Corrective Measures Effectiveness Report
Twelfth Year Long-Term Monitoring
Former Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Prepared for:

McCLELLAN
DEVELOPMENT AUTHORITY

McClellan Development Authority
Anniston, Alabama

Prepared by:

Matrix
ENVIRONMENTAL

283 Rucker St
Anniston, AL 36205

(256) 847-0780
Fax (256) 847-0905

April 2023
Revised September 2023

This page intentionally left blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

1,1-DCE	1,1-dichloroethene
ADEM	Alabama Department of Environmental Management
ASTM	ASTM International
CA	*Cleanup Agreement*
cis-1,2-DCE	cis-1,2-dichloroethene
CMER	Corrective Measures Effectiveness Report
CMIR	Corrective Measures Implementation Report
COC	Chemical of concern
Draft CMIR	*Draft Corrective Measures Implementation Report, Former Small Weapons Repair Shop, Parcel 66(7)*
EBS	Environmental Baseline Study
ESE	Environmental Science & Engineering, Inc.
Final CMIP	*Final Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7)*
Final CMIP Addendum	*Tech Memo Addendum* to the *Final CMIP*
GES	Groundwater & Environmental Services, Inc.
ISCO	In-Situ Chemical Oxidation
IT	IT Corporation
LTM	Long-term monitoring
LUC	Land use control
LUCER	Land use control effectiveness report
McClellan	Former Fort McClellan
MDA	McClellan Development Authority
MES	Matrix Environmental Services, LLC
PDB	Passive Diffusion Bag
QA	Quality Assurance
QAP	*Quality Assurance Plan*
RBTL	Risk-Based Target Level
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SAP	*Installation-Wide Sampling and Analysis Plan*
Second Addendum to CMIP	*Second Addendum to Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7)*
Shaw	Shaw Environmental, Inc.
SI	Site Investigation
Site	Former Small Weapons Repair Shop, Parcel 66(7)
TCE	Trichloroethene
trans-1,2-DCE	trans-1,2-dichloroethene
VOC	Volatile organic compound

This page intentionally left blank

EXECUTIVE SUMMARY

The purpose of this Corrective Measures Effectiveness Report (CMER) is to document the effectiveness of the remedial action for contaminated groundwater at the Former Small Weapons Repair Shop, Parcel 66(7) (Site), located at the former Fort McClellan (McClellan) in Anniston, Alabama, during the twelfth year of Long-Term Monitoring (LTM) from May 2022 to October 2022. This report was prepared by Matrix Environmental Services, LLC (MES) on behalf of the McClellan Development Authority (MDA).

Pursuant to the *Second Amendment to Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7) McClellan, Anniston, Alabama (MES, 2018),* In-situ Chemical Oxidation (ISCO) using hydrogen peroxide with sodium persulfate injection was performed in December 2018. The ISCO was performed to further lower the concentrations of the chemicals of concern (COCs) (cis-1,2-dichloroethene (DCE), trichloroethene (TCE), and vinyl chloride) and their degradation products (1,1-DCE and trans-1,2-DCE). This reporting period covers the on-going monitoring events and post injection events.

Groundwater samples were collected from eight LTM wells (four residuum wells, three transition wells, and one bedrock well) and other select wells during the post-injection sampling events in between May 2022 and October 2022 and analyzed for one or more of the following: COCs, degradation products and dissolved gases. The groundwater sample results were compared to the groundskeeper risk-based target levels (RBTLs) to assess progress of the corrective measures at the Site.

Only vinyl chloride exceeded the groundskeeper RBTLs during the twelfth year of LTM, in residuum wells PPMP-66-MW02RR and in transition well PPMP-66-MW23R. Both of these wells are located in the vicinity of the estimated source area, south and southwest of the former Building 335. The lateral extent of vinyl chloride remained static in both the residuum and transition groundwater zones, compared to the baseline sampling event.

This page intentionally left blank

1.0 INTRODUCTION

The purpose of this CMER is to document the effectiveness of the remedial action for contaminated groundwater at the Former Small Weapons Repair Shop, Parcel 66(7) (Site), located at the former Fort McClellan (McClellan) in Anniston, Alabama, during the twelfth year of LTM from May to October 2022. Figure 1-1 shows a site map of McClellan and Figure 1-2 shows a parcel location map of the Site. This report was prepared by MES on behalf of the MDA.

1.1 Report Purpose and Objectives

This CMER summarizes groundwater monitoring data collected from May 2022 to October 2022, to evaluate the effectiveness of corrective measures as outlined in the *Final Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7) (Final CMIP)* (MES, 2007) and the *Tech Memo Addendum* to the *Final CMIP (Final CMIP Addendum)* (MES, 2009) and the *Second Addendum to Corrective Measures Implementation Plan, Former Small Weapons Repair Shop (Second Addendum to CMIP), Parcel 66(7) McClellan, Anniston, Alabama (MES, 2018)*.

Objectives for these monitoring events and this CMER include:

- Describe the activities performed at the Site during the twelfth year of LTM.
- Summarize environmental sampling data from previous investigations and monitoring events and present analytical results for the May to October 2022 monitoring events.
- Compare the current results of the groundwater samples to historical groundwater results to evaluate the effectiveness of the corrective measures for COCs in groundwater at the Site.
- Compare the results to risk-based target levels (RBTLs) to assess whether continued monitoring of the corrective measures is necessary.

1.2 Report Organization

This CMER is organized as follows:

- Section 1.0 - summarizes the project background, purpose of the CMER, and report organization.
- Section 2.0 - presents a summary of the Site characterization.
- Section 3.0 - describes the activities conducted during the twelfth year of LTM.
- Section 4.0 - presents the results of the twelfth year of LTM.
- Section 5.0 - presents the summary, conclusions, and recommendations.
- Section 6.0 - provides the references cited in this report.
- Tables that support the CMER.
- Figures that support the CMER.
- Appendix A contains the Groundwater Sampling Documentation.
- Appendix B contains the Chain-of-Custody Forms.
- Appendix C contains the Data Quality Summary.

This page intentionally left blank

2.0 SITE CHARACTERIZATION

This section summarizes the Site description and physical setting, land use, previous investigations, and corrective measures activities performed at the Site.

2.1 Site Description

The Site consists of 1.15 acres and is located in the central portion of McClellan at the intersection of Waverly Road and Fremont Road (Figure 1-2). Two buildings (Buildings 335 and 336) were formerly located within the parcel boundary of the Site. Building 335 formerly housed the Small Weapons Repair Shop where weapons used for training exercises were stored, disassembled, and cleaned using various solvents. It is reported that the main part of Building 335 was used primarily for Tank Repair (IT Corporation [IT], 2002). Building 336, located just east of Building 335, historically was used as boiler plant and as a paint storage area.

The Small Weapons Repair Shop was built in 1941, although it is not known when operations began at this location. The operation was moved to the Consolidated Maintenance Facility (Building 350) in approximately 1991. From 1991 to circa 2003, Building 335 was used by the Alabama National Guard for boiler plant storage (Environmental Science & Engineering, Inc. [ESE], 1998). The history of the Site is described in more detail in the *Final CMIP* (MES, 2007).

Drainage ditches border the Site along Waverly Road to the north and Fremont Road to the west. Buildings 335 and 336 were removed from the Site in 2007 (MES, 2012).

2.2 Land Use and Land Use Controls

The proposed future land use for the Site is a light industrial and business park. Based on the presence of volatile organic compounds (VOC) in groundwater, MDA has implemented land use controls (LUCs) to limit exposure to groundwater. LUCs include a prohibition on consumptive use or direct contact with groundwater and installation of any well for extraction of groundwater for purposes of consumptive or other uses within the covenant boundary. In accordance with the *Cleanup Agreement* (CA) and Alabama Uniform Environmental Covenants Act, Code of Alabama 1975, §§ 35-19-1 to 35-19-14 and the Alabama Department of Environmental Management (ADEM) Admin Code r. 335-5, effective May 26, 2009, MDA filed Environmental Covenant No. FY 12-07.00 in Calhoun County Probate on March 7, 2013, which documents the LUCs. A copy of the recorded Environmental Covenant No. FY 12-07.00 was included as a slip page to the Department for incorporation into the *Final Corrective Measures Implementation Report (CMIR)* dated January 10, 2013. MDA will administer and enforce the LUCs and certify, after inspection, that the LUCs are in place in an Annual Land Use Controls Effectiveness Report (LUCER).

2.3 Summary of Previous Investigations

Investigative activities at the Site were conducted in multiple phases from 1998 to 2004 by several contractors to the Army and the JPA, including: ESE, IT, (formerly Shaw Environmental, Inc. currently APTIM), and MES. The previous investigations included:

- *1998 Environmental Baseline Study (EBS)* (ESE, 1998)
- *1999 Site Investigation (SI)* (IT, 2002)
- *2002 Remedial Investigation (RI)* (IT, 2002)
- *2004 RCRA Facility Investigation (RFI)* (MES, 2006)

These investigations led to the development of a Corrective Measures Implementation Plan in 2007 to address VOCs in the groundwater.

2.4 2010/2011 Corrective Measures Implementation

Based on the data assessment presented in the *Final CMIP* (MES, 2007) and *Final CMIP Addendum* (MES, 2009), cis-1,2-DCE, TCE, and vinyl chloride in groundwater were determined to be human health COCs at the Site. No ecological COCs were identified in media at the Site.

From October 2010 to February 2011, corrective measures were implemented at the Site as outlined in the *Final CMIP* (MES, 2007) and *Final CMIP Addendum* (MES, 2009) to reduce concentrations of VOCs in groundwater at the Site to levels acceptable for industrial use. Details of the corrective measures activities are documented in the *Final Corrective Measures Implementation Report (CMIR), Former Small Weapons Repair Shop, Parcel 66(7)* (*Final CMIR*) (MES, 2013).

Corrective measures activities included: 1) the abandonment of groundwater monitoring wells PPMP-66-MW02, PPMP-66-MW06, PPMP-66-MW12, PPMP-66-MW18, PPMP-66-MW23, and PPMP-66-MW24 located in the target treatment area, 2) anhydrous quicklime blending into the soil of the target treatment area to reduce residual COCs concentrations in the soil that may provide a source of contaminants to the groundwater plume, 3) direct application of solid potassium permanganate to the exposed bedrock during quicklime mixing activities to promote the chemical oxidation of the COCs in groundwater, 4) site restoration and re-vegetation, and 5) replacement of the residuum and transition groundwater monitoring wells in the target treatment area, that were previously abandoned, for use in LTM.

2.5 2018 Corrective Measures Implementation

Based on the data assessment presented in the *Second Addendum to CMIP (MES, 2018)* cis-1,2-DCE, TCE, and vinyl chloride were determined to be human health COCs at the Site. No ecological COCs were identified in media at the Site.

In December 2018. Corrective measures were implemented at the Site as outlined in the *Second Addendum to CMIP* (MES, 2018) to reduce the VOCs further in groundwater at the Site to levels acceptable for industrial use. Details of the corrective measures activities are documented in the *Corrective Measures Implementation Report Addendum* (Groundwater & Environmental Services, Inc., 2019). Corrective measures consisted of in-situ chemical oxidation (ISCO) of strong oxidizing agents – hydrogen peroxide activated sodium persulfate into 13 shallow temporary injection points ranging in depth from 3 ft below ground surface (bgs) to 15 ft bgs and 13 deep temporary injection points ranging in depth from 11 ft bgs to 30 ft bgs.

3.0 SUMMARY OF TWELFTH YEAR OF LTM ACTIVITIES

To meet the recommended actions outlined in the *Final CMIP* (MES, 2007) and the *Final CMIP Addendum* (MES, 2009) and Second Addendum (MES, 2018), and provide data to evaluate the long-term performance of the corrective measures, the following activities were performed during the twelfth year of LTM:

- Collected groundwater samples and groundwater level measurements from eight LTM wells (four residuum wells, three transition wells, and one bedrock well) during the 2022 semi-annual sampling events. Samples were analyzed for the COCs (cis-1,2-DCE, TCE, and vinyl chloride) and their degradation products (1,1-DCE and trans-1,2-DCE) by EPA Method SW8260B.
- Collected groundwater samples from select wells and analyzed for one of more of the following; COCs, degradation products, dissolved gases, total organic carbon and chloride.

3.1 Groundwater Sampling

Since the completion of the corrective measures performed at the Site in 2010 (see Section 2.4 for details), groundwater samples have been collected from eight LTM wells (listed below).

Residuum Wells	Transition Wells	Bedrock Wells
PPMP-66-MW02RR	PPMP-66-MW17	PPMP-66-MW08
PPMP-66-MW06R	PPMP-66-MW23R	
PPMP-66-MW16	PPMP-66-MW24R	
PPMP-66-MW18R		

During the twelfth year of LTM, groundwater samples were collected in May 2022 and October 2022.

3.1.1 Sampling Method

Groundwater samples were collected using low-flow sampling procedures, i.e., using an adjustable rate pump to remove water from the screened interval at a rate that produces minimal drawdown, as well as turbidity in the sample. Tubing leading from the discharge side of the submersible pump was connected to a flow-through cell equipped with a multiparameter meter to measure chemical and physical parameters. These measurements were used to indicate when groundwater quality stabilized and sampling could begin.

Groundwater levels were measured to the nearest hundredth of a foot using a Solinst™ water level indicator and recorded. The monitoring well sample collection documentation is provided in Appendix A.

3.2 Management of Investigation Derived Waste

The aqueous investigation derived waste generated during the groundwater sampling was collected in a 55-gallon drum stored on-site, including the left-over purged water.

3.3 Data Quality Review

MES reviewed the analytical data for the groundwater samples collected during the May to October 2022 sampling events. The data quality review was performed in accordance with the *Quality Assurance Plan (QAP)* (MES, 2004) to assess compliance with the Quality Assurance (QA) objectives, and to assess hard copy and electronic deliverable consistency and integrity and is included in Appendix C along with the analytical data packages for the May to October 2022 monitoring events.

3.4 Deviations from Planned LTM

LTM activities were performed in accordance with the *Final CMIP Addendum* (MES, 2009) and *Second Amendment to Corrective Measures Implementation Plan* (MES, 2018). No deviations occurred during the sampling events.

4.0 RESULTS OF TWELFTH YEAR OF LTM ACTIVITIES

The activities conducted at the Site during the twelfth year of LTM from May 2022 to October 2022 are presented in the following subsections.

4.1 Groundwater Sampling

This section discusses the results of the groundwater sampling events at the Site.

4.1.1 Groundwater Elevations

Groundwater elevations measured during the May to October 2022 groundwater sampling events are presented in Table 4-1. Figures 4-1 and 4-2 show groundwater elevations and potentiometric elevations for the residuum groundwater zone for the May to October 2022 sampling events. Transition groundwater wells are located only in the source area and additionally are co-located with residuum wells, thus not providing any additional potentiometric elevation information. For this reason, no transition potentiometric maps were constructed. Furthermore, potentiometric groundwater maps were not constructed for the bedrock zone due to the limited number of LTM wells.

Groundwater was encountered at the Site at shallow depths for both semi-annual monitoring events during the twelfth year of LTM. During the twelfth year of LTM, groundwater in the residuum and transition zones appeared to flow radially from the site (Figures 4-1 and 4-2) and is consistent with past data.

To further aid in assessing groundwater flow at the Site, horizontal and vertical hydraulic gradients were calculated using the groundwater measurements during the twelfth year of LTM, and are presented in Tables 4-2 and 4-3, respectively. The hydraulic gradients in the residuum, bedrock, and transition zones were low indicating a relatively flat water table, which is consistent with historical horizontal gradients calculated at the Site.

4.1.2 Groundwater Field Parameter Results

Field screening parameters, i.e., pH, conductivity, dissolved oxygen, turbidity, etc., are typically used by field personnel to assess when a well has been adequately purged and a representative groundwater sample can be collected. Field parameters are presented in Table 4-4.

4.1.3 Analytical Data and Data Quality Review

The analytical data for the May to October 2022 monitoring events is included in Appendix C. Samples were analyzed for VOCs by Method SW8260B, dissolved gases by RSK-175, total organic carbon by Method SW9060A, and chloride by SW9056A. MES reviewed the analytical data in accordance with the *QAP* (MES, 2004). Based on the data quality review, the analytical data generated for these monitoring events are adequate to fulfill program objectives and are suitable for preparation of this report.

4.1.4 Summary of Groundwater Analytical Results

The analytical results for the groundwater samples collected during the twelfth year of LTM are shown in Tables 4-5a, 4-5b, and 4-5c. The historical analytical results for COCs from previous sampling events are also shown in the Tables.

VOC concentrations detected in the groundwater samples were compared to the groundskeeper RBTLs in Table 4-5a. One COC (vinyl chloride) exceeded the groundskeeper RBTL in two groundwater wells from samples collected during the twelfth year of LTM. Due to instrument problems and approaching holding times, the October samples were subcontracted to XENCO laboratories. Reporting limits were higher than recent analyses but less than the RBTLs.

Samples collected from the wells were used to 1) evaluate the effectiveness of the corrective measures, and 2) evaluate contaminant concentration changes over time that occurred in response to the corrective measures, and 3) assess the long-term performance of the corrective measures in reducing contaminant concentrations.

4.1.5 Concentration Trends Over Time

Figures 4-3 to 4-6 show the trends in concentrations over time for the COCs. As indicated in the trend figures and Table 4-5a, well PPMP-66-MW02RR showed small decreasing concentrations during the twelfth year of monitoring compared to the prior year. Well PPMP-66-MW23R showed small increasing concentrations of COCs and vinyl chloride nearly doubled in concentration during the twelfth year of monitoring compared to the prior year.

The COC concentrations in wells PPMP-66-MW06, PPMP-66-MW08, PPMP-66-MW16, PPMP-66-MW17, PPMP-66-MW18, PPMP-66-MW22, and PMP-66-MW24R were less than the groundskeeper RBTLs during this reporting period. Due to instrument problems the October samples were subcontracted to XENCO laboratories. Reporting limits were higher than recent analyses but less than the RBTLs.

4.1.6 Distribution of Corrective Action COCs in Groundwater

Figures 4-7 and 4-8 present the estimated lateral extent of TCE and vinyl chloride concentrations exceeding the groundskeeper RBTLs for the residuum and transition groundwater zones at the Site for the baseline September/October 2010 sampling event. Figures 4-9 to 4-12 present the estimated lateral extent of TCE and vinyl chloride concentrations for the residuum and transition groundwater zones at the Site for the twelfth year of LTM. The concentrations of vinyl chloride exceeding the groundskeeper RBTL in groundwater during this reporting period were located south and southwest of former Building 335.

During the twelfth year of LTM, the vinyl chloride plume for both the residuum and transition groundwater zones remained in the vicinity of the estimated source area. The lateral extent of vinyl chloride exceeding groundskeeper RBTLs is limited to only one residuum well and one transition well located to the south and southwest of former Building 335. Although vinyl

chloride concentrations were above groundskeeper RBTLs for both events in monitoring wells PPMP-66-MW02RR and PPMP-66-MW23R the concentrations have decreased over time.

5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This section summarizes the activities performed and the results from groundwater monitoring during the twelfth year of LTM at the Site and presents conclusions and recommendations.

5.1 Summary of Activities

Activities conducted at the Site included:

- Collected semi-annual groundwater samples and groundwater level measurements from four residuum wells, three transition wells, and one bedrock well in 2022 semi-annual sampling events in May and October. Analyzed the groundwater samples for the COCs and their degradation products.
- Collected groundwater samples from select wells during the post-injection sampling semi-annual events in May and October. Analyzed the groundwater samples for one or more of the following: COCs, degradation products, dissolved gases and total organic carbon.

5.2 Summary of Results

Results from the twelfth year of LTM at the Site indicate the following:

- Groundwater was encountered at the Site at shallow depths and the direction of flow was radially from the site.
- Groundwater occurrence and flow direction are consistent with historical patterns.
- One of the three COCs (vinyl chloride) exceeded the groundskeeper RBTL in groundwater collected during the twelfth year of LTM from May to October 2022 at only one location (two adjacent wells).
- Vinyl chloride concentrations exceeding the groundskeeper RBTL during the twelfth year of LTM were found in groundwater from residuum well PPMP-66-MW02RR and the adjacent transition well PPMP-66-MW23R located in the vicinity of the estimated source area.
- The overall trend in Site groundwater COCs showed small fluctuations during the twelfth year of LTM compared to the prior year.

5.3 Conclusions and Recommendations

MDA has implemented two rounds of groundwater remediation (2010/2011 and 2018) at the site with some improvement observed after each round. Analytical results indicate the ISCO injection had some impact on reducing the COC concentrations. During the twelfth year of LTM, COC concentrations in residuum well PMP-66-MW06R did not exhibit any rebound and concentrations continued to stay below RBTLs. Despite exceeding RBTLs in both the residuum and transition groundwater zones (PMP-66-MW02RR and PMP-66-MW23R), vinyl chloride is a byproduct of the original chlorinated compound contaminants. Comparing concentrations to 2010/2011 and 2018 remediation events, the vinyl chloride levels have slightly decreased, suggesting the effectiveness of the remediation process. MDA proposes to continue monitored natural attenuation with groundwater monitoring unless there is a significant increase in contaminant concentrations or MDA desires to attempt additional treatment. This proposed course of action is supported by the fact that the site is in an identified industrial park, potable

water is provided, the groundwater is only used for monitoring purposes, and any construction on the site would have to address impacts to construction workers and vapor intrusion in any buildings erected.

In addition to MDA's proposal to continue monitored natural attenuation, the MDA proposes to alter the groundwater frequency from semi-annual to annual. This revised monitoring frequency is justified by the stability of the contaminant concentrations and overall decreasing levels. Upon ADEM's acceptance of the revised groundwater monitoring frequency, the MDA will submit a revision to the CMIP to document the future monitoring frequency.

6.0 REFERENCES

Environmental Science & Engineering, Inc. (ESE). 1998. *Final Environmental Baseline Survey, Fort McClellan, Alabama*, prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland. January.

IT Corporation (IT). 2002. *Draft Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7).* May.

MES. 2004. *Quality Assurance Plan (Appendix A of the Installation Wide Sampling and Analysis Plan)*. January.

MES. 2006. *Final Resource Conservation and Recovery Act Facility Investigation for Small Weapons Repair Shop, Parcel 66(7)*. February.

MES. 2007. *Final Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7)*. March.

MES. 2009. *Tech Memo Addendum* to the *Final Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7)*. March.

MES. 2013. *Final Corrective Measures Implementation Report, Former Small Weapons Repair Shop, Parcel 66(7)*. January.

MES. 2018. *Second Amendment to Corrective Measures Implementation Plan, Former Small Weapons Repair Shop, Parcel 66(7)*. June.

MES. 2019. *Corrective Measures Implementation Report, Former Small Weapons Repair Shop, Parcel 66(7)*. (March).

Paul, C.J. and R.W. Puls. 2007. *Impact of Turbidity on TCE and Degradation Products in Groundwater*, Groundwater Monitoring and Remediation. https://doi.org/10.1111/j.1745-6592.1997.tb01192.x.

United States Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste-Physical Chemical Methods*. Office of Solid Waste, Washington, D.C., SW-846, 3rd Edition. Update I, 1992, Updates II, IIA, and III 1996, Updates IIIA and IIIB 2002.

This page intentionally left blank