical surveys, completion of geophysical investigations, excavation of anomalies, and the destruction of all MEC recovered. MEC recovered during subsurface removal is detonated in place or moved to an area designated for destruction. MPPEH recovered during a subsurface removal is inspected to determine whether it presents an explosive hazard. MPPEH determined not to present an explosive hazard is documented as not presenting an explosive hazard and turned in to a scrap metal recycler.

Technologies used for this alternative include magnetic or electromagnetic geophysical detection technologies. This alternative includes surface removal over the entire MRS with excavation and removal in impact areas or suspected burial grounds. The effort associated with implementing this alternative varies depending upon vegetation and site access.

This alternative does not require consideration of annual operation and maintenance costs. Such cost may be incurred only if additional intrusive activities are to be conducted below the removal depth. Given limitations in detection technology and variants in site condition, a subsurface removal to depth will not result in the detection and removal of all MEC potentially present. Intrusive activities that may require excavations below the removal depth must be evaluated and performed in conjunction with construction support. Therefore, LUCs (e.g., construction permitting, dig restrictions) may be required to supplement this alternative.

5. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Activities associated with the EE/CA field investigation were presented at a public meeting held in conjunction with a Restoration Advisory Board (RAB) meeting in July 2006. After U.S. Army and regulatory agency personnel reviewed the Draft EE/CA Report, the U.S. Army presented the results of the EE/CA activities, including the recommended response actions to the RAB at its June 12, 2007 meeting.

The public was informed of the location of the administrative record file that has been established for the project site. The administrative records are located at Marshall Public Library. The administrative records contain documents that are accessible to the public and that were prepared in support of the ordnance investigation at the MRSs. The public was notified in the Marshall News Messenger on 5 August 2007 that the Draft-Final EE/CA was available for review and comment at the Marshall Public Library for a thirty day period beginning on 6 August 2007.

6. COORDINATION SUMMARY

This project was coordinated with several federal, state, and local agencies, including the U.S. Army, USFWS, U.S. EPA, USACE, and TCEQ, as well as citizen advisory groups (i.e., the RAB and local community groups) before and during the EE/CA process. All stakeholders were

encouraged to participate in the EE/CA process, and copies of the EE/CA Work Plan and the EE/CA Report were made available to the aforementioned groups for their review and comment.

7. SELECTION CRITERIA

Each of the munitions response action alternatives was evaluated against the following criteria: effectiveness, implementability, and cost. These criteria are discussed in greater detail in Chapter 6 of the EE/CA Report.

7.1. Effectiveness

Effectiveness is the measure of a response alternative to reduce the potential for exposure to or interaction with MEC. Additionally, it is a measure of a response alternative's ability to meet the criteria of protecting public safety and the identified applicable or relevant and appropriate requirements (ARARs) while still accomplishing the goals established at the first Technical Project Planning meeting. Effectiveness analysis considers protection of human health and safety, compliance with ARARs, and both the long- and short-term effectiveness.

7.2. Implementability

Implementability is a measure of whether a munitions response action alternative can be physically and administratively implemented, maintained, and enforced. It is also a measure of the availability of the services and materials needed to implement the alternative. Another consideration for implementability is regulatory agency and community acceptance of a given alternative. For implementability, the response alternatives are ranked by technical and administrative feasibility, the availability of services and materials, and the regulatory agency and community acceptance of the alternative.

7.3. Cost

Cost is a measure of the actual dollar value of each response action alternative, the investment value, and its corresponding benefit. Both the initial alternative implementation and post-implementation costs are considered. For initial implementation, the costs are one-time costs for labor, materials, specialty subcontractors, equipment rental, etc., necessary for a contractor to conduct the field activities (e.g., surface removal, geophysical mapping, intrusive investigation, installing signs).

Post-implementation costs are recurring costs such as 5-year reviews and maintenance costs for LUCs (e.g., replacing weathered signs). Cost considerations are evaluated using detailed cost estimates. The cost of implementing each of the munitions response action alternatives has been estimated and backup cost data is presented in Appendix E of the EE/CA Report.

The benefit of the investment in risk reduction is also considered when ranking munitions response action alternatives. This involves evaluating the reduction in risk to the public versus the cost of implementing the alternative. For example, if two alternatives provide an equal or comparable amount of risk reduction, the less expensive alternative provides greatest benefit for the dollars spent, and therefore, would be ranked as the better alternative in terms of cost benefit.

8. DESCRIPTION OF SELECTED REMEDIES

The recommendations for the MRSs at LHAAP were developed to provide the most effective protection to the public from MEC. The recommendations were based on numerous data, including past, current, and future land use; the quantities and locations of MEC recovered during the EE/CA field investigation; and the results of the qualitative risk analysis presented in Chapter 5. of the EE/CA Report. These recommendations were also based on a detailed evaluation that takes into account the effectiveness, implementability, and cost of each munitions response action alternative, as presented in Chapter 6. of the EE/CA Report. Costs for the munitions response actions were developed in the EE/CA Report and can be found in Appendix E of the EE/CA Report.

The following table summarizes the selected munitions response action alternative and estimated implementation cost for each site:

Selected Response Actions	Site 27 (79 Acres)	Site 53 (27 Acres)	Site 54 (80 Acres)
Surface Removal	\$389,081.53	N/A	\$392,317.98
Subsurface Removal to Depth ¹	\$221,855.81	N/A	N/A
Explosives Safety Submission	N/A	\$8,586.86	N/A
Land Use Controls	\$36,365.19	N/A	\$34,228.63
Total Removal Action Costs	\$647,302.53	\$8,586.86	\$426,546.61
Long-Term Monitoring (5-Year Reviews) ²	\$210,000.00	N/A	\$210,000.00
Remedial Design Costs ³	TBD	N/A	TBD
Total Estimated Cost	\$857,302.53	\$8,586.86	\$636,546.61

¹ Subsurface removal cost is for the OB/OD area only (approximately 11 acres).

² Cost is for six 5-year reviews (estimated at \$35,000 each) to cover a period of 30 years.

³ To be determined - the remedial design will be performed by the USACE Design Center.

8.1. Site 27 – South Test Area/Bomb Test Area

The assessment of UXO, DMM and MC potentially present at this MRS and an evaluation of munitions response action alternatives for it indicated that a Surface Removal over the entire site (79 acres), a subsurface removal to depth in the OB/OD Area (11 acres), and implementation of selected LUC would be the most appropriate munitions response actions for this MRS. The U.S. Army and USACE concur with this response action.

The decision for Site 27 is based upon the following:

- Geophysical investigation of this site was exploratory and a portion of the site (approximately 2 acres) was geophysically mapped during the EE/CA field investigation to assess whether any MEC was present as a result of past military munitions-related activities. As a result of this investigation:
 - 21 photoflash cartridges were recovered. This equates to an average density of 10.5 items per acre.
 - 19 of the 21 items recovered were found clustered within the vicinity of the former OB/OD Area.
- There were no high explosives or fuzed military munitions recovered. The munitions debris (i.e., the photoflash cartridges) were inspected and determined to have a low hazard and a low sensitivity value. This means these military munitions are not highly sensitive to movement and are not likely to function if stepped on or moved by natural events. If detonated by an individual's action, they are likely to cause only minor injuries.
- Environmental soil sampling results at the site indicated that MCs are not present in the soils at concentrations that would pose a risk to human health and safety.
- The anticipated future land use of this MRS is incorporation into the existing wildlife refuge, where the general public would have access to the sites; therefore, the contact risk associated with future human activities is significant.

Based on these factors, a Surface Removal across the entire MRS and a subsurface removal in the MRS's OB/OD Area will be performed. LUCs (e.g., posting of warning signs, incorporation of land use and dig restrictions into transfer documents, continuation of education programs to authorized workers and visitors) will also be implemented. Additionally, consistent with the CERCLA process, 5-year reviews will also be conducted for a minimum of 30 years. This response will reduce the risk associated with this MRS's anticipated land use.

The estimated cost, including for required 5-year reviews, to implement this munitions response action is approximately \$857,303. The cost details are included in Appendix E of the EE/CA Report.

8.2. Site 53 – Static Test Area

The assessment of UXO, DMM and MC potentially present at this MRS and an evaluation of the munitions response action alternatives for it indicated that No Action is required at Site 53. Preparation of an Explosives Safety Submission for a No Further Action determination will be required. The U.S. Army and USACE concur with this response action. This decision is based upon the following:

- Geophysical investigation of this MRS was exploratory, with a portion geophysically mapped during the EE/CA field investigation to assess whether any MEC was present as a result of past military munitions-related activities.
- Environmental soil sampling results indicated that MCs are not present in the soils at concentrations that would pose a risk to human health and safety.
- Because there was no physical evidence that MEC was present—no MEC or material that would be considered MPPEH was recovered) and because MC was not detected at concentrations that would pose a risk to human health and safety during the EE/CA field investigation, there is no need for a munitions response in this area.

The estimated cost to prepare an Explosives Safety Submission for a No Further Action determination is approximately \$8,587. The cost details are included in Appendix E of the EE/CA Report.

8.3. Site 54 – Ground Signal Test Area

The assessment of UXO, DMM and MC potentially present at this MRS and an evaluation of the munitions response action alternatives for it indicated that a Surface Removal over the entire site (80 acres), along with the implementation of selected LUCs, would be the most appropriate response action for this MRS. The U.S. Army and USACE concur with this response action.

The decision for Site 54 is based upon the following:

- Geophysical investigation of this MRS was exploratory, with a portion (approximately 2 acres) geophysically mapped during the EE/CA field investigation to assess whether any MEC was present as a result of past military munitions-related activities. As a result of this investigation, 14

military munitions were recovered. Although this equates to an average density of seven items per acre, this density may be lower because 13 of these items were found clustered within the vicinity of the suspected Mortar Test Area that only occupies 5 acres of this MRS.

- The Mortar Test Area was historically used only to fire illumination rounds. The nature of an illumination round is such that it falls to the ground very slowly, which greatly reduces the ability of the round to penetrate deeply into the subsurface.
- There were no high explosives or fuzed military munitions recovered. No high explosives or fuzed items were identified during the inspections of the recovered munitions (CDU 10 components, 60-millimeter (mm) illumination mortar, 60-mm illumination candles, 4.2-inch illumination candle, 81-mm illumination mortar, and miscellaneous mortar fuzes).
- The recovered munitions were determined to have a low hazard and a low sensitivity value. This means these military munitions are not highly sensitive to movement and are not likely to function if stepped on or moved by natural events. If detonated by an individual's action, they are likely to cause only minor injuries.
- Environmental soil sampling indicated that MCs are not present in the soils at concentrations that would pose a risk to human health and safety.
- The anticipated future land use is incorporation into the existing wildlife refuge, where the general public would have access to the sites; therefore, the contact risk associated with future human activities is significant

Based on these factors, a Surface Removal across the entire MRS will be performed, and LUC (e.g., posting of warning signs, incorporation of land use and dig restrictions into transfer documents, and continuation of education programs to authorized workers and visitors) will also be implemented at the site. Additionally, consistent with the CERCLA process, 5-year reviews will also be conducted for a minimum of 30 years. This response will reduce the risk associated with this MRS's anticipated land use.

The estimated cost, including for required 5-year reviews, to implement this response action at Site 54 is approximately \$636,547. The cost details are included in Appendix E of the EE/CA Report.

9. TRADE OFF ANALYSIS

The selected munitions response alternative recommended for Sites 27, 53, and 54, which

are acceptable federal, state, and local agencies and the community, were determined to be the best alternative for each of these MRS. This determination was made through evaluation of response alternatives based on MRS-specific conditions, evaluation of the EE/CA Report and use of the Ordnance and Explosives Risk Impact Assessment (OERIA).

10. DOCUMENTATION OF SIGNIFICANT CHANGES

If the response actions outlined in this Action Memorandum are delayed or are not implemented, the potential exists for continued endangerment to human safety. Delay in addressing the explosive hazards known to be present at Sites 27 and 54 will pose a potential hazard to human health and safety.

11. RESPONSIVENESS SUMMARY

Activities associated with the fieldwork performed during this project were presented at a public meeting held in conjunction with the RAB meeting in July 2006. The results of the EE/CA activities, including the recommended response actions, were presented at the June 12, 2007, RAB meeting after review of the Draft EE/CA Report by U.S. Department of the Army, USACE, and regulatory agency personnel.

The Draft-Final EE/CA Report (CAPE, 2007) was made available to the public at the Marshall Public Library in Marshall, Texas, beginning on August 6, 2007, for a formal 30-day public review and comment period. Public comments were considered and no impacts to the final recommendations were encountered. No significant public comments were received during this period. The Final EE/CA Report was provided to the Marshall Public Library on 9 October 2007.

8. REFERENCES

CAPE, 2007. *Final Engineering Evaluation/Cost Analysis for Longhorn Army Ammunition Plant, Karnack, Texas*. August.

**ENGINEERING EVALUATION/COST ANALYSIS
ACTION MEMORANDUM
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS**

The following document, Engineering Evaluation/Cost Analysis Action Memorandum for Longhorn Army Ammunition Plant, Karnack, Texas, was prepared and reviewed by the following persons, technically qualified to perform the work:

Robert Vinson, P.E., Project Manager

Michael Lamon, QC Manager, Remediation

Amanda Easley, Project Engineer

Richard Norton, Senior UXO Supervisor

PROFESSIONAL ENGINEER'S CERTIFICATION

The Engineering Evaluation/Cost Analysis Action Memorandum for Longhorn Army Ammunition Plant, Karnack, Texas, was prepared for the U.S. Army Corps of Engineers Fort Worth District under my direction and supervision. I hereby certify that, within the scope of work and limitations stated herein, all data contained in this memorandum are true and correct to the best of my knowledge and belief as of the date of this document.

By: _____ Date: _____

Robert L. Vinson III, P.E.
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