

**FINAL
DECISION DOCUMENT (REMEDIAL ACTION)**

**FORMER SPENCER ARTILLERY RANGE
MUNITIONS RESPONSE SITE 05**

VAN BUREN COUNTY, TENNESSEE

FUDS Project No. G04TN017805



**Prepared by:
U.S. Army Corps of Engineers, Savannah District**

September 2021

EXECUTIVE SUMMARY

1.0 This Decision Document is presented by the United States Army Corps of Engineers to describe the selected remedy for Munitions Response Site 05 within the former Spencer Artillery Range, Formerly Used Defense Site Project Number G04TN017805, in Van Buren County, Tennessee. Munitions Response Site 05 consists of 646 acres within the former Spencer Artillery Range.

2.0 The selected alternative for Munitions Response Site 05 is Geophysical Investigation and Munitions and Explosives of Concern Removal with Educational Awareness. The regulatory agency, Tennessee Department of Environment and Conservation, concurs with the selected remedy.

3.0 The remedial action objective for Munitions Response Site 05 is based on site-specific conditions, such as receptors and current and reasonably foreseeable future land use. The remedial action objective for Munitions Response Site 05 will be achieved by implementing the selected remedy, which will address risks associated with receptor interaction with Munitions and Explosives of Concern on the surface and in the subsurface during intrusive activities. A potentially complete Munitions and Explosives of Concern exposure pathway is reduced through Munitions and Explosives of Concern source removal and/or increasing awareness of Munitions and Explosives of Concern hazards.

4.0 The estimated total cost to implement the selected remedy is \$13,045,666.

5.0 Implementation of the selected remedy at Munitions Response Site 05 meets the remedial action objective established in the Feasibility Study but does not achieve unlimited use/unrestricted exposure. Therefore, five-year reviews that evaluate the effectiveness of the selected remedy to protect human health are required.

6.0 Geophysical Investigation and Munitions and Explosives of Concern Removal with Educational Awareness is protective of human health and the environment and minimizes explosive hazard risks. Land Use Controls in the form of educational awareness is required.

7.0 Five remedial alternatives were evaluated during the Final FS Addendum. The alternatives evaluated in addition the selected remedy were: No Further Action; Land Use Controls in the form of Educational Awareness; Surface Removal with Educational Awareness; and Excavation and Sifting.

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GLOSSARY OF TERMS

Administrative Record – The documents that form the basis for the selection of a response action compiled and maintained by the lead agency.

Advanced Geophysical Classification – A method of using digital geophysical sensors to acquire data and then classify detected anomalies as either targets of interest or clutter.

Anomaly – Any item classified as a subsurface irregularity after geophysical investigation. This irregularity will deviate from the expected subsurface ferrous and non-ferrous material at a site (e.g., pipes, power lines).

Applicable or Relevant and Appropriate Requirements – Applicable requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

Decision Document – The USACE uses the term “Decision Document” for the final remedial action decision at Formerly Used Defense Sites properties. Same as Record of Decision as listed in the National Oil and Hazardous Substances Pollution Contingency Plan.

Defense Environmental Restoration Program (DERP) – This congressionally authorized program (10 U.S.C. § 2701, et seq.) provides for environmental responses at specific sites under the jurisdiction of the Secretary of Defense as defined under statute in accordance with CERCLA. The scope of the DERP is defined in 10 USC § 2701(b), which states that the: “Goals of the program shall include the following: (1) The identification, investigation, research and development, and cleanup of contamination from hazardous substances, and pollutants and contaminants. (2) Correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment. (3) Demolition and removal of unsafe buildings and structures, including buildings and structures of the Department of Defense at sites formerly used by or under the jurisdiction of the Secretary.”

Feasibility Study (FS) – A study undertaken by the lead agency to develop and evaluate options for remedial action. The RI data are used to define the objectives of the response action, to develop remedial action alternatives, and to undertake an initial screening and detailed analysis of the alternatives. The term also refers to a report that describes the results of the study.

Formerly Used Defense Site (FUDS) – Facility or site which was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances, or pollutants or contaminants, and that was transferred from DoD control prior to 17 October 1986.

Military Munitions Response Program (MMRP) – Program that addresses the potential explosives safety, health, and environmental issues caused by past Department of Defense (DoD) munitions related activities.

Munitions Constituents (MC) – Any materials originating from unexploded ordnance (UXO), discarded military munitions (DMM), or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions and Explosives of Concern (MEC) – Specific categories of military munitions that may pose unique explosives safety risks, specifically composed of (a) unexploded ordnance, (b) discarded military munitions, or (c) munitions constituents (e.g., 2,4,6-trinitrotoluene (TNT), hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)) present in high enough concentrations to pose an explosive hazard.

Munitions Response Site (MRS) – A discrete location within a munitions response area that is known to require a munitions response.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The plan revised pursuant to 42 USC 9605 and found at 40 CFR Part 300 that sets out the plan for hazardous substance remediation under CERCLA.

Preferred Alternative – The alternative that, when compared to other potential alternatives, was determined to best meet the CERCLA evaluation criteria, and is proposed for implementation at a site.

Proposed Plan – A plan that identifies the preferred remedial alternative for a site and is made available to the public for comment.

Remedial Investigation (RI) – A process undertaken by the lead agency to determine the nature and extent of the problem presented by the release. The RI emphasizes data collection and site characterization and is generally performed concurrently and in an interactive fashion with the feasibility study. The RI includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for remedial action and to support the evaluation of remedial alternatives.

Technical Project Planning – The U.S. Army Corps of Engineers developed the technical project planning process to improve project planning activities associated with the Military Munitions Response Program. This process is initiated at the start of the project and continues through the project life cycle, helping to ensure that the requisite type, quality, and quantity of data are obtained to satisfy project objectives that lead to informed decisions and site closeout.

Unexploded Ordnance (UXO) – Military munitions that (a) have been primed, fuzed, armed, or otherwise prepared for action; (b) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (c) remain unexploded either by malfunction, design, or any other cause.

ACRONYMS AND ABBREVIATIONS

AP	armor piercing
ARAR	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DMM	discarded military munitions
DoD	Department of Defense
EE/CA	engineering evaluation and cost analysis
ESQD	explosive safety quantity distance
FS	feasibility study
FUDS	formerly used defense site(s)
HA	hazard assessment
HE	high-explosive
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MRS	munitions response site
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operations and maintenance
RAO	remedial action objective
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	remedial investigation
RMIS	Risk Management Information System
ROE	right-of-entry
TBC	to be considered
TDEC	Tennessee Department of Environment and Conservation
TNT	2,4,6-trinitrotoluene
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UU/UE	unlimited use / unrestricted exposure
UXO	unexploded ordnance

PART 1 DECLARATION

1.0 PROJECT NAME AND LOCATION

This Decision Document (DD) addresses Munitions Response Site 05 (MRS-05) within the former Spencer Artillery Range Formerly Used Defense Site (FUDS) Project Number G04TN017805 in Van Buren County, Tennessee (Table 1 and Figure 1). Separate DDs have been prepared to address the other six Remedial Action project areas. The two No Further Action project areas were closed in 2014.

2.0 STATEMENT OF BASIS AND PURPOSE

The United States Army is the lead agency on behalf of the Department of Defense (DoD), and the United States Army Corps of Engineers (USACE) has mission execution authority for the FUDS Program. This DD is presented by USACE to describe the DoD selected remedy for MRS-05 at the Spencer Artillery Range FUDS in Spencer, Tennessee.

The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C § 9601 *et seq.*, as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300. This decision is based on the Administrative Record file for this site.

Representatives of the Tennessee Department of Environment and Conservation (TDEC) have reviewed and concur with the selected remedy.

3.0 ASSESSMENT OF THE MRS

The response action selected in this DD is necessary to protect human health and the environment. An evaluation of site data indicates a potential for human receptors to come into contact with munitions and explosives of concern (MEC) at MRS-05. The most likely MEC exposure scenario in MRS-05 is associated with the potential for people (e.g., residents, construction workers, commercial workers, ranchers, recreational users, and visitors) interacting with MEC on the surface or in the subsurface during intrusive activities. If present and acted upon, MEC is a safety hazard. Therefore, the response action selected in this DD is necessary to protect human health and the environment.

USACE has determined that implementation of the selected remedy, Geophysical Investigation and MEC Removal with Educational Awareness, will reduce potential human exposure to residual surface and subsurface explosive hazards within MRS-05. The selected remedy described in this document will minimize exposure to explosive hazards and provide protection of human health and the environment through informing the public of the actions to take should they encounter MEC to reduce risk of interaction with explosive hazards to an acceptable level.

Table 1
Summary of Project Areas and Munitions Response Sites
Recommended for Further Action
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

Project Area	Classification	RI Recommended MRSs	Area: (acres)
Project 01 ¹	RI Long-Term Monitoring Areas	MRS-01 (partial), -02, -11, -12, -14, -15 (partial)	4,120
Project 03	Covenant Farms – 5-Acre Lots	MRS-03	262
Project 04	Covenant Farms – Large Lots	MRS-04	60
Project 05	Recreation/Cabins	MRS-05	646
Project 06	Sequoia Subdivision	MRS-06	241
Project 07 ¹	Indian Trails Development	MRS-07 (partial), -08 (partial)	352
Project 08 ¹	Rocky River Road – Residential	MRS-13	260
TOTAL			5,941

Note: Shaded cells reflect information for other Remedial Action project areas included as reference.

¹ The original 16 MRSs were realigned. Project 01 contains MRS 01, Project 07 contains MRS 07, and Project 08 contains MRS-08.

4.0 DESCRIPTION OF SELECTED REMEDY

The selected alternative for MRS-05 is Geophysical Investigation and MEC Removal with Educational Awareness. Figure 2 presents this alternative as well as those addressed in separate DDs for the other six project areas.

USACE has determined that Geophysical Investigation and MEC Removal with Educational Awareness is the appropriate remedy at MRS-05. The total estimated cost for the selected remedy for MRS-05 is \$13,045,666 (Table 2). The major components of this selected remedy include:

- Removal of brush and lower-story vegetation (as needed to provide sufficient access).
- Performing a geophysical survey that includes the use of advanced geophysical classification.
- Removal of surface and subsurface MEC for items identified as targets of interest based on advanced sensors to a depth of up to 36 inches depending on the size of the MEC; However, MEC detected at deeper depths will be removed as well.
- Intrusive investigation and removal of MEC by trained unexploded ordnance (UXO) technicians.
- Destruction of recovered UXO.
- MD will be assessed and determined to be MDAS prior to release from DoD control in accordance with DESR 6055-09.
- Restoration of detonation locations to original condition.
- Educational awareness (to include developing and distributing educational materials).
 - Informed people are more likely to respond appropriately to recognize the hazard, retreat, and report it to authorities.

FIGURE 2

SELECTED ALTERNATIVES
SPENCER ARTILLERY RANGE

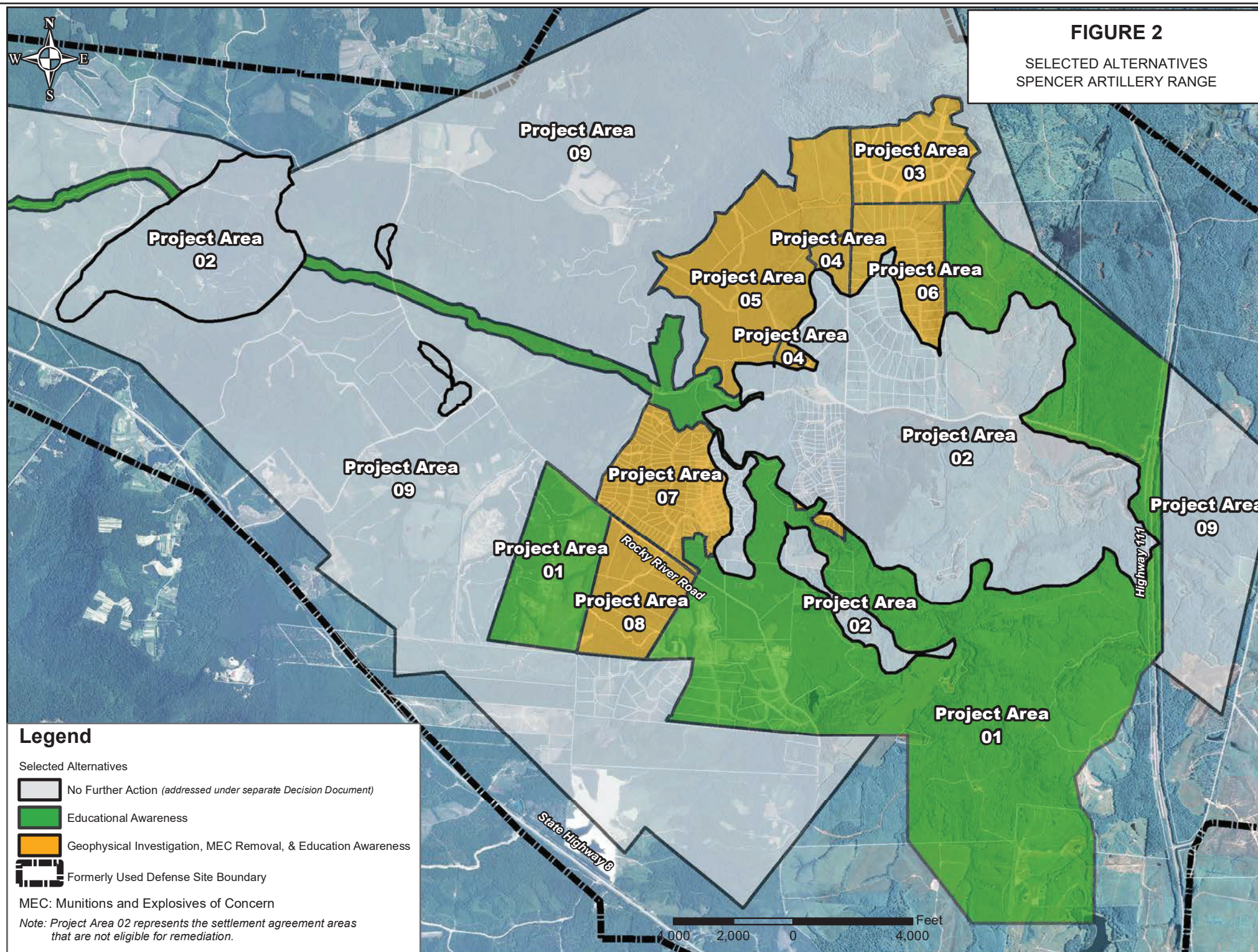


Table 2
Summary of Selected Remedies, Cost, and Estimated MEC Removal Duration

Project Area	Selected Remedy	Cost	MEC Removal Duration
Project 01	Educational Awareness	\$643,368	NA
Project 03	Geophysical Investigation and MEC Removal with Educational Awareness	\$4,361,093	11 months
Project 04	Geophysical Investigation and MEC Removal with Educational Awareness	\$1,990,872	4 months
Project 05	Geophysical Investigation and MEC Removal with Educational Awareness	\$13,045,666	40 months (3.3 years)
Project 06	Geophysical Investigation and MEC Removal with Educational Awareness	\$8,456,656	27 months (2.2 years)
Project 07	Geophysical Investigation and MEC Removal with Educational Awareness	\$6,644,187	18 months (1.5 years)
Project 08	Geophysical Investigation and MEC Removal with Educational Awareness	\$5,263,405	15 months (1.2 years)
TOTAL		\$40,405,247	

Note: Shaded cells reflect information for other Remedial Action project areas included as reference.

5.0 STATUTORY DETERMINATIONS

Based on the information currently available, the selected remedy for MRS-05, Geophysical Investigation and MEC Removal with Educational Awareness, is protective of human health and the environment, minimizes explosive hazard risks, and satisfies the statutory requirements of CERCLA § 121(b). The Geophysical Investigation and MEC Removal with Educational Awareness remedy will protect human health and the environment by directly removing MEC where MEC is most likely to be encountered. Removing the source where the likelihood of encountering MEC is greatest provides receptor protection. The Educational Awareness remedy will protect human health by educating landowners and students of the possible dangers associated with the area. Education will make people more likely to respond appropriately if suspected MEC is found.

The selected remedy for MRS-05 is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial actions, is cost-effective, and uses a permanent solution and alternative treatment technologies to the maximum extent practicable. There is also a statutory preference for treatment as a principal element of the remedy, the MEC destruction remedies and how it reduces the explosive hazard risk to human health and the environment.

It is anticipated that the selected remedy for MRS-05 will not allow for unlimited use/unrestricted exposure (UU/UE). Therefore, it will be necessary to conduct five-year reviews.

6.0 DATA CERTIFICATION CHECKLIST

The following information is included or otherwise addressed in this DD:

- Information on MEC and MD encountered at the MRS.
- A summary of the MEC and munitions constituents (MC) risks.
- Current and reasonably anticipated future land use assumptions for the MRS.
- Key factors that led to selecting the remedy.
- Estimated costs related to the selected remedy.
- Cleanup levels established for chemicals of concern and the basis for these levels.

7.0 AUTHORIZING SIGNATURE

This DD presents the selected remedy for MRS-05 at the former Spencer Artillery Range in Van Buren County, Tennessee. The U.S. Army is the lead agency under the Defense Environmental Restoration Program at the former Spencer Artillery Range FUDS and USACE has mission execution authority for the FUDS program. USACE has developed this DD consistent with CERCLA, as amended, and the NCP. This DD will be incorporated into the larger Administrative Record file for the former Spencer Artillery Range, which is available for public review at Burritt Memorial Library, 427 College Street, Spencer, Tennessee 38585 and USACE, Savannah District Office, 100 W. Oglethorpe Ave, Savannah, Georgia 31401. This document, presenting the selected remedy for MRS-05 with a present worth cost estimate of \$13,045,666, is approved by the undersigned, pursuant to Memorandum, CEMP-CED (200-1a), August 10, 2019, Subject: Re-delegation of Assignment of Mission Execution Functions Associated with Department of Defense Lead Agent Responsibilities for the FUDS Program (USACE, 2019b).

APPROVED:



LARA E. BEASLEY
Chief, Environmental Division
Directorate of Military Programs



20 Sept 2021

Date

PART 2

DECISION SUMMARY

1.0 PROJECT NAME, LOCATION, AND BRIEF DESCRIPTION

The former Spencer Artillery Range encompassed 30,618 acres in Van Buren, Warren, Sequatchie, and Bledsoe counties, approximately 10 miles southeast of McMinnville, Tennessee, and 12 miles south of Spencer, Tennessee (Figure 1). Based on results of the RI, 16 MRSs were recommended covering 18,555 acres. These 16 MRSs were later realigned into nine project areas. Two of the areas were closed in 2014. Separate DDs have been prepared to address the six other project areas.

The MRS addressed by this DD comprises approximately 646 acres (Table 1) of the former Spencer Artillery Range within Van Buren County. The MRS is privately owned and heavily wooded, with a predominant vegetation of forests with coniferous and deciduous trees. The area is used for recreational purposes (e.g., hiking, and camping), and the recreational users may occasionally include Boy Scout troops. Five cabins (not permanent residences) are present within MRS-05.

2.0 PROJECT HISTORY AND ENFORCEMENT ACTIVITIES

2.a PROJECT HISTORY

From 1941 until 1944, Spencer Artillery Range served as the main artillery range for Camp Forrest in Tullahoma, Tennessee, 45 miles to the southwest. Two impact areas – Jake’s Mountain (5,060 acres) and Bald Knob (2,090 acres) – were established, and troop training was conducted using 37 millimeter (mm) anti-aircraft guns, field and heavy artillery, mortars, anti-tank rockets, and target rockets. After troop training ended in September 1944, arrangements were made for Dyersburg Army Air Field to use the Spencer Artillery Range as an air-to-ground gunnery range. The land was returned back to the original 25 leaseholders in the summer of 1946. Several surface decontamination sweeps were completed on portions of the former range in the 1950s. Thereafter, financial settlement agreements were reached between the government and two property owners within the historical boundaries of Spencer Artillery Range. On January 22, 1965, the Court of Claims recommended that Congress award the Rock River Company and Macy Land Corporation \$88,729.60 for diminution of 3,059 acres (USACE, 1985). The properties that accepted settlement agreements are not eligible for remedial action under the FUDS Military Munitions Response Program. Since then, numerous tracts of land have been sold and/or subdivided, significantly increasing the number of property owners from the original 25 to several hundred landowners today.

2.b INVESTIGATION ACTIVITIES

Various site investigations, including a historical records search, an analysis of historical air photographs, an engineering evaluation and cost analysis (EE/CA), and an RI have been completed at Spencer Artillery Range to determine the presence of MEC and MC.

2007 Engineering Evaluation and Cost Estimate

An EE/CA was completed in 2007 to assess the presence of MEC on the surface at the FUDS. An instrument-aided reconnaissance investigation was conducted using metal detectors and visual observations to evaluate the presence of metallic items. The EE/CA field team found no evidence of fragments or any specific items with a confirmed or potential explosive hazard during the ground reconnaissance. The team did identify significant evidence of prior military activity, such as foxholes and remains of concrete footers indicating the location of the firing point for the Bald Knob impact area and several depressions with magnetic anomalies east of Rocky River Road.

Based on the results of the EE/CA reconnaissance investigation and information contained in the 2001 Archives Search Report (ASR), digital geophysical mapping (DGM) and an intrusive investigation were conducted in 2 areas of the FUDS to assess the presence of subsurface MEC. The investigation included the impact area in the central eastern portion of the site and a small area in the southeast. The results of the intrusive investigation confirmed the results of the ASR and the analysis of the aerial historical photographs that indicated ordnance contamination is present within the Property. Five MEC items were found during the intrusive investigation. Two of the items were identified; one as a 75 mm armor piercing projectile with tracer and the other as a 155 mm high-explosive (HE) projectile. The locations of the MEC items are identified in Table 3.

To assess the presence of MC in surface soil at the FUDS, soil sampling was conducted. A combination of discrete soil samples and samples using the Cold Regions Research and Engineering Laboratory 7-point wheel composite method were collected from 11 locations, including background, known target areas, and pre-detonation and post-detonation areas within the FUDS. Based on the MC sampling results, unacceptable risks associated with MC contamination are not expected at the site. The EE/CA recommended interim response alternatives to reduce MEC-related risks until the completion of a remedial investigation and feasibility study (FS).

2010 Remedial Investigation

An RI was conducted at the 17,260-acre Range Complex No.1 MRS in 2010. During the 2010 RI field activities, 21 miles of instrument-aided reconnaissance was conducted to assess the presence of MEC on the surface within six areas of the FUDS. During this effort, no MEC or MD was identified. DGM data were also collected in transects totaling 59.41 acres. Approximately 160 miles of brush cutting was completed in advance of DGM transect data collection. DGM grids totaling 5.17 acres were also located and collected based on the results of the transect anomaly density. Within the DGM transect and grid data, 8,474 anomalies were identified, 1,503 of which were intrusively investigated. Twelve MEC items and over 1,000 MD items were recovered during the intrusive investigation. Of the 12 MEC items found during the intrusive investigation, eight were UXO items and four were fused, discarded military munitions. MD items recovered at MRS-05 included 37 mm, 105 mm, and 155 mm projectiles; small arms ammunition; an unknown munitions debris; and an M-51 fuze. No documented MEC has been recovered from within MRS-05.

No MC contamination was identified during the EE/CA; therefore, it was determined during the technical project planning process that additional sampling for explosives and munitions-related metals was not necessary at the MRS during the RI. Perchlorate, however, was subsequently identified as a possible munitions-related constituent. To complete characterization of MC at Spencer Artillery Range, groundwater samples were collected for perchlorate analysis. Twelve groundwater samples (including 2 quality control samples) were collected from existing wells at Spencer Artillery Range. Wells selected for sampling were existing domestic wells and groundwater monitoring wells. Perchlorate was not detected in

the groundwater samples collected during the RI. With no source identified, there was no potentially complete exposure pathway; therefore, no risk assessment was performed for perchlorate.

A summary of the EE/CA and RI results is shown in Table 3. Figure 3 presents the location and boundary for MRS-05, in conjunction with the geophysical anomaly density and MEC findings (using both EE/CA and RI data). As shown in Table 3, MD accounted for the vast majority of recovered items (97.4%). MD items found at Spencer Artillery Range generally included remnants of various projectiles (37 mm, 75 mm, 76 mm, 105 mm, and 155 mm), expended fuzes, and hundreds of pieces of unidentifiable munitions fragments. Small arms ammunition (i.e., .50 caliber) was also identified throughout the areas investigated. MD was found in the subsurface at MRS-05 at a maximum depth of 36 inches (Table 3).

2.c CERCLA ENFORCEMENT ACTIVITIES

To date, there have been no enforcement activities at the MRS.

3.0 COMMUNITY PARTICIPATION

The following activities were conducted to disseminate information to and solicit input from the community:

- An Administrative Record was established at the Burritt Memorial Library in Spencer, Tennessee, and at the USACE, Savannah District Office, 100 W Oglethorpe Ave, Savannah, Georgia 31401.
- A public meeting was held February 9, 2010, to receive comments and questions regarding the proposed RI field activities. The public was notified of the meeting in local radio and newspaper announcements.
- A meeting was held with the planning commission September 8, 2011 to solicit information on anticipated future land uses across the MRS.
- Once the 2012 Proposed Plan was placed in the information repository, a newspaper announcement notified the public of their ability to review the Proposed Plan at the local library.
- A public meeting was held March 20, 2012, in Spencer, Tennessee to present the results and recommendations detailed in the 2012 Proposed Plan (Parsons, 2012) and to solicit public comment. At this meeting, representatives from USACE and TDEC were available to answer questions about the remedial alternatives.
- A follow-on virtual public meeting was held August 18, 2020, to present the revisions detailed in the Final Proposed Plan (USACE, 2020) and to solicit public comment. At this meeting, representatives from USACE and TDEC were available to answer questions about the remedial alternatives. The public was notified of the meeting in the local newspaper, library, and USACE website. The PP was also made available on USACE Savannah District's public website August 14, 2020. No members of the public attended this virtual public meeting, and no comments were made; as such, no transcript was made.
- The Responsiveness Summary, which is part of this DD, summarizes comments received from the public during the public comment periods for both the Proposed Plan and Final Proposed Plan.

Table 3
Summary of Findings for Recommended Project Areas
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

MRS	Current/Future Land Use	Project Area (acres)	Past DoD Use	1956 Surface Removal (count of items)	RI and EE/CA MEC (depth)	Average anomaly density for RI DGM area (anomalies/acre)	Estimated Total Anomaly Count	RI and EE/CA Munitions Debris (count)	Rationale for Delineation
Project 01	Wooded/Hunting/Logging/Commercial/Undeveloped Subdivision/Hunting/Ranching/Trail of Tears	4,120	Jakes Mountain Artillery Impact Area, Bald Knob 37mm impact area possible firing point, timber, and impact craters present.	155 mm (1) 105 mm (1) 37 mm (4) 20 mm (2) unknown munitions (6)	4 each 37 mm, MkII (0.25", 4", 9", 10") 2 each 37 mm, BaseFuze High-explosive (HE) (2",5")	79	48,822	155 mm munitions debris (1) [3"] 105 mm munitions debris (4) [30"] 75 mm munitions debris (12) [3" – 10"] 37 mm armor piercing (AP)/HV (2) [2" – 6"] 37 mm munitions debris (98) [0.5" – 18"] 76 AP (9) [1" – 37"] unknown munitions debris (186) [0" – 36"] fuze (11) [0.5" – 36"] small arms ammunition (45) [0" – 7"]	MEC found, former impact area, high anomaly density, possible firing point found, commercial land use, future residential development, active ranching, portions of the MRS within high-density areas, National Parks Service recognizes the Trail of Tears as a National Historic Trail.
Project 03	Active Development/Residential (Covenant Farms – 5-acre lots)	262	Northern edge of known impact area	Not Applicable	None	92	24,104	155 mm munitions debris (9) [1" – 5"] 37 mm AP (1) [0"] 37 mm munitions debris (1) [4"] unknown munitions debris (2) [4" – 5"]	Residential area, proximity to known impact area, MD found
Project 04	Active Development/Residential (Covenant Farms – large lots)	60	Jakes Mountain Artillery Impact Area	Not Applicable	None	354	21,948	155 mm munitions debris (9) [1" – 8"]	Residential development, known impact area, high anomaly density
Project 05	Recreation/Cabins	646	Jakes Mountain Artillery Impact Area	Not Applicable	None	259	167,314	155 munitions debris (68) [0" – 22"] 105 mm munitions debris (1) [3"] 37 mm munitions debris (3) [3" – 4"] unknown munitions debris (86) [4" – 36"] small arms ammunition (5) [4" – 9"] M-51 Fuze (1) [0"]	Former impact area, high anomaly density, camping and recreational land use
Project 06	Undeveloped Subdivision (Sequoia Subdivision)	241	Jakes Mountain Artillery Impact Area	17-50 CAL (1)	None	688	165,808	155 munitions debris (12) [0 – 3"] 37 mm munitions debris (4) [4" – 6"] unknown munitions debris (5) [3" – 18"] small arms ammunition (13) [4" – 6"] M-51 Fuze, 0.50 Cal Link (1) [0']	Future residential development, former impact area, high anomaly density
Project 07	Undeveloped Subdivision (Indian Trails Phase I, II, III)	352	Jakes Mountain Artillery Impact Area	75mm (1)	None	188	66,176	37 mm munitions debris (3) [2" – 6"] 37 mm AP (1) [16"] 75 mm munitions debris (1) [3"] 76 mm AP (3) [14" – 19"] unknown munitions debris (2) [1"] small arms (4) [3" – 6"]	Future residential development, former impact area, high anomaly density

Table

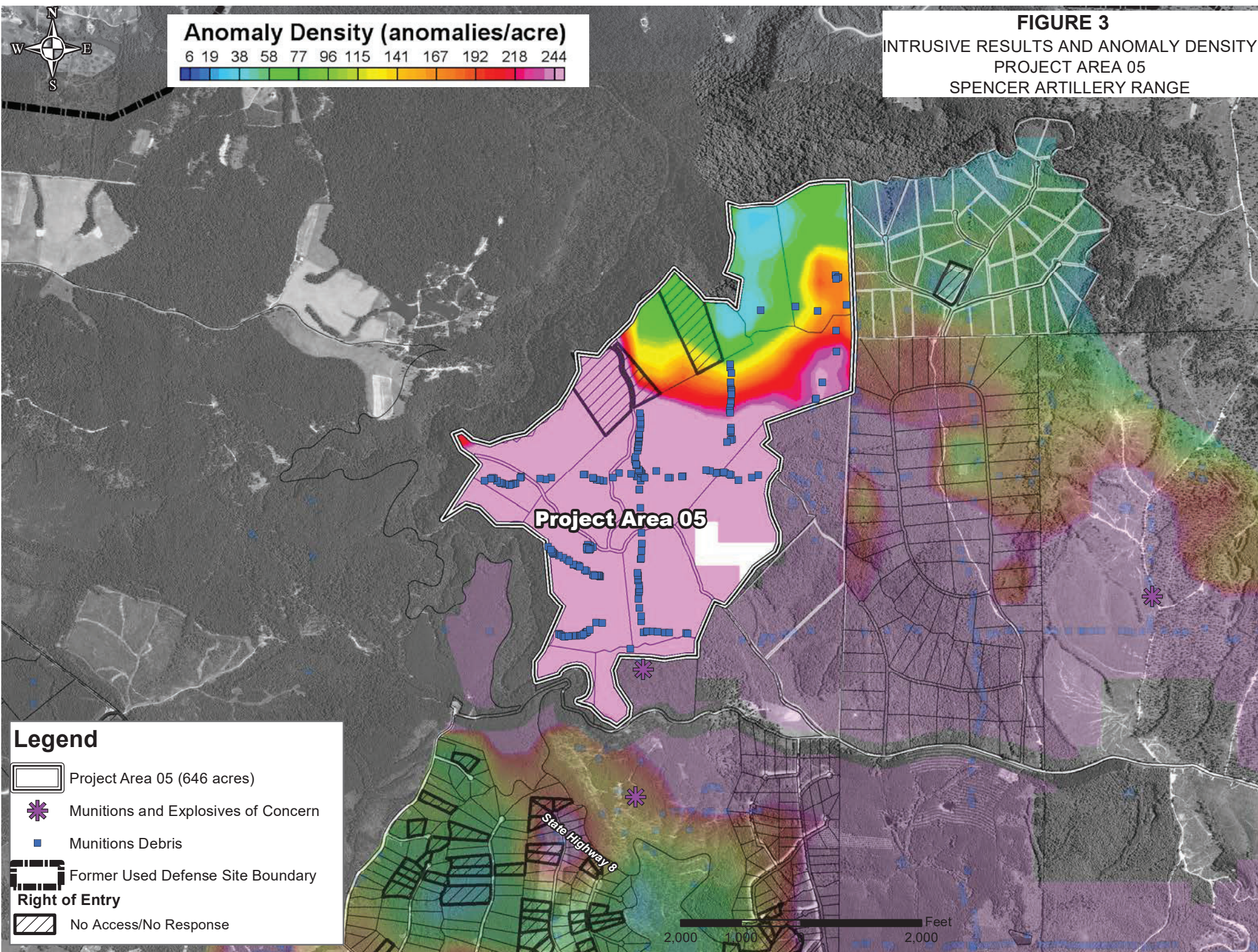
Summary of Findings for Recommended MRSs

3(Continued)

Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

MRS	Current/Future Land Use	Project Area (Acres)	Past DoD Use	1956 Surface Removal (count of items)	RI and EE/CA MEC (Depth)	Average anomaly density for RI DGM area (anomalies/acre)	Estimated Total Anomaly Count	RI and EE/CA Munitions Debris (Count)	Rationale for Delineation
Project 08	Active Development/ Residential	260	Unknown. Timber cleared; evidence of impact craters.	Not included as part of 1956 surface removal	None	197	51,220	155 mm munitions debris (10) [1” – 6”] 37 mm AP (1) [7”] 76 AP (4) [4” – 32”] fuze (1) [2”] 37 mm munitions debris (11) [1” – 8”] 60 mm mortar munitions debris (3) [3” – 4”] unknown munitions debris (31) [0” – 10”] small arms (44) [0” – 6”]	Residential development, high anomaly density

Note:
Shaded cells reflect information for other Remedial Action MRSs included as reference.



4.0 SCOPE AND ROLE OF RESPONSE ACTION

The contamination to be addressed at MRS-05 is related to the potential MEC hazards. This DD covers MRS-05. USACE has determined that implementation of the selected remedy, Geophysical Investigation and MEC Removal with Educational Awareness, at MRS-05 will reduce potential human exposure to residual surface and subsurface explosive hazards within MRS-05. The overall strategy of USACE is to decrease or eliminate the potential for munitions-related injuries resulting from interaction with MEC at MRS-05.

5.0 SITE CHARACTERISTICS

5.a CONCEPTUAL SITE MODEL

The conceptual site model is presented in Table 4 and describes the potential site contamination sources, the human and/or ecological receptors present, and the possible interactions between the two.

The RI noted the potential for MEC to be encountered at MRS-05. If MEC is present and encountered by people, the MEC exposure pathway is potentially complete. No unacceptable risks associated with MC were identified; therefore, potential contaminant exposure pathways for MC are not present.

5.b MRS OVERVIEW

The former Spencer Artillery Range encompassed 30,618 acres; the MRS addressed by this DD comprises approximately 646 acres (Table 1).

The topography at former Spencer Artillery Range is typically flat with numerous undulations formed by streams running across and off the Cumberland Plateau. Numerous streams occur in narrow valleys and draws. At the north end of the FUDS, the Rocky River has carved deeply into the Cumberland Plateau, and a 500-foot drop is observed along the Rocky River Gorge. In the southeastern corner of the FUDS, Jake's Mountain rises above the plateau to an elevation of 2,400 feet above mean sea level.

Much of the land within the former Spencer Artillery Range is undeveloped, wooded land consisting of forests of predominately coniferous and deciduous trees. These trees are largely the result of grow-back after surface and clear-cutting activities, and undergrowth is pervasive. Other parts of the site include farm areas, agricultural land, and residential properties. One state-listed endangered species (white fringeless orchid) and 1 species deemed in need of management (barking tree frog) have been identified within the FUDS. Low wet woods and swamps, especially with ephemeral ponds, provide important habitat for the barking tree frog. Acidic seeps and stream heads provide important habitat for the white fringeless orchid. Both habitats are present within the former Spencer Artillery Range.

Professional archaeological investigations at the former Spencer Artillery Range began in the early 1970s. These investigations confirmed that a portion of the Trail of Tears crosses the MRS. Also, in the mid-1970s, archeological sites were discovered within or immediately adjacent to the Spencer Artillery Range project boundaries. Most of the sites recorded within the site are lithic scatters or isolated lithic artifact finds, lacking diagnostic artifacts. Sites with known cultural components (based on presence of diagnostic lithics) include four Early Archaic, one Middle Archaic, three Late Archaic, three Early Woodland, five Middle Woodland, and one Late Woodland. Most of these sites are on ridge tops or sides, while the remaining sites are in stream bottoms (USACE, 2005).

MRS-05 is located on the northwestern edge of the Jake's Mountain Impact Area. A decontamination sweep conducted by the DoD in the 1950s within MRS-05 discovered no MEC items. However, large quantities of MD were recovered during the EE/CA and RI, including fragments from 37mm and 155mm HE projectiles. The land use within MRS-05 is recreational (e.g., hiking and camping), and the recreational users may occasionally include Boy Scout troops. Five cabins (not permanent residences) are present within the MRS.

5.c SAMPLING STRATEGY

Munitions and Explosives of Concern

The RI strategy consisted of collecting additional geophysical data to supplement the data collected previously during the EE/CA. The intent of the additional data was to determine the extent of MEC and MD identified during the EE/CA and to determine whether other impact areas were present. During the RI, geophysical data were collected along 163 miles of transects and 5.2 acres of grids. The geophysical data were processed, and 8,474 anomalies were identified that were consistent with subsurface munitions. Intrusive investigation of 1,503 anomalies was completed during the RI to determine the source of the anomaly. MD was found in the subsurface at MRS-05 at a maximum depth of 36 inches.

Munitions Constituents

Soil samples were collected during the EE/CA to assess the presence of MC at the MRS. A combination of discrete soil samples and samples using the Cold Regions Research and Engineering Laboratory 7-point wheel composite method were collected from 11 locations, including background and known target areas as well as pre-detonation and post-detonation areas within the FUDS. The samples were analyzed for explosives and target metals, which included arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Perchlorate was also assessed in groundwater during the RI because of the potential use of munitions associated with perchlorate at the FUDS. Twelve groundwater samples (including two quality control samples) were collected from existing wells at Spencer Artillery Range. Wells selected for sampling included existing domestic wells and groundwater monitoring wells within the Cumberland Plateau aquifer system.

5.d NATURE AND EXTENT OF CONTAMINATION

Munitions and Explosives of Concern

A potentially complete MEC exposure pathway is confirmed for the Project. Figure 3 displays an interpolation of the anomaly densities across all MRSs, based on digital geophysical mapping. In addition, Figure 3 presents the locations of MD finds within MRS-05. Although no MEC was found within MRS-05 during the EE/CA and RI, MD was recovered including 37mm, 105mm, and 155mm projectiles; small arms ammunition; unknown munitions debris; and an M-51 fuze. MD was found on the surface to a maximum depth of 36 inches, as presented in Table 3.

Munitions Constituents

Based on the sampling results of the EE/CA and the RI, potential risks from exposure of receptors to MC are not anticipated at the MRS.

Table 4
Summary of Revised Conceptual Site Model and Potentially Complete Exposure Pathways
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

Munitions Response Site ⁽¹⁾	Potential Receptors	Munitions and Explosives of Concern		Munitions Constituents	
		Contaminant	Potentially Complete MEC Exposure Pathways	Chemicals of Potential Concern ⁽²⁾	Potentially Complete MC Exposure Pathways
Project 01 (Private Property, Commercial, Whispering Pines, Mason Property, and Road/Trail of Tears)	Loggers, construction workers, site visitors, recreational users (e.g., hikers and hunters), commercial workers (explosives storage and tree farming), future residents, and ranch workers (e.g., cattle handlers).	Projectiles (20 mm, 37 mm, 75 mm, 105 mm, and 155 mm), Armor piercing projectiles (37 mm and 76 mm)	Potential surface and subsurface (0” – 37”)	N/A	None
Project 03 (Covenant Farms – 5-acre lots)	Residents, construction workers.	Projectiles (37mm)	Potential surface and subsurface (0” – 5”)	N/A	None
Project 04 (Covenant Farms – large lots)	Residents, construction workers, site visitors, and recreational users (e.g., hikers and hunters).	Projectiles (155mm)	Potential subsurface (1” – 8”)	N/A	None
Project 05 (Leborne, others)	Part-time residents, site visitors, and recreational users (e.g., hikers, boy scouts, and hunters).	Projectiles (37 mm, 105 mm, and 155 mm)	Potential surface and subsurface (0” – 36”)	N/A	None
Project 06 (Sequoia Subdivision)	Future residents, construction workers, site visitors, and recreational users (e.g., hikers and hunters).	Projectiles (37 mm and 155 mm)	Potential surface and subsurface (0” – 18”)	N/A	None
Project 07 (Indian Trails Phase I, II, III)	Future residents, construction workers, site visitors, and recreational users (e.g., hikers and hunters).	Projectiles (37 mm, 75 mm, and 76 mm)	Potential subsurface (1” – 19”)	N/A	None
Project 08 (Active Development/Residential)	Residents, ranch workers (e.g., cattle handlers), and construction workers.	Armor piercing projectiles (37 mm and 76 mm)	Potential surface and subsurface (0” – 32”)	N/A	None

(1) More detailed information on the land uses, potential receptors, and munitions known or suspected to be presented at each MRS is provided in the RI report (Parsons 2011a).
(2) Chemicals of potential concern were not identified during the EE/CA, and perchlorate was not detected in groundwater during the RI.
Shaded cells reflect information for the other Remedial Action MRSs included as reference.

5.e TYPES OF AFFECTED MEDIA

A potentially complete MEC exposure pathway is confirmed in soil and subsurface soil. Potential MC exposure pathways are not present in any site media.

5.f LOCATION OF CONTAMINATION AND EXPOSURE ROUTES

Munitions and Explosives of Concern

No MEC was found in MRS-05; however, MD has been discovered on the surface and in the subsurface (maximum depth of 36 inches) in MRS-05; therefore, the vertical extent of contamination is approximately 0 to 36 inches. The lateral extent of contamination is identified to be within the MRS boundaries.

The two primary natural processes that may cause migration of MEC at the MRS include erosion and frost heave. In general, surface topography at Spencer Artillery Range is heavily wooded. Vegetation of the area includes forests of predominantly coniferous and deciduous trees. The heavy vegetation stabilizes the soil, minimizing the potential for erosion and frost heave.

As summarized in Table 4, the potentially exposed population (human receptors) associated with MRS-05 includes part-time residents, site visitors, and recreational users (e.g., hikers, boy scouts, and hunters).

Although ecological receptors are present in the area, the focus for possible MEC exposure is on human receptors; ecological receptors are not considered for MEC exposure.

Munitions Constituents

No unacceptable risks associated with MC were identified; therefore, potential contaminant exposure pathways for MC are not present. No groundwater contamination is present at the site.

6.0 CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

Land Uses

MRS-05 is primarily used for recreation. Current receptors include part-time residents, site visitors, and recreational users (e.g., hikers, boy scouts, and hunters).

Groundwater and Surface Water Uses

The Rocky River is the water supply for the city of Spencer to the north and has its source in the many tributaries within the boundaries of the former Spencer Artillery Range. Surface water flow for most of the site is to the north-northwest, toward the Rocky River Gorge.

There are drinking water wells and monitoring wells within the FUDS and MRS-05. Existing drinking water wells are tapping the Cumberland Plateau Aquifer System at depths from 50 to 260 feet below ground surface (Parsons, 2011a). MC contamination was not identified within these monitoring wells. Therefore, existing monitoring wells are planned to be properly closed and abandoned.

7.0 SUMMARY OF MRS RISKS

A risk assessment was performed to evaluate potential current and future adverse health effects caused by MEC. In addition, the risk assessment is used to discuss the magnitude of the risk at the site and aid in the development, evaluation, and selection of appropriate response action. A potentially complete MEC exposure pathway is present any time a receptor can come into contact and interact with the MEC in a manner that might result in its detonation. The three elements of a MEC exposure pathway – a source of MEC, a receptor, and interaction between the MEC source and receptor – must all be present for a complete MEC exposure pathway to exist.

Large quantities of MD were recovered during the EE/CA and RI at MRS-05, including fragments from 37 mm and 155 mm HE projectiles. Potential receptors of MEC hazards present at MRS-05 include part-time residents, site visitors, and recreational users (e.g., hikers and hunters). Activities related to camping could result in intrusive activities in the shallow subsurface (up to 12 inches). An unacceptable MEC risk has been identified at MRS-05 based on the presence of MEC, elevated geophysical anomaly density, and current land use.

As explained previously, unacceptable risks associated with MC contamination are not present at the former Spencer Artillery Range. Therefore, response actions are not needed at the site to protect human health and the environment from releases of MC from this site.

7.a BASIS FOR RESPONSE ACTION

Based on the data collected for this site, the most likely exposure scenario is associated with receptors interacting with MEC on the surface and in the subsurface during intrusive activities. Table 4 identifies the receptors and potentially complete MEC exposure pathways for each MRS. If present and acted upon, MEC is a safety hazard. Therefore, the response action selected in this DD is necessary to protect human health and the environment from the potential hazards.

8.0 REMEDIAL ACTION OBJECTIVES

The remedial action objective (RAO) for MRS-05 is based on site-specific conditions, such as receptors and current and reasonably foreseeable future land use. Table 5 summarizes the conditions and the remedial action objective for MRS-05. The RAO for MRS-05 will be achieved by implementing the selected remedy. The RAOs address risks associated with people potentially encountering MEC on the surface and in the subsurface during intrusive activities. A potentially complete MEC exposure pathway is reduced through MEC source removal and/or increasing awareness of MEC hazards.

9.0 DESCRIPTION OF ALTERNATIVES

Five remedial alternatives were evaluated during the Final FS Addendum (USACE, 2019a), and the major components of each alternative are summarized below.

9.a REMEDY COMPONENTS

Alternative 1: No Further Action Alternative

- No remedy implemented to reduce the potential safety risk posed by MEC.

- Assumes continued use of the site in its current condition.

Alternative 2: Educational Awareness

- Development of educational fact sheets and webpage aimed at making the public aware of potential hazards and reducing the risk of exposure.
- Educational training available for Van Buren and Warren county schools.

Alternative 3: Surface Removal with Educational Awareness

- Brush clearing of dense vegetation to facilitate personnel access and to free space for sweeping with metal detection equipment (e.g., Schonstedt).
- Instrument-aided visual surface inspection for potential MEC.
- Removal and disposal of recovered surface MEC.
- Educational awareness program.

Alternative 4: Geophysical Investigation and MEC Removal with Educational Awareness

- Brush removal (as needed to provide sufficient access).
- Performing a geophysical survey using advanced classification across the MRS.
- Performing subsurface MEC removal for items identified as targets of interest based on advanced sensors.
- Implementation of an educational awareness program.

Alternative 5: Excavation and Sifting

- Brush removal (as needed to provide access).
- Excavation of soils to the depth identified for explosive hazard exposure.
- Sifting of the soil to remove MEC.
- Backfilling soil and seeding/revegetation (as needed).

9.b COMMON ELEMENTS AND DISTINGUISHING FEATURES***Applicable or Relevant and Appropriate Requirements (ARARs)***

The location specific ARAR identified for the MRSs applies to the open detonation of consolidated MEC (40 CFR 264.601 [Miscellaneous Treatment Units]). This will occur when MEC can be safely moved from the location it was found to a safe area for demolition. MEC that cannot be moved safely will be blown in place. No chemical- or action-specific ARARs have been identified at the Spencer Artillery Range. The evaluation of the ability of the alternatives to comply with ARARs included a review of the ARARs pertinent to this remediation. Alternatives 1 and 2 have no ARARs associated with them. Implementation of Alternatives 3, 4, and 5 would comply with Resource Conservation and Recovery Act when moving munitions.

Long-Term Reliability

Alternatives 4 and 5 were determined to provide the best long-term effectiveness based on their ability to significantly reduce the risk of encountering MEC. Alternative 3 only removes MEC currently on the surface and relies on educational awareness for long-term effectiveness. Alternative 2 can deter inappropriate interaction with MEC, but it cannot prevent it.

Time Required for Implementation

USACE conducted a public outreach campaign during the EE/CA and RI projects; therefore, the time required to implement Alternative 2 would be minimal. Alternatives 3, 4, and 5 would require extensive planning, and work plans would be required before implementation of the work. Work plan development and approval is estimated to require approximately one year to complete. The duration for Alternative 4 is dependent on accessible acreage, vegetation, and anomaly density. The estimated duration of fieldwork associated with Alternative 4 for MRS-05 is 40 months. Estimated durations are based on using two, three-person teams. That estimate could be reduced by adding additional teams and conducting brush clearing concurrently.

Cost

The cost criterion evaluates the financial cost to implement the alternative. The cost criterion includes direct, indirect, long-term operation, and maintenance costs. Direct costs are those costs associated with the implementation of the alternative. Indirect costs are those costs associated with administration, oversight, and contingencies. These costs were adapted from costs associated with similar activities on the site and cost estimates prepared for other sites in Tennessee.

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 further action; therefore, no costs are incurred. Alternative 2 requires relatively low costs compared to Alternative 5, which is the costliest approach to implement.

Costs range from \$0 (Alternative 1) to approximately \$69 million (Alternative 5). Alternative 5 has the highest cost, because of the expenses associated with renting and operating the heavy equipment required for sifting. Table 6 summarizes costs for all alternatives.

Table 5
Summary of Remedial Action Objectives
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

MRS (Acres)	Current/ Future Land Use	Past DoD Use	Contaminant	Rationale for Delineation	Potentially Complete MEC Exposure Pathway [Potential Receptors]	Remediation Action Objective
Project 01 (4,120)	Wooded / Hunting / Logging / Commercial / Undeveloped Subdivision / Hunting / Ranching / Trail of Tears	Jakes Mountain Artillery Impact Area, Bald Knob and 37mm impact area. Possible firing point, timber, and impact craters are present.	Projectiles (20 mm, 37 mm ^(a) , 75 mm, 105 mm, and 155 mm), Armor piercing projectiles (37 mm and 76 mm)	MEC found, former impact area, high anomaly density, possible firing point, commercial land use, future residential development, active ranching, portions within high-density areas, National Parks Service recognizes the Trail of Tears as a national historic trail.	Potential surface and subsurface. [Future residents, commercial workers, ranch workers, loggers, construction workers, site visitors, and recreational users (e.g., hikers and hunters).]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.
Project 03 (262)	Active Development / Residential (Covenant Farms – 5-acre lots)	Northern edge of known impact area	Projectiles (37 mm)	Residential area, proximity to known impact area, and MD found.	Potential subsurface. [Residents and construction workers.]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.
Project 04 (60)	Active Development / Residential (Covenant Farms – large lots)	Jakes Mountain Artillery Impact Area	Projectiles (155 mm)	Residential development, known impact area, and high anomaly density.	Potential subsurface. [Residents, construction workers, site visitors, and recreational users (e.g., hikers and hunters)]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.
Project 05 (646)	Recreation/Cabins	Jakes Mountain Artillery Impact Area	Projectiles (37 mm, 105 mm, and 155 mm)	Former impact area, high anomaly density, camping, and recreational land use.	Potential surface and subsurface. [Part-time residents, site visitors and recreational users (e.g., hikers and hunters).]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.
Project 06 (241)	Undeveloped Subdivision (Sequoia Subdivision)	Jakes Mountain Artillery Impact Area	Projectiles (37 mm and 155 mm)	Future residential development, former impact area, and high anomaly density.	Potential surface and subsurface [Future residents, construction workers, site visitors and recreational users (e.g., hikers and hunters)]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.
Project 07 (352)	Undeveloped Subdivision (Indian Trails Phase I, II, III)	Jakes Mountain Artillery Impact Area	Projectiles (37 mm, 75 mm, and 76 mm,)	Future residential development, former impact area, high anomaly density.	Potential subsurface [Future residents, construction workers, site visitors and recreational users (e.g., hikers and hunters)]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.
Project 08 (260)	Active Development / Residential	Unknown. Timber cleared. Evidence of impact craters.	Armor piercing projectiles (37 mm and 76 mm)	Residential development and high anomaly density.	Potential surface and subsurface [Residents, ranch workers (e.g., cattle handlers), and construction workers.]	Reduce risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported.

a) Some 37 mm projectiles recovered in MRS-01 were not fired and could represent discarded military munitions.

Note: Maximum depth shown is based on empirical data and does not represent the theoretical maximum penetration depth associated with the munition.

Shaded cells reflect information for the other Remedial Action MRSs included as reference.

9.c EXPECTED OUTCOMES OF EACH ALTERNATIVE

Alternative 1: No Further Action Alternative

Alternative 1 does not reduce the potential for current and future MEC exposure hazards. The NCP requires the No Further Action alternative be evaluated, meaning simply that a remedial action would not be implemented. No restrictions or limitations would be placed on land use, and no costs are associated with this alternative because there would be no further action.

Alternative 2: Educational Awareness

The educational awareness program has the goal of raising public awareness of existing hazards and providing information regarding the appropriate response if MEC is encountered. An educational awareness program would consist of development of educational tools and materials (e.g., fact sheets and a webpage). No restrictions or limitations would be placed on land use. Although this alternative does not meet the RAOs for MRSs with high anomaly densities and future residential/intrusive land use, educational awareness educates the public on the actions they should take if they encounter MEC, which reduces the risk of exposure.

Landowners, potential land users, and students would receive information regarding the risks associated with using the land and the actions they should take if they encounter MEC through educational awareness efforts. A person who has seen a fact sheet is more likely to respond appropriately if a suspected item is found (versus a person who has not seen a fact sheet). There is no source reduction of potential MEC associated with this alternative. Alternative 2 provides overall protection of human health and the environment. Given the relative low cost to implement this alternative and the potential for educational awareness to potentially limit interaction with MEC, Alternative 2 is considered cost-effective.

Alternative 3: Surface Removal with Educational Awareness

Surface MEC clearance would be conducted by trained UXO technicians using metal detectors to aid in the discovery of potential UXO on the ground surface (those items lying on the ground or protruding from the ground). Suspected UXO would be removed and disposed of on-site using demolition procedures and in accordance with site ARAR 40 CFR 264.601 (Miscellaneous Treatment Units). MD will be assessed and determined to be MDAS prior to release from DoD control in accordance with DESR 6055-09.

Upon completion of the surface clearance, an educational awareness program would be implemented, as described under Alternative 2. No restrictions or limitations would be placed on land use. This alternative does meet the RAOs in MRSs where only surface interaction with MEC is anticipated (e.g., hikers and hunters). However, this alternative may not provide protection to people if current and future planned land use activities are expected to penetrate the ground (e.g., residential).

Alternative 3 would reduce the MEC risk for future residents, but it would not eliminate risk because MEC would only be removed from the surface and only in areas accessible during brush removal and surface sweep operations and where right-of-way has been granted. Consequently, there would still be risk in MRSs associated with residential land use because property owners may encounter MEC while conducting intrusive activities (e.g., construction, gardening, fence installation).

There would also be some reduction of toxicity, mobility, or volume through removal of MEC on the surface. The cost to implement Alternative 3 is greater than Alternative 2; the former also provides

additional surface-level clearance and protection to human health and the environment. As mentioned above, MEC risk may remain in residential areas where subsurface activities are likely to exist. Therefore, Alternative 3 is not cost-effective given the greater cost and potential for MEC to remain in subsurface soil. Educational awareness would be implemented to provide long-term effectiveness.

Alternative 4: Geophysical Investigation and MEC Removal with Educational Awareness

This alternative uses a combination of activities to achieve a reduction in the MEC hazards and also minimizes the potential for people to encounter MEC in the subsurface. This alternative includes the use of advanced geophysical classification. Advanced geophysical sensors can differentiate between MEC and other nonhazardous metallic debris. Removal efforts would focus on items that are suspected to be an explosive hazard (other metallic debris is left in the ground). Understandably, larger munitions produce larger responses and can therefore be more easily detected at deeper depths.

If MEC items are limited in depth to the range where the geophysical sensors are capable of reliably detecting them, then the location of MEC can accurately be determined. Conversely, if MEC items are at depths greater than the maximum depth of detection for that item, then the geophysical method may not establish the maximum depths. During the RI and EE/CA, the source of 95% of all anomalies dug were found within 12 inches of the surface; therefore, it is assumed that the depth of most detected anomalies would be less than 12 inches. MEC removal is anticipated to extend to the depth of the detected anomaly, which may extend to 36 inches depending on the size of the MEC items. The depth of detection may extend deeper than 36 inches because MEC detected below 36 inches will be removed as well.

The removal of understory vegetation and brush would be conducted (where needed) to clear the areas for the subsequent MEC clearance. Mitigation measures may be required during vegetation and brush removal to ensure that marshy grounds and the habitats of the barking tree frog and white fringeless orchid are identified and when possible, avoided.

The detection and identification of anomalies attributable to MEC would be performed by specialists (geophysicists) experienced in the detection of buried munitions. These geophysicists would conduct DGM using a specialized metal detector that records the locations of buried metallic items and interprets the data to identify locations of subsurface MEC. The sensors would help to evaluate the geophysical anomalies and reduce the required number of intrusive investigations. It is anticipated that using the advanced sensor would reduce the number of intrusive investigations by 70%. Overall, the use of these sensors could eliminate a significant number of excavations and reduce the cost of remediating the MRSs.

Suspected UXO would be removed and disposed of on-site using demolition procedures and in accordance with site ARAR 40 CFR 264.601 (Miscellaneous Treatment Units). All MD would be inspected, certified, and shipped off-site for disposal. The MEC removal would be conducted by trained UXO technicians. MD will be assessed and determined to be MDAS prior to release from DoD control in accordance with DESR 6055-09. No restrictions or limitations would be placed on land use.

TABLE 6
Overview of Estimated Costs
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

MRS (acres)	Evaluated Alternatives	Estimated Costs	
MRS-05 (646)	2 - Education	Capital Cost =	\$12,238
		Annual O&M =	\$16,585
		Total Costs =	\$480,968
	3 - Surface Clearance	Capital Cost =	\$4,128,942
		Annual O&M =	\$16,585
		Total Costs =	\$4,609,910
	4 - MEC Removal	Capital Cost =	\$12,564,698
		Annual O&M =	\$16,585
		Total Costs =	\$13,045,666
	5 - Excavation/Sifting	Capital Cost =	\$68,960,000
		Annual O&M =	\$0
		Total Costs =	\$68,960,000

Note:

The preferred alternative is in bold text.

Due to limitations in detection technology and because 100% coverage would not be possible in all areas of the MRS, it is possible that some munitions may be missed. As part of Alternative 4, an educational awareness program would be conducted as described under Alternative 2. The RAOs would be achieved through implementation of Alternative 4, and this alternative would provide overall protection of human health and the environment. The cost to implement Alternative 4 is approximately \$13 million and adds protection of subsurface soil via MEC/MD removal. The cost-effectiveness for Alternative 4 is low compared to Alternative 2, given the high-cost difference and potential for MEC items to be missed or not acquired due to lack of right-of-entry (ROE) or inaccessible areas.

Alternative 5: Excavation and Sifting

DoD guidance requires inclusion of at least one alternative that can provide unlimited use/unrestricted exposure upon completion of the remedial action. Although UU/UE would result through implementation of the excavation and sifting alternative, this alternative is costly (near \$69 million), may be difficult to implement, and risks adversely affecting the environment. Moreover, excavation and sifting may have adverse impacts to the Trail of Tears. Though it would include restoration, that may impact the historical accuracy of the trail. Suspected UXO would be removed and disposed of on-site using demolition procedures and in accordance with site ARAR 40 CFR 264.601 (Miscellaneous Treatment Units). MD will be assessed and determined to be MDAS prior to release from DoD control in accordance with DESR 6055-09. No educational awareness or five-year reviews would be needed for this alternative because of the removal of subsurface MEC. Alternative 5 provides overall protection of human health and the environment.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial action alternatives were compared and evaluated using nine criteria, which are presented in Table 7. These fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria:

- Threshold criteria are requirements that each alternative must meet in order to be eligible for selection.
- Primary balancing criteria are used to weigh major tradeoffs among alternatives.
- Modifying criteria can be fully considered only after public comment is received on the Proposed Plan. In the final balancing of tradeoffs between alternatives upon which the final remedy selection is based, modifying criteria such as community acceptance are of equal importance to the balancing criteria.

The details of the 9 evaluation criteria are explained further in Table 8 for threshold criteria and in Table 9 for the primary balancing criterion. The alternatives evaluation for MRS-05 is presented, by criteria type, in the following subsections.

Threshold Criteria

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and /or institutional controls.

All the alternatives, except the No Further Action alternative (Alternative 1), are protective of human health and the environment by eliminating, reducing, or controlling risks posed by the site.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP § 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations identified at the time of ROD signature, which are collectively referred to as “ARARs,” unless such ARARs are waived under CERCLA section 121(d)(4).

Alternatives 3, 4, and 5 comply with the location specific ARAR regarding open detonation of consolidated MEC (40 CFR 264.601 [Miscellaneous Treatment Units]) since each of these alternatives provides a mechanism for consolidating, detonating, and removing MEC. Alternatives 1 and 2 do not include MEC removal; therefore, this ARAR is not applicable to those alternatives.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence

The permanence criterion evaluates the degree to which an alternative permanently reduces or eliminates the potential for MC or MEC exposure hazards.

Alternatives 2 through 5 were determined to provide some effectiveness by reducing possible receptor interaction with MEC. Alternative 5 provides the best long-term effectiveness and permanence based on the ability to remove the risk due to possible MEC in subsurface soil. Alternative 2 leaves MEC contamination in place and relies on educational awareness to limit or prevent exposure.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternative 2 does not include treatment as a component of the remedy. Therefore, Alternative 2 would not reduce the toxicity, mobility, or volume of MEC contamination at MRS-05. Alternatives 3, 4, and 5 offer a reduction in toxicity, mobility, or volume by removal of detectable MEC. Alternative 5 provides the greatest reduction in the toxicity, mobility, and volume of MEC-contaminated soil by removing soil and implementing sifting, as that would ensure the greatest amount of MEC is found and disposed of.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternatives 3, 4, and 5 involve possible interaction with MEC and could lead to adverse impacts to workers, the community, and the environment during field activities. Implementing educational awareness would present no short-term impacts or adverse impacts on workers and the community.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternatives 1 and 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. Alternatives 2, 3, and 4 involve educational awareness and would be both readily implementable and administratively feasible. Long-term maintenance would be required for the webpage and distribution of educational materials. Alternatives 3, 4, and 5 involve the use of specialized geophysical equipment and require qualified technicians and a work plan to implement. Equipment and technicians are available, and it would be both technically and administratively feasible to implement the alternatives. Alternatives 3, 4, and 5 could involve the destruction and removal of UXO. This would require additional specialized personnel and coordination with local officials to effectively implement this effort. The development of a work plan will ensure properly trained staff are available should UXO be encountered.

Cost

The estimated present worth costs for the alternatives, not including the No Further Action alternative, ranges from approximately \$481,000 for Alternative 2 to approximately \$69 million for Alternative 5. The cost of each alternative increases as the degree of soil treatment increases. Cost summaries can be found in Table 6.

State Acceptance

TDEC reviewed the PP and concurs with the preferred alternative for MRS-05 at the former Spencer Artillery Range.

Community Acceptance

A public meeting was held March 20, 2012, to present the 2012 Proposed Plan (Parsons, 2012) and preferred alternative to the community. Three comments were received from the community, as discussed in the Responsiveness Summary included in Part 3 of this DD. The community accepts the selected remedy.

A follow-on virtual public meeting was held August 18, 2020, to present the revised Final Proposed Plan (incorporating the settlement areas and re-grouped MRSs) and preferred alternative to the community. No one from the community attended the meeting; consequently, no transcript was prepared. Seven comments were received from the community, as discussed in the Responsiveness Summary included in Part 3 of this DD. The community accepts the selected remedy.

Table 7
Evaluation Criteria for Superfund Remedial Alternatives
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

Criteria	Threshold	Overall Protection of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to human health and the environment through institutional controls, engineering controls, or treatment.
		Compliance with ARARs evaluates whether the alternative meets cleanup criteria, standards of control, or other requirements found in federal and state environmental statutes and regulations that have been determined to be applicable or relevant and appropriate to the remediation or hazardous substances involved, or whether a waiver is justified.
	Primary Balancing	Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
		Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
		Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
		Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
		Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 %.
	Modifying	State Acceptance considers whether the state agrees with the analyses and recommendations, as described in the FS and Proposed Plan.
		Community Acceptance considers whether the local community agrees with analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Table 8
Evaluation of Alternatives Using Threshold Criteria
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

	Criterion	No Further Action Alternative 1	Educational Awareness Alternative 2	Surface Removal with Educational Awareness Alternative 3	Geophysical Investigation/MEC Removal with Educational Awareness Alternative 4	Excavation and Sifting Alternative 5
Threshold Criteria	Overall Protection of Human Health and the Environment	Does not provide overall protection of human health and the environment.	Does provide overall protection of human health and the environment.	Does provide overall protection of human health and the environment.	Does provide overall protection of human health and the environment.	Does provide overall protection of human health and the environment.
	Compliance with ARARs	No ARARs apply to the Alternative.	No ARARs apply to the Alternative.	Does comply with 40 CFR 264.601 (Miscellaneous Treatment Units).	Does comply with 40 CFR 264.601 (Miscellaneous Treatment Units).	Does comply with 40 CFR 264.601 (Miscellaneous Treatment Units).

Table 9
Evaluation of Alternatives Using Primary Balancing Criteria
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

	Criteria	No Further Action Alternative 1	Educational Awareness Alternative 2	Surface Removal with Educational Awareness Alternative 3	Geophysical Investigation and MEC Removal with Educational Awareness Alternative 4	Excavation and Sifting Alternative 5
Primary Balancing Criteria	Long-Term Effectiveness & Permanence	Not applicable. Does not satisfy threshold criteria.	Although there would be no reduction of MEC hazards, education can increase awareness and appropriate responses to safety hazards. Requires self-implementation by USACE and public. Educational fact sheets and a webpage aimed at making the public aware of potential hazards will reduce the risk of exposure. A limitation is that fact sheets and webpage may not be effective for all persons.	Effective if surface MEC is present at the MRS but does not reduce subsurface MEC. Provides protectiveness for surface activities, but MEC sources could remain in the subsurface.	Effective at removing UXO located within MRS-05 (surface and subsurface).	Effective at removing identified UXO located within MRS-05 (surface and subsurface). Most effective.
	Reduction of Toxicity, Mobility, and Volume through Treatment		No reduction of source.	Significant reduction in source. Identified surface MEC hazards are removed from the site. Involves treatment through the destruction of UXO.	Reduction of toxicity for identified MEC within MRS. Possible MEC left behind. Involves treatment through the destruction of UXO.	Significant reduction in source. Reduction of toxicity for identified MEC within MRS. Low probability of MEC left behind. Involves treatment through the destruction of UXO.

Table 9 (Continued)
Evaluation of Alternatives Using Primary Balancing Criteria
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

	Criteria	No Further Action Alternative 1	Educational Awareness Alternative 2	Surface Removal with Educational Awareness Alternative 3	Geophysical Investigation and MEC Removal with Educational Awareness Alternative 4	Excavation and Sifting Alternative 5
Primary Balancing Criteria	Short-Term Effectiveness		No short-term impacts to workers, community, and the environment. Provides short-term protection due to increased awareness.	Risk to workers, community, and the environment associated with possible interaction with MEC. Durations range from 5 months – 7 years to meet RAOs.	Risk to workers, community, and the environment associated with possible interaction with MEC, but with limited duration of field activities due to advanced geophysical classification. Durations range from 5 months – 13 years to meet RAOs.	Risk to workers, community, and the environment associated with possible interaction with MEC. Long-term duration to achieve RAOs.
	Implementability	Not applicable. Does not satisfy threshold criteria	Technically and administratively feasible. Information readily available and easily developed into educational materials. Requires public involvement.	Requires qualified technicians with specialized (but readily available) equipment and training. Requires work plan and ROE access.	Requires qualified technicians with specialized (but available) equipment. Requires work plans and ROE.	Requires qualified technicians with specialized equipment. Requires work plans, coordination with property owner, and avoidance of sensitive environments. Requires ROE access.
	Cost	\$0	\$480,968	\$4,609,910.	\$13,045,666	\$68,960,000

11.0 PRINCIPAL MEC ISSUES

A potentially complete MEC exposure pathway is possible in MRS-05. MD found at the site includes various projectiles (e.g., 37mm, 75mm, and 155mm) resulting from live-fire artillery training during World War II. If MEC is present, a receptor and interaction between the MEC source and receptor must also be present for a complete MEC exposure pathway to exist. MEC removal reduces the source, and educational awareness increases the likelihood of an appropriate response/interaction if a receptor does encounter MEC. As detailed in Section 12, below, the selected remedy for MRS-05 is protective of human health and the environment, complies with 40 CFR 264.601 (Miscellaneous Treatment Units) for the regulation of open detonation of consolidated MEC, is cost-effective, and uses a permanent solutions and alternative treatment technologies to the maximum extent practicable. There is also a statutory preference for treatment as a principal element of the remedy, which the MEC destruction remedies provide by reducing the explosive hazard risk to human health and the environment.

The remedy for MRS-05 may result in hazardous substances, pollutants, or contaminants (MEC) remaining on site above levels that would allow unlimited use and unrestricted exposure; therefore, a statutory review will be conducted every five years after initiation of the selected remedy to ensure that the remedy is, or will be, protective of human health and the environment.

12.0 SELECTED REMEDY

The selected remedy for MRS-05 is Geophysical Investigation and MEC Removal with Educational Awareness. This remedy will protect human health and the environment by directly removing MEC and informing recreational users (e.g., hikers and hunters), part-time residents, site visitors, construction workers, students, and the public of possible dangers associated with the area, thereby making these receptors more likely to respond appropriately if a suspected MEC item is found. The selected remedy for MRS-05 is shown in Figure 2 and described in Section 12.b and Table 10.

12.a RATIONALE FOR THE SELECTED REMEDY

Implementing Alternative 4: Geophysical Investigation and MEC removal with Educational Awareness is protective, provides short- and long-term effectiveness and permanence, source removal, reduction of toxicity, and is readily implementable.

Alternative 4 (Geophysical Investigation and MEC Removal with Educational Awareness) would be protective of current and reasonably foreseeable land use. Currently the site is used by part-time residents. Therefore, MEC removal is a priority in remedy selection because residential activities in MRS-05 could result in soil disturbance to depths of 5 feet or more (e.g., site grading, foundations, gardening, fence installation, etc.). While Alternative 2 provides short-term effectiveness at a lower cost compared to the other evaluated alternatives, there is no reduction in MEC. Alternative 3 combines educational awareness with a surface clearance but is not an effective remedy because MD was also found in the subsurface at MRS-05. That alternative also does not reduce MEC in subsurface soil.

12.b DESCRIPTION OF THE SELECTED REMEDY

Geophysical Investigation and MEC Removal with Educational Awareness (Alternative 4)

MEC Removal with Educational Awareness is the selected remedy for MRS-05. Alternative 4 focuses on removal of the MEC source. The performance standard for effective implementation of the remedy will be based on “reducing risk of exposure to explosive hazards for land users such that a determination of negligible risk can be supported,” as identified as the RAO for the MRSs (presented in Table 5). Negligible risk will be achieved by removal of all identified MEC hazards to the detection limit for that particular size of MEC. The detection technology used will demonstrate that the detection depth of intact munitions is greater than or equal to the expected depth of the munition.

MEC removal would be conducted by trained UXO technicians and geophysical personnel within MRS-05 to identify and remove MEC on the ground surface and in the subsurface. Geophysical data would be collected over the entire accessible area of the MRS, and selected anomalies would be identified within the data and located for intrusive excavation. Engineering controls and/or evacuations may be required when working close to residences. This remedy includes the use of advanced geophysical classification, which can differentiate between MEC and other nonhazardous metallic debris. Removal efforts would focus on items that are suspected to be an explosive hazard (other metallic debris is left in the ground). Suspected anomalies would be investigated to the depth of detection, and if MEC were encountered, it is anticipated that the munition(s) would be destroyed using blow-in-place procedures. However, munitions deemed acceptable to move could be transported to a nearby designated area for demolition. MD will be assessed and determined to be MDAS prior to release from DoD control in accordance with DESR 6055-09.

The MEC removal would not be conducted under existing roads, streams, and structures. Most of the site is currently undeveloped, so vegetation would need to be cleared to allow access for the geophysical instruments. Extensive vegetation removal is expected to be required across large portions of the MRS.

The completion of the MEC removal would significantly reduce MEC hazards; however, due to limitations in detection technology and because 100% coverage will not be possible in all areas of the site, it is likely that some munitions may be missed. Educational awareness would provide additional protection by making information concerning MEC hazards at the site available to the public. USACE conducted a public outreach campaign during the EE/CA and RI projects; public awareness of existing hazards within the former Spencer Artillery Range can be facilitated and maintained through continued use of these proven methods.

An educational awareness program would focus on making known those areas containing MEC hazards and would provide information regarding the appropriate response if MEC is encountered. Van Buren County has limited administrative resources; therefore, handouts through Van Buren County administrative resources (e.g., permitting offices, recorder of deeds) are not anticipated as part of the educational awareness program. However, direct mailing of fact sheets to property owners and distribution of fact sheets in public locations (e.g., libraries, stores, schools) and the development of a webpage are considered as part of the remedy. Educational training will be provided to schools of Van Buren and Warren County, as requested. An educational awareness implementation plan will be developed and maintained to ensure proper distribution of educational materials and to account for changes in ownership and land uses within MRS-05.

TABLE 10
Overview of Evaluated Alternatives
Spencer Artillery Range, Van Buren, Warren, and Sequatchie Counties, Tennessee

MRS (acres)	Land Use	Evaluated Alternatives	Total Cost	Rationale
MRS-05 (646)	Recreation/ Cabins	1 - No Action	\$0	No reduction of risk.
		2 - Educational Awareness Education	\$480,968	Reduce risk by providing information to the owners/public. Fact sheets and website will provide hazard recognition to reduce chances of exposure.
		3 - Surface Clearance	\$4,609,910	Recreational users may still encounter subsurface MEC while conducting intrusive activities (i.e., digging holes, staking down tents).
		4 - Geophysical Investigation and MEC Removal with Educational Awareness	\$13,045,666	High level of effectiveness for recreational users.
		5 - Excavation and Sifting	\$68,960,000	Not considered due to long-term management, limitation of technology, extreme cost, and potential for ecological destruction.

Note:

The preferred alternative is in bold text.

Warning signs are not a component of the selected remedy because the clearance and distribution of educational materials has been determined to be protective of human health and the environment. While warning signs are not necessary to reduce risk, USACE will consider warning signs during the five-year review process if circumstances change. Warning signs may be considered appropriate in many cases to inform potential visitors of site risks; however, signs previously posted in the area were destroyed by vandalism on multiple occasions. Therefore, warning signs were only considered for areas near the Trail of Tears. Future development of the Trail of Tears may include designated trailhead parking areas. Installation of signs regarding the historical use of the site and appropriate response if MEC is encountered is included as part of the remedy for MRS-05. Educational Awareness uses a combination of activities to reduce the MEC hazards and minimize receptor interaction. Educational Awareness focuses on hazard recognition and limiting potential encounters with MEC. Surface and subsurface clearance assumes a vertical distribution to a depth of 36", however AGC can clear to a depth of 64" and would meet RAOs based on the depth of detection for 155 mm projectiles (Parsons, 2011b) identified during previous investigations within MRS-05.

12.c COST ESTIMATE FOR THE SELECTED REMEDY

Estimated capital, annual operation and maintenance (O&M), and present worth costs for the selected remedy is presented in Table 6. Annual O&M costs are calculated from the completion of the first year. Present worth costs are calculated over 30 years consistent with EPA guidance and include capital costs plus 29 years of annual O&M in the form of educational awareness. The anticipated total cost to implement the selected remedy is \$13,045,666.

12.d EXPECTED OUTCOMES OF THE SELECTED REMEDY

With implementation of the selected remedy – MEC Removal and Educational Awareness – for MRS-05, the expected outcomes are anticipated to include the following:

- No restriction will be placed on current or future land use.
- No limitations will be placed on groundwater or surface water use.
- MEC removal is anticipated to extend to the depth of detection. MEC that can be detected below 36 inches with Advanced Geophysical Classification will be removed as well.
- The selected remedy will likely boost the local economy by bringing in a workforce and using local suppliers for support.

Table 2 presents the duration of field activities associated with MEC removal.

With implementation of the selected remedy for MRS-05, which includes Educational Awareness, the expected outcomes are anticipated also to include the following:

- Foreseeable land use will remain unchanged.
- No restriction will be placed on current or future land use.
- No limitations will be placed on groundwater or surface water use.

13.0 STATUTORY DETERMINATIONS

Based on the information currently available, the selected remedy (Figure 2) is protective of human health and the environment, minimizes explosive hazard risks, and satisfies the statutory requirements of CERCLA § 121(b) with regard to the former use of the MRS by the DoD. Alternative 4, Geophysical Investigation and MEC Removal with Educational Awareness, will protect human health and the environment by directly removing MEC hazards. Removing the source where the likelihood of encountering MEC is greatest provides receptor protection. The remedy will also protect human health and the environment by educating landowners (and land users such as students) of the possible dangers associated with the area. Education will make people more likely to respond appropriately if suspected MEC is found. As implementing Alternative 4 for MRS-05 may result in MEC remaining on-site above levels that allow unlimited use and unrestricted exposure, a statutory review will be conducted every five years after initiation of the selected remedy to ensure that the remedy is, or will be, protective of human health.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The selected remedy described in this DD (Figure 2) is unchanged from that detailed in the Final Proposed Plan (USACE, 2020).

PART 3

RESPONSIVENESS SUMMARY

1.0 STAKEHOLDER ISSUES AND LEAD AGENCY RESPONSES

A public meeting was conducted by USACE and TDEC March 20, 2012, to review the Proposed Plan (Parsons, 2012) for the former Spencer Artillery Range. The meeting was announced through notices in the *Mountain View* and *Southern Standard* newspapers as well as a news release to local media outlets. In addition, landowners within the Former Spencer Artillery Range investigation area were notified directly of the meeting via email and the U.S. mail. Copies of the news release and newspaper notices are provided on the enclosed DD compact disc. Approximately 25 landowners and community members attended the meeting. PowerPoint slides were presented to the audience summarizing the history of the site, the results of investigation activities, and the preferred response alternatives for each MRS. Throughout the presentation, audience members were encouraged to ask questions. Most of the questions related to land use and public safety.

The public comment period from March 12 to April 20, 2012, resulted in three comments on the Proposed Plan. The comments and responses are provided below:

Comment #1: I am writing to confirm that my highest priority property needing clearing of unexploded ordinance is the Bald Knob area, which is near "Burned Stand Road" between US Hwy 8 and Harper County Road. I would very much like this relatively small parcel to be cleared of ordinance as soon as possible.

Response #1: The referenced location (MRS-09) is identified for MEC Removal and Educational Awareness; however, prioritization of implementing the remedy will be based on risk and availability of funding.

Comment #2: I would strongly support the Federal Government to purchase all questionable properties and turn management over to State or National Parks.

Response #2: The government is not in the position to purchase land from private landowners as part of a remedial response.

Comment #3: Please consider Indian Trails Estates, Phase II a top priority for remedial action as it is a planned residential community with further construction occurring in the development. The developer has already graveled the roads and installed underground conduit.

Response #3: The referenced location (MRS-08) is identified for MEC removal; however, prioritization of implementing the remedy will be based on risk and availability of funding.

A follow-on virtual public meeting was conducted by USACE and TDEC August 18, 2020, to review the Final Feasibility Study Addendum (USACE, 2019a) and revised Final Proposed Plan (USACE, 2020) for the former Spencer Artillery Range. The meeting was announced through a notice in the *Southern Standard* newspaper August 2, 2020. A copy of the newspaper notice is provided on the enclosed DD compact disc. An announcement was also posted in the local library. In addition, Van Buren County Contacts were

notified. No members of the public attended this virtual public meeting, and no comments were made; as such, no transcript was prepared.

The public comment period from August 3 to September 3, 2020, resulted in seven comments on the Final Proposed Plan. The comments and responses are provided below:

Comment #1: Is USACE aware of the recent designation of The Higginbotham Trace on the National Register? I assume that the same criteria will apply to it as with the Trail of Tears.

Response #1: USACE will consider the recent designation of the Higginbotham Trace in future planning documents for Spencer Artillery Range.

Comment #2: I further assume that USACE has informed the Office of Surface Mining-Knoxville of the proposed plan as well. Sharing information is very important in reviewing any future mining permits.

Response #2: USACE provided Julie Cook, Office of Surface Mining Reclamation and Enforcement – Knoxville, Division Chief, a copy of the Final Proposed Plan for distribution to interested parties.

Comment #3: I urge that along with Van Buren County officials that the educational awareness include the Schools of Van Buren County. This is VERY important.

Response #3: Details on education awareness have been updated to include education in schools.

Comment #4: Re-Posting of signs should be done very 3 years. A contact person should be made available to the public.

Response #4: Although warning signs may be considered appropriate in many cases to inform potential visitors of site risks, signs previously posted in the area were destroyed due to vandalism on multiple occasions. Therefore, warning signs are only considered for the Trail of Tears located within Project Area 01.

Comment #5: Proposed planning information should be sent to the Van Buren County Historical and Heritage Museum as well.

Response #5: USACE contacted Donna Sullivan with Van Buren County Historical and Heritage Museum to provide proposed planning information. A notification was also posted to their Facebook page.

Comment #6: USACE should recheck to see if ALL prior information about the project is still available at the county library since it was damaged by water last year; county mayor office since many records were lost in the fire of 2015.

Response #6: A CD containing project documents (RI, FS Addendum and Final Proposed Plan) was sent to the Burritt Memorial Library in early August 2020. Project documents are also available at the USACE, Savannah District Office, 100 W Oglethorpe Ave, Savannah, GA, 31401.

Comment #7: Property owner, Mr. ^{Redacted - Privacy Act} inquired about the disposition of his land.

Response #7: USACE provided Mr. ^{Redacted - Privacy} a map showing his property in relation to the designated project areas and corresponding remedial alternatives. Mr. ^{Redacted - Privacy} had no additional questions.

Representatives of the Tennessee Department of Environment and Conservation (TDEC) have reviewed and concur with the selected remedy.

2.0 TECHNICAL AND LEGAL ISSUES

There were no technical or legal issues raised during development of this DD.

REFERENCES

- Parsons, 2011a. *Final Remedial Investigation Report, Former Spencer Artillery Range, Spencer/Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. March 24.
- Parsons, 2011b. *Final Feasibility Study Report, Former Spencer Artillery Range, Spencer/Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. October 25.
- Parsons, 2012. *Final Proposed Plan, Former Spencer Artillery Range, Spencer/Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. March.
- USACE, 1985. *Inventory Project Report: Spencer Artillery Range, Van Buren, Warren, Sequatchie, Bledsoe Counties, Tennessee*.
- USACE, 2001. *Archives Search Report Findings for the former Spencer Artillery Range, Van Buren, Warren, Sequatchie, and Bledsoe Counties, Tennessee*. November.
- USACE, 2005. *Cultural and Historical Context: Former Spencer Artillery Range, Bledsoe, Sequatchie, Van Buren, and Warren Counties, Tennessee*. June.
- USACE, 2014. Approval of Defense Environmental Restoration Program- (DERP-FUDS) Revised INPR. Department of the Army, U.S. Army Corps of Engineers, Atlanta, Georgia. 30303-8801. June 3.
- USACE, 2019a. *Final Feasibility Study Addendum, Former Spencer Artillery Range, Spencer/Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. July.
- USACE, 2019b. Re-delegation of Assignment of Mission Execution Functions Associated with Department of Defense Lead Agent Responsibilities for the Formerly Used Defense Sites Program, Department of the Army, U.S. Army Corps of Engineers, Washington, DC. August.
- USACE, 2020. *Final Proposed Plan, Former Spencer Artillery Range, Spencer/Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.
- USACE, 2021a. *Final Decision Document (No Further Action), Former Spencer Artillery Range, Project Areas 02 and 09, Warren, Van Buren, and Sequatchie Counties, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.
- USACE, 2021b. *Final Decision Document (Remedial Action), Former Spencer Artillery Range, Project Area 01, Van Buren and Sequatchie Counties, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.

USACE, 2021c. *Final Decision Document (Remedial Action), Former Spencer Artillery Range, Project Area 03, Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.

USACE, 2021d. *Final Decision Document (Remedial Action), Former Spencer Artillery Range, Project Area 04, Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.

USACE, 2021e. *Final Decision Document (Remedial Action), Former Spencer Artillery Range, Project Area 06, Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.

USACE, 2021f. *Final Decision Document (Remedial Action), Former Spencer Artillery Range, Project Area 07, Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.

USACE, 2021g. *Final Decision Document (Remedial Action), Former Spencer Artillery Range, Project Area 08, Van Buren County, Tennessee*. Prepared for the U.S. Army Engineering and Support Center, Huntsville and USACE, Mobile District. August.

USEPA, 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. USEPA Office of Solid Waste and Emergency Response. EPA 540-R-98-031. July.